PROTECT
PROCURING INNOVATIVE CLIMATE CHANGE SERVICES

D1.2 Cross-cutting analysis of drivers and barriers of the demand for climate services

Lead beneficiary : CKIC

Dissemination level: Public

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Project acronym	PROTECT
Project title	Preparing a Pre-Commercial Procurement for end-user services based on Environmental Observation to adapt and mitigate climate change
Thematic priority	HORIZON-CL6-2021-GOVERNANCE-01
Type of action	PU - Public
Deliverable number and title	D1.2
Work package	WP1
Due date	30/04/2023
Submission date	30/11/2023
Start date of the project	01/06/2022
End date of the project	31/05/2024
Deliverable responsible partner	EIT Climate-KIC (CKIC)
Version	V3
Status	Final
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Document type	R – Report
Dissemination level	PU – Public

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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Versioning and contribution history			
Version	Date	Modified by	Comments
0.1	10/11/2022	Beatrice Malnati, Stefka Domuzova (CKIC)	Draft table of content & elements
0.2	10/01/2023	Ana Lucia Jaramillo, Beatriz Gomez (CPS), Ioana Rosca (AV)	Contributions to sections to the report
0.3	13/04/2023	Kevin Ramirez, Thanh-Tâm Lê, Stefka Domuzova (CKIKC)	Integration of partners' tasks and draft of contributions
0.4	21/04/2023	Thanh-Tâm Lê, Stefka Domuzova (CKIK)	Integration of partners' tasks and draft of contributions
0.5	24/04/2023	Axel Veitengruber (CA)	Peer review
1.0	26/04/2023	Marc Pattinson, Melissa Campagno (GAC)	Final review
2.0	14/11/2023	Stefka Domuzova (CKIC), Ioana-Simona Rosca (AV)	Editing content and formatting for re-submission
3.0	31/07/2024	Melissa Campagno (GAC)	Editing for final re-submission

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Project abstract

PROTECT aims at levering innovation procurement to unlock the climate service (CS) market's potential to support urgent climate adaptation and mitigation. The project will allow public and private organisations to build up and integrate their knowledge and skills about climate change, environmental observation (EO) and innovation procurement, notably enabling public authorities to shift to a proactive governance model, using innovative public procurement approaches to increase value and climate impact for money. It shall increase access of CS SME providers across Europe to public procurement markets and shape solutions that best address public demand, both specific and systemic. The initial focus will be on five encompassing application domains (Utilities, Green cities, Health, Land use & Marine environment, Security) and their contributions to the areas of sustainability in Horizon Europe's Cluster 6. The project will source and assess existing and high-potential CS solutions and technologies that use EO data. It will engage with an extensive and varied community of procurers, inform the definition and aggregation of their needs and functional requirements for CS, explaining, fostering and supporting a 'buying with impact' approach. Clearer, less fragmented demand shall guide and support R&D for future CS. PROTECT will prepare the operational ground for one or more joint, cross-border or coordinated pre-commercial procurement (PCP) processes and identify short-term actions so that Public Procurement of Innovative Solutions (PPI) can be activated towards or right after the project's end. At the policy level, it will provide decision-makers for procurement, climate and policy, at EU, national, regional and local levels, with practical recommendations and guidelines to boost the use of innovation procurement for climate action.

Keywords

Climate services, cross-analysis, EO, Earth Observation, Pre-Commercial Procurement, PCP, Innovation Procurement

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Table of Content

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Table of Figures

Table of Tables

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List of abbreviations

Acronym	Definition
AFOLU	Agriculture, Forestry, and Other Land Use
AI	Artificial intelligence
ANAC	Autorità Nazionale Anticorruzione
API	Application Programming Interface
AT	Austria
AV	Aerospace Valley
AVI	Agència Valenciana de la Innovació
BAM	Federal Institute for Materials Research and Testing
BE	Belgium
BFD	Federal Financial Directorate
BG	Bulgaria
BMWK	Federal Ministry for Economic Affairs and Climate Action (Germany)
BV	Besloten vennootschap (business structure with legal personality- NL)
CAP	Common Agricultural Policy
CBP	Central Purchasing Body
CDTI	Centro para el Desarrollo Tecnologico e Industrial (Spain)
CFP	Common Fisheries Policy
CKIC	EIT Climate-KIC
CLS	Collecte Localisation Satellites (company)
CMS-FOR	Central Procurement Body for the Federal Services (BE)
COAR	Government Administration Service Centre (PL)
CPB	Central Purchasing Body
CPO	Central Purchasing Organisation
CPV	Common Procurement Vocabulary

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Acronym	Definition
CS	Climate service
CY	Cyprus
CZ	Czechia
DCMR	Environmental Protection Agency (NL)
DE	Germany
DG-REGIO	Commission's Directorate-General for Regional and Urban Policy
DK	Denmark
DRM	Disaster risk management
EAFIP	European Assistance For Innovation Procurement
EC	European Commission
ECSS	European Cooperation for Space Standardization
EE	Estonia
EIT	European Institute of Technology
EL	Greece
EO	EO
ES	Spain
ESA	European Space Agency
ETA	Research and Technological Development (EL)
EU	European Union
EUSPA	European Union Agency for the Space Programme
FAST	Functional Analysis System Technique
FI	Finland
FR	France
GAIN	Agencia Gallega de Innovación (ES)
GDPR	General Data Protection Regulatio
HR	Human resources

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Acronym	Definition
HU	Hungary
IACS	Instituto Aragonés de Ciencias de la Salud (ES)
ICT	Information and communications technology
IE	Ireland
IIAMA	Research Institute of Water and Environmental Engineering
IPCC	Intergovernmental Panel on Climate Change
IPR	Intellectual property right
IT	Italy
IUU	Illegal, unreported and unregulated fishing
KEINO	Competence Centre for Sustainable and Innovative Public Procurement
KIC	Knowledge and innovation community
LCSP	Ley de Contratos del Sector Público (ES)
LT	Lithuania
LU	Luxembourg
LULC	Land Use Land Cover
LV	Latvia
LVPA	Lithuanian Business Support Agency
MEAE	Ministry of Economic Affairs and Employment (FI)
MITA	Agency for Science, Innovation and Technology (LT)
MS	Member State
MT	Malta
NCBR	National Centre for Research and Development (PL)
NL	Netherlands
OCPI	Innovative Public Procurement Office (ES)
OCSE	Organization for Security and Co-Operation in Europe
OMC	Open Market Consultation

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Acronym	Definition
PACA	Provence-Alpes-Côte d'Azur
PARP	Polish Agency for Entrepreneurship Development
PCP	Pre-commercial procurement
PIO	Programme for Innovation Procurement (BE)
PL	Poland
PP	Public Procurement
PPI	Public Procurement of Innovative Solutions
PPL	Public Procurement Law (PL)
PPO	Public Procurement Office
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia
SME	Small and medium-sized enterprise
SOTA	State of the art
STIB-MIVB	Brussels Intercommunal Transport Company
SYKE	Finnish Environment Institute
TEG	Technical Expert Group
TRL	Technology readiness level
TRO	Temporary Restraining Ordinary Procedure (GR)
UAS	Unmanned Aerial Systems
UGAP	Union of Public Purchasing Groups (FR)
UVO	Public Procurement Office (SK)
VOB	Vertragsordnung für Bauleistungen (DE)
VOL	Vergabe- und Vertragsordnung für Leistungen (DE)

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Acronym	Definition
VSD	Value Stream Design
VSM	Value Stream Mapping
WFD	EU Water Framework Directive
WG	Working group

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Executive Summary

EU's Roadmap for climate services defines climate services (CS) as the: "*transformation of climate-related data — together with other relevant information — into customised products such as projections, forecasts, information, trends, economic analysis, assessments (including technology assessment), counselling on best practices, development and evaluation of solutions and any other service in relation to climate that may be of use for the society at large. As such, these services include data, information and knowledge that support adaptation, mitigation and disaster risk management (DRM).*"

The broadness of this definition and the large number of instances it includes, partially explains why the market of climate services, despite steadily growing, remains an immature and fragmented one. In fact, the large numbers of stakeholders, services, and interests at play, may at times make it seem almost artificial to talk about a singular "climate services market". And nonetheless, **climate services do share common traits and tackle common problematics such as climate change mitigation and adaptation, as well as disaster risk management**.

This document looks into the climate services market, in particular at the drivers and barriers of the demand, and how these interact and influence each other in various dimensions, such as climate and procurement policies, perception of climate risks, existing market solutions and other elements.

The intersections of the above aspects, once identified, can be used to assess **the state-of-play of the market, and foresee where the existing demand could meet with a technically feasible offer**, in order to create the possibility for innovative climate change mitigation/adaptation solutions through the means of pre-commercial procurement, in particular:

- **The analysis of European Union (EU) policies in the 5 PROTECT domains** (Section 2) shows that there are numerous areas where Innovation Procurement can enable access to innovative solutions to tackle unmet challenges related to climate legislation, regulations and policies at the EU, regional and local levels. While these are more numerous in some PROTECT domains (e.g. Energy and utilities) and less so in others (e.g. Marine and coastal environment), this can be used as an indicator to assess the overall need/potential contribution of Innovation procurement in the specific domains, but should also be considered in the time and political context (for instance, the policy analysis took place in late 2021-early 2022 when the EU was putting in place many energy-related policy, both stemming from the Green Deal, but also in times when, due to the Russian invasion in Ukraine, Europe was redefining its energy independence. This may to an extent explain the prevalence of policies considered as relevant in this specific domain).

- **The analysis of climate challenges in EU regions** (Section 3) shows countless regions experience similar climate challenges. This however is not sufficient to identify regions that share common climate needs, and that may be, for instance, interested in taking part in the same Innovation procurement. However, it is easier to pinpoint this common climate needs, when the focus is no longer on a single climate challenge but on all climate risks on a certain territory and their interaction, attesting for common intention to solve the same complex and systemic issues.

- **The analysis of the Earth Observation (EO)-based CS in the five selected application domains** (Section 4) shows that there are numerous services already on the market and even more to come, as it will be seen in the graphs showcasing the increased numbers of the CS identified between the 2 mapping stages. By looking at the application domains, while a big amount of the CS are having applicability in the Agriculture, forestry and other land uses application domain, the results are indicating that CS developed for other application domains such as Energy and Utilities are emerging as well. On the other hand, from geographical point of view it can be observed that while the Western countries are leading by far the development of the EO-based CS, services are emerging as well across several countries from the European Union which are being supported throughout various initiatives by the European Commission (EC) and by the European Space Agency (ESA), as well as national ones.

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The **cross-cutting analysis of the results** of works contained in the document was used as a basis to develop a methodology and provide some examples of cases where there is need of Pre-Commercial Procurement (PCP) (Section 5).

These include Challenges presented by:

- Water scarcity
- Supporting the transition towards green energy
- Waste management and related storage issues,
- Flooding in coastal areas, Illegal waste dumping,
- Detecting climate vulnerability in agriculture and planning resilience.

More showcases can be identified in similar manner using the information contained in the herein document and its annexes.

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1. Scope and structure of the document

D1.2 Cross-cutting analysis of drivers of the demand for climate services and barriers looks at the outcomes of different project tasks contained herein, in an attempt to combine them into an integrated analysis framework. The aim is to identify drivers of the demand, and eventually use the outcomes and correlations emerging from the cross-analysis of the tasks into the future development of the PROTECT project, such as, for instance, for identifying possible procurers interested in certain types of climate services, priority climate services to structure a pre-commercial procurement around, or others.

This methodology relies on and combines several analyses, which structure the document:

The EU climate policy framework has been analysed in order to identify legislative acts that may favour the deployment of Pre- Commercial Procurement (PCP) for the development of Earth Observation (EO)-based climate services (CS). This is the subject of **Section 2 European policies driving the demand for climate services and PCP.**

In **Section 3 Analysis of climate challenges in European Union regions**, the adaptation strategies of European regions across several pre-identified Member States have been used as a starting point towards identifying the main issues that require climate services deployment at scale, and could potentially allow for mapping regional and other stakeholders and grouping them around common priority climate risks, especially as long as the mean to address these risks can come from a solution developed through pre-commercial procurement.

Building on what has already been developed in ***D1.1 Updated database of EU existing and upcoming CS classified with relevant taxonomy (Confidential deliverable, but PROTECT Taxonomy available here)***, **Section 4 Sourcing and analysis of EO-based CS in PROTECT's application domains** provides an overview of the supply side of the EO-based climate services market and the existing off-the-shelf solutions. This helps to shed light on the current gaps between the demand for EO-based climate services and the existing offer. Gaps which may in some cases be bridged by solutions developed through the means of pre-commercial-procurement.

Section 5 Cross-analysis of climate services and barriers builds towards a state-of-play of the intersection of climate services, EO, climate risks, and pre-commercial procurement. It aims at drawing potential paths and identifying spaces where needs and opportunities would meet and where innovation procurement could bring relevant formats to optimise the match between supply and demand. How these findings can be used further in PROTECT is then discussed at the end of the chapter and of the deliverable.

Supporting materials used in the cross-analysis are included in the Annexes. Notably the report on **Innovation procurement enabling legal and policy framework** looks into the national legislations of pre-selected Member States with regards to pre-commercial procurement, to identify which countries (and the procurers based therein) can engage in the practice with the most ease - while providing guidelines to all procurers as to what they should be warry of in the process. And the **Analysis of common needs of public procurers in the five domains using value methodologies** delves into developing and implementing a methodology for pre-identifying potential needs for EO-based climate services that may be the subject matter of a potential pre-commercial procurement.

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2. European policies driving the demand for climate services and PCP

2.1. Scope

The objective of this chapter is to present the findings of the comprehensive desktop research carried out on existing EU climate legislations and policies, with the primary goal of pinpointing areas where there is an emerging demand and necessity for Innovation Procurement. The research was conducted on the five priority domains of PROTECT:

- Energy and utilities;
- Sustainable urban communities;
- Marine and coastal environment;
- Agriculture, forestry, and other land use;
- Civil security and protection.

This research is particularly relevant as European policies could significantly contribute to shaping the demand for EO-based climate services and PCP. The research mainly focused on three types of policy instruments: regulations, directives and communications. These policy instruments were selected based on their relevance within the EU's policy system.

Over recent years, the EU has introduced numerous policies aimed at reducing greenhouse gas emissions and mitigating the impacts of climate change. These policies have generated a need for innovative solutions and services to help achieve climate objectives and adapt to the consequences of a shifting climate.

One crucial area where European policies are stimulating demand for climate services is EO. The European Union is at the forefront of EO, with numerous programmes and initiatives centred on enhancing our comprehension of the planet's systems and monitoring the impacts of climate change. Through initiatives such as Copernicus, the EU generates extensive EO data, opening doors for innovation in data processing, analysis, and visualisation. The uptake of EO data has also been supported by different policy instruments as well as several European projects which facilitate the integration of EO data into several application domains, and EO data has proven useful in various climate service applications.

PCP can facilitate the development of novel EO and other products and services that utilise this data to tackle environmental challenges, ranging from predicting natural disasters to assessing the well-being of ecosystems.

This research is therefore focused on recent and current EU policies that are relevant to the fields of climate services and EO. By examining these policies and their implications, we can identify potential opportunities and gaps in the market where Innovation Procurement can play a critical role in fostering the growth of climate services and enabling the development of cutting-edge solutions to address climate change challenges.

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2.2. Methodology

The aim of this section is to illustrate the methodology used to conduct the research and its relevance to pre-commercial procurement in the field of climate services and EO. To identify the most impactful areas where pre-commercial procurement can generate innovative solutions to address unmet challenges, a comprehensive desktop research was conducted to map European-level policies that are relevant to Innovation Procurement. **For the purpose of said research, a policy was deemed to be relevant for PCP (and, in particular for PROTECT), when the policy was deemed capable of stimulating the development of novel EO-based climate services in one of the 5 PROTECT domains.** The selected policies were then analysed based on their typology, objectives, and relevance to the project, with a focus on identifying areas where pre-commercial procurement could be useful in the field of EO and climate services.

The mapping of different policy instruments was captured within a table characterising each policy element starting with the name of the policy instrument, followed by a summary of the assessed policy. The table also offered information about the type of policy instrument (communication, directive, regulation or other), the application domain to which it can be associated with and its geographical scope. The final elements of the table provided information about the, identified key performance indicators linked to the policy instrument as well its enforcement date and, relevance to the project (low, medium, and high). The table is available in Annex Annex 1: Mapping of EU Policies relevant for the Pre-Commercial Procurement of EO-based end user services.

2.3. Results

Following an extensive review of more than 100 policy instruments, a subset of 50 elements has been chosen for in-depth analysis within the scope of this task. The preliminary examination of the diverse policy instruments showed that the *Energy and utilities* domain had the highest number of policies, directives, and communications reflected in the policy map. This was followed by the *Sustainable urban communities* and the *Agriculture, forestry, and other land use* domains. The C*ivil security and protection*, along with the M*arine and coastal environment* domains, were found to have the least representation in the policy assessment.

The research conducted successfully identified measurable key performance indicators (KPIs) for each policy instrument. These KPIs serve as concrete targets for specific policy instruments, requiring action by member states to meet their requirements. Notably, the identified KPIs also highlight areas where pre-commercial procurement of climate services could play a significant role in supporting the process of achieving these indicators.

The larger representation of policy instruments dealing with Energy and utilities in this research can be explained by the following factors:

- **Emissions from energy production** - Energy production is a major contributor to greenhouse gas emissions, which are the primary drivers of climate change. Burning fossil fuels for energy, such as coal, oil, and natural gas, releases carbon dioxide (CO2) into the atmosphere, contributing to global warming. As a result, policies that focus on reducing greenhouse gas emissions from the energy sector are considered crucial in mitigating climate change.
- **Energy security and independence** - European countries have historically been reliant on imported fossil fuels for their energy needs. To enhance energy security and reduce dependence on external energy sources, European countries have prioritised policies that promote renewable energy sources, energy efficiency, and domestic energy production. These policies aim to decrease reliance on fossil fuels and increase self-sufficiency in energy production, thereby reducing the geopolitical risks associated with energy imports.
- **Renewable energy potential** - Europe has significant renewable energy potential, including solar, wind, hydropower, and bioenergy resources. European countries have recognised the potential of these renewable energy sources to reduce greenhouse gas emissions and have implemented

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policies to promote their deployment. These policies include feed-in tariffs, renewable portfolio standards, and other incentives to promote renewable energy development.

- **Global leadership and international commitments** - European countries have been at the forefront of global efforts to combat climate change and have made commitments under international agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. As part of these commitments, European countries have implemented policies aimed at reducing greenhouse gas emissions, with a particular focus on the energy sector.
- **Economic opportunities** - European countries have recognised the economic opportunities associated with the transition to a low-carbon economy. Policies promoting renewable energy and energy efficiency have been seen as drivers of economic growth, innovation, and job creation. As a result, European countries have implemented policies that not only address climate change but also foster economic development.

The assessment of European policies further highlighted a range of policy instruments that are applicable to the five priority domains of the project. In the subsequent section, we will provide a concise overview of some of the key transversal instruments that offer significant opportunities for advancing the pre-commercial procurement of climate services.

European Green Deal - The European Green Deal, as defined by the EC, is a comprehensive and ambitious plan that sets out the strategic vision of the EU for achieving climate neutrality by 2050 and promoting sustainable economic growth. It encompasses a wide range of policy areas, including but not limited to energy, transport, agriculture, circular economy, biodiversity, and more. The European Green Deal aims to transform Europe into a greener, more sustainable, and climate-resilient continent by promoting the efficient use of resources, reducing greenhouse gas emissions, protecting the environment, and fostering sustainable innovation and economic development, while ensuring a just and inclusive transition for all stakeholders.

European Climate Law - The European Climate Law is a regulation that sets binding targets for the European Union to achieve climate neutrality by 2050. It establishes the legal foundation for the EU's commitment to combat climate change and implement the objectives of the European Green Deal. The European Climate Law enshrines the EU's target of reducing net greenhouse gas emissions to at least 55% below 1990 levels by 2030, and achieving climate neutrality - i.e., balancing greenhouse gas emissions with removals - by 2050. It also establishes a framework for regular monitoring, reporting, and review of the EU's progress towards these targets, and provides a mechanism for adjusting the targets in light of scientific, technological, and socio-economic developments. The European Climate Law serves as a key policy instrument to drive the EU's efforts in addressing the urgent global challenge of climate change and transitioning towards a sustainable, low-carbon future.

Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information (recast) - is a legislative act issued by the European Union that aims to promote the availability and re-use of public sector information as open data. The Directive replaces and recasts the previous Directive 2003/98/EC on the re-use of public sector information, with the goal of modernizing and harmonizing the legal framework for open data across EU member states. The Directive establishes principles for the re-use of public sector information, such as the presumption that public sector information should be made available for re-use as open data, unless exceptions apply. It sets out rules for non-discriminatory access, transparency, and fair competition in the re-use of public sector information and promotes the use of standard licenses and formats to facilitate interoperability and reusability of data.

The wide-ranging diversity, extensive scope, and intricate granularity of the policy instruments identified in the policy map pose challenges when trying to pinpoint specific areas where pre-commercial procurement of climate services is more likely to occur.

However, the abundance of policy instruments in the energy sector indicates that member states must actively develop and seek technological solutions to meet the targets and indicators outlined in the policies. This context offers significant opportunities for exploring the development of such solutions through innovative approaches such as the pre-commercial procurement of climate services.

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In the Agriculture, forestry, and other land use domain, policies like the Farm to Fork strategy aim to reduce greenhouse gas emissions in agriculture, fisheries, and aquaculture by over 50% by 2030. These policies provide a strong incentive for adopting and integrating more sustainable and efficient agricultural practices. The use of EO based solutions supporting farmers in crop monitoring, yield prediction, land use and land cover mapping, precision agriculture and many other applications can be enhanced by the co-developing approach offered by the pre-commercial procurement of climate services. Within the *Sustainable urban communities* domain, several policies have identified the necessity for more ambitious targets and actions in sub-sectors such as circular economy, mobility, air quality, and health.

In the domain of *Marine and coastal environment*, the exercise has identified relevant policies, including the *Common Fisheries Policy* (CFP), which has established harmonised provisions to ensure the sustainability of fisheries and aquaculture in EU waters. Pursuing pre-commercial procurement solutions can be an effective tool to support the CFP, as this policy emphasises the importance of adaptive management, involving regular updates and adjustments to management measures based on new information and changing environmental conditions. Climate services developed through PCP can contribute to adaptive management by providing EO-based real-time or near-real-time data and forecasts on climate-related variables such as sea surface temperature, ocean acidification, and changes in marine biodiversity. This information enables policymakers to make timely adjustments to fishing quotas, gear regulations, and other management measures, accounting for climate-related changes and ensuring the sustainability of fish stocks.

Finally, the *Civil security and protection* domain was sparsely represented on the policy map, which could be attributed to its cross-sectoral nature, with relevant elements often being mapped under other domains such as *Energy and utilities* or *Sustainable urban communities*. However, the limited entries on the policy map do not imply the insignificance of this domain in any way. In fact, climate services developed through PCP can provide advanced warning and risk assessment of climate-related hazards, such as extreme weather events, flooding, wildfires, and other natural disasters. These services can utilise predictive models, remote sensing data, and real-time monitoring to provide timely and accurate information on potential hazards, their severity, and their impacts. This information can help civil security and protection agencies to better understand and prepare for climate-related risks, take proactive measures to mitigate their impacts, and ensure the safety and well-being of communities and infrastructure.

2.4. Conclusions

The main conclusion of the research on European policies and their potential for influencing the precommercial procurement of EO-based climate services, is that there are numerous areas where Innovation Procurement can enable access to innovative solutions to tackle unmet challenges related to climate legislation, regulations and policies at the EU, regional and local levels.

Indeed, the procurement of EO climate services is an essential tool for supporting the implementation of EU climate policies. EO provides critical data and information on a wide range of climate-related variables, including greenhouse gas emissions, atmospheric composition, sea level rise, and climate change impacts.

Innovation procurement can play a key role in enabling access to innovative solutions that leverage EO climate services to address unmet challenges related to climate policy implementation. For example, Innovation Procurement can enable the development of new tools and applications that use EO data to improve climate monitoring, modelling, and forecasting, as well as to support decision-making and risk management in areas such as disaster response, water resource management, and energy systems.

Innovation procurement can also support the development of new business models and service delivery models that leverage EO climate services to enable more sustainable practices in areas such as agriculture, forestry, and urban planning.

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3. Analysis of climate challenges in European Union regions

3.1. Scope

This section presents a snapshot mapping of the main climate issues at regional level in several European Member States and across PROTECT's five application domains, with a focus on adaptation and resilience challenges, whereas the previous section took a stronger (but not exclusive) climate change mitigation focus, not least due to the weight of the Energy sector. It is also based on comprehensive desktop research carried out within the framework on T1.1. The countries included in this mapping have been chosen in agreement with the whole consortium and notably with the partner leading on the innovation procurement analysis. While it does not exclude any of the other countries potentially eligible for a PCP, this allows initial focus on a smaller set of countries which show promising potential to apply innovation procurement and PCP to climate services. **These are: Belgium, Finland, France, Germany, Greece, Italy, Lithuania, the Netherlands, Poland, Slovakia and Spain**. The spatial resolution adopted for this mapping is that of EU Territories in the sense of the Smart Specialisation Platform. The mapping restricts itself to those climate challenges that are directly relevant to at least one of the five application domains. Cross-reference is made to country-level priorities as identified in national adaptation strategies and plans.

The mapping is available as Annex 2: Snapshot of Climate challenges in EU regions.

3.2. Methodology

Due to the current lack of unified and comprehensive terminologies, norms and indicators to identify the main climate challenges facing European regions, measures of their relative scale and impact, and classify them in order of priority, providing even a quick and simplified snapshot of these climate challenges requires to deal with a range of sources that diverge in format, content and intent, to the point where drawing comparisons between regions can be difficult and subject to multiple interpretation biases. This is much more marked for adaptation and resilience challenges, which form the bulk of the mapping as opposed to the mitigation challenges. In that sense, the mapping exercise is somewhat 'impure' by construction.

In this mapping, we draw whenever available on documents and syntheses published either by regional authorities and regional public bodies or on scientific reports that inform regional adaptation and resilience strategies and action plans. The overarching logic is that the main challenges are identified here from a combination of academic research on their reality and intensity at national and regional scales and the perception that each region, represented by its public governance, has of the most pressing or significant challenges. For some regions, other surveys have been made by consultancies and other private organisations, but these were deemed less appropriate to that logic.

It is worth noting that the way regions present their main challenges in official documents is widely variable. Some documents consist mostly of scientific data deriving e.g., from IPCC WP1 reports: these tend to be more comprehensive and quantitative while saying little about how the regions hierarchize the range of challenges described. In such cases, we allow ourselves a margin of interpretation to identify which of the challenges described seemed to be the most prominent in each regional context, confirming this interpretation with complementary documents when available. At the other end of the spectrum, some documents largely skip the data and facts and focus primarily on the actions prioritized by the regions in their climate adaptation or mitigation plans. In such cases, we look for scientific reports that provide data and facts and apply the official documents as filters to identify which of the challenges described by scientific communities are effectively perceived as priority by public authorities. (Many regions opt for combinations of the two approaches.)

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The degree of detail and granularity provided in such official documents also varies a lot, for instance in terms of geographic scale, of sectoral focus, of emphasis on very specific challenges that are being addressed through dedicated action lines. In this mapping, we opt for a relatively low degree of detail and granularity and seek similar formulations for largely common challenges, mainly to keep the mapping within workable dimensions and to help spot similar challenges across regions. While we are aware that this choice entails loss of information, the rationale is that once possible cases for PCPs have been identified, the documents referenced will still allow to bring back finer elements for analysis and deeper comparison for each of those cases. However, we do not attempt to achieve a very homogeneous level of detail and specificity across all regions, as we consider that variations between regions reflect to some extent the way they approached the variety of their respective climate challenges. Moreover, some of the regions are still in the process of deciding on their priority topics for climate action, meaning that the snapshot provided here is only temporary; we must accept this as a fact. In a few countries, official documents relevant for this mapping exercise have not been identified at the level of regions: in such situations, we have worked on national documents and retain the elements that are relevant for each region. We also acknowledge that in some cases, EU territories in the sense of the Smart Specialisation platform do not correspond to levels of political decision. The choice of this spatial resolution is meant to facilitate further links with Smart Specialisation Strategies (S3), also considering that NUTS1 and NUTS2 levels both pose similar problems.

The mapping takes the lens of PROTECT's five application domains. This is rather straightforward for regions where official documents are (partly) structured by sector and theme, which often correspond to one domain or part of one domain. When a sector or theme spans more than one application domain, we list the corresponding challenge in each of the relevant domains. More broadly, if, for instance, a chapter of the official document deals with water challenges, we may reference these under several of

PROTECT's application domains (e.g. AFOLU, Marine and Coastal, Critical Infrastructures) as relevant, even when the corresponding chapters in the document do not mention water again. When regions do not present their climate challenges by sector, more work is required to reference each challenge under the relevant application domain(s). (It should be kept in mind that a number of climate challenges do not pertain to any of the five application domains and may thus be left out of this mapping, despite being fully relevant to climate action in a particular region.)

Finally, we apply another lens of country-level priority areas for climate adaptation and resilience. Here as well, the way such priorities are identified in national adaptation strategies and plans differs a lot from one country to another, as does the number of such priorities. For this mapping, we base ourselves on syntheses provided by Climate-ADAPT, complemented, when necessary, by direct use of official documents from national adaptation strategies and plans. These national priorities are indicated in column H of the mapping, each priority being designated by an abbreviation of one or more letters in square brackets. (Please note that the abbreviations are country specific – the same abbreviation may not correspond to the same priority or field in two different countries.) For each challenge identified at the regional level, a reference is then added to every national priority to which the challenge is closely related. The aim of this cross-referencing is to connect national and regional scales and to provide gateways that can facilitate linking main regional climate challenges with supportive national policies and regulations down the line. (*NB*. Ultramarine regions are not referenced in subsection 3.3 below but they are included in the mapping in Annex 2: Snapshot of Climate challenges in EU regions).

3.3. Results

3.3.1. Energy and Utilities

Several challenges are widely shared across Europe. Increased frequency of droughts and of heatwaves is a concern from Lithuania and Poland to Spain, from Belgium to France, Germany, Greece and Italy, with consequences both on water quality and quantity and indirectly on other economic sectors, e.g. energy production (water scarcity in highly industrialised regions of western Germany and in Marche, impact of hotter waters in parts of Belgium, France, Italy, Lithuania). More broadly,

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hydrogeological instability threatens regional water balance and availability, from southern Germany to southern Italy. The multiplication of extreme events – flooding, either extreme rainfall or sea level rise, threatens to disrupt energy production in Germany, Lithuania, Poland; frost is mentioned as a disrupting factor in some Polish regions, but also in Tuscany (affecting water provision), as can be tree falls resulting from storms e.g. in Finland. Increase in other more specific risks ranges from water pollution, landfill flooding and fires (Lithuania) to peak flood discharges (northern Germany) or consequences of ocean acidification on infrastructures (western France). Besides energy and water, extreme events as well as longer term processes such as soil shrinking and swelling also threaten railways and roads (e.g. in some French regions). Systemic risks such as coupled issues on water availability or quality and energy production are amplified in densely populated areas such as the Berlin and Paris regions. Cascading effects are expected as energy demand rises (e.g. during heatwaves, in Italy but also in less hot countries such as the Netherlands or Slovakia), water reserves are put under growing strain, and the effects of suboptimal insulation and energy efficiency of buildings across Europe are aggravated by climate change.

3.3.2. Sustainable urban communities

Cities are affected by many the challenges linked to other application domains, often at more acute levels due to the concentration of population and economic activities. Classic examples are heatwaves, who are generally expected to rise in frequency, duration and intensity, and urban heat islands mostly in meridional regions. Heatwaves are mentioned in almost every region of the mapping. Being characterised in comparison with average local temperatures, they remain globally hotter in more southern regions; however, they also come on top of climate challenges in regions that are generally cooler (from the northeast of France to the southern half of Finland) as local populations are much less used to dealing with abnormally high temperatures, both biologically and in terms of housing design, insulation and equipment. In many cases, e.g., in Spain and in parts of Italy, heatwaves and degradation of air quality (as well as increase in allergens such as pollens, often linked to northbound migration of vegetal species, and in infectious diseases gaining ground) are coupled and amplify each other's negative impact on human health. Droughts, water quality and quantity concerns appear wherever they also affect energy and utilities: they have been a major challenge in the southern half of Europe for many years, where they are often linked with water scarcity including drinking water, but they are now also concerning countries such as Belgium, the Netherlands, the south of Germany. One other frequently recurring challenge is the growing risk of flooding in urban areas, coming from heavy rainfall or from river overflow, marine submersion or sea level rise, often aggravated by soil degradation, itself amplified by droughts. Almost every province in Belgium and in the Netherlands is affected, as are some Greek, Italian, Polish and inland French regions. Swelling and shrinking soils are also an increasingly common consequence of hydrogeological instability, for instance in southern France and in Italy: they primarily affect agriculture and land use but also create vulnerability for building foundations in urban areas, and sometimes landslide risks.

3.3.3. Marine and coastal environment

With the exception of Slovakia, all countries addressed by this mapping have coastal regions. Risks of erosion are increasing (northern Germany, northern and southern Italy, Spanish Atlantic and Mediterranean coast), with quality degradation of coastal waters (French Atlantic and Mediterranean coast), shrinking natural areas (Netherlands, Normandy) including beaches (e.g. Asturias, Provence Côte d'Azur), lagoons (Occitania), coastal sediment stocks (Nouvelle-Aquitaine). Flooding risks are mentioned in almost all coastal regions, associated with sea level rise (French Mediterranean coastline, Liguria, Andalusia, Balearic Islands, but also northern Germany and Poland, Asturias, Friuli Venezia Giulia), marine submersion (North and Baltic seas, Cantabria, Liguria, Provence Côte d'Azur), extreme rainfall, thunderstorms and gales (Poland, Cantabria), combinations of those factors (e.g. northern Germany, northern Spain, Netherlands, Lithuania, French Atlantic coast), general hydrogeological instability (western and eastern Italy) combined with more frequent droughts and change in rainfall regime (e.g. Liguria). Coastal water issues include increased saltwater intrusions, risks of salinization and freshwater & drinking water shortages (western France, Emilia-Romagna, Spain, the

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Netherlands…), decreased water quality (Lithuania, Tuscany, bathing water quality in the Netherlands), stress on the aquatic ecology notably due to high water temperatures, sea acidification (northern Germany, Canarias, Galicia, Murcia with reduced capacity of carbon storage), toxic algae (Catalonia, Italian lakes). Fishing and aquaculture are also affected (Galicia, northern Italy, France), sometimes with mixed effects linked to e.g. migration of species or jellyfish proliferation. Effects of climate change are also seen inland: higher risks of land subsidence and of peat oxidation (northern Netherlands), of landslides (Pomerania), biodiversity loss, affected endorheic ecosystems, eutrophication of water bodies, damaged ecosystem services (Asturias, Emilia-Romagna, Galicia, Bremen), but also potential threats on inland waterway transport (e.g. Antwerp, Bremen). Systemic issues are highlighted, such as the increasing tension between urbanisation and vulnerable natural environments or the challenge of high emissions from major ports.

3.3.4. Agriculture, Forestry, and Other Land Use

Climate challenges and risks for Agriculture, Forestry, and Other Land Use (AFOLU) are rather more extensively documented than other application domains in regional climate reports.

Drought and water related issues are threats found in the largest number of regions. More frequent and longer periods of drought are notably expected in Germany (Baden-Württemberg, Brandenburg, Saxony, Thuringia), northern and southern Italy, across the Netherlands and Spain (Andalusia, Castilla Mancha, Canarias, Catalonia, Extremadura, Galicia); they are often coupled with water quality and quantity concerns (Brussels region and several Flemish regions, Emilia-Romagna, Lombardy, Apulia, Aragon, most regions across France, Lithuania), causing competition for water between urban and agricultural use (e.g. Sardinia), stress in natural ecosystems, agriculture and forestry (north-western Germany, Balearic Islands), risks of desertification (Basilicata, Calabria, Emilia-Romagna, and Sicily). Closely related is the issue of water scarcity and associated threats of lower water recharge and decrease in aquifer levels (e.g. PACA, Apulia, Piedmont, Balearic Islands, the Netherlands), risks on pastures and fodder (Poland) and vegetation areas (e.g. Thuringia). Precipitations are expected to overall decrease in a few regions such as Bratislava and western Slovakia, with reduced river flows (e.g. Pays de la Loire), higher transpiration and water stress (Murcia, Navarra, Île-de-France). Impacts shall be aggravated as more frequent or abundant irrigation should be required in the agricultural sector (e.g. North Rhine-Westphalia, Tuscany, Aosta Valley, Galicia), while water shortages are expected to create negative impact on industrial and agricultural production (e.g. Bremen).

Soils will also be affected. Erosion, increased soil vulnerability and degradation will happen across the continent (e.g. Île-de-France, Saarland, Saxony, Thuringia, Mecklenburg-Vorpommern with stronger winds, Lombardy, Marche, Lithuania, Slovakia, Andalusia, Castilla-Leon, Valencian Community,

Asturias…), possibly provoking run-off and mudflows (Normandy), landslide risks (Åland, Lappi, Lower Saxony) and desertification (Galicia). Swelling and shrinking soils should notably affect much of France

(Île-de-France, Bourgogne Franche-Comté, Auvergne Rhône-Alpes, Nouvelle-Aquitaine, Occitania,

PACA); soil degradation may trigger various negative effects such as impairment or loss of soil functions (Bremen), decrease of soil moisture (Lazio) with desiccation and salinization of soil in Slovak low lands; risks of land subsidence and peat oxidation will increase (northern Netherlands), combining with increasing soil consumption (e.g. Abruzzo, Campania, Emilia-Romagna). Thermal stress will further increase in southern regions such as Canary Islands, Catalonia, Extremadura, Castilla-La Mancha. As mentioned above, coastal regions will be affected by higher risks of salinization (e.g. northern Netherlands), sea water intrusions combined with the risk of sea level rise (e.g. Andalusia).

More frequent or intense extreme events shall also impact land use, often in combinations (floodings, droughts, heavy rains, storms) from southwestern (Emilia Romagna, Lombardy, Aragon) to northeastern Europe (Lithuania, Poland). Flooding risk will increase notably in agricultural areas (e.g. Åland, Lappi, Île-de-France, Thuringia, Sardinia, Veneto, Canary Islands…), amplified by destructive storms (e.g. east of France), more intense rainfall episodes (Friuli-Venezia Giulia, Tuscany) and globally

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increased precipitation (e.g. northern Slovakia). These events are often causing faster surface run-off, less soil hydration and erosion (e.g. Poland). Another fast-increasing risk, as abundantly seen in the summer of 2022, concerns forest fires and wildfires, for instance in Wallonia, Antwerp province, in the southern half of Finland, northern and central Italian regions as well as Sicily, in most French regions, across Germany from Saarland to Bavaria or Berlin, several Greek regions, Spain from the south to central inland regions up to Catalonia. In the Netherlands, extreme events combined with the risk of longer wet periods will be affecting harvests, while mountainous regions may see an increase in torrents and avalanches (e.g. Bavaria).

Climate change will hit productivity. Agricultural yield may decrease in very different contexts (Centre Val de Loire, Saarland, Berlin, Hessen, Mecklenburg-Vorpommern, Emilia Romagna, Liguria, Marche,

Sardinia, Tuscany, the Netherlands, Castilla-Leon, Murcia…), linked with higher evaporation (southern Spain), shorter crop maturation due to higher average temperatures (Galicia), higher risk of loss of nutritional value (Sardinia). Plants and animals may reach their adaptation limits (e.g. Hessen, Saxony). Impacts on agriculture will often depend on species. A risk on fruit ad vine already observed with increasing frequency is linked to frost risk during flowering, which can trigger earlier harvests (e.g. PACA). Other challenges come from thinner snow cover (alpine Italian regions), higher volatility of snow cover and vegetation periods (Lithuania), negative consequences on permafrost (Trentino Alto Adige). Generally, there are fears of more inadequacy of precipitation cycles to seasonal agricultural needs (e.g. in Poland). Forests shall suffer as well with degradation risks (e.g. PACA, Saarland), high vulnerability of species to droughts and parasites (Wallonia, Grand Est, Île-de-France, Pays de la Loire); in contrast, forests are expected to extend further in Lappi, which may provoke albedo reduction. Higher risks of infectious diseases, pests, fungi, also invasive species are foreseen everywhere, linked or not to the migration of species (e.g. Grand Est, Galicia, Bavaria, North Rhine-Westphalia, Saxony, Thuringia, northern Italy, regions across Spain – Aragon, Asturias, Canary Islands, Extremadura, Navarra, Valencian Community); longer wet periods and modified climate patterns will probably increase diseases, mosquitoes and pests (the Netherlands). Other negative developments concern eutrophication in the summer (e.g. Saarland), increased oxidation by ozone and high concentrations of ozone and air pollutants in dry seasons that can also affect plant growth (Île-de-France, Saarland), risks on pasture lands (PACA), even threats to reindeer husbandry (Lappi – the rest of Finland expects mixed or overall slightly positive effects of climate change).

Biodiversity threats are also more and more emphasised (Antwerp, Brussels, most French regions and half of Spanish regions including Canary Islands, Lower Saxony, Emilia Romagna, Liguria, Aosta Valley…); more broadly, biodiversity displacement and change, migration of alien species, combined with other phenomena such as tropicalisation, might have more mixed impacts (Bavaria, North Rhine Westphalia, Saxony, Thuringia, Friuli Veneto Giulia, Piedmont, Murcia, Poland…). Other expected changes whose effects have yet to be further assessed include changes in seasonal rhythms, modification of flowering cycles (e.g. Centre-Val de Loire), potentially longer and more productive agricultural seasons as well as timber production expected to increase but more vulnerable to the extreme weather events (Aosta Valley), extension of the growing period and vegetation cycles (eastern Slovakia, Poland).

3.4. Conclusions

Within the limitations and the caveats indicated in previous sections, this mapping provides some valuable insights. While many of the challenges encountered here are present to some extent in all or most of the regions, they do not always appear among the main risks and threats highlighted by the referenced documents. In that sense, what is not mentioned for a given region and application domain can be as interesting as what is mentioned. It is not based on robust and universally agreed metrics and indicators in the way an equivalent mapping on mitigation issues could be, but it incorporates some perspective from (mainly public) actors on how they perceive the importance and urgency of those challenges within their respective regional contexts. This, in turn, informs strategic priorities for regional

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authorities and, directly or indirectly, the speed and level at which demand for climate services is likely to develop at those scales in a foreseeable future.

Another interesting perspective is given by taking the angle of application domains and types of risks. While stakeholders and, in particular, public procurers may be aware to a degree of the main climate risks affecting their own regions, seeing which other regions across Europe also view similar risks as priorities can enable new connections and create opportunities to exchange knowledge and open questions. Such connections, which are quite often not very intuitive in geographic terms, can allow clusters of regions to shape demand that is both more consistently formulated and possibly richer and more comprehensive, while also exploring how generically similar challenges can call either for similar or for quite different approaches and combinations of solutions, depending on each regional context.

This is also a way to help individual users that are confronted to specific needs in positioning those needs more clearly within, or in connection with the landscape of climate adaptation and resilience challenges in their regions (and in other regions with comparable challenges). It shall facilitate the aggregation of specific user needs at organisation or community levels, while ensuring that the way aggregated demand is formulated, and sets of solutions are identified and co-designed in dialogue with the climate service market, will then contribute more effectively to addressing priority adaptation and resilience challenges at regional level, better integrating systemic interactions and interdependencies between those challenges.

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4. Sourcing and analysis of EO-based CS in PROTECT's application domains

4.1. Background and context

As previously discussed at length in *D1.1 Updated database of EU existing and upcoming climate services classified with relevant taxonomy,* aimed to source and analyse the European market of CS in the five selected application domains. The aim is to produce comprehensive state of the art of CS supply by mapping 200 providers and services through 4 main parameters:

- Technology Readiness Level (TRL):
    - Operational technologies and solutions (>TRL7).
    - Solutions at a low technology maturity level (TRL5 and 6) with high prospects of being commercialised in the medium term (4 years).
    - Solutions at a very low maturity level (<TRL 4) presenting important technological barriers that could be lifted in the medium term with R&D investments.
- Type of CS (taxonomy)
- Technology used
- Application domains they apply to

The CS mapping has been divided in two stages as it follows:

The first stage has been conducted between the 27th of October – 15th of December 2022 and its main focus was on desk research. Final results of this stage are presented later in the deliverable.

Due to uncertainties regarding the accuracy of the technical details from the desk research in order to feed the community of procurers with market information (T2.3), prepare the ground for State-Of-TheArt (SOTA) analysis (T3.2) and support the fine-tuning of a first list of providers to invite to the OMC (T3.3), the consortium has decided to conduct a second stage of the mapping.

The second stage has been conducted between 13th of February – 20th of March 2023 and its main focus was on consultations and direct contact of the providers identified in the first stage, in order to verify the state of the CS services identified in the first stage. The final results of this stage are presented in this deliverable.

The objective of this overview is on the one hand to provide to the public authorities' community a snapshot of the EU market of the CS selected in the 5 application domains, and on the other hand, to identify CS with a TRL up to 6 which could be a good fit for the future PCP process.

4.2. Methodology

4.2.1. Climate services mapping

As mentioned below, three distinct methodologies were used to source and analyse CS, technologies, and suppliers on the market with in five main application domains:

- **Desk Research** is a type of research that is based on the material published in reports and similar documents that are available in public libraries, websites, data obtained from surveys already carried out, etc.

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- **Survey Research** is the collection of information from a sample of individuals through their responses to questions.
- **Consultation** is a one-to-one meeting between two parties with the scope of getting more accurate information.

The following subsections will provide further details on how the techniques have been applied.

4.2.2. Desk research

Aerospace Valley had selected a consultant from TerraWatch Space company who has prior experience mapping EO-based CS providers and detailed understanding of the EO industry. The desk research process conducted by the consultant was similar to the process mentioned in D1.1, but focused on identifying relevant CS providers with appropriate offerings relevant to this project:

- Identification: This involved the identification of the list of relevant climate service providers operating in the five application domains, extracted from both the internally maintained database of TerraWatch Space as well as sourced from ESA Phi Lab portfolio, ESA BIC Networks, Space Climate Observatory among others.
- Analysis: The second step involved conducting a high-level analysis of the service offering of the selected providers, to make sure only those with a specific focus on climate are selected for the data collection phase with the Survey Research as described in the next section.

4.2.3. Survey

In the first stage of the mapping, the following steps were taken in the survey research procedure carried out by the AV, by the consultant, and by the PROTECT consortium partners as described in the D1.1:

1. Creation: This step has been based on the main 4 parameters:

- TRL level :
  - Operational technologies and solutions (>TRL7).
  - Solutions at a low technology maturity level (TRL5 and 6) with high prospects of being commercialised in the medium term (4 years).
  - Solutions at a very low maturity level (<TRL 4) presenting important technological barriers that could be lifted in the medium term with R&D investments.
- Type of CS (taxonomy)
- Technology used
- Application domains they apply to

As mentioned in *D1.1 Updated database of EU existing and upcoming climate services classified with relevant taxonomy*, EU Survey is the instrument that has been used to present the survey during the distribution phase. Back then, the poll went through several revisions and was evaluated by all consortium members before it was made public. TRLs have been assigned to solutions based on application areas, CS (taxonomy) type, data and technology employed.

After consultations with the consortium regarding the type of information needed for the next tasks through this survey, it has been decided to include also the city-related information which will be used in order to display the CS in the future e-catalogue. At the same time, some of the questions have not been treated in this deliverable because they constitute a base for the upcoming Orientation Papers. The survey's structure and content can be seen in Annex 3: Survey for mapping EO-based climate services.

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4.3. Dissemination

In the first stage of the mapping, the dissemination actions were undertaken between 27th of October and 15th of December 2022. In the second stage case, the dissemination actions took place between the 13th of February and the 20th of March 2023.

Even though the KPIs of the identification of 200 CS providers have been already met in the first stage of the mapping, AV together with TerraWatch Space had the goal of gathering 200 CS which could be involved in the PROTECT project.

In this stage, AV had two different strategies for the dissemination of the survey:

- **The "top-down" approach** which has been used for the first stage of the mapping as well. This approach was mainly starting with contacting the big space stakeholders across European Union, the ESA BICs Network and space tech accelerators/clusters in order to reach out to as many providers as possible. A list of all the multipliers which have been contacted can be seen in Annex 4: List of multipliers that supported the dissemination for the survey.
- **The "bottom-up" approach** which in the first stage of the mapping has been used mainly by TerraWatch Space. In the frame of the second stage, AV has supported TerraWatch Space in this action due to the initially short time-frame of the expected outcomes. Therefore, the providers identified through the desk research in the first stage of the mapping have been contacted via email or LinkedIn in order to introduce them to the PROTECT project. The information was disseminated via the AV website, emails, and sharing with the AV and PROTECT partners network, as well as via social media profiles, particularly LinkedIn. Whenever necessary, AV has given assistance to providers in filling out the survey. For a better monitoring of the dissemination, a central database of prospective providers contacted throughout dissemination has been constructed and is reported in Annex 5: List of providers to whom the survey was disseminated.

Due to the support of various multipliers or due to the desk research which has focused as well on identifying suitable providers which were already a part of other very well-known projects or initiatives, PROTECT project identified a total of 55 providers this way and it can be observed below:

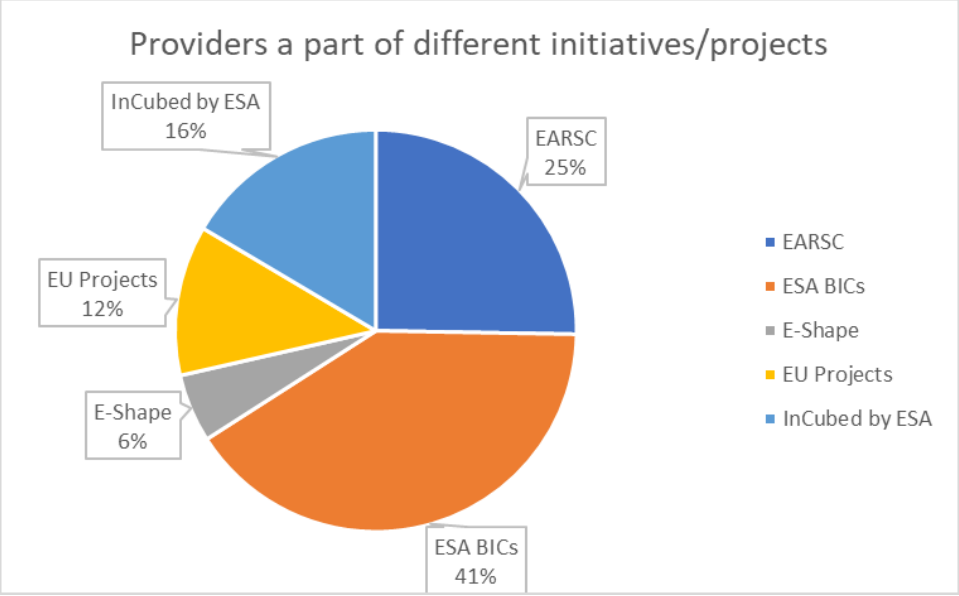

Figure 1: Analysis of the projects/ initiatives providers participate in

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4.4. Consultations

Considering that in the first stage of the mapping, the consultations were used only for verifying assumptions and gather further information about the technicalities of the CS, in the second stage of the mapping the consultations were a bit different.

AV and TerraWatch Space had used the consultations as a complementary methodology to the dissemination. These consultations were needed to provide an overview and guidelines regarding the objectives and the expectations of PROTECT. A total of at least 100 consultations took place through LinkedIn, email and teleconferences, between the 13h of February and the 20th of March 2023, resulting in the addition of 30-40 CS to the mapping.

4.5. Results

- Total Number of contributions through Survey: 143
- Total Number of CS collected through Survey: 167 (from 115 companies/organisations)
- Number of CS sustainable for PROTECT: 164
- Number of CS collected through Survey first stage: 80
- Number of CS collected through Survey second stage: 87
- Number of Countries of Origination of the CS: 17

The following section highlights the expected outcomes of the mapping. A complete mapping of the climate service providers is provided in Annex 6: Climate Services mapping . This Annex will be delivered separately to the European Commission due to the sensitive information regarding the technical aspects of the CS. This has been decided due to the following reasons:

1. Deliverable D1.2 is a public document, and it might give the opportunity of the CS providers' competitors to have an insight of the technical details.
2. No formal consent of publishing these types of information in a public way has currently been asked from the providers.
3. Due to highly sensitive information, in the Annex will be mentioned only the names of the providers and the country.

Data collected from CS providers through the survey models were analysed based on the three criteria:

1. Whether the CS was a commercial service offering with sufficient efforts invested into its development
2. Whether the CS fit the requirements of the scope of the project
3. Whether the identified CS continued to remain in operation with serving customers

Responses from each CS provider were verified to make sure the details they had provided were valid by checking the company websites or other means, following which the suitability for each CS has been defined.

4.5.1. Type of Enterprises Analysed

The EU SME definition rules have been used to reach a high granularity level of analysis and to be able to correlate it with TRL levels to assess the potential time to market of CS assessed.

1. **Micro Enterprises** are small businesses employing less than 10 employees;
2. **Small Enterprises** are businesses employing between 10 and 49 employees;
3. **Medium-sized Enterprises** are businesses employing between 50 and 249 employees;
4. **Large Enterprises** are businesses employing more than 250 employees;
5. **Public Organizations** are owned and operated by the government, as well as being funded through the government in the form of taxes;
6. **Others** included private universities and other research organisations.

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4.5.2. TRLs Analysed

The following table provides the definition for the TRLs (between 1 and 9) used to analyse and classify the mapped climate services.

TRL	Definition
1	Preliminary algorithmic stage. Publication of research results.
2	Individual algorithms or functions are prototyped.
3	Prototype of the main functionalities of the integrated system.
4	Alpha version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software development life-cycle; that implements the main functionality of the software and by which preliminary verification and validation activities are archived.
5	Beta version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software life-cycle, that implements the complete functionality of the software and by which preliminary verification and validation activities are archived.
6	Ready for use in an operational or production context, including user support, as a building block or a tool.
7	Demonstrator. Building block and tailored generic software product qualified for a particular purpose.
8	System qualified and ready to be applied in an operational environment.
9	Has been applied in the execution of an operational environment

Table 1: Definition for the technology readiness levels

4.5.3. Types of Technologies by Climate Services

When talking about CS mapping, the main focus of PROTECT project has been EO-based services in the five application domains. CS which show synergies between EO and other technologies have been included, as long as the primary technology used was the EO one. The analyzed types of technologies are:

- Satellites are objects which has been sent into space in order to collect information.
- Drones are robotic aircrafts that are controlled remotely by a pilot or by an onboard computer.
- Aircrafts are vehicles (such as an airplane or balloon) for traveling through the air.

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- Ground sensors IoT are devices that can detect external information (humidity, temperature, soil content etc.), replacing it with a signal that humans and machines can distinguish. • Artificial Intelligence (AI)/ Machine Learning (ML) is the capability of a computer system to mimic human functions such as learning and problem-solving; through AI, a computer system uses maths and logic to simulate the reasoning that people use to learn from new information and decisions

- Others is the sum of other types of technologies and data used in complementarity with EO (ex: In-situ, High Altitude Platform Station (HAPS), citizen observations, crowd sourcing).

4.5.4. Climate Services by country

Of the 167 climate services analysed, France (61), Germany (24) and Netherlands (24) made up over half of the mapping, while Spain (16), Italy (9) and Luxembourg (9) also had a substantial share of the overall distribution. CS providers also originated from other countries within the EU including from Belgium (4), Finland (4), Czech Republic (4) and Austria (3). Within the mapping, there were 2 CS providers from Ireland and Portugal and one each from Lithuania, Hungary, Greece, Latvia and Slovenia.

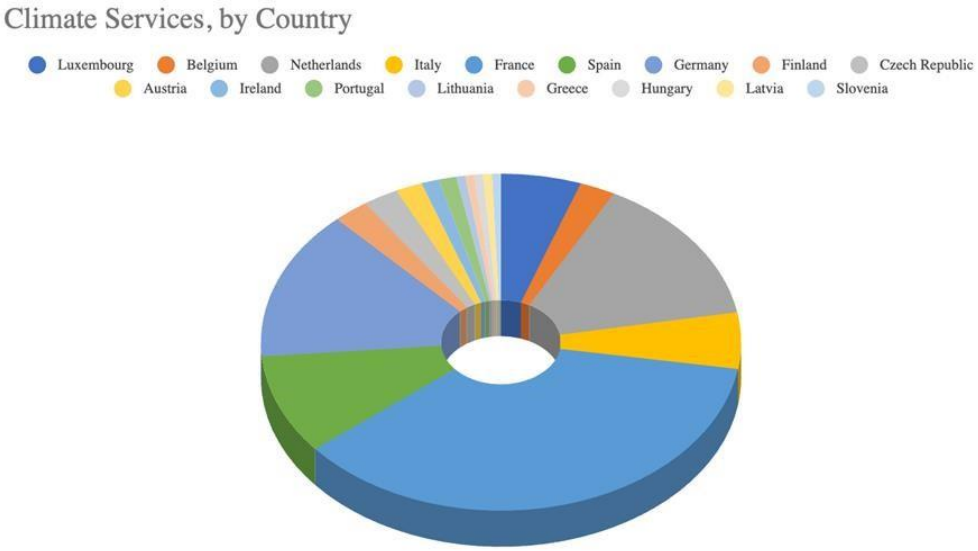

Figure 2: Climate services by country

As a comparison between the two stages of the mapping, it has been noted an increase in the number among the countries providing CS from 12 to 17 (Finland, Ireland, Lithuania, Slovenia and Greece). At the same time, the number of CS per country increased as showed below:

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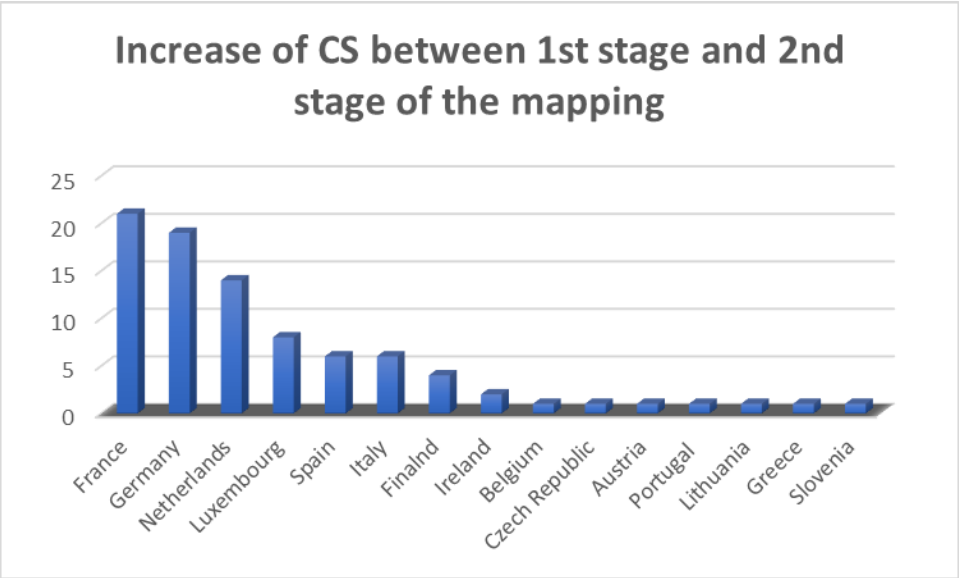

Figure 3: Increase of cs per country between 1st stage and 2nd stage of the mapping

4.5.5. Climate Services by type of enterprises

About one-third of the overall CS providers were identified as Small Enterprises, while almost a half of them were marked as Micro Enterprises. About 26 providers belonged to the categories of Large Enterprises and Medium-Sized Enterprises, while the rest were identified as Public Organisations or belonged to other categories of organisations such as research institutes and non-profits.

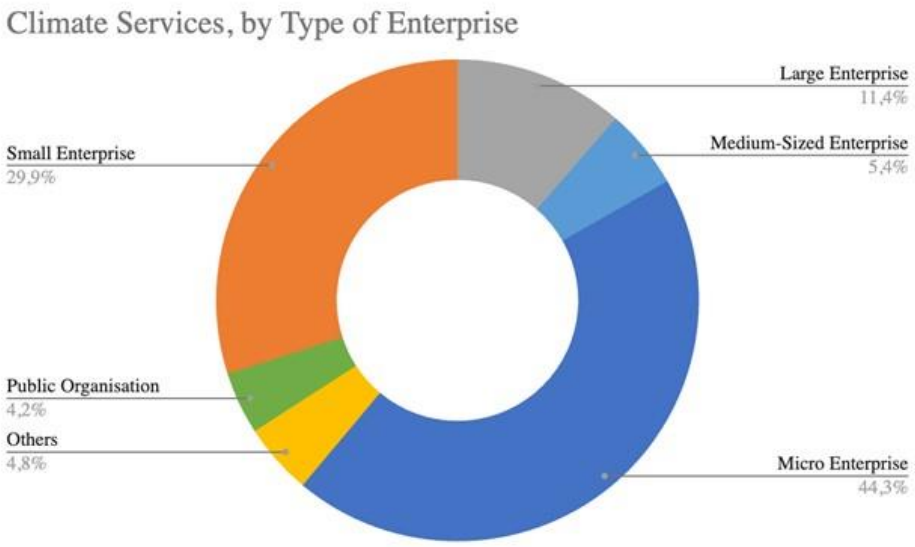

Figure 4: Climate services by type of enterprise

4.5.6. Climate Services by Application Domain

Within the mapping of CS providers classified by their application domain, it was found that the

'*Agriculture, forestry and other land use*' category had the highest share taking up over half of the overall share, while those operating in the application domain of '*Sustainable urban communities*' was

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the second highest making up about 20 percent of the mapping. The remaining three application domains of '*Energy and utilities'*, '*Civil security and protection*' and *'Marine and coastal environment'* had an almost equal number of CS providers, totalling up to 20, 20 and 18 respectively.

In the disseminated survey, the "Civil security and protection" application domain was referred to as "Security and civil protection", and this is reflected in showcasing results of the survey below. This, however, does not affect other tasks.

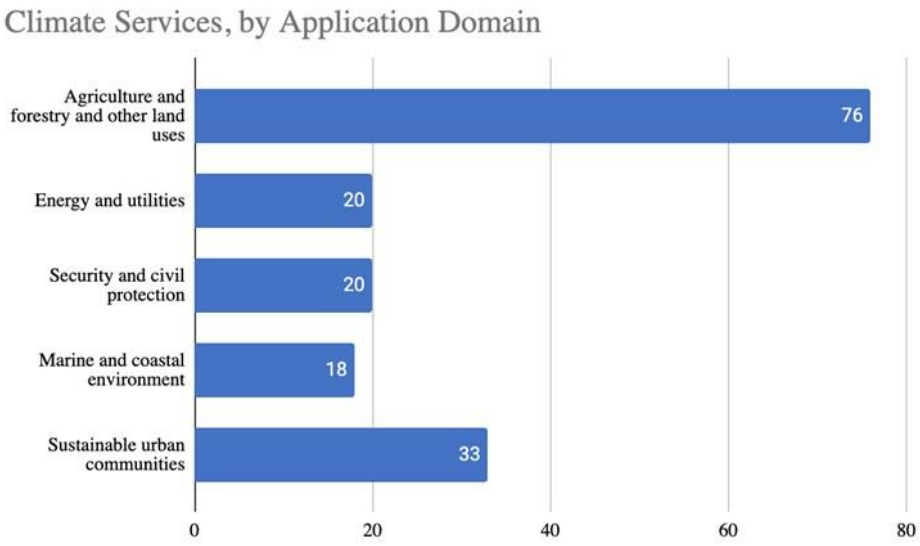

Figure 5: Climate services by application domain

Even though the dominant application domains remain the same since the first stage of the mapping, in the figure below it can be noticed an increase in the number of CS for the remaining application domains:

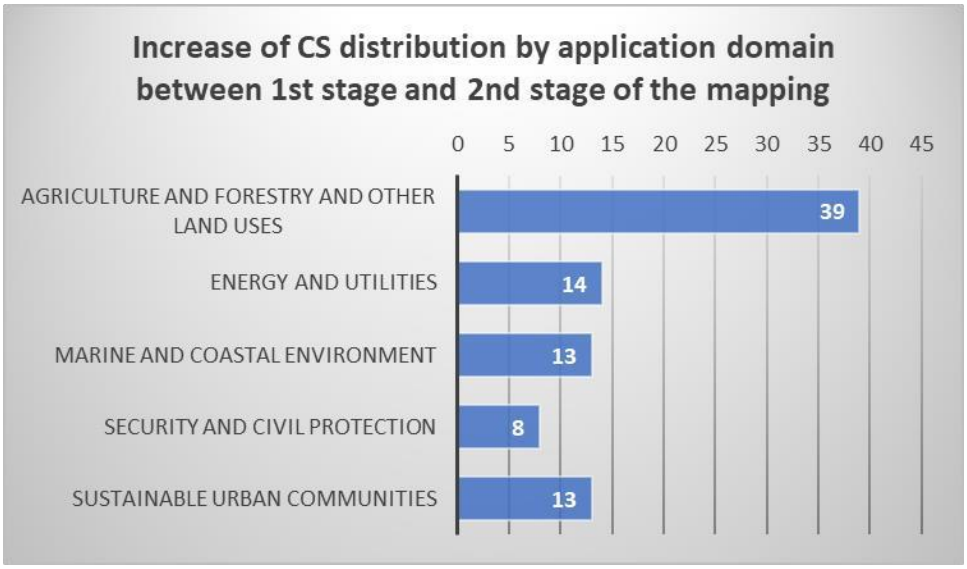

Figure 6: Increase of climate service per application domain between 1st stage and 2nd stage of the mapping

4.5.7. Climate Services by TRL

CS with TRLs of 8 and 9 had the highest count in the mapping with over 50 percent of the total followed by those with TRLs between 5 and 7. Those with "low" TRLs between 1 and 4 amounted to 28, making

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them the lowest share of the mapped CS providers. One reason for the presence of CS providers with high TRL could be due to the growing demand from commercial customers across all five application domains.

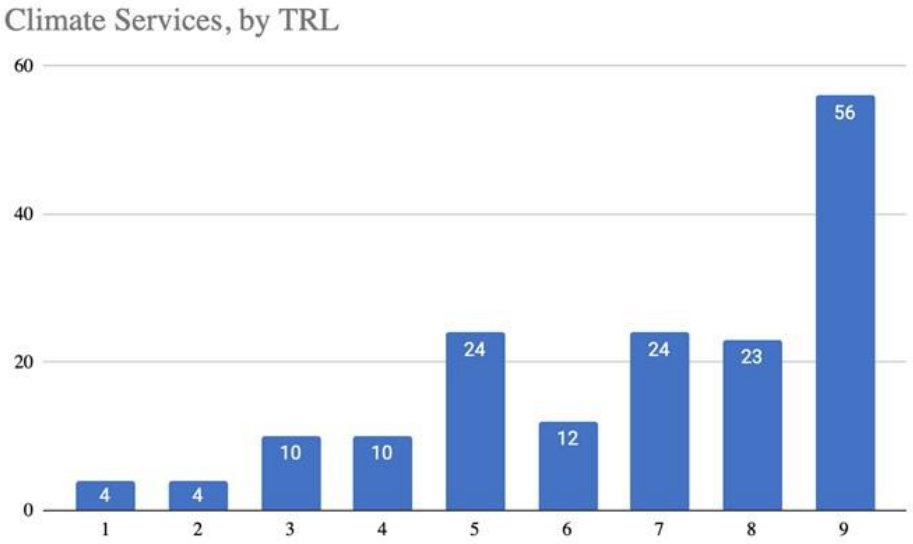

Figure 7: Climate services by TRL level

Due to more support received in the dissemination of the second stage of the mapping, PROTECT has been able to reach out to more CS with low TRL than in the previous stage. Therefore, as a result it has been noticed in the range of TRL 1-9 an increased which almost doubled, if not more, in some case. A representative figure of the increase can be seen below:

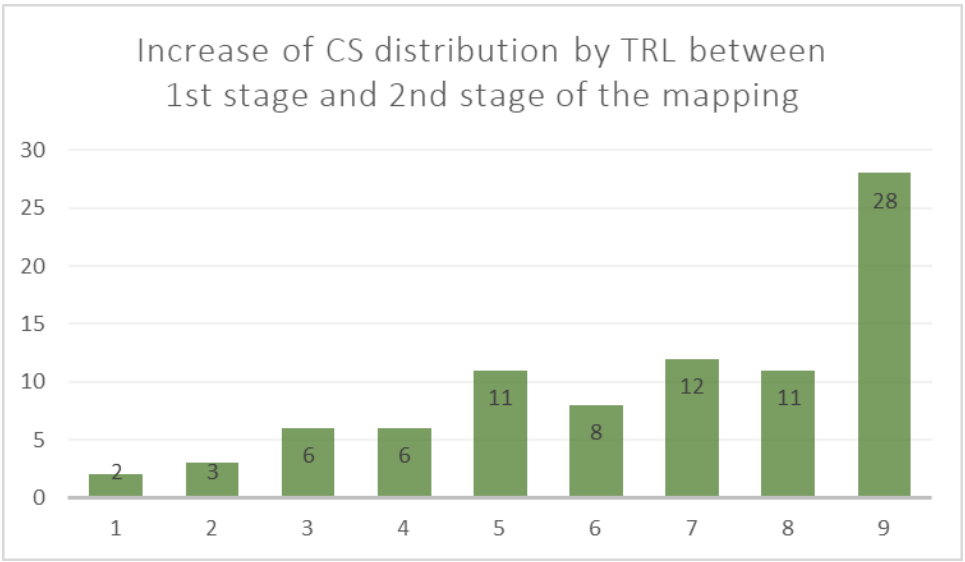

Figure 8: Increase of climate services per TRL between 1st stage and 2nd stage of the mapping

4.5.8. Climate Services by Technology Used

1. Over 1 in 3 of climate services used artificial intelligence as one of their core technologies.
2. Nearly 80% of the climate services identified and analysed used a source of data from satellites as a fundamental part of their applications.

3. Over 75% of the services analysed utilised data from the Sentinel missions and/or made use of the one of the Copernicus Services to derive their insights

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4.5.9. Analysis of the Geographical Distribution of the Climate Services, by Application Domain

France, Germany, Netherlands, Italy and Spain have the highest share of climate services in the 'Agriculture, forestry and other land use' domain. This is potentially a result of the internal demand for such services as well as the maturity of the agricultural and forestry sectors within these countries. Being the application domain with the highest share of CS mapped in this exercise, CS in the 'Agriculture, forestry and other land use' were also identified in Member States such as Austria, Czech Republic, Finland, Greece, Ireland, Latvia, Lithuania and Portugal.

CS from the 'Sustainable urban communities' were also almost equally spread across various Member States, while 'Security and civil protection' and 'Sustainable urban communities" 'Energy and utilities' were identified in at least 5 Member States.

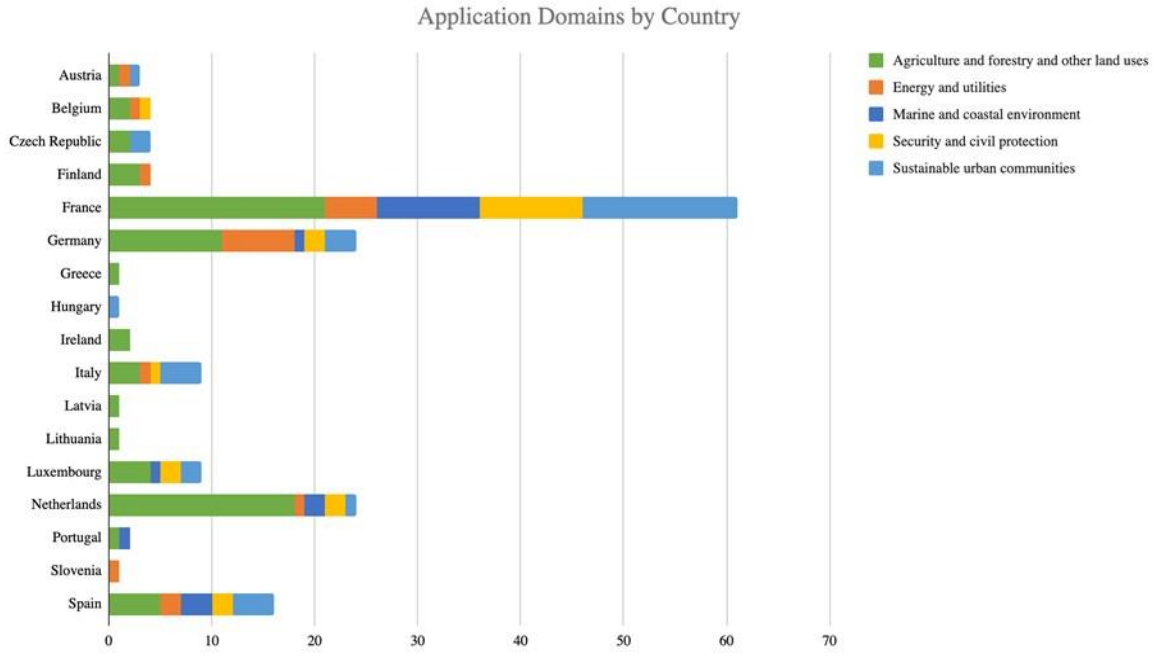

Figure 9: Geographical distribution of the cs by application domain

4.5.10. Analysis of the Geographical Distribution of the Climate Services, by TRL

The chart below presents the distribution of CS across low TRL between 1 and 4 (in green), mid-TRL including 5 and 6 (in amber) and high TRLs between 7 and 9 (in blue), across the selected countries. Some countries, such as Austria, France, Germany, Netherlands, Portugal and Spain have an equal share of low TRL and mid-TRL CS, showing the presence of providers with varying maturity of service offerings.

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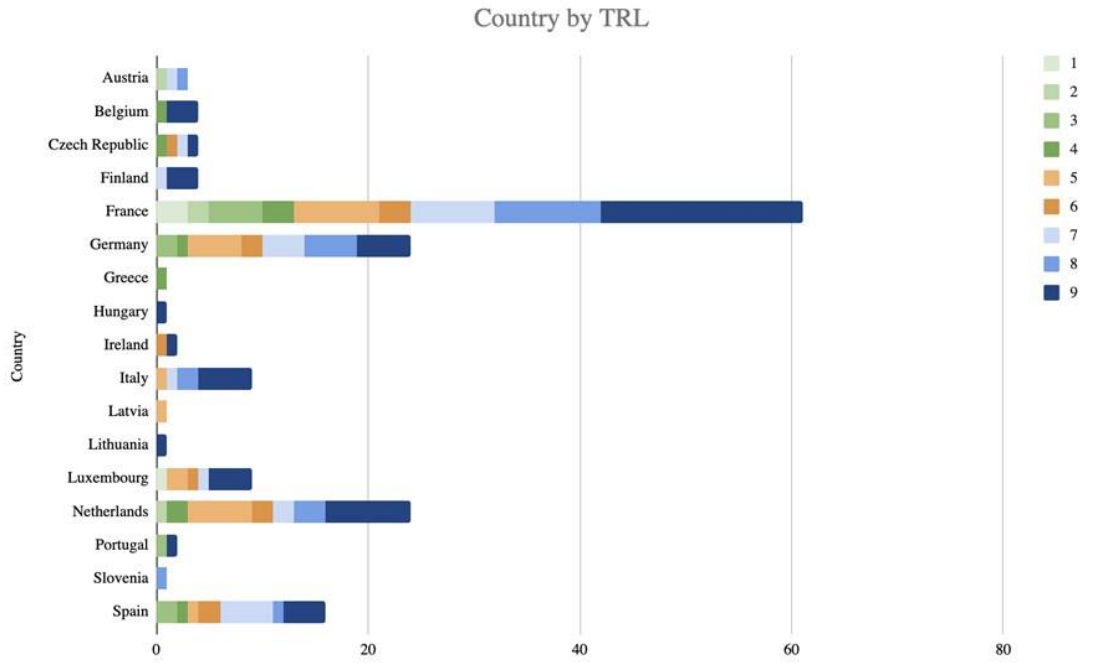

Figure 10: Geographical distribution of the climate service by TRL

4.6. Conclusions and further steps

As it can be seen in the previous chapter, the mapping of the EO-based CS showcased impressive results. Even though, the scope of a PCP is CS with TRL between3 and 8, the mapping had a double goal as it follows:

- To identify as many CS as possible on the market to have a support for the State-of-the-Art analysis which will be conducted in the upcoming activities. This had the solely purpose of being able to provide a good overview to the public authorities in order to finetune their needs. Therefore, one of the focuses were technologies with high TRL.
- To identify CS holding a TRL between 1 to 8 to be able to give an overview to the public authorities regarding what is coming up on the market and to understand how these services could be improved in order to tackle their needs.

At the same time, in the upcoming activities in the frame of the project, one will be to select 4 challenges for further steps. One of the main important criteria in this selection, besides the will of involvement from the public authorities, is to see if there could be solutions which could tackle those needs under development or if they are already in the market, as it will be showcased in the Chapter 7 of this deliverable. Thereby, the importance of having different solutions with various TRLs is crucial in the upcoming steps.

In conclusion, the EO-based CS market is actively expanding, including in the space emerging countries from the Easter Europe throughout several initiatives supported by European Commissions, European Space Agency, but also by national public and private initiatives.

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5. Cross-analysis of climate services and barriers

5.1. Outcomes and conclusions of the cross-analysis

Various types of analyses have been considered in the document so far. They all look at different aspects of climate services and pre-commercial procurement, with the aim of providing clear potential paths and identifying spaces where needs and opportunities would meet and where innovation procurement could bring relevant formats to optimise the match between supply and demand.

At this stage of the project, comparing the outcomes from Tasks 1.1, 1.3 and 1.5 shows broad consistency across scales between priority needs that could be addressed through, or supported by climate services. However, it also confirms that each level – European Union policies, national strategies and plans, main challenges and risks as highlighted in regional documents and surveys, challenges identified by individual procurers – brings up complementary perspectives that reflect different perimeters and levers for action.

Notably, the granularity exhibited in the desktop research on regional challenges is less detailed than some of the needs that emerged in the workshops as a result of direct interaction with stakeholders, e.g., waste fires or climate impacts associated with illegal dumping. While some of the documents that fed into the table of climate challenges per region contain more specific elements than can be found in that table, they generally remain more generic than the above-mentioned needs. Information collected in the T1.3 work to source and analyse climate services, technologies and providers, can be quite precise as some of the providers are focusing on niches, both in terms of technology and of envisioned customer segments, but their potential applications frequently – and understandably – span wider scopes than those needs.

A few showcases have been considered below. They are based on intersections between findings from the various tasks, combined with desktop research and expert knowledge within the consortium.

The following showcases have exemplative, and non-restrictive scope. They serve as examples of how findings from the various tasks can be crossed in the search for potential PCP topics. Examples other than these showcases can be similarly drawn using the findings, as published in the annexes of this document. All of these initial findings are subject to further rounds of validation. At the same time, the showcases in the following pages are the most complete instances coming out of this initial cross-analysis, in terms of looking at whether, based on the available information, the following criteria are met, simultaneously and to the highest possible extent of overlap:

- there is a clear (abstract) climate challenge perceived by a number of potential procurers, as per the analysis in T1.1.2
- there is a (specific) need for a climate service (expressed by a potential procurer in T1.5 or perceived by the consortium, based on their expertise)
- there is room for climate services using EO beyond those available off-the-shelf today and analysed in T1.3 (as otherwise, there would be no need of PCP) and potential providers which may be interested in participating in the PCP
- the above criteria intersect and point to a precise (narrow or broad) topic or intersections of topics prone to be (after further validations) subject of PCP, or -at the very least- to draw potential procurers together around their interest and willingness to discuss the topic.

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5.1.1. Showcase 1: Water scarcity

Showcase title (T1.5)	**Challenges presented by water scarcity**
Domain (cross-analysis)	Energy and utilities (also AFOLU, Sustainable urban communities, Marine and coastal)
Explanation (T1.5)	Droughts can put stress in the provision of water for different uses, such as irrigation, drinking water. This can be felt in terms of water quantity but also of deterioration of the water quality. The depletion of water sources (e.g. less water in the rivers due to lack of melting ice from mountains) may be overcome by connecting the supply and demand of sweet water with data from the whole water cycle with insights - including for sectors that are not always connected (e.g., on sewage system water and the requirements of treated water for farming) and a common language/taxonomy.
Concerned climate challenges (T1.1.2)	Drought and water related issues are threats found in the largest number of regions. More frequent and longer periods of drought are notably expected in Germany (Baden-Württemberg, Brandenburg, Saxony, Thuringia), northern and southern Italy, across the Netherlands and Spain (Andalusia, CastillaMancha, Canarias, Catalonia, Extremadura, Galicia); they are often coupled with water quality and quantity concerns (Brussels region and several Flemish regions, Emilia-Romagna, Lombardy, Apulia, Aragon, most regions across France, Lithuania), causing competition for water between urban and agricultural use (e.g. Sardinia), stress in natural ecosystems, agriculture and forestry (north-western Germany, Balearic Islands), risks of desertification (Basilicata, Calabria, Emilia-Romagna, Sicily). Closely related is the issue of water scarcity and associated threats of lower water recharge and decrease in aquifer levels (e.g. PACA, Apulia, Piedmont, Balearic Islands, the Netherlands), risks on pastures and fodder (Poland) and vegetation areas (e.g. Thuringia). Increased frequency of droughts and of heatwaves is a concern from Lithuania and Poland to Spain, from Belgium to France, Germany Italy, and Greece with consequences both on water quality and quantity and indirectly on other economic sectors, e.g. energy production (water scarcity in highly industrialised regions of western Germany and in Marche, impact of hotter waters in parts of Belgium, France, Italy, Lithuania). More broadly, hydrogeological instability threatens regional water balance and availability, from southern Germany to southern Italy. General hydrogeological instability (western and eastern Italy) can also be combined with more frequent droughts and change in rainfall regime (e.g. Liguria). For coastal regions, coastal water issues include increased saltwater intrusions, risks of salinization and freshwater & drinking water shortages (western France, Emilia-Romagna, Spain, the Netherlands…), decreased water quality (Lithuania, Tuscany, bathing water quality in the Netherlands), stress on the aquatic ecology notably due to high water temperatures, sea acidification (northern Germany, Canarias, Galicia, Murcia with reduced capacity of carbon storage), toxic algae (Catalonia, Italian lakes)."

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Possible scopes (cross-analysis)	- need for finer management of scarce water resources across levels of quality as much as between competing uses (incl. effects on energy production, on agriculture, on aquatic ecology) - competition between urban, agricultural and other use of water - need for quicker and more agile access to shared data to inform consistent decision-making across user segments
Relevant EU legislation (T1.1.1)	The EU Water Framework Directive 2000 (WFD) is arguably the most important, far-reaching, water legislation ever to emerge from the EU. It was transposed into law in EU Member States by the end of 2003. In addition to chemical water quality targets, ecological objectives have been set for each water body. A key aim of the WFD is for all water bodies to achieve 'good ecological and chemical status'. The original target for achieving good status was 2015, but further deadlines have been set for 2021 and 2027.
Showcase title (T1.5)	**Challenges presented by water scarcity**
Companies offering EO-based CS in similar domains (T1.3)	EOMAP, FutureWater, InSitu-Systems, MEOSS, Nelen & Schuurmans, Research Institute of Water and Environmental Engineering (IIAMA), Arpae SIMC Emilia-Romagna, BlackShore, constellr GmbH, Foundation for Climate Research, MURMURATION, TERRANIS, VisioTerra, vorteX.io, Water Insight
Possible topics for PCP (cross-analysis)	**Finer management of scarce water resources across levels of quality as much as between competing uses (e.g. in mixed urban / agricultural areas)**

Table 2: Water scarcity showcase

5.1.2. Showcase 2: Supporting the transition towards green energy

Showcase title (cross-analysis)	**Supporting the transition towards green energy**
Domain (cross-analysis)	Energy and utilities (also: Sustainable urban communities, Marine and coastal, Civil security and protection)
Explanation (crossanalysis)	Europe is aiming at leading the way towards renewables for the purposes of both increased sustainability and geopolitical independence. Many climate services exist and more can be developed around renewable energy (solar, wind and others). As energy storage is still a critical point to maximise the energy efficiency of renewables, EO data can be extremely valuable in forecasting energy peaks, as well as more broadly, for planning and monitoring purposes.

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Concerned climate challenges (T1.1.2)	Several challenges are widely shared across Europe. Increased frequency of droughts and of heatwaves is a concern from Lithuania and Poland to Spain, from Belgium to France, Germany, Italy and Greece, with consequences both on water quality and quantity and indirectly on other economic sectors, e.g. energy production (water scarcity in highly industrialised regions of western Germany and Marche, impact of hotter waters in parts of Belgium, France, Italy, Lithuania). More broadly, hydrogeological instability threatens regional water balance and availability, from southern Germany to southern Italy. The multiplication of extreme events – flooding, either extreme rainfall or sea level rise, threatens to disrupt energy production in Germany, Lithuania, Poland; frost is mentioned as a disrupting factor in some Polish regions, but also in Tuscany (affecting water provision), as can be tree falls resulting from storms e.g. in Finland. Increase in other more specific risks ranges from water pollution, landfill flooding and fires (Lithuania) to peak flood discharges (northern Germany) or consequences of ocean acidification on infrastructures (western France). Systemic risks such as coupled issues on water availability or quality and energy production are amplified in densely populated areas such as the Berlin and Paris regions. Cascading effects are expected as energy demand rises (e.g. during heatwaves, in Italy but also in less hot countries such as the Netherlands or Slovakia), water reserves are put under growing strain, and the effects of suboptimal insulation and energy efficiency of buildings across Europe are aggravated by climate change.
Possible scopes (cross-analysis)	- need for more integrated forecasting capabilities (including between different energy sources) - need for a more agile system for water-based energy due to draughts
Relevant EU legislation (T1.1.1)	**2030 climate & energy framework** The 2030 framework proposes new targets and measures to make the EU's economy and energy system more competitive, secure and sustainable. It includes targets for reducing greenhouse gas emissions and increasing use of renewable energies and proposes a new governance system and performance indicators. **Renewable energy targets** The energy sector is responsible for more than 75% of the EU's greenhouse gas emissions. Increasing the share of renewable energy across the different sectors of the economy is therefore a key building block to reach the EU's energy and climate objectives: (I) cutting greenhouse gas emissions by at least 55% (compared to 1990) by 2030 and (II) becoming a climate neutral continent by 2050 **The Clean energy for all Europeans package** The Clean energy for all rules will bring considerable benefits for consumers, the environment, and for the economy. By coordinating these changes at EU level, the legislation also underlines EU leadership in tackling global warming and makes an important contribution to the EU's long-term strategy of achieving carbon neutrality (net-zero emissions) by 2050.

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Companies offering EO-based CS in similar domains (T1.3)	SARWind EOMAP Foundation for Climate Research geopredict HD Rain Hydroclimat SUEZ EAU France – Center Rivages Pro Tech Ticinum Aerospace Srl
Possible topics for PCP (cross-analysis)	**Integrating data to address coupled issues on water availability or quality (incl. temperature) and energy production (focus on clean energy?)**

Table 3: Supporting the transition towards green energy showcase

5.1.3. Showcase 3: Waste management and related storage issues

Showcase title (T1.5)	**Waste management and related storage issues**
Domain (cross-analysis)	Sustainable urban communities (also: Energy and utilities, Civil security and protection, AFOLU)
Explanation (crossanalysis)	Due to their complexity and importance, waste management systems could seek at tacking issues coming from climate and non-climate factors. Thermal monitoring and predicting waste fire can help avoid the spontaneous ignition in waste storages. Certain conditions (like the level of humidity, air temperature, hight of the pile of waste, etc.) are conducive to spontaneous waste ignition. This causes bad air quality and if not controlled on time it could cause material and/or human damage and loses.

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Concerned climate challenges (T1.1.2)	Waste management appears little in the mapping, partly because associated climate challenges may pertain more to mitigation than to adaptation. However, waste management and storage issues should be coupled with adaptation challenges as some of the latter are likely to aggravate or complexify the impact of such issues; conversely, waste value chains are sufficiently important to be taken into account in adaptation plans. Taking this two-way perspective can allow to surface gaps and needs for (combinations / developments of) innovative products and services. Cities are affected by many the challenges linked to other application domains, often at more acute levels due to the concentration of population and economic activities. Classic examples are heatwaves, who are generally expected to rise in frequency, duration and intensity, and urban heat islands mostly in meridional regions. Heatwaves are mentioned in almost every region of the mapping. Being characterised in comparison with average local temperatures, they remain globally hotter in more southern regions; however, they also come on top of climate challenges in regions that are generally cooler (from the northeast of France to the southern half of Finland) as local populations are much less used to dealing with abnormally high temperatures, both biologically and in terms of housing design, insulation and equipment. In many cases, e.g. in Spain and in part of Italy, heatwaves and degradation of air quality are coupled and amplify each other's negative impact on human health. Droughts, water quality and quantity concerns appear wherever they also affect energy and utilities: they have been a major challenge in the southern half of Europe for many years, where they are often linked with water scarcity including drinking water, but they are now also concerning countries such as Belgium, the Netherlands, the south of Germany. Swelling and shrinking soils are also an increasingly common consequence of hydrogeological instability, for instance in southern France and in Italy: they primarily affect agriculture and land use but also create vulnerability for building foundations in urban areas, and sometimes landslide risks. (possibly less relevant here) One other frequently recurring challenge is the growing risk of flooding in urban areas, coming from heavy rainfall or from river overflow, marine submersion or sea level rise, often aggravated by soil degradation, itself amplified by droughts. Almost every province in Belgium and in the Netherlands is affected, as are some Greek, Italian, Polish and inland French regions.
Companies offering EO-based CS in similar domains (T1.3)	Disaitek
Possible topics for PCP (cross-analysis)	**Predicting and preventing waste fires**

Table 4: Waste management and related storage issues showcase

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5.1.4. Showcase 4: Flooding in coastal areas

Showcase title (cross-analysis)	**Flooding in coastal areas**
Domain (cross-analysis)	Marine and coastal environment (also: Sustainable urban communities, Civil security and protection, Energy and utilities)
Explanation (crossanalysis)	Floods pose risks to the cities in coastal areas leading to potential disaster. More insights into the phenomena are needed, overcoming data gaps and combining data in a timely manner. Reliable mapping of flooded areas is needed for planning, preventing, predicting and for post event intervention, as well as for cooperation towards a positive end result.
Concerned climate challenges (T1.1.2)	With the exception of Slovakia, all countries addressed by this mapping have coastal regions. Flooding risks are mentioned in almost all coastal regions, associated with sea level rise (French Mediterranean coastline, Liguria, Andalucia, Balears, but also northern Germany and Poland, Asturias, Friuli Venezia Giulia), marine submersion (North and Baltic seas, Cantabria, Liguria, Provence Côte d'Azur), extreme rainfall, thunderstorms and gales (Poland, Cantabria), combinations of those factors (e.g. northern Germany, northern Spain, Netherlands, Lithuania, French Atlantic coast), general hydrogeological instability (western and eastern Italy) combined with more frequent droughts and change in rainfall regime (e.g. Liguria). It may be relevant also to feed in elements related to flooding from other application domains: energy and utilities, sustainable urban communities, AFOLU. The multiplication of extreme events – flooding, either extreme rainfall or sea level rise, threatens to disrupt energy production in Germany, Lithuania, Poland. Increase in other more specific risks ranges from water pollution, landfill flooding and fires (Lithuania) to peak flood discharges (northern Germany) or consequences of ocean acidification on infrastructures (western France). One other frequently recurring challenge is the growing risk of flooding in urban areas, coming from heavy rainfall or from river overflow, marine submersion or sea level rise, often aggravated by soil degradation, itself amplified by droughts. Almost every province in Belgium and in the Netherlands is affected, as are some Italian, Polish and inland French regions. More frequent or intense extreme events shall also impact land use, often in combinations (floodings, droughts, heavy rains, storms) from southwestern (Emilia Romagna, Lombardy, Aragon) to north-eastern Europe (Lithuania, Poland). Flooding risk will increase notably in agricultural areas (e.g. Åland, Lappi, Île-de-France, Thuringia, Sardinia, Veneto, Canary Islands…), amplified by destructive storms (e.g. east of France), more intense rainfall episodes (Friuli-Venezia Giulia, Tuscany) and globally increased precipitation (e.g. northern Slovakia), often causing faster surface run-off, less soil hydration, erosion (e.g. Poland).

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Possible scopes (cross-analysis)	- water quality and quantity - flood mapping (incl. post-event analysis)
Relevant EU legislation (T1.1.1)	Directive for Maritime Spatial Planning Marine Strategy Framework Directive (indirectly)
Companies offering EO-based CS in similar domains (T1.3)	CLS, DIGINOVE, GECOSistema, GMV, Hydroclimat PREDICT SERVICES, SUEZ EAU France – Center Rivages Pro Tech, Thales Services Numériques, WASDI sarl
Possible topics for PCP (cross-analysis)	**Integrating real time analytics and mapping on a relevant range of risks: flooding, sea level rise, marine submersion, extreme rainfall and storms/gales coupled data between above risks and infrastructural risks.** **(multiplication of extreme events etc.)**

Table 5: Flooding in coastal areas showcase

5.1.5. Showcase 5: Illegal waste dumping

Showcase title (T1.5)	Illegal waste dumping
Domain (cross-analysis)	Civil security and protection (also: Sustainable urban communities, Marine and coastal environment)
Explanation (crossanalysis)	When waste is dumped illegally (in water or elsewhere), it may be difficult for law enforcement agencies to trace the responsible of criminal behaviour. It is also not possible to inform and prevent the flow of the waste cross-borders. There is no data which can be used in criminal proceedings as proof.
Concerned climate challenges (T1.1.2)	Many of the challenges pertaining to civil security and protection stem from other application domains. (Also see comments above on Waste management and storage.) Increased frequency of droughts and of heatwaves is a concern from Lithuania and Poland to Spain, from Belgium to France, Germany, Italy and Greece, with consequences both on water quality and quantity and indirectly on other economic sectors, e.g. energy production (water scarcity in highly industrialised regions of western Germany and in Marche, impact of hotter waters in parts of Belgium, France, Italy, Lithuania). The multiplication of extreme events – flooding, either extreme rainfall or sea level rise, threatens to disrupt energy production in Germany, Lithuania, Poland; frost is mentioned as a disrupting factor in some Polish regions, but also in Tuscany (affecting water provision), as can be tree falls resulting from storms e.g. in Finland. Increase in other more specific risks ranges from water pollution, landfill flooding and fires (Lithuania) to peak flood discharges (northern Germany) or consequences of ocean acidification on infrastructures (western France).

Table 6: Illegal waste dumping showcase

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5.1.6. Showcase 6: Building an restoring climate-resilient infrastructure

Showcase title (cross-T1.5)	**Building and restoring climate-resilient infrastructure**
Domain (cross-analysis)	Civil security and protection (also: Sustainable urban communities, Energy and utilities)
Explanation (crossanalysis)	Infrastructure is, ideally, built to last. Nonetheless, the current best practices do not always take into consideration the latest and future evolution of the climate crisis, thus not accounting for the increased number and frequency of extreme events when building or restructuring resilient infrastructure.
Concerned climate challenges (T1.1.2)	Some challenges are very widely shared across countries and regions, notably those related to flooding risks and a range of others, separately or in combination: heavy rainfall, storms and hailstorms, sea level rise, groundwater rise, river overflow, marine submersion, landslides, mudflows, avalanches… affecting land use, urbanised areas and built environments, critical infrastructures, energy and water production, transportation and mobility; to severe droughts and acute water scarcity; to forest fires; to increasingly intense, frequent and longer heatwaves, which can also trigger cascading effects and disrupt key value chains; to swelling and shrinking soils.
Possible scopes (cross-analysis)	- planning of new resilient infrastructure - making existing infrastructure more climate-change-resilient - monitoring of multiple (integrated) risks
Relevant EU legislation (T1.1.1)	The European Green Deal aims to transform Europe into a greener, more sustainable, and climate-resilient continent by promoting the efficient use of resources, reducing greenhouse gas emissions, protecting the environment, and fostering sustainable innovation and economic development, while ensuring a just and inclusive transition for all stakeholders.
Companies offering EO-based CS in similar domains (T1.3)	SARWind EOMAP Foundation for Climate Research geopredict HD Rain Hydroclimat Ticinum Aerospace Srl CLS DIGINOVE GECOSistema GMV PREDICT SERVICES SUEZ EAU France – Centre Rivages Pro Tech Thales Services Numériques (WASDI sarl)

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Possible topics for PCP (cross-analysis)	Integrating data to anticipate and react to cascading effects as energy demand rises. Also as above: integrating real time analytics and mapping on a relevant range of risks: flooding, sea level rise, marine submersion, extreme rainfall and storms/gales, coupled data between above risks and infrastructural risks.

Table 7: Building and restoring climate-resilient infrastructure showcase

5.1.7. Showcase 7: Detecting climate vulnerability in agriculture and planning resilience

Showcase title (1.5)	**Detecting climate vulnerability in agriculture and planning resilience**
Domain (cross-analysis)	AFOLU
Explanation (crossanalysis)	The climate crisis is putting more and more and more pressure on agricultural species. Information and forecasting of the environmental conditions, combined with other data can be a valuable input for mitigation actions.

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Concerned climate challenges (T1.1.2)	Climate change will hit productivity. Agricultural yield may decrease in very different contexts (Centre-Val de Loire, Saarland, Berlin, Hessen, Mecklenburg-Vorpommern, Emilia Romagna, Liguria, Marche, Sardinia, Tuscany, the Netherlands, Castilla-Leon, Murcia…), linked with higher evaporation (southern Spain), shorter crop maturation due to higher average temperatures (Galicia), higher risk of loss of nutritional value (Sardinia). Plants and animals may reach their adaptation limits (e.g. Hessen, Saxony). Impacts on agriculture will often depend on species. A risk on fruit and vine already observed with increasing frequency is linked to frost risk during flowering, which can trigger earlier harvests (e.g. PACA). Other challenges come from thinner snow cover (alpine Italian regions), higher volatility of snow cover and vegetation periods (Lithuania), negative consequences on permafrost (Trentino Alto Adige). Generally, there are fears of more inadequacy of precipitation cycles to seasonal agricultural needs (e.g. in Poland). Forests shall suffer as well with degradation risks (e.g. PACA, Saarland), high vulnerability of species to droughts and parasites (Wallonia, Grand Est, Île-deFrance, Pays de la Loire); in contrast, forests are expected to extend further in Lappi, which may provoke albedo reduction. Higher risks of infectious diseases, pests, fungi, also invasive species are foreseen everywhere, linked or not to the migration of species (e.g. Grand Est, Galicia, Bavaria, North Rhine-Westphalia, Saxony, Thuringia, northern Italy, regions across Spain – Aragon, Asturias, Canary Islands, Extremadura, Navarra, Valencian Community); longer wet periods and modified climate patterns will probably increase diseases, mosquitoes and pests (the Netherlands). Other negative developments concern eutrophication in the summer (e.g. Saarland), increased oxidation by ozone and high concentrations of ozone and air pollutants in dry seasons that can also affect plant growth (Île-de-France, Saarland), risks on pasture lands (PACA), even threats to reindeer husbandry (Lappi – the rest of Finland expects mixed or overall slightly positive effects of climate change). Biodiversity threats are also more and more emphasised (Antwerp, Brussels, most French regions and half of Spanish regions including Canary Islands, Lower Saxony, Emilia Romagna, Liguria, Aosta Valley…); more broadly, biodiversity displacement and change, migration of alien species, combined with other phenomena such as tropicalisation, might have more mixed impacts (Bavaria, North Rhine-Westphalia, Saxony, Thuringia, Friuli Veneto Giulia, Piedmont, Murcia, Poland…). Other expected changes whose effects have yet to be further assessed include changes in seasonal rhythms, modification of flowering cycles (e.g. Centre-Val de Loire), potentially longer and more productive agricultural seasons as well as timber production expected to increase but more vulnerable to the extreme weather events (Aosta Valley), extension of the growing period and vegetation cycles (eastern Slovakia, Poland).
Possible scopes (cross-analysis)	- decrease of agricultural yield - plant and animals hitting their adaptation limits, lower tolerance to pests and parasites - thinner snow cover - biodiversity risks
Relevant EU legislation (T1.1.1)	A Farm to Fork strategy New CAP (2023-2027)

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Companies offering EO-based CS in similar domains (T1.3)	Will depend on narrower / more clearly defined scope
Possible topics for PCP (cross-analysis)	**Increased coordination on data for land use between sectoral public bodies, EO and climate/weather services and stakeholders/users across scales**

The above showcases are only exemplative. However, they attest to several possible, and complementary, paths to progress towards relevant PCP preparations by the end of the project.

5.2. Way forward

The specific needs mentioned above will be further explored with the procurers who pushed them forward. Consortium members shall investigate whether organisations in their respective networks (in particular regional and metropolitan or municipal authorities) could share a common interest for the same needs and could be willing to engage in a dialogue to understand similarities and differences in their respective place-based perception of these needs, with the aim to increase the critical mass of procurers interested and their aggregated capacity to reach out to the market.

The needs will be linked with broader patterns and clusters of regions identified through the mapping of regional challenges. This may help approach more proactively public procurers across regions that share common priority climate challenges related to the above-mentioned needs, while potentially widening the scope of CS applications around those needs, which could help engage further stakeholders once interested procurers are found and consolidate demand, increasing the benefit for procuring organisations and visibility for providers.

The work to consolidate demand and benefits for both the procurer and the provider sides will be further informed and refined by going back in greater detail to the relevant regional plans and surveys and EU, national and regional regulations. This shall be crossed checked with findings on national procurement legal frameworks, providing guidance to procurers interested in pursuing work towards possible PCPs while navigating more efficiently and effectively the possibilities of, or barriers to joint cross-border procurements linking the countries of the identified procurers.

Conversely, we shall seek to identify other granular needs in thematic areas where the analysis of climate challenges and risks across regions, complemented by findings from other sections of this document, may suggest strong potential added value for PCPs to unlock climate service development and use. The same steps as above shall be used to confirm or infirm the capacity to gather viable groups of public procurers to work on such possible PCPs.

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Annexes

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Annex 1: Mapping of EU Policies relevant for the Pre-Commercial Procurement of EO-based end user services

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
The strategy will contribute to achieving the EU's biodiversity objectives as well as greenhouse gas emission reduction target of at least 55% by 2030 and climate neutrality by 2050.	Communication	Agriculture, forestry, and other land use	The EU Biodiversity Strategy for 2030 sets outs a pledge to plant at least 3 billion additional trees by 2030 in full respect of ecological principles with a long-term planning and monitoring.	2021	High	In this context, Earth Observation offers key status and temporal trend data on forest cover and composition, forest biomass and carbon stock, forest condition, forest disturbances, deforestation and forest degradation in Europe and the rest of the world. Additional key products EO offers in this domain support emergency management with respect to natural hazards affecting EU forests
The Farm to Fork Strategy is at the heart of the Green Deal. It addresses comprehensively the challenges of sustainable food systems and recognises the inextricable links between healthy people, healthy societies and a healthy planet.	Communication	Agriculture, forestry, and other land use	Farm to Fork 2030 targets * Increase agriculture, fisheries and aquaculture GHG reduction target to over 50%	2020 (May)	High	High relevance for the project: Agriculture Earth Observation enhances agriculture In agriculture, Earth Observation imagery and data analytics have revolutionised food production and supply chain management

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
The strategy is also central to the Commission's agenda to achieve the United Nations' Sustainable Development Goals (SDGs). All citizens and operators across value chains, in the EU and elsewhere, should benefit from a just transition, especially in the aftermath of the COVID-19 pandemic and the economic downturn. A shift to a sustainable food system can bring environmental, health and social benefits, offer economic gains and ensure that the recovery from the crisis puts us onto a sustainable path. Ensuring a sustainable livelihood for primary producers, who still lag behind in terms of income, is essential for the success of the recovery and the transition.			* 25% of agriculture land to be used for organic farming * 50% reduction in sales of antimicrobials used for farmed animals * 50% reduction of the use and risk of pesticides 20% reduction in the use of fertilisers			with the development of precision farming.

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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Launched in 1962, the EU's common agricultural policy (CAP) is a partnership between agriculture and society, and between Europe and its farmers. support farmers and improve agricultural productivity, ensuring a stable supply of affordable food; safeguard European Union farmers to make a reasonable living; help tackle climate change and the sustainable management of natural resources; maintain rural areas and landscapes across the EU; keep the rural economy alive by promoting jobs in farming, agri-food industries and associated sectors.	Other	Agriculture, forestry, and other land use	10 different 'general' objectives, and then related country-specific objectives	2021 (December last update)	High	Several areas of the Common Agricultural Policy (CAP) benefit from Copernicus data and services. These span from monitoring of agricultural market, the CAP control systems, environmental monitoring and farmer level support. Specific examples include improvement in environmental performance of farms, the Land Parcel Identification System, on-demand EO data, along with high resolution data to monitor agricultural practices, integration with modelling for yield forecasting and identifying exceptional circumstances which can support both environmental compliance measures and on-farm agronomic practices
The EAFRD aims to improve competitiveness for farming, protect the environment and the countryside, improve the quality of life and diversification of the rural economy, and support locally based	Other	Agriculture, forestry, and other land use	The EAFRD priorities are in turn broken down into 18 specific focus areas. In their programmes, countries set out targets relating to their chosen priorities	2021	High	EO solutions are well established and extremely useful when it comes to the classification and monitoring of crops. Through the computation of vegetation indices from satellite

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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approaches to rural development. ach EU country will design a CAP Strategic Plan, combining funding for income support, rural development, and market measures. When designing their strategic plans, EU countries will contribute to the nine specific objectives through a toolbox of broad policy measures provided by the Commission, which can be shaped around national needs and capabilities.			and focus areas, as well as a strategy for meeting their targets.			data, the health, growth rate and projected yields of crops can be understood which can help decision making, and in particular, help to optimise resource utilisation, such as fertilizer application, irrigation or weed spraying. - Programme duration: 2021-2027
In 2012 EIP AGRI was launched to contribute to the EU's strategy for smart, sustainable and inclusive growth. EIP-AGRI brings together innovation actors (farmers, advisers, researchers, businesses, NGOs etc.) in agriculture. Its aim is to strengthen research and innovation to foster competitive and sustainable farming.	Other	Agriculture, forestry, and other land use	The aim of EIP-AGRI in the new programming period shall be to stimulate innovation and improve the exchange of knowledge and contribute to achieving the specific objectives of the new European CAP Network.	2012	High	Companies are using satellites to try to shed light on the sometimes tightly held secrets in the commodity trading world, from corn to barley to oranges. EO can help monitor the regional and international and trade of many agricultural commodities

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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The European Green Deal presents a roadmap for making the EU's economy sustainable by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all. The European Green Deal aims to boost the efficient use of resources by moving to a clean, circular economy and stop climate change, revert biodiversity loss and cut pollution. It outlines investments needed and financing tools available and explains how to ensure a just and inclusive transition. The European Green Deal covers all sectors of the economy, notably transport, energy, agriculture, buildings, and industries such as steel, cement, ICT, textiles, and chemicals. The European Green Deal provides an action plan, to boost the efficient use of resources by moving to a clean, circular economy and to restore biodiversity and cut pollution.	Other	All	* Reducing net greenhouse gas emissions by at least 55% by 2030 No net emissions of greenhouse gases by 2050	2020 (year of approval of the set of policies)	High	Earth observation is a key tool for the implementation of the European Green Deal, because it provides unique information, invisible down to earth. Timeline: https://drive.google.com/file/d/1FWuBXyo6WwWfZfPEM6lUYa3UA92CF3qL/view?usp=sharing

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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It embraces various policy areas (compare timeline to the right)						
The European climate law sets a binding Union climate target of a reduction of net greenhouse gas emissions (emissions after deduction of removals) by at least 55% by 2030 compared to 1990. It aims to put climate at the heart of all EU policy making, ensuring that future regulations support the emissionscutting aims. This law also requires the creation of an independent expert body to advise on climate policies, and to develop a mechanism to calculate the total emissions the EU can produce from 2030-2050.	Regulation	All	The Climate Law includes: * an objective for the Union to reach climate neutrality by 2050 * an ambitious 2030 climate target of at least 55% reduction of net emissions of greenhouse gases as compared to 1990, with clarity on the contribution of emission reductions and removals * recognition of the need to enhance the EU's carbon sink through a more ambitious LULUCF regulation, for which the Commission made a proposal in July 2021 a process for setting a 2040 climate target,	2021	Medium	Clear climate target that could possibly be monitored through, among others, EO technologies

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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			taking into account an indicative greenhouse gas budget for 2030-2050 to be published by the Commission * a commitment to negative emissions after 2050			
The European Green Deal Investment Plan, also known as the Sustainable Europe Investment Plan, aims to contribute to financing a sustainable transition, while supporting the regions and communities most exposed to its impact. By combining legislative and non-legislative initiatives, the plan addresses three aspects: 1) mobilising funding worth at least €1 trillion from the EU budget and other public and private sources over the next decade; 2) putting sustainability at the heart of investment decisions across all sectors; and 3) providing support to public administrations and project	Communication	All	The plan will mobilise 25% of the EU budget for climate financing and invest in environmental objectives through several EU programmes.	2021	High	Very relevant for the project, as there is push for investments in the sustainability field

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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promoters to create a robust pipeline of sustainable projects						
The Arctic's fragile environment is a key indicator of climate change, which requires specific mitigation and adaptation actions as agreed with the global agreement at the COP-21 held in Paris in December 2015. To this end, the integrated EU Arctic policy has identified three priority areas: climate change and safeguarding the Arctic environment, sustainable development in and around the Arctic, and international cooperation on arctic issues.	Communication	Civil security and protection	One of the goals: contribute to improving maritime SAR, making greater use of EU satellite systems and cooperation between coastguards, in particular the Arctic Coast Guard Forum. Also, promote research and collection of satellite data on the long-term implications of thawing permafrost, to assess the potential impacts on communities, health and sustainable development and develop mitigation measures.	2021	High	Earth Observation -and Copernicus in particular- addresses these policy areas with a dedicated Arctic Ocean monitoring and forecasting centres that maintain long-time series of changes in the Arctic. Additionally, EO data for cryosphere monitoring, climate records on sea-ice and glaciers, and maritime surveillance services for Arctic fishing and shipping purposes also help shape action to safeguard the Arctic and polar areas.
The Safe System includes demands for safer and improved infrastructure • Properly maintained roads are	Other	Civil security and protection	The introduction of a first set of eight key performance indicators (KPIs) will enable a more targeted analysis of	2021	Medium	Remote sensing can be applied to map overground road networks, including a classification of road type and surface material. At the

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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believed to reduce the probability of road traffic accidents			Member States' performances and identify deficiencies. The 8 KPI: DISTRACTION, DISTRACTION TARGET, VEHICLE SAFETY, VEHICLE SAFETY TARGET, INFRASTRUCTURE, INFRASTRUCTURE TARGET, POSTCRASH CARE, POST-CRASH CARE TARGET			same time, characteristics associated with ageing of specific materials can be detected, revealing or even predicting damages in the surface. Radar is applied to detect anomalies such as ground movement and change detection, e.g. displacement of bridges or rails can be performed based on historical data, enabling action before failure.
The EU emissions trading system (ETS)156 sets a fixed amount (cap) of allowable GHG emissions for EU electricity generation and industry. It covers around 45 % of the EU's greenhouse gas emissions. Economic operators are required to acquire an EU emission allowance (EUA) for each tonne of CO2e that they emit. Allowances can be acquired at	Other	Energy and ulilities	The overall volume of greenhouse gases that can be emitted by power plants, industry factories and aviation sector covered by the EU Emissions Trading System (EU ETS) is limited by a 'cap' on the number of emission allowances. Within the cap, companies receive or buy emission	2021 (phase 4)	High	Satellite data could play a role in monitoring, reporting and verifying compliance with emissions trading systems also known as cap and trade. To date, satellite data has not been widely applied to the task of supporting those systems. This raises interest for pre-commercial procurement.

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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auction and traded between operators. This would lead to cost-effective emissions reductions, as operators would reduce emissions where this has lower costs than the market price of allowances. Emissions covered under the ETS must be reduced by 43 % by 2030, compared with the levels in 2005, the year when the EU ETS was set up. The Carbon Capture and Storage (CCS) Directive sets the legal framework for carbon capture and storage in the EU.			allowances, which they can trade as needed. The cap decreases every year, ensuring that total emissions fall			
On 27 February 2018 the Council formally approved the reform of the EU emissions trading system (ETS) for the period after 2020. The revised ETS directive is a significant step towards the EU reaching its target of cutting greenhouse gas emissions by at least 40% by 2030, as agreed under the EU's 2030 climate and energy framework and fulfilling its	Other	Energy and ulilities	The long- term objective for 2050, agreed by the European Council in 2009, is an 80-95 % reduction in GHG emissions compared to 1990. In the medium term, the EU aims to reduce GHG emissions by 20 % by 2020, and by 40 % by 2030.	2020	High	Satellite data could play a role in monitoring, reporting and verifying compliance with emissions trading systems also known as cap and trade. To date, satellite data has not been widely applied to the task of supporting those systems. This raises interest for pre-commercial procurement.

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commitments under the Paris Agreement.						
The Fit for 55 package is a set of proposals to revise and update EU legislation and to put in place new initiatives with the aim of ensuring that EU policies are in line with the climate goals agreed by the Council and the European Parliament. The package of proposals aims at providing a coherent and balanced framework for reaching the EU's climate objectives, which: • ensures a just and socially fair transition • maintains and strengthens innovation and competitiveness of EU industry while ensuring a level playing field vis-à-vis third country economic operators underpins the EU's position as leading the way in the global fight against climate change	Other	Energy and ulilities	Reduce greenhouse gas emissions by 55% by 2030.	Proposed: July 2021 (the plans may become law in 2022)	Medium	Relevant field, but no specific call for EO pre-commercial procurement

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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In July 2016, the European Commission presented a proposal for a regulation to limit post-2020 national emissions of greenhouse gases (GHG) in sectors not covered by the EU emissions trading system (ETS). These include transport, buildings and agriculture. The proposed regulation would be the successor of the Effort Sharing Decision that sets annual national GHG emission limits for the period 2013-2020. The proposed regulation is part of the EU's efforts to reduce its GHG emissions by at least 40% below 1990 levels by 2030. This target was set by the European Council in October 2014, and also constitutes the EU's international commitment under the 2015 Paris Agreement on climate change.	Regulation	Energy and ulilities	The maximum limit that can be used annually in 20212030 is set at 2% of each country's emissions in 2005, except for Ireland, Luxembourg and Iceland that are allowed up to a limit of 4%. The total maximum amount for all eleven eligible countries is limited to 107 million tonnes.	2018	High	Advancements in satellite technology and imaging can support national emission reporting exercises under the Paris Agreement. It is possible to monitor the geologic storage of carbon dioxide using multicomponent SAR and optical interferometry. Interest for precommercial procurement of tools that can conduct this type of monitoring.
The 2030 framework proposes new targets and measures to make the EU's economy and energy system more	Other	Energy and ulilities	The 2030 Climate and Energy Framework set three key targets for the year 2030:	2020 (These targets have since been revised	High	Advancements in satellite technology and imaging can support national emission

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
competitive, secure and sustainable. It includes targets for reducing greenhouse gas emissions and increasing use of renewable energies, and proposes a new governance system and performance indicators.			- at least 40% cuts in greenhouse gas emissions from 1990 levels - at least 27% share for renewable energy at least 27% improvement in energy efficiency	again under the European Green Deal published in December 2019, the European Commission's 'Roadmap' for moving to a climate neutral economy by 2050)		reporting exercises under the Paris Agreement
In November 2017, the European Commission proposed a revision of Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles (the Clean Vehicles Directive), after an evaluation showed that the directive had yielded limited results. The proposed directive aims to promote clean mobility solutions in public procurement	Directive	Energy and ulilities	The national targets are defined as a minimum percentage of clean vehicles in the aggregate public procurement across a Member State. This means, Member States have full flexibility in how they distribute the effort across different contracting authorities and contracting entities.	2021	Medium	Literature shows that satellite data can be used to track vehicles emissions. For example, cities and states may soon have a new high tech tool in the battle against automotive air pollution, thanks to NASA satellite technology originally developed to track global greenhouse gases and the Earth's protective ozone layer. This raises interest in pre-commercial procurement for this type of technology. Nevertheless,

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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tenders and thereby raise the demand for, and the further deployment of, clean vehicles. The proposal provides a definition for clean light-duty vehicles based on a combined CO2 and air-pollutant emissions threshold; for heavy-duty vehicles, it gives a definition based on alternative fuels. The proposal is in line with the European Commission's energy union package, which plans action on the further decarbonisation of road transport in line with the 2030 climate and energy targets						this type of monitoring requires a very high-res solution (both temporal and spatial). I do not see it feasible in the short-mid term.
On 30 November 2016, the European Commission presented a proposal for a revised Energy Efficiency Directive, as part of the Clean Energy package. This aims to adapt and align EU energy legislation with the 2030 energy and climate goals and contribute towards delivering the energy union strategy. The	Directive	Energy and ulilities	* The revised directive introduces a binding EU 30 % energy efficiency target, to be achieved by means of indicative national energy efficiency contributions * The 1.5% annual energy savings	2018	Medium	EO has a growing importance in the field of energy saving. An example are the upcoming Sentinel missions, which are part of the Copernicus programme, that will aid in identifying potential sites for solar or wind power generation.

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
Commission initially proposed a 30 % binding EU energy efficiency target for 2030, to be achieved by means of indicative national targets and the extension beyond 2020 of the energy savings obligation scheme, which currently requires utility companies to help their consumers use 1.5 % less energy each year. The Commission proposal also aims to make the rules on energy metering and billing clearer for consumers. Trialogue negotiations started in February 2018 and resulted in a provisional agreement among the EU Institutions on 19 June 2018.			obligation is extended from 2020 to 2030 and possibly beyond.			
The Directive aims to provide guiding principles on financial support schemes for RES, renewable energy self-consumption, energy communities and district heating. It seeks to enhance mechanisms for cross-border cooperation, simplify	Directive	Energy and ulilities	The revised directive sets higher GHG emissions savings criteria for biofuels and bioliquids. New installations, from 2021, will need to reduce GHG emissions by 65 % (compared to equivalent	2018	High	High potential for the project Because it can provide high temporal and spatial resolution, remote sensing technology is already making available quality-controlled geodata and information. This now makes it possible to support the routine and standardized monitoring of

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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administrative processes, strengthen the sustainability and greenhouse gas emissions-savings criteria for biofuels, and mainstream the use of RES in the transport sector and in the heating and cooling sector.			fossil fuels), in order to be defined as a RES. Meanwhile, biomass for electricity, heating and cooling will need to reduce GHG emissions by 70 % from 2021, rising to 80 % reductions from 2026.			biomass resources over large areas. This raises interest in precommercial procurement for this type of technology.
This Communication proposes an EU strategy to make offshore renewable energy a core component of Europe's energy system by 2050. This requires taking a diversified approach tailored to different situations. Therefore the strategy presents a general enabling framework, addressing barriers and challenges common to all offshore technologies and sea basins but also sets out specific policy solutions adapted to the different state of development of technologies and regional contexts.	Communication	Energy and ulilities	The strategy sets targets for an installed capacity of at least 60 GW of offshore wind and 1 GW of ocean energy by 2030, and 300 GW and 40 GW, respectively, by 2050.	The strategy sets targets for an installed capacity of at least 60 GW of offshore wind and 1 GW of ocean energy by 2030, and 300 GW and 40 GW, respectively, by 2050.	High	High potential for the project: The problem is there is hardly any offshore wind data available to industry. Furthermore, existing data record mainly extreme wind events. And to gather in-situ data from a single offshore meteorological mast can cost a million Euros a year, and provides data only for a small area. But using satellites enables a shift from a local to a global view. The sophisticated Synthetic Aperture Radar (SAR) instruments on board ESA's ERS-2 and Envisat can provide high-resolution 100-metre data on the wind field, and a decade-long data archive is available. There is therefore

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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						incentive for pre-commercial procurement, to get the right technology to built offshore energy stations.
The Clean energy for all Europeans package consists of 8 new laws. Following political agreement by the EU Council and the European Parliament (finalised in May 2019) and the entry into force of the different EU rules, EU countries have 1-2 years to convert the new directives into national law. The new rules will bring considerable benefits for consumers, the environment, and for the economy. By coordinating these changes at EU level, the legislation also underlines EU leadership in tackling global warming and makes an important contribution to the EU's long-term strategy of achieving carbon neutrality (net-zero emissions) by 2050.	Directive	Energy and ulilities	n/a	2019	Medium	As mentioned above, there are several possible applications for precommercial procurement of EO technology in the filed of energy

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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Sector integration means linking the various energy carriers - electricity, heat, cold, gas, solid and liquid fuels - with each other and with the end-use sectors, such as buildings, transport or industry. Linking sectors will allow the optimisation of the energy system as a whole, rather than decarbonising and making separate efficiency gains in each sector independently. The new EU strategy will involve various existing and emerging technologies, processes and business models, such as ICT and digitalisation, smart grids and meters and flexibility markets.	Other	Energy and ulilities	The strategy aims to ensure that the EU fully exploits its head-start and expertise in renewable and smart energy technologies	2020	High	Relevant for PROTECT, since a lot of what EO does for energy can feed into integrating the right sources together for this purpose
This Regulation lays down rules for the timely development and interoperability of trans-European energy networks in order to achieve the energy policy objectives of the Treaty on the Functioning of the	Regulation	Energy and ulilities	Set of guidelines for the timely development and interoperability of energy infrastructure priority corridors and areas that contribute to ensuring climate change mitigation, in	2013	High	Earth Observation is key in reaching energy efficiency and energy saving and the development of new and renewable forms of energy. For this reason, there is a high potential for PROTECT and

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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European Union (TFEU) to ensure the functioning of the internal energy market and security of supply in the Union, to promote energy efficiency and energy saving and the development of new and renewable forms of energy, and to promote the interconnection of energy networks.			particular achieving the EU's 2030 energy and climate targets and overall climate neutrality by 2050.			precommercial procurement in this field.
The EU Industrial Strategy is meant to support the twin transition to a green and digital economy, make EU industry more competitive globally, and enhance Europe's open strategic autonomy. As a primary vehicle of innovation in the various ecosystems, small and medium enterprises (SMEs) need to be borne in mind in all actions under this Strategy. This is reflected in a horizontal manner by increased attention to regulatory burdens for SMEs. New actions will strongly benefit SMEs and start-ups, whether it be from a	Communication	Energy and ulilities	The 2020 Industrial Strategy included a list of actions to support the green and digital transitions of EU industry, many of which have already been adopted or launched.	2020	Medium	No clear link with EO, but there are several fields in which it would be relevant. Such as: energy intensive and renewable energy industries

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strengthened Single Market, reduced supply dependencies or the accelerated green and digital transitions. The Strategy also includes some measures dedicated to SMEs such as on increased resilience, combating late payments, and supporting solvency.						
To pursue this dual ambition of energy gains and economic growth, in 2020 the Commission published the strategy "A Renovation Wave for Europe – Greening our buildings, creating jobs, improving lives" to boost renovation in the EU. It aims to double annual energy renovation rates in the next 10 years. As well as reducing emissions, these renovations will enhance quality of life for people living in and using the buildings, and should create many additional green jobs in the construction sector.	Communication	Energy and ulilities	It aims to double annual energy renovation rates in the next 10 years. As well as reducing emissions, these renovations will enhance quality of life for people living in and using the buildings, and should create many additional green jobs in the construction sector.	2020	Medium	No clear link with EO, but there are several fields in which it would be relevant. Such as: public buildings and infrastructure, decarbonising heating and cooling, and monitoring buildings' energy efficiency.

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The Renovation Wave identifies 3 focus areas: • Tackling energy poverty and worstperforming buildings • Public buildings and social infrastructure • Decarbonising heating and cooling						
REPowerEU is the European Commission's plan to make Europe independent from Russian fossil fuels well before 2030, in light of Russia's invasion of Ukraine. The REPowerEU plan sets out a series of measures to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition, while increasing the resilience of the EU-wide energy system.	Communication	Energy and ulilities	* 2/3 cut in Russian gas consumption by the end of 2022 * Increase the binding 'Energy Efficiency Directive (EED)' target to 13% from 9%. Increase the EU's headline 2030 target for renewables from 40% to 45%	Published: 18-May-2022	Medium	This policy is relevant for PROTECT in at least two ways: first, through the push for more renewables will enable the use of EO for renewables. Secondly, since EO can be used for mapping energy efficiency of buildings.
As part of the REPowerEU plan, this strategy aims to bring online over 320 GW of solar photovoltaic by 2025 (more than doubling compared to	Communication	Energy and ulilities	* 320 GW of solar photovoltaic by 2025 and almost 600 GW by 2030	2022	High	Accessible earth observation data can enhance clean energy projects by enabling monitoring energy capacity and maintenance status at scale. Incorporating satellite-based earth observation

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Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
2020) and almost 600 GW by 2030 . These frontloaded additional capacities displace the consumption of 9 bcm of natural gas annually by 2027.						will help to fast track this by providing advanced insights that can be used for forecast models, information products and other tools to improve decision making – be it at an organisational or policy-making level. Earth Observation can be used for planning on where to deploy single PVs (solar atlas) and solar farms.
The EU Water Framework Directive 2000 (WFD) is arguably the most important, farreaching, water legislation ever to emerge from the EU. It was transposed into law in EU Member States at the end of 2003. In addition to chemical water quality targets, ecological objectives have been set for each water body. A key aim of the WFD is for all water bodies to achieve 'good ecological and chemical status'. The original target for achieving good status was 2015, but further deadlines are set for 2021 and 2027.	Directive	Marine and Coastal environment	In addition to chemical water quality targets, ecological objectives have been set for each water body. A key aim of the WFD is for all water bodies to achieve 'good ecological and chemical status'. The original target for achieving good status was 2015, but further deadlines are set for 2021 and 2027	2014	High	In this context, Earth Observation data from satellite are useful to integrate and coordinate different sources of information for decision-making, as well as to model for forecasting and alerts (these are services built on EOdata, so perfect for PROTECT). For instance, this includes the near real-time detection of pollution from satellite together with ship position from traffic monitoring systems at least for ship-based pollution (the union maritime information and exchange system - SafeSeaNet) and manned or unmanned aerial means from coastal states for verification and identification of polluters

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
The Directive for Maritime Spatial Planning in Europe was adopted to reduce conflicts, encourage investments (blue economy), increase cross-border cooperation and protect the environment.	Directive	Marine and Coastal environment	Objectives: reducing conflicts and creating synergies between different activities encouraging investment through predictability, transparency and legal certainty increasing cross-border cooperation between EU countries to develop renewable energy, allocate shipping lanes, lay pipelines and submarine cables etc protecting the environment by assigning protected areas, calculating impacts on ecosystems and identifying opportunities for multiple uses of space	2014	High	Part of such environmental information is provided by Copernicus through long-time series of ocean products necessary to produce atlas (European Atlas of the Seas). However, there is a need for additional Earth Observation services to identify and monitor manmade activities like shipping lanes, fisheries and aquaculture grounds along with land-sea consistent data and information products for coastal management.
The aim of the European Union's ambitious Marine Strategy Framework Directive is to protect more effectively	Directive	Marine and Coastal environment	The new EU Biodiversity Strategy for 2030 (adopted in May 2020) aims to strengthen the protection of marine ecosystems and to	2017	High	Earth Observation supports a wide range of coastal and marine environment applications such as those on rising sea levels and sea surface temperature, but also with increasing emphasis on the

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
the marine environment across Europe.			restore them to achieve "good environmental status", including through the expansion of protected areas and the establishment of strictly protected areas for habitats and fish stocks recovery			"green" ocean aspects with products addressing coastal ecology, biogeochemistry and pollution/eutrophication. There is therefore a significant opportunity to develop new applications and services that would facilitate the implementation of this directive
The Common Fisheries Policy (CFP) Regulation has defined a set of harmonised provisions to ensure sustainability of fisheries and aquaculture in EU waters and for the EU fleet worldwide	Regulation	Marine and Coastal environment	Goal: to ensure sustainable fisheries and guarantee incomes and stable jobs for fishers.	2013	High	High relevance for PROTECT, as there is large potential for EO services in the field of sustainable fisheries. This includes. In fact, satellite data is already widely used to monitor the marine environment, support maritime safety and help manage fishing activities as well as detecting illegal fishing activities.
The European Climate Pact is an opportunity for people, communities, and organisations to participate in climate action across Europe: • learn about climate change • develop and implement solutions	Other	All	the Pact is part of the European Green Deal and is helping the EU to meet its goal to become climateneutral by 2050.	2019	High	As for the Green Deal, this policy is relevant for the project, as there is push for investments in the sustainability field. In this case, even more so due to the element of citizen engagement.

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
• connect with others and maximise the impact of these solutions As part of the European Green Deal, the Pact aims to become a lively space to share information, debate, and act on the climate crisis, and offer support for a European climate movement to grow and consolidate.						
It strategy aims to support the financing of the transition to a sustainable economy by proposing action in four areas: transition finance, inclusiveness, resilience and contribution of the financial system and global ambition.	Communication	Sustainable urban communities	The strategy includes six sets of actions: (1)Extend the existing sustainable finance toolbox to facilitate access to transition finance (2)Improve the inclusiveness of small and medium-sized enterprises (SMEs), and consumers, by giving them the right tools and incentives to access transition finance.	2021	High	Very relevant for the project, as there is push for investments in the sustainability field

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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			(3)Enhance the resilience of the economic and financial system to sustainability risks (4)Increase the contribution of the financial sector to sustainability (5)Ensure the integrity of the EU financial system and monitor its orderly transition to sustainability (6)Develop international sustainable finance initiatives and standards, and support EU partner countries			
The EU ETS is a cornerstone of the EU's policy to combat climate change and its key tool for reducing greenhouse gas emissions cost-effectively. It is the world's first major carbon market and remains the biggest one.	Directive	Sustainable urban communities	The sectors covered by the EU Emissions Trading System (EU ETS) must reduce their emissions by 43% compared to 2005 levels. To increase the pace of emissions cuts, the overall number of emission allowances will	2021	High	EO pre-commercial procurement is extremely relevant for the monitoring of emissions.

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
			decline at an annual rate of 2.2% from 2021 onwards, compared to 1.74% currently.			
It aims to protect the environment in the European Union (EU) from the adverse effects (such as eutrophication) of urban wastewater. It sets out EU-wide rules for collection, treatment and wastewater discharge. The law also covers wastewater generated by industries such as the agro-food industries (like food-processing and brewing).	Directive	Sustainable urban communities	By 2040 the new rules will (1) save almost EUR 3 billion per year across the Europe, (2) reduce greenhouse gas emissions by over 60% compared to 1990, (3) decrease water pollution by more than 365 thousand tonnes, (4) cut microplastics emissions by 9%	2021	Medium	Satellite imaging has potential for the monitoring of waste water treatment. Therefore there is a link with pre-commercial procurement and PROTECT
The EU Covenant of Mayors for Climate & Energy brings together thousands of local governments voluntarily committed to implementing EU climate and energy objectives. The Covenant of Mayors was launched in 2008 in Europe with the ambition to gather local governments voluntarily committed to achieving and exceeding the EU climate and	Other	Sustainable urban communities	Goals for 2030: Reducing CO2 (and possibly other greenhouse gas) emissions on the territory of our municipalities by at least 40% by 2030, namely through improved energy efficiency and the greater use of renewable energy	2008	High	Adapting to climate change requires data and information from all Earth system components: the atmosphere, the land, the cryosphere and oceans. As an example, in order to adhere to Covenant of Mayors Sustainable Energy and Climate Action Plan (SECAP) commitments, it is imperative to have both reference time series (data demonstrating of changes and trends) and climate change indicators that cover composite or

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Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
energy targets. Not only did the initiative introduce a first-of-its-kind bottom-up approach to energy and climate action, but its success quickly went beyond expectations.			sources; Goal for 2050: Decarbonised territories, thus contributing to keeping average global warming well below 2°C above pre-industrial levels. Universal access to secure, sustainable and affordable energy services for all, thus enhancing quality of life and improving energy security. Grant universal access to secure, sustainable and affordable energy services for all, thus enhancing quality of life and improving energy security.			specific economic sectors impacted by regional and international policies
The Directive on open data and the re-use of public sector information provides common rules for a European market for government-held data. The Directive introduces the concept of high-value datasets.	Directive	All	n/a	2019	Medium	Once fully transposed on the national level, the new rules will: - stimulate the publishing of dynamic data and the uptake of

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Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
Defined as documents, the re-use of high-value datasets is associated with important benefits for the society and economy. They are subject to a separate set of rules ensuring their availability free of charge, in machine readable formats. They are provided via Application Programming Interfaces (APIs) and, where relevant, as a bulk download. The thematic scope of high value datasets is provided in an Annex to the Directive. The thematic categories of high-value datasets, as referred to in Article 13(1) of the Directive, are: 1. geospatial 2. earth observation and environment 3. meteorological 4. statistics companies and company ownership 6. mobility						Application Programme Interfaces (APIs); - limit the exceptions which currently allow public bodies to charge more than the marginal costs of dissemination for the re-use of their data; - enlarge the scope of the Directive to: *Data held by public undertakings, under a specific set of rules. In principle, the Directive will only apply to data which the undertakings make available for re-use. Charges for the re-use of such data can be above marginal costs for dissemination; *Research data resulting from public funding – Member States will be asked to develop policies for open access to publicly funded research data. New rules will also facilitate the re-usability of research data that is already contained in open repositories. - strengthen the transparency requirements for public–private agreements involving public sector information, avoiding exclusive arrangements.

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
The current proposal complements the Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information (Open Data Directive) 6 . This proposal addresses data held by public sector bodies that is subject to rights of others and therefore falls outside the scope of this Directive. The proposal has logical and coherent links with the other initiatives announced in the European strategy for data. It aims at facilitating data sharing including by reinforcing trust in data sharing intermediaries that are expected to be used in the different data spaces. It does not aim to grant, amend or remove the substantial rights on access and use of data. This type of measures is	Other	All	n/a	n/a	Medium	The adoption of this proposal would facilitate the use of data which might lead to the development of additional and more diverse climate services.

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
envisaged for a potential Data Act (2021) 7 .						
A key pillar of the European strategy for data, the Data Governance Act seeks to increase trust in data sharing, strengthen mechanisms to increase data availability and overcome technical obstacles to the reuse of data. The Data Governance Act will also support the set-up and development of common European data spaces in strategic domains, involving both private and public players, in sectors such as health, environment, energy, agriculture, mobility, finance, manufacturing, public administration and skills.	Other	All	n/a	2022 (23 June)	Medium	The initiative aims to make more data available and facilitate data sharing across sectors and EU countries in order to leverage the potential of data for the benefit of European citizens and businesses.
The Taxonomy Regulation was published in the Official Journal of the European Union on 22 June 2020 and entered into force on 12 July 2020. It establishes the basis for the EU taxonomy by setting out 4	Regulation	All	n/a	2020	Medium	The systemic use of the taxonomy could foster the uptake of climate services.

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Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
overarching conditions that an economic activity has to meet in order to qualify as environmentally sustainable. The Taxonomy Regulation establishes six environmental objectives Climate change mitigation Climate change adaptation The sustainable use and protection of water and marine resources The transition to a circular economy Pollution prevention and control The protection and restoration of biodiversity and ecosystems Different means can be required for an activity to make a substantial contribution to each objective.						

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
The EU's transport policy aims to increase mobility, remove major barriers in key areas and fuel growth and employment. Articles 90-100 of the Treaty on the Functioning of the European Union provide the legal bases for the EU's transport policy.	Directives	Sustainable urban communities	The European Commission's Sustainable and Smart Mobility Strategy together with an Action Plan of 82 initiatives, guide the work in the field of EU transport policy for the period 2021-2024. This strategy lays the foundation for how the EU transport system can achieve its green and digital transformation and become more resilient to future crises. The result will be a 90% cut in emissions by 2050, delivered by a smart, competitive, safe, accessible and affordable transport system. The EU has also defined clear goals: the European Commission's current "White Paper on Transport" calls for 30	Common policy started in 1992, but new objectives set regularly	High	Evolving needs have shown that the sector has a need of Earth Observation data for a broad range of applications like topography (digital elevation models), geophysical and soil characteristics for civil engineering related to networks deployment, real-time monitoring and long-time records of known sites affected by ground motion or natural risks and more.

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments/ Opportunities for PROTECT
			percent of road freight transport to be transferred to other modes of transport such as rail or shipping by 2030, rising to more than 50 percent by 2050. With regard to urban and private mobility, the share of “conventionally fuelled” vehicles in city centres is to be halved by 2030 and reduced to the absolute minimum by 2050.			

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Annex 2: Snapshot of Climate challenges in EU regions

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
BELGIUM **Adaptation priorities/fields (climate adapt):** **National level: [b] Biodiversity, [c] Crisis management, [e] Energy, [h] Health, [ic] International cooperation, [r] Research,[t] Transversal issues** **Regional level:[a] Climate adaptive agriculture and food chain, [ce] Climate adaptive and circular economy, [gb] Green blue networks and biodiversity, [h] Health, [ie] Climate adaptive infrastructure and environment, [sp] Spatial planning, [w] Water management**						
Antwerpen	Massive emissions from Port of Antwerp and petrochemical cluster (world no. 2) [e] *Geothermal energy potential [e]*	Massive emissions from Port of Antwerp and petrochemical cluster [e] High emissions from very dense road network and from heating of buildings [h][ie][sp] Untapped potential of residual heat [e]	Massive emissions from Port of Antwerp and petrochemical cluster (second largest in the world) [e] Potential threats on inland shipping [c][ie]	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Higher forest fire risk [c][h][gb] Biodiversity threats [b][gb][h]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	https://www.gouverneurantwerpen.be/sterk-antwerpen/klimaat-en-energie.html

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Brabant Wallon	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	Higher forest fire risk [c][h][gb] High vulnerability of forest species to droughts and parasites [c][gb]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	CPDT Wallonie (incl. https://cpdt.wallonie.be/sites/default/files/pdf/dt2_defi_2.pdf)
BruxellesCapitale	Greater pressure on energy consumption [e][ie]	More frequent heatwaves, heat island effect [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Biodiversity threats [b][gb][h]	Higher flooding risk [c][gb][ie][sp][w]	https://document.environnement.brussels/opac_css/elecfile/Clim_06

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Hainaut	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	Higher forest fire risk [c][h][gb] High vulnerability of forest species to droughts and parasites [c][gb]	Higher flooding risk (incl. groundwater rise in former mining areas) [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	CPDT Wallonie (incl. https://cpdt.wallonie.be/sites/default/files/pdf/dt2_defi_2.pdf)
Liège	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	Higher forest fire risk [c][h][gb] High vulnerability of forest species to droughts and parasites [c][gb]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	CPDT Wallonie (incl. https://cpdt.wallonie.be/sites/default/files/pdf/dt2_defi_2.pdf)

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Limburg	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	https://klimaat.vmm.be/tools/impact
Luxembourg	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	Higher forest fire risk [c][h][gb] High vulnerability of forest species to droughts and parasites [c][gb]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	NBRACER project proposal (currently in GAP phase)

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Namur	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	Higher forest fire risk [c][h][gb] High vulnerability of forest species to droughts and parasites [c][gb]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	CPDT Wallonie (incl. https://cpdt.wallonie.be/sites/default/files/pdf/dt2_defi_2.pdf)
Oost-Vlaanderen	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	-	n/a	Higher water erosion of the fertile arable land in hilly areas [a][gb][ie][w]	Higher flooding risk (rainfall, fluvial) [c][gb][ie][sp][w]	NBRACER project proposal (currently in GAP phase)

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Vlaams-Brabant	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	Higher flooding risk (rainfall, fluvial) [c][gb][ie][sp][w]	https://klimaat.vmm.be/tools/impact
West-Vlaanderen	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	-		More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	Higher flooding risk (rainfall, fluvial, marine), heightened by polder structure under sea level [c][a][gb][ie][sp][w]	NBRACER project proposal (currently in GAP phase)

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
FINLAND **National adaptation priorities/fields (climate adapt): [b] Biodiversity, [c] Buildings and construction, [e] Environmental protection, [l] Land use, [w] Use and management of water resources**						
Åland	-	-	Some flooding risk (limited) [e]	-	Some flooding risk (limited) [e]	https://www.regeringen.ax/miljonatur/klimat
Etelä-Karjala	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Etelä-Pohjanmaa	Risk of disrupted energy production (tree fall…)	-	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production	https://www.stat.fi/tup/khkinv/luku6

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
					Higher risk of infectious bacteria [e][l][w]	
Etelä-Savo	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Kainuu	Risk of disrupted energy production (tree fall…)		n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Kanta-Häme	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Keski-Pohjanmaa	Risk of disrupted energy production (tree fall…)	-	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Keski-Suomi	Risk of disrupted energy	-	n/a	Higher flooding risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w]	https://www.stat.fi/tup/khkinv/luku6

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	production (tree fall…)			Erosion and landslide risk [e][l][w]	Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	
Kymenlaakso (Kymmenedalen)	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Lappi	Risk of disrupted energy production (tree fall…)	-	Increased risk of erosion and quality degradation of coastal waters [e][w]	Extension of forests and albedo reduction [e][l] Threats to reindeer husbandry [l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Päijät-Häme	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Pirkanmaa	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Pohjanmaa	Risk of disrupted	-	Increased risk of erosion and	Higher flooding risk	Higher flooding risk [e][l][w]	https://www.stat.fi/tup/khkinv/luku6

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	energy production (tree fall…)		quality degradation of coastal waters [e][w]	[e][l][w] Erosion and landslide risk [e][l][w]	Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	
Pohjois-Karjala	Risk of disrupted energy production (tree fall…)	-	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Pohjois-Pohjanmaa	Risk of disrupted energy production (tree fall…)	-	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Pohjois-Savo	Risk of disrupted energy production (tree fall…)	-	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Satakunta	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Uusimaa (Nyland)	Risk of disrupted energy	More frequent heatwaves [c][e]	Increased risk of erosion and quality degradation of	Higher flooding risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w]	https://www.stat.fi/tup/khkinv/luku6

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	production (tree fall…)		coastal waters [e][w]	Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	
Varsinais-Suomi (Egentlig a Finland)	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
FRANCE **National adaptation priorities/fields (climate adapt): [a] Agriculture, [fa] Fishing and aquaculture, [fi] Finance and insurance, [fw] Forestry and its wood sector, [nbe] Nature, biodiversity and environmental heritage, [pr] Prevention and resilience to extreme events, [t] Tourism**						
Auvergne - Rhône-Alpes	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr]	More frequent heatwaves [pr] Swelling and shrinking soils [a] Higher flooding risk [fi][pr] More frequent droughts, water quality and quantity concerns [a][pr]	n/a	Higher forest fire risk [fi][fw][pr] Swelling and shrinking soils [a] Biodiversity threats [nbe]	Higher forest fire risk [fi][pr] Higher flooding and landslide risk [fi][pr] Higher ozone pollution risk Higher risk of infectious bacteria in hotter fresh water [fa]	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Bourgogne-Franche-Comté	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr]	Degradation of roads and railways [fi][t] More frequent droughts, water quality and quantity concerns [a][pr] Higher flooding risk [fi][pr] More frequent heatwaves and heat islands (low tolerance of local populations) [pr]	n/a	More frequent droughts, water quality and quantity concerns [a][fa][fw][nbe][pr] Swelling and shrinking soils [a] Higher risk of destructive storms [a][fi][fw][pr] Higher forest fire risk [fw][pr] High vulnerability of forest species to droughts and parasites [fw] *Earlier vine harvests and*	Higher flooding and landslide risk [fi][pr] Higher risk of infectious bacteria and tiger mosquito Higher forest fire risk [fi][pr] Higher risk of destructive storms [a][fi][pr]	https://www.alterrebourgognefranchecomte.org/_rechercheimages/download/8965/pdf/488/0

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		Swelling soils		*sweeter wines [a]*		
Bretagne	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr]	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][pr]	Higher risk of marine submersion (incl. touristic areas) [fi][pr][t] Risk on fishing and shellfish farming [fa]	More frequent droughts, water quality and quantity concerns [a][fa][fw][nbe][pr] Biodiversity threats [nbe]	Higher sea and river flooding risk [fi][pr]	https://bretagne-environnement.fr/contenus?f%5B0%5D=field_tag_th_matique_gemet%3A1200

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Centre-Val de Loire	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr]	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][pr]	n/a	Higher forest fire risk [fi][fw][pr] More frequent droughts, water quality and quantity concerns [a][fw][nbe][pr] Modification of flowering cycles [a][nbe] Limited productivity (soft wheat) [a] Biodiversity threats [nbe]	Higher forest fire risk [fi][pr] Higher pollen allergy risk	https://www.centre-val-deloire.developpement-durable.gouv.fr/changement-climatique-r1396.html
Corse	More frequent heatwaves [pr]	More frequent heatwaves [pr] More frequent	Higher risk of marine submersion (incl. ports, touristic beaches)	Higher forest fire risk [fi][fw][pr] More frequent droughts,	Higher forest fire risk [fi][pr]	https://www.cerema.fr/system/files/documents/2021/06/analyse_des_effets_du_changement_climatique_en_corse_vfinale.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	More frequent droughts, water quality and quantity concerns [a][fa][pr] Risk on hydroelectricity	droughts, water quality and quantity concerns [a][pr]	[fi][pr][t] Higher risk of sea level rise [fi] Risk on fishing and shellfish farming [fa]	water quality and quantity concerns [a][fa][fw][nbe][pr] Biodiversity threats [nbe]	Higher flooding risk [fi][pr] Higher risk of infectious bacteria and tiger mosquito [fa]	
Grand Est	Impact of hotter waters on energy production	More frequent heatwaves (low tolerance of local populations) [pr] More frequent droughts, water quality and quantity concerns [a][pr]	n/a	Higher forest fire risk [fi][fw][pr] More frequent droughts, water quality and quantity concerns [a][fw][nbe][pr] Potentially higher risk of infectious	Higher forest fire risk [fi][pr] Higher risk of ground collapse due to underground cavities [fi][pr] Higher risk of infectious human diseases	https://www.grand-est.developpementdurable.gouv.fr/changement-climatique-r6352.html

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				diseases (vine, corn) [a] High vulnerability of forest species to droughts and parasites [fw]		
Guadeloupe	More frequent droughts, water quality and quantity concerns [a][fa][pr] Risk of salination of sweet water ecosystems [nbe]	More frequent droughts, water quality and quantity concerns [a][fa][pr] More frequent and intense cyclones [pr] Higher risk of marine submersion [fi][pr][t]	Some risk of sea level rise [fi][t] Higher risk of marine submersion [fi][pr][t] Higher risk of coastal erosion [nbe][t] Risk of salination of sweet water ecosystems [nbe] Risk on aquaculture	Risk of massive agricultural productivity drop (sugar cane, banana) [a] Higher impact of water scarcity on fodder [a] Biodiversity threats (marine and terrestrial) [nbe] Higher impact of cyclones on	Higher risk of marine submersion [fi][pr][t] More frequent and intense cyclones [pr] Higher flooding risk [fi][pr]	https://guadeloupe.ademe.fr/sites/default /files/profil-vulnerabilite-guadeloupechangement-climatique-2018.pdf https://www.ecologie.gouv.fr/sites/default /files/ONERC_Rapport_2012_OutreMer_W EB.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
			(cyclones, coral reef degradation) [fi]	forests and mangroves [fw]		
Guyane française	More frequent droughts, impact on hydroelectricity [pr] Risk of salination of sweet water ecosystems [nbe]	Higher risk of marine submersion [fi][pr][t] Higher risk of coastal erosion [nbe][t] Higher flooding risk [fi][pr] Risk of increased thermal stress	Higher risk of marine submersion [fi][pr][t] Higher risk of coastal erosion [nbe][t] Risk of salination of sweet water ecosystems [nbe] Negative impact of higher sea temperatures on fishing, ecosystems Higher risk of marine submersion [fi]	Higher impact of water scarcity on fodder and on agricultural productivity, subsequent increase in deforestation [a] Loss of agricultural land due to coastal erosion [a] Higher forest fire risk [fi][fw][pr] Higher risk of drought [fw]	Higher risk of marine submersion [fi][pr][t] Higher flooding risk [fi][pr] Higher forest fire risk [fi][fw][pr] Higher risk of development for tropical diseases Higher risk of landslides [fi][pr]	https://guyane.ademe.fr/sites/default/files /rapport-changement-climatique-pistesreflexion-adaptation-regionale.pdf https://www.ecologie.gouv.fr/sites/default /files/ONERC_Rapport_2012_OutreMer_W EB.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				High vulnerability of forest species to climate change, threats on biodiversity [fw][nbe]		
Hauts-deFrance	More frequent heatwaves [pr]	More frequent heatwaves (low tolerance of local populations) [pr]	Higher risk of marine submersion [fi][pr][t] Risk on fishing? [fa]	Water scarcity [a][fw][nbe] More frequent droughts, water quality and quantity concerns [a][fa][fw][nbe][pr]	Higher risk of marine submersion [fi][pr]	observatoireclimat-hautsdefrance.org (incl. https://www.observatoireclimat-hautsdefrance.org/Les-grandes-questions/Changement-climatique-enHauts-de-France-ou-en-sommes-nous)
Île-de-France	More frequent heatwaves (risk of electric grid	More frequent heatwaves [pr] Heat islands, hot	n/a	Higher forest fire risk [fi][fw][pr] (Somewhat) more frequent droughts	More frequent heatwaves [pr]	https://www.arec-idf.fr/fileadmin/NewEtudes/000pack3/Etude_2851/20221115_diag_PRACC.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	disruption) [pr] Increased flooding risk [pr] Indirect impact of hotter waters on energy availability Impact of heatwaves and extreme rainfall on railways [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr] Amplified systemic risk	summer nights [t] (Somewhat) more intense extreme rainfall events, increased flooding risk [fi][pr] (Somewhat) more frequent droughts [a][pr] Low air quality Urban biodiversity threats [nbe] *Adaptation of public buildings and housing to increased*		[a][fw][nbe][pr] Water quality and quantity concerns, stress on humid areas [a][fa][nbe] Swelling and shrinking soils [a] Increased soil vulnerability [a][fw] Increased flooding risk [a] [fi][fw][pr] Increased oxidation by ozone [a][fw][nbe] Biodiversity threats [nbe] High vulnerability of	Increased flooding risk [fi][pr] Increased risk on energy availability Continuing ozone pollution risk Higher risk of infectious human diseases, pollen allergies Swelling and shrinking soils (risk for built areas)	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	(very dense urban area)	*thermal stress* *[pr]*		forest species and agriculture to droughts and parasites [fw][nbe]		
Martinique	More frequent droughts, water quality and quantity concerns [a][fa][pr] More frequent droughts, impact on hydroelectricity [pr] Higher risk of landslides, threat on water availability [fi][pr]	More frequent droughts, water quality and quantity concerns [a][fa][pr] More frequent and intense cyclones [pr] Higher risk of marine submersion [fi][pr][t] Higher flooding risk [fi][pr]	Some risk of sea level rise [fi][t] Higher risk of marine submersion [fi][pr][t] Higher risk of coastal erosion and beach & ecosystem destruction [nbe][t] Risk on aquaculture (cyclones, coral reef degradation) [fi]	Risk of massive agricultural productivity drop (sugar cane, banana) [a] Higher impact of water scarcity on fodder [a] Biodiversity threats (marine and terrestrial) [nbe] Higher impact of cyclones on forests and mangroves	More frequent and intense cyclones [pr] Higher flooding risk [fi][pr] Higher risk of marine submersion [fi][pr][t] Higher risk of landslides, threat on water availability [fi][pr]	http://www.biodiversite-martinique.fr/sites/default/files/etude_et_ evaluation_des_impacts_de_la_vulnerabilite_et_de_ladaptation_de_la_martinique_au_changement_climatique_climpact_2012. pdf https://www.martinique.developpementdurable.gouv.fr/IMG/pdf/diagnostic_vf.3.p df https://www.ecologie.gouv.fr/sites/default /files/ONERC_Rapport_2012_OutreMer_W EB.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	Potential positive effect on solar energy		Higher flooding risk [fi][pr]	[fw]		
Mayotte	Risk of salination of sweet water ecosystems [nbe]	Higher risk of sea level rise [fi] Higher risk of marine submersion [fi][pr][t] Risk of salination of sweet water ecosystems [nbe]	Higher risk of sea level rise [fi] Higher risk of marine submersion [fi][pr][t] Risk of salination of sweet water ecosystems [nbe]		Higher risk of marine submersion [fi][pr][t] Higher risk of development for tropical diseases	https://www.ecologie.gouv.fr/sites/default /files/ONERC_Rapport_2012_OutreMer_W EB.pdf
Normandie	Risk of strongly decreased water quantity (both on the ground and	More frequent heatwaves [pr] Increased risk of skin diseases	Widespread coastal erosion, cliff collapse [nbe][pr][t] Increased flooding risk	Increased soil erosion, run-off and mudflows [a][pr]	Higher sea and river flooding risk [fi][pr] Higher mudflow risk [pr]	https://www.normandie.fr/giec-normand (several synthetic and more extended reports)

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	underground) [a] Concern on water quality (soil erosion, chemical concentration, saltwater intrusions) [a][fa]	More frequent droughts, water quality and quantity concerns [pr] Increased air quality concerns	(sea level, rivers) [fi][pr] Increased saltwater intrusions [a] Risk of environmental contamination in estuaries [a][fa][nbe] Threats on oyster farming + several other shellfish *(positive impact for scallops)[fa]* Decrease of cod population (and probably	Increased thermal stress (impact on grain, cattle) [a] (Partially) higher risk of droughts [a][fw][nbe][pr] Decrease of agricultural yield [a]	Higher ozone pollution risk Higher risk of infectious bacteria in hotter fresh water [fa]	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
			temperate and cold water fish)[fa]			
Nouvelle-Aquitaine	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][pr]	More frequent heatwaves [pr] Swelling and shrinking soils [a] More frequent droughts, water quality and quantity concerns [a][pr]	Higher coastal risk of marine flooding (storms, erosion, modified rainfall and waves) [fi][pr][t] Higher risk of saltwater intrusions Disappearance of coastal sediment stocks [a]	Higher forest fire risk [fi][fw][pr] More frequent droughts, water quality and quantity concerns [a][fw][nbe][pr] Swelling and shrinking soils [a] Biodiversity threats (esp. coastal, mountain) [nbe]	Higher forest fire risk [fi][pr] Higher flooding and landslide risk [fi][pr]	Changement climatique en Aquitaine : quels impacts pour les risques naturels et comment s'y adapter ? (INP Bordeaux)

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Occitanie	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr]	More frequent heatwaves [pr] Swelling and shrinking soils [a] More frequent droughts, water quality and quantity concerns [a][pr]	Higher risk of marine submersion (incl. touristic beaches) [fi][pr][t] Higher risk of sea level rise [fi] Risk of lagoons disappearing [nbe] Risk on fishing and shellfish farming [fa]	Higher forest fire risk [fi][fw][pr] More frequent droughts, water quality and quantity concerns [a][fw][nbe][pr] Swelling and shrinking soils [] Biodiversity threats (esp. coastal, mountain) [nbe]	Higher forest fire risk [fi][pr] Higher sea and river flooding risk [fi][pr] Higher landslide risk [fi][pr] Higher ozone pollution risk Higher risk of infectious bacteria in hotter fresh water [fa]	https://www.occitanie.developpementdurable.gouv.fr/changement-climatique-r1610.html
Pays de la Loire	More frequent and longer heatwaves [pr] More frequent and	Higher flooding risk (sea level, river overflow) [fi][pr]	Higher risk of marine submersion [fi][t] Higher risk of sea level rise [fi]	More frequent and intense, longer droughts [a][fw][nbe][pr]	Higher risk of marine submersion [fi][pr] Higher risk of coastal erosion	http://www.comite21.org/docs/2022/giec-des-pays-de-la-loire---1er-rapport-(29-092022).pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	intense, longer droughts, water quality and quantity concerns [a][fa][pr] Risk on infrastructures due to ocean acidification [fa] More frequent extreme rainfall, risk of rainwater overflow, energy supply disruption [pr] Risk of road infrastructure	More frequent and longer heatwaves, higher risk for ageing population [pr] Heat islands Risk of drinking water shortages [pr][t] Higher vulnerability to storms [fi][pr]	Higher risk of coastal erosion [t] Increasing tension between urbanisation and vulnerable natural environments [nbe][t] Risk of environmental contamination in estuaries [a][fa][nbe] Threats on some species (e.g. salmon) [fa][nbe]	Higher forest fire risk [fi][fw][pr] High vulnerability of forest species and agriculture to droughts and parasites [fw] High biodiversity threats (both coastal and inland) [nbe] Reduced river flows [a][fa][nbe]	More frequent extreme rainfall, risk of rainwater overflow, energy supply disruption [pr] Risk of road infrastructure deformations (brutal temperature change, swelling and shrinking soils, storms, heavy rainfall) [fi][pr][t] Higher forest fire risk [fi][pr] Risk of drinking water	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	deformations (brutal temperature change, swelling and shrinking soils, storms, heavy rainfall) [pr]				shortages [pr][t]	
Provence - Alpes-Côte d'Azur	More frequent and intense droughts [a][fa][pr] Higher risk of water scarcity (lower water recharge) [a][fa] More frequent extreme rainfall	More frequent heatwaves Heat islands, hot summer nights Higher risk of water scarcity (lower water recharge) [a] More frequent and intense	Higher risk of marine submersion [fi][pr] Higher risk of sea level rise [fi] Higher risk of beach erosion or destruction [nbe][t] Risk of saltwater intrusion	Higher risk of water scarcity (lower water recharge) [a][fw][nbe] Higher forest fire risk (frequency, intensity) [fi][fw][pr] Degradation and migration of forest species [fw]	Extended periods for mosquitos *(variable effects on diseases)* Risk of longer and more intense pollen allergies	http://www.grec-sud.fr/wp-content/uploads/2017/09/GREC-PACA_Enjeux_CC_BD_062015.pdf http://www.grec-sud.fr/wp-content/uploads/2018/09/GREC_PACA_Cahier_Mer_Littoral_ref.pdf http://www.grec-sud.fr/wpcontent/uploads/2023/01/Cahier_territorial_NCA_GREC_SUD_juin_2021_VF_MD.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	(longer term) [pr]	extreme rainfall [pr] Higher risk of river flooding, landslides [fi]	(uncertain) [a] Threats on marine species due to warmer and acidified sea (fish, shellfish) [fa][nbe] Jellyfish proliferation *[fa]*	risk on fruit and vine linked to frost risk during flowering, earlier harvests [a] risk on pasture lands [a] Swelling and shrinking soils [a] Impacts on agriculture depending on species [a] Threats on biodiversity [nbe]		
Réunion	More frequent droughts, impact on hydroelectricity	Higher risk of sea level rise [fi]	More frequent and intense cyclones and rainfalls [pr]	Risk of massive agricultural productivity drop (sugar cane) [a]	More frequent and intense cyclones and rainfalls [pr]	https://www.departement974.fr/sites/default/files/pcet-diagnostic-vulnerabilite.pdf https://www.profil-environnemental.re/media/fiches/Fiche_risques_naturels.pdf https://www.ecologie.gouv.fr/sites/default

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	[pr] Higher flooding risk, threat on electricity production and (shoemwhat) on waste treatment [pr]	Higher flooding risk [fi][pr] Higher risk of marine submersion [fi][pr][t] Heat islands	Higher risk of sea level rise [fi] Higher flooding risk [fi][pr] Higher risk of marine submersion [fi][pr][t] Risks on marine biodiversity [nbe]	Higher impact of water scarcity on fodder [a] Risks on river system due to droughts, water scarcity [fi][nbe] Higher landslide risk [a][pr] Higher forest fire risk [fi][fw][pr] Higher risk of invasive species [nbe]	Higher flooding risk [fi][pr] Higher risk of marine submersion [fi][pr][t] Higher landslide risk [a][pr] Higher forest fire risk [fi][fw][pr] Higher risk of development for tropical diseases	/files/ONERC_Rapport_2012_OutreMer_W EB.pdf
Saint-Martin	Risk of salination of sweet water ecosystems [nbe] Higher vulnerability of drinking	More frequent droughts, water quality and quantity concerns	Some risk of sea level rise [fi] Higher risk of marine	Higher impact of water scarcity on fodder [a]	More frequent and intense cyclones [pr] Higher risk of marine	http://www.com-saint- martin.fr/ressources/Fascicule-6-Quellecapacit%C3%A9-d-accueil-etmodalit%C3%A9s-de- d%C3%A9veloppement-demain.pdf https://www.ecologie.gouv.fr/sites/default /files/ONERC_Rapport_2012_OutreMer_W EB.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	water availability [pr] More frequent heatwaves and higher energy needs	[a][fa][pr] More frequent and intense cyclones [pr Higher risks on urban infrastructures [fi][pr] Risk of salination of sweet water ecosystems [nbe] Higher risk of marine submersion [fi][pr][t]	submersion [fi][pr][t] Somewhat higher risk of coastal erosion [t]		submersion [fi][pr][t] Higher vulnerability of drinking water availability [pr] Higher risks on urban infrastructures [fi][pr] Higher risk of development for tropical diseases	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
GERMANY **National adaptation priorities/fields (climate-adapt): [e] Economy, [h] Health, [i] Infrastructure, [l] Land, [sc] Spatial Planning and Civil Protection**						
Baden-Württemberg	More frequent heatwaves [h] More frequent droughts, water quality and quantity concerns, floods [e][h][i][sc][w]	Higher flooding risk [e][i][sc] Higher risk of heatwaves [h] Higher risk of diseasecarriers from warmer climate [h] Higher risk of tropical diseases such as chikungunya and dengue fever [h]	n/a	Higher risk of more frequent and longer periods of drought during the summer months [e][l][w] Higher risk of species of fauna and flora migration	Higher risk of sever hailstorms that can cause massive damage to buildings, vehicles and fields [e][i][sc] Higher risk of flooding for smaller rivers and streams [sc][w]	https://www.baden-wuerttemberg.de/fileadmin/redaktion/m-um/intern/Dateien/documents/publication/Climate_Change.pdf https://www.hochwasser.badenwuerttemberg.de/ https://lokale-klimaanpassung.de/lokalesklimaportal/ https://www.heidelberg.de/hd/HD/Leben/klimawandel-anpassung.html
Bayern	Higher risk of damaging infrastructure for electricy supply [e][i][sc]	More frequent droughts, water quality and	n/a	Higher risk of changes in crop yields and increased	Higher flooding risk [e][i][sc][w]	https://www.bestellen.bayern.de/application/eshop_app000003?SID=44167250&ACT

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		quantity concerns [e][h][w] Higher flooding risk [e][i][sc]		spread of invasive species [e][l] Higher risk of wild fires [e] Biodiversity displacement and change [h] Higher risk of pest and disease increase [h] Higher risk of torrents and avalanches [h]		IONxSESSxSHOWPIC(BILDxKEY:%27stmuv_ klima_012%27,BILDxCLASS:%27Artikel%27, BILDxTYPE:%27PDF%27) https://www.bestellen.bayern.de/application/eshop_app000007?SID=589832196&ACTIONxSESSxSHOWPIC(BILDxKEY:%27stmuv _vs_056%27,BILDxCLASS:%27Artikel%27, BI LDxTYPE:%27PDF%27)
Berlin	Risk of higher energy demand due changing weather patterns and rising temperatures [e] Higher risk of damage of power lines and other	Higher risk of flooding [e][i][sc] Higher risk of heatwaves and air pollution [h] Higher risk to water resources [e][h[i][w]	n/a	Higher risk of changes in crop yields [e] Risk of spread of invasive species [h] Higher risk of wildfires [h]	Higher risk of disruptions of transport networks and energy systems [e][i][sc] Higher risk of damage of critical	https://cdn.locomotive.works/sites/5ab410c8a2f42204838f797e/content_entry5ab410faa2f42204838f7990/5da8946484832e00a69c5586/files/bek2030_broschuere_en.pdf?1632314683

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	infrastructure [e][i][sc]				infrastructure [e][i][sc] Higher risk of heat-related illnesses and other health impacts [h][sc]	
Brandenburg	The changes in the water supply will have serious effects on the regional water balance in general, on water availability and on a wide variety of economically important sectors [e][i][w]	Higher risk of flooding [e][i][sc]	n/a	Higher risk of drought (frequency and length) [l][w] Higher risk of forest fires [h]	Higher risk of heat-related illnesses and other health impacts [h][sc]	https://www.ioew.de/fileadmin/user_upload/Zwischenbericht-Gutachten-KlimaplanBB.pdf https://www.umweltbundesamt.de/themen/klima-energie/klimafolgenanpassung/folgen-des-klimawandels/klimafolgen-deutschland/regionale-klimafolgen-in-brandenburg#wichtige-studien-und-projekte
Bremen	Higher risk of outage of supply facilities and	More frequent heatwaves [h]	Eutrophication of bodies of water due to the	Shifting species diversity/spread of	Increase in the number of days of extreme	https://www.klimaanpassung.bremen.de/sixcms/media.php/13/SUMMARY_Climate%

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	networks (energy, water, heat and telecommunications) [e][i][sc][w] Higher risk of demand on resources for the maintenance of bodies of water and for municipal cleaning [i][w] Reduced output by power plants arising from restricted access to cooling water due to drought [e][i][w]	Increased humanbioclimatic impact due to heat stress [h] Higher risk of wear and tear on green spaces and recreation grounds due to increased solar irradiation and intensive usage [l][sc] Higher risk of congestion of the sewage network as a result of heavy precipitation exceeding the established thresholds [e][h][i][sc]	erosion of dry soils (esp. in areas on the urban fringe) [w] Restrictions on inland waterway transport due to high and low water levels	invasive thermophilic animal and plant species [l] Damage (e.g. protein coagulation) to heat-stressed vegetation [l] Impairment/loss of soil functions due to increased soil temperature [e][l] Higher risk of damage to and loss of soil functions due to erosion and the entry of pollutants [e][l] Higher risk of damage to	precipitation [sc] Increase physical strain and risk of accidents due to heat stress and a reduced ability to concentrate [h][sc] Establishment of new and spread of existing pathogenic agents and disease carriers [h][sc] Higher risk of material stress and damage to transport	2BAdaptation%2BStrategy%2BBremen%2BBremerhaven%2BWEB.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				vegetation/crops due to increased waterlogging [e][l][w] Risk of fire and falling branches due to drought Pest infestations and fungal diseases affecting trees due to increased humidity Negative impact on industrial/agricultural production due to water shortages [e][l][w]	routes due to heat and temperature fluctuations [e][i][sc] Higher risk of flooding and damage of private and public buildings and property [e][i][sc] Higher risk of damage to buildings and infrastructure due to changes in soil and groundwater levels in	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
					conjunction with rising sea levels [e][i][sc]	
Hamburg	Rising sea levels can threaten coastal power plants and distribution networks [e][i]	Higher risk of flooding [e][i][sc]	Higher risk of sea level rise that can lead to increased coastal erosion, flooding, and storm surges that can damage coastal infrastructure such as buildings, roads, and ports [e][i][sc]		Higher risk of sea level rise that can lead to increased coastal erosion, flooding, and storm surges that can damage coastal infrastructure such as buildings, roads, and ports [e][i][sc]	https://climate-adapt.eea.europa.eu/en/metadata/casestudies/four-pillars-to-hamburg2019s-green-roof-strategy-financial-incentivedialogue-regulation-and-science/hamburg_doc1_climate_plan.pdf/view
Hessen	Negative consequences	More frequent heatwaves [h]	n/a	Higher risk of yield losses of crops [e][l]	Higher risk of disrupting private and public	https://umwelt.hessen.de/sites/umwelt.hessen.de/files/2021-06/integrierter_klimaschutzplan.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	resulting from changing precipitation patterns and the associated changes in the discharge process of both fossil and regenerative generation plants as well as the supply networks and their infrastructure [e][i]	Higher risk of groundwater contamination [h][w] Higher risk of spread of invasive species Increase in the intensity of pollen allergies [h] Increase in the transmission of infection diseases (Chicunguña and Zika) [h]		Higher risk of erosion and nutrient leaching as well as increased drying of the harvest [e][l] Higher risk that plants and animals can no longer adapt to the changed weather conditions [h][l]	transport due to road flooding [e][i][sc][w] Higher risk of heavy rainfall events Higher risk of heat waves [h][sc] Higher risk of transport and transportation infrastructure being affected [e][i][sc]	
Mecklenburg-Vorpommern	-	More frequent heatwaves [h]	-	Higher risk of erosion by wind [l] Higher risk of more frequent negative effects on plant growth,	-	https://www.regierung-mv.de/Landesregierung/lm/Klima/Klimaschutz/ https://www.umweltbundesamt.de/themen/klima-energie/klimafolgenanpassung/folgen-des-

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				product quality and yields [l]		klimawandels/klimafolgendeutschland/regionale-klimafolgen-inmecklenburg- vorpommern#landerspezifischeklimaanderungen https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2021-06-10_cc_212021_kwra2021_land_1.pdf
Niedersachsen	Higher risk of periods of time in which the water supply will not be sufficient without human management [e][w] Increases in peak flood discharges of at least 20% at many gauges in Lower Saxony, especially in the summer months [w]	More frequent heatwaves [h] More frequent heavy precipitations that might lead to flooding [sc][w] Increasing heat stress in metropolitan areas and the associated burden on health [h]	Increased risk of coastal and inland flooding [e][i][sc] Stress on the aquatic ecology due to high water temperatures and high oxygen levels	Increasing drought stress in natural ecosystems and in agriculture and forestry [l][w] Increasing risk of forest fires [l][w] Increasing soil erosion due to heavy rain or extreme drought [l][w] Higher risk of invasive species and the	Declining snow reliability in winter sports areas [e]	https://www.umwelt.niedersachsen.de/startseite/themen/klima/klimaschutz/klimaschutz_in_niedersachsen/klimaschutz-inniedersachsen-200413.html https://www.arl-net.de/system/files/media-shop/pdf/ab/ab_011/ab_011_gesamt.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				preservation of biodiversity [l]		
Nordrhein-Westfalen	Higher risk of water scarcity for the cooling of power plants during long periods of heat	-	-	Biodiversity displacement and change [l] Higher risk of climateinduced migration of species from southern areas [l] More frequent irrigation is expected in the agricultural sector [l][w] Increased risk for drought damages, plant diseases and pests in agriculture and forestry [l][w]	-	https://www.klimaschutz.nrw.de/fileadmin/Dateien/Download-Dokumente/Broschueren/klimaschutzbericht_nrw_151201.pdf https://www.klimlandrp.de/en/background/#:~:text=In%20Rhineland%2DPalatinate%20there%20are,of%20the%20vegetation%20growth%20period.
Rheinland-Pfalz	-	Higher risk of flooding [e][i][sc]	n/a	-	-	https://mkuem.rlp.de/fileadmin/mulewf/Themen/Klima-_und_Ressourcenschutz/Klimaschutz/Klimaschutzkonzept/Klimaschutzkonzept_Strategie_net_01_02_2021.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		More frequent heatwaves [h]				https://hochwassermanagement.rlp-umwelt.de/servlet/is/176954/Wasser_und_Klimawandel_in_RLP.pdf?command=downloadContent&filename=Wasser_und_Klimawandel_in_RLP.pdf
Saarland	Higher risk of changes in precipitation patterns and water availability can impact the efficiency of hydropower plants [e][w] Higher risks to the energy sector due to extreme weather events such as heatwaves, droughts, and floods which can disrupt power	Higher flooding risk [e][i][sc]	n/a	Higher risk of soil erosion [l] Higher risk of soil degradation [l] Higher risk of forest fires Higher risk of eutrophication in the summer Higher risk of forest degradation Decline in yields of some agricultural products (cereals, potatoes, silo maize, etc) [e][l]	Higher risk of flooding of lowlying settlement areas [e][i][sc] Higher risk of falling trees on roads an railway lines [i][sc]	https://www.izes.de/sites/default/files/publikationen/KlimaKomPass_IZES.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	generation and transmission [e][i][sc]			High concentrations of ozone and air pollutants in dry seasons also affect plant growth [l]		
Sachsen	Higher risk of infrastructure damage due to heavy precipitation and floodings [i][w]	Higher flooding risk [sc][w] Higher risk of heatwaves [h]	n/a	Higher risk of droughts [l][w] Biodiversity displacement and change [l] Higher risk of pest and disease increase [h][l] Higher risk of soil erosion [l][w] Higher risk that plants and animals can no longer adapt to the changed weather conditions [h][l]	Higher risk of infrastructure damage due to heavy precipitation and floodings [i][w]	https://publikationen.sachsen.de/bdb/artikel/37830

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Sachsen-Anhalt	-	Higher risk of heavy rains events combined with flooding, hailstorms and lightning strikes	n/a	-	-	https://mwu.sachsen-anhalt.de/fileadmin/Bibliothek/Politik_und_Verwaltung/MWU/Klimaschutz/00_Startseite_Klimaschutz/190205_Klima-_und_Energiekonzept_Sachsen-Anhalt.pdf https://www.umweltbundesamt.de/themen/klima-energie/klimafolgenanpassung/folgen-des-klimawandels/klimafolgen-deutschland/regionale-klimafolgen-in-sachsen-anhalt
SchleswigHolstein	-	More frequent heatwaves [h]	Higher risk of sea level rise that can lead to increased coastal erosion, flooding, and storm surges that can damage coastal infrastructure	-	-	https://www.umweltbundesamt.de/themen/klima-energie/klimafolgenanpassung/folgen-des-klimawandels/klimafolgen-deutschland/regionale-klimafolgen-in-schleswig-holstein#bereits-aufgetreteneund-erwartete-klimaanderungen

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
			such as buildings, roads, and ports [e][i][sc]			
Thüringen	Risk of a slight decrease in wind speeds for the production of solar energy Higher risk of damage of critical energy infrastructure [e][i][sc]	More frequent heatwaves [h] Higher risk of skin cancer [h] Increase in vectors of disease transmission [h] Higher risk of food being spoiled by high temperatures [h] Higher risk from allergies and germs [h]	n/a	Biodiversity threats [h] Higher flooding risk [e][l] Higher risk of an increase of dry spells [l] Risk of larger range of plant pests and weeds [e][l] Risk of water scarcity for vegetation areas [l][w] Higher risk of water erosion [l][w] Increased risk of forest fires [h] Higher risk of disruptions in	Higher risk from allergies and germs [h][sc] Higher risk of impairing road safety Higher risk of flooding causing damages to buildings [e][i][sc]	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				timber harvesting [e]		

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
GREECE **National adaptation priorities/fields (ESPKA): [aa] Agriculture and animal husbandry, [ac] Action, [aq] Aquaculture, [be] Biodiversity and ecosystems, [ch] Cultural heritage, [co] Coastal zones, [fi] Fishing, [fo] Forestry, [he] Health, [is] Insurance sector, [it] Infrastructure and transport, [mi] Mining industry, [se] Structured environment, [to] Tourism, [wr] Water resources**						
Ανατολική Μακεδονία και Θράκη (Eastern Macedonia and Thrace)	-	-	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	Higher risk of forest fires [fo][is]	-	https://www.bankofgreece.gr/Publications /ClimateChange_FullReport_bm.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Αττική (Attica)	-	More frequent heatwaves [he][it] Higher flooding risk [co][he][is][it] Higher occurrence of extreme precipitation events [aa][co][fo][is][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi] Higher risk of coastal erosion [be][ch][co][is][it][to]	Higher risk of forest fires [fo][is]	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Βόρειο Αιγαίο (North Aegean)	Higher risk of water scarcity [aq][be][co][wr]	-	Higher risk of migration of species due to changes in water temperature [aq][co][fi] Higher risk of coastal erosion [be][ch][co][is][it][to]	Higher risk of forest fires [fo][is]	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Δυτική Ελλάδα (Western	-	-	Higher risk of migration of species due to	-	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Greece)			changes in water temperature [aq][co][fi]			
Δυτική Μακεδονία (Western Macedonia)	-	More frequent heatwaves [he][it] Higher flooding risk [co][he][is][it]	-	-	Higher risk of landslides, floods [aa][co][he][is][it][mi]	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Ήπειρος (Epirus)	-	Higher flooding risk [co][he][is][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	-	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Θεσσαλία (Thessaly)	Higher risk of water scarcity [aq][be][co][wr]	Higher flooding risk [co][he][is][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi] Higher risk of coastal erosion [be][ch][co][is][it][to]	Higher risk of forest fires [fo][is]	Higher risk of landslides, floods [aa][co][he][is][it][mi]	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Ιόνια νησιά (Ionian Islands)	-	Higher flooding risk [co][he][is][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi] Higher risk of coastal erosion [be][ch][co][is][it][to]	-	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Κεντρική Μακεδονία (Central Macedonia)	-	Higher flooding risk [co][he][is][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	Higher risk of forest fires [fo][is]	Higher risk of landslides, floods [aa][co][he][is][it][mi]	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Κρήτη (Crete)	-	More frequent heatwaves [he][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	Higher risk of forest fires [fo][is]	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Νότιο Αιγαίο (South Aegean)	Higher risk of water scarcity [aq][be][co][wr]	Higher flooding risk [co][he][is][it] More frequent heatwaves [he][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi] Higher risk of coastal erosion	Higher risk of forest fires [fo][is]	-	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
			[be][ch][co][is][it][to]			
Πελοπόννησος (Peloponnese)	-	Higher flooding risk [co][he][is][it] More frequent heatwaves [he][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	Higher risk of forest fires [fo][is]	-	
Στερεά Ελλάδα (Central Greece)	Higher risk of water scarcity [aq][be][co][wr]	Higher flooding risk [co][he][is][it] More frequent heatwaves [he][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	-	-	

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
ITALY						

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
National adaptation priorities/fields (climate adapt):[a] Agriculture, food, aquaculture, fishing, [ci] Critical infrastructures, [e] Energy, [h] Health, [i] Infrastructure, [l] Land (incl. ecosystems, forests, droughts), [t] Tourism, [u] Urban settlements, [w] Water						
Abruzzo	Hydrogeological instability [ci][e][i][w]	Higher risk of heatwaves [h][u] Higher risk of heavy rainfall and thunderstorms [e][i][u][w] Higher risk of urban flooding [ci][i][u][w] Higher risk of droughts [a][l][u][w]	Hydrogeological instability [ci][e][i][w]	Soil consumption [a][l]	Hydrogeological instability [ci][e][i][w] Increased flooding risk [ci][e][i][u][w] Risk of more irregular and unforeseeable snowfalls, greater risk of avalanches [h][w]	No regional plan available, ABRUZZO rapporto sullo stato dell'ambiente 2018 https://www.artaabruzzo.it/download/pubblicazioni/relaz_stato_ambiente_abruzzo_2018.pdf
Basilicata	Hydrogeological instability posing risk to energy production [ci][e][i][w]	Higher risk of droughts[l][u][w]	-	Higher risk of droughts, desertification [a][l][w]	-	Legge 15 ottobre 2018, n.32 REGIONE BASILICATA Decarbonizzazione e politiche regionali sui cambiamenti climatici (Basilicata Carbon Free)

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Calabria	Hydrogeological instability [ci][e][i][w]	More frequent heatwaves [h][u] Swelling and shrinking soils [i][u] More frequent droughts, water quality and quantity concerns [a][ci][h][i][l][u][w]	Higher risk of erosion [i][l][u]	Higher risk of droughts, desertification [a][l][w]	Higher risk of extreme weather events [ci][e][i][u]	https://www.irpi.cnr.it/wp-content/uploads/2016/05/focus-siccit%C3%A0-desertificazione-cambiamenti-climatici-calabria-2.pdf, https://www.lacnews24.it/ambiente/il-cambiamento-climatico-fa-paura-ma-in-calabria-di-piu-secondo-legambiente-e-trale-regioni-piu-colpite_162752/
Campania	Slow adoption of renewables [e][u] Suboptimal insulation of buildings [e][u]	Poor air quality [h][u] Ageing population [h][u]	-	Soil consumption [a][l]	Hydrogeological instability [ci][e][i][w] Higher risk of extreme events (floodings, droughts, heavy rains) [ci][e][i][l][u][w]	Legambiente – Il Clima è già cambiato: la Campania, una sfida per l'Europa - https://legambiente.campania.it/wpcontent/uploads/2019/05/dossier-clima-campania.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Emilia-Romagna	Growth of energy demand [e][u] Less energy produced by hydro sources [e][w]	Water quality concerns (driven by large quantity of water being used for irrigation) [a][h][i][u][w] Desertification [a][l][u] Negative effects on health [h][u] Negative impact on economic activities [i][t][u] Damage on the built environment [i][t][u] Increased insurance costs [u]	Coastal erosion [i][l][t][u] Saltwater intrusion [a] Biodiversity loss (incl. local fisheries) [a][h][l]	Higher risk of extreme events (floodings, droughts, heavy rains) [l][w] Higher risk of forest fires [l] Soil consumption [a][l] Desertification [a][l] Loss of agricultural production (in term of quantity and quality) [a][l] Decreased water quantity and	Higher risk of extreme events (floodings, droughts, heavy rains) [ci][e][i][l][u][w] Higher risk of forest fires [ci][h][l] Hydrogeological instability [ci][e][i][w]	Documento di sintesi della Strategia di mitigazione e adattamento per i cambiamenti climatici https://ambiente.regione.emiliaromagna.it/it/cambiamenti-climatici/temi/la-regione-per-il-clima/strategia-regionale-per-i-cambiamenti-climatici/la-regione-per-ilclima-la-strategia-di-mitigazione-eadattamento-per-i-cambiamenti-climatici

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		Loss of value of affected buildings [i][u] Higher health risk (incl. pathologies related to the effects of climate change) [h][u]		quality [a][l][w] Loss of biodiversity [h][l]		
Friuli-Venezia Giulia	Expected decrease of energy consumption in the winter, later increase of energy consumption in the summer [e][u]	Higher risk of droughts and heatwaves [h][l][u][w] Negative effects on health [h][u]	Hydrogeological instability [ci][e][i][w] Increased sea level [e][i][l][u] Risk for the local marine biodiversity [a][h] Risk for aquaculture (esp.	Fewer but more intense rainfalls [l][w] Higher risk of droughts and heatwaves [a][h][l] risk for biodiversity - some species (e.g. in the field of forestry) react	-	Sintesi dello Studio conoscitivo dei cambiamenti climatici e di alcuni loro impatti in Friuli Venezia Giulia - https://www.meteo.fvg.it/clima/clima_fvg/03_cambiamenti_climatici/02_SLIDES_cambiamenti_climatici_e_impatti_per_il_FVG/ 00_report_completo_in_slides/CambiaClimaFVG_sintesiStudio.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
			in lagoons) [a]	negatively to warmer and dryer conditions (and others react positively) [h][l]		
Lazio	Increased energy demand in summer [e][u]	Increased frequency of heatwaves [h][u]	Hydrogeological instability [ci][e][i][w] Coastal erosion [i][l][u]	High risk of forest fires [l] Reduction of soil moisture [a][l]	Higher risk of landslides, floods [ci][e][i][u][w]	Lazio, Regione partecipata e sostenibile – Il contributo dell'adattamento ai cambiamenti climatici - https://progetti.regione.lazio.it/contrattidif iume/wp-content/uploads/sites/53/LAZIO- SOSTENIBILE-Contributo-adattamentocambiamenti-climatici.pdf
Liguria	More blackouts [ci][e][i][u] Hydrogeological instability [ci][e][i][w] More frequent heatwaves [h][u]	Higher risk of heatwaves (esp. at higher altitude and in western Liguria) [h][u] Higher risk of flooding [ci][i][u][w]	Hydrogeological instability - incl. storm surges [ci][e][i][w] Increasing water levels [ci][i][u] More frequent droughts,	More frequent droughts, esp. near the coast [a][l][w] Biodiversity threats (incl.	Higher flooding, drought, and landslide risk [ci][e][i][l][u][w] Risk of more damaged buildings [i][u]	Strategia regionale di adattamento ai cambiamenti climatici - https://www.regione.liguria.it/homepageambiente/cosa-cerchi/sviluppo- sostenibile/strategia-adattamentocambiamenti-climatici.html

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	More frequent droughts, water quality and quantity concerns [a][ci][i][l][u][w] Suboptimal energy efficiency of the built environment [e][u]	More frequent droughts, water quality and quantity concerns - incl. quantity of drinking water [ci][h][i][l][t][u][w] Harmful effects on urban infrastructure - transport and others [ci][i][t][u]	water quality and quantity concerns [ci][h][i][l][t][u][w] Fewer winter precipitation in the East, more in the West, fewer summer precipitations overall [w] Strong precipitations to become more common in the East, less common in the West [w] Risk for aquaculture and fishing activities, incl. the invasion of alien	invasions of fungi, insects. migrations of species) [a][h][l] Reduction of agricultural production [a] Increasing risk of forest fires [h][l]		

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
			species from warmer zones [a] High risk of erosion [i][l]			
Lombardia	-	Populations exposed to worse air quality [h][u]	Changes in the hydrogeological cycle [w] Increased risk of algal blooms [a]	Negative effects on soil quality, water quantity [a][l] Increased risk of extreme events [a][e][l] Increased risk of diffusion of parasites and fungi [a][l] Reduced quantity and quality of waters [a][w]	-	DOCUMENTO DI AZIONE REGIONALE PER L'ADATTAMENTO AL CAMBIAMENTO CLIMATICO IN LOMBARDIA - https://www.regione.lombardia.it/wps/wcm/connect/946249ce-87c4-4c39-88f95eab3a264f14/Documento+Azione+Adattamento+RL_9dic.pdf?MOD=AJPERES&CACHEID=946249ce-87c4-4c39-

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Marche	Water scarcity influencing the production of hydro energy [h][t][u][w] Not self-sufficient at the level of regional energy production Increased energy demand in summer [e][u] More blackouts [ci][e][i][u]	Water scarcity [h][t][u][w] Higher risk of flooding [ci][i][u][w] Increased health risk (chronic diseases) [h][u]	Increased risk of algal blooms [a] Very high risk of coastal erosion (especially in coastal tourist areas) [i][l][t][u] Higher risk of coastal floods [ci][e][i][u][w] Biodiversity threats (due to higher temperatures and decreased levels of oxygen in the waters and introduction of non-local	Water scarcity (Also due to intensive agriculture practices) [h][t][u][w] Soil erosion [a][b] Higher risk of loss of agri production [a][h][i][l][w]	Higher risk of floods [ci][e][i][u][w] Higher risk of avalanches [h][t] Biodiversity threats in coastal areas (due to anthropization) [b][hl][hr]	Piano di adattamento al cambiamento climatico Regione Marche 2023 - 2029 https://www.regione.marche.it/portals/0/Ambiente/VAS/VASR/VAS_0038/Piano_Rev0.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
			species) [b][hl][hr			
Molise	-	-	-	-	-	
Piemonte	Unforeseeable peaks of energy demand [e][u] Water scarcity [h][t][u][w]	Increased health risk (chronic diseases) [h][u]	n/a	Thinner show cover [l][t] *Migration of flora and fauna, moving the line* *between Mediterranean and Alpine species* [a][l] Increase of damage caused by parasites [a][l] Water scarcity [h][t][u][w] Variation in	Higher risk of extreme events (stemming from the change of precipitation cycles) influencing the public safety[h][t]	Strategia Regionale sul Cambiamento Climatico - https://www.regione.piemonte.it/web/te mi/ambiente-territorio/cambiamentoclimatico/strategia-regionale-sulcambiamento-climatico So far only the first part of the plan is available, focused mainly on biodiversity Annex 1 of SET DI STRATEGIE DI ADATTAMENTO AI CAMBIAMENTI CLIMATICI PER LA ZONA OMOGENEA PINEROLESE DELLA CITTÀ METROPOLITANA DI TORINO PER GLI STRUMENTI DI PIANIFICAZIONE DI LIVELLO LOCALE E DI AREA VASTAhttp://www.cittametropolitana.torino.it/cms/risorse/territorio/dwd/urbanistica

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				the sugar content of vines [a][l]		/ProgEurop/WP4.2_Strategie%20_di_adattamento_%20all_1.pdf
Puglia	-	Water scarcity [h][t][u][w] More frequent droughts, water quality and quantity concerns [ci][h][l][t][u][w]	-	Water scarcity [a][h][u][w] More frequent droughts, water quality and quantity concerns [a][h][i][l][w]	Water scarcity [h][t][u][w]	PNACC https://www.mase.gov.it/sites/default/files/archivio/allegati/clima/PNACC_versione_dicembre2022.pdf A consultation phase is undergoing, a regional plan still does not exist (Feb 2023). Aditional source: https://focusicilia.it/clima-impazzito-citta-a-rischio-175-eventi-estremi-in-sicilia-in12-anni/
Sardegna	Droughts influencing the production of energy [e][l][w]	Higher risk of heatwaves [h][u] Higher risk of flooding in urban areas [i][u][w] More frequent droughts, water quality	Higher risk of coastal flooding [ci][i][l][t][u] Higher risk of coastal erosion [i][l][t][u]	More frequent droughts, water quality and quantity concerns - causing competition for water use between	Higher risk of floods [ci][e][i][u][w] Hydrological risk for infrastructure (e.g. rails) [ci][e][i][u][w] Landslide risk for infrastructure	Allegato 1 alla SRACC: studio per l'elaborazione della Strategia - https://delibere.regione.sardegna.it/protected/45525/0/def/ref/DBR45368/

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		and quantity concerns - causing competition for water use between urban (esp. touristic areas) and agricultural [a][ci][h][l][t][u][w] Landslide risk in urban environments [i][u] Hydrological risk for productions and industries [ci][e[i][u][w]		urban and agricultural [a][l][u][w] Higher risk of loss of agri production [a][h][i][l][w] Higher risk of loss of nutritional value of agri production [a][h] Higher risk of forest fires and fires in rural areas [l] Higher risk of floods in agricultural areas [a][l]	(e.g. rails) [ci][e][i][u]	
Sicilia	-	-	Increasing water levels [ci][i][u]	Higher risk of desertification [h][t]	Higher risk of extreme events	A regional adaptation plan does not exist. For a couple of sectors (agriculture and energy), there are approved guidelines for the creation of similar strategies.

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				[a][b][fo][hr][w] Higher risk of fires [f][h][ri]	Higher risk of fires [f][h][ri]	https://pti.regione.sicilia.it/portal/pls/portal/docs/152524670.PDF http://pti.regione.sicilia.it/portal/pls/portal/docs/151514774.PDF So far, no official documents identifying climate risk in Sicily are available.
Toscana	Results of extreme events (snow storms, landslides, fallen trees) can cause disruption in the delivery of energy [ci][e][u] Increased energy demand in summer [e][u] Increased difficulty to cool down power plants (due	Higher risk of heatwaves [h][u] Higher risk of flooding [ci][i][l][u][w] Increased health risk (cardiovascular and respiratory, diseases spreadable by vector insects) [h][u]	Decreased water quality, loss of habitats [a][h][t][u][w]	More prolonged periods of both droughts and heavy rains [a][l][w] Increased demand for water for irrigation [a][w] Reduced (in quantity and in quality) agri production [a[h][l] Increased diffusion of parasitic	Higher risk of flooding [ci][e][i][l][u][w]	ANALISI VRV E PIANO DI ADATTAMENTO Comune di Firenze - https://www.comune.fi.it/system/files/2022-04/FIRENZE_VRV_azioniadattamento%20%281%29.pdf The plan of the city of Florence also provides an overview of regional challenges.

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	to limited water resources and increasing temperature) [ci][e][w] The provision of drinking water can be interrupted in case of extreme events (incl. very low temperature) [ci][i][u][w]			and invasive species [a][l]		
Trentino-Alto Adige / Südtirol	Suboptimal energy efficiency of the built environment [e][u] Hydrogeological instability [ci][e][i][w]	Higher risk of heatwaves [h][u]	n/a	Negative consequences on the permafrost [l] Fewer precipitation overall (fewer in altitude and	Hydrogeological instability [ci][e][i][w] Higher risk of flooding [ci][e][i][u][w] Higher risk of avalanches [h][t]	I CAMBIAMENTI CLIMATICI IN TRENTINO. OSSERVAZIONI, SCENARI FUTURI E IMPATTI: http://www.climatrentino.it/binary/pat_climaticamente/notizie_clima/Report_clima_documento_di_posizionamento_finale2023.1672934412.pdf, https://pericolinaturali.provincia.bz.it/it/cambiamento-climatico

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				in summer) [w]		
Umbria	-	Higher risk of heatwaves [h][u] Increased health risk [h][u]	n/a	?	?	No official sources on existence - or preparation-- or regional adaptation plan or other official sources on climate risk.
Valle d'Aosta	Effects on hydroelectrical energy (the plants using seasonal pools would be less impacted, more at risk will be plants using running water or very small water pools) [ci][e][u][w] Less energy	Increased risk of heatwaves (esp. within vulnerable citizens- allergies, age, cardiovascular diseases) [h][u] Decrease of quantity and quality of drinking water [ci][h][i][t][u][w]	n/a	Increasingly melting snow cover [t][w] *Potentially longer and more productive agricultural season [a][l]* Higher risk of droughts, increased need for irrigation [a][l][w]	Higher risk of extreme events (in particular for the cryosphere - glaciers, permafrost, snow - incl. avalanches) [h][t] Increased risk for mountain infrastructure [i][t]	Strategia di adattamento ai cambiamenti climatici - Valle d'Aosta - https://www.arpa.vda.it/it/effetti-sul-territorio-dei-cambiamenti-climatici/3716-strategia-di-adattamento-ai-cambiamenti-climatici-valle-d-aosta

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	consumption for heating (and more for cooling in summer) [e][u]			Risk for biodiversity (rare plants being substituted by a more common and more adaptable ones) [h][l] *Potential changes for forests (increased timber production, but more vulnerable to the extreme weather events) [l]*		
Veneto	-	Higher risk of flooding	-	Higher risk of flooding	Higher risk of flooding	Presentazione L'ALLINEAMENTO NELLA PIANIFICAZIONE LOCALE DELLE POLITICHE

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		[ci][e][i][l][u][w] Increased health risk (esp. for the newborns and the elderly, and for cardiovascular or respiratory pathologies) [h][u]		[a][ci][e][i][l][w] Higher risk of droughts [a][l][w] Higher risk of forest fires [h][l]	[a][ci][e][i][u][w] Higher risk of landslides [ci][e][i][l][u] Higher risk of forest fires [h][l]	PER IL CLIMA Luca Marchesi Direttore Area Tutela e Sicurezza del Territorio - https://www.venetoadapt.it/wp-content/uploads/2021/12/10.-Marchesi.pdf A regional adaptation strategy does not exist but is currently under elaboration.

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
LITHUANIA **National adaptation priorities/fields (climate adapt): [a] Agriculture/aquaculture, [e] Emergency management, [f] Forestry, ecosystems, biodiversity and landscape, [h] Public health, [io] Intersectoral objective, [is] Infrastructure, [t] Transport, [u] Urbanized areas, [w] Water resources**						

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
(Lietuva)	Higher risk of extreme events [is][e] Impact of hotter waters on energy production [is][e] Higher risk of droughts, reduction of river runoff and extreme water level fluctuations [w][is] Higher risk of flooding (sea level rise) [is][e] Higher risk of water pollution and landfill fires [w][is][e]	More frequent heatwaves [h][e][u] Higher risk of droughts [w][u] Higher risk of flooding (rainfall and storms, sea level rise) - coastal regions [f][t][is][e][u]	Higher risk of flooding (rainfall and storms, sea level rise) [f][t][is][e][u] Risk of salinity changes [w][f][a][h] Risk of water quality deterioration [w][a][h][e][u]	Higher volatility of vegetation period and snow cover [f][a] Higher risk of droughts [f][a] Higher flooding risk [f][a][e] Higher forest fire risk [f][e] Higher risk of other extreme events (frost, storms) [f][a][e] Risk of disease and pest	Higher risk of flooding (rainfall and storms, sea level rise) - coastal regions [f][t][is][e][u] Higher risk of extreme events [f][t][is][a][e][u]	www.meteo.lt https://am.lrv.lt/uploads/am/documents/files/KLIMATO%20KAITA/Studijos%2C%20metodin%C4%97%20med%C5%BEiaga/Klimato%20kaita_galutine%20ataskaita_2015_08_31.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	Vulnerability of landfills to flooding [is][e]			increase [f][a][h] Risk of soil degradation and changes in soil, water and air quality [f][a][h]		

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
NETHERLANDS **National adaptation priorities/fields (climate adapt): [a] Agriculture, horticulture, [ce] Cascading effects, [ci] Critical infrastructures, [h] Health (incl. allergies, infections), [n] Nature (incl. ecosystems), [w] Water**						
Noord-Nederland	Longer heatwaves, higher energy consumption Risk of more frequent and intense	More frequent droughts [n][w]	Higher risk of land subsidence [a][n] Higher risk of peat oxidation [n]	Higher risk of land subsidence [a][n] Higher risk of peat	Higher risk of drinking water shortage [ci][h][w]	NBRACER project proposal (currently in GAP phase) https://klimaatadaptatienederlandnl.translate.goog/kennisdossiers/

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	extreme events (wind, storms, rainfall) affecting electricity provision and infrastructure accessibility [ce][ci][w]	Higher flooding risk [ci] Risk of exposure to water-borne pathogens from flooded streets [ce][h] Higher risk of pollen allergy linked to CO2 increase, or longer allergy periods [h] Higher risk of heatwaves [h]	Higher risk of salinization, drinking water shortage [a][h][n][w] Higher flooding risk [ci]	oxidation [n] Higher risk of salinization [a][n][w] Risk of droughts affecting soils and groundwater levels [a][n][w] Risk of longer wet periods and extreme events affecting harvests [a] Risk of lower crop yields [a] Longer wet periods and	Higher flooding risk [a][ci]	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				modified climate patterns increasing diseases, mosquitoes and pests [a][h][n]		
Oost-Nederland	Longer heatwaves, higher energy consumption Risk of more frequent and intense extreme events (wind, storms, rainfall) affecting electricity provision and infrastructure	More frequent droughts [n][w] Higher flooding risk [ci] Risk of exposure to water-borne pathogens from flooded streets [ce][h] Higher risk of pollen allergy	Risk of coastal erosion shrinking natural areas [n] Higher risk of salinization, drinking water shortage [a][ci][h][n][w] Possible deterioration of bathing water quality [h] Higher flooding risk [ci] Migration of fish species	Risk of droughts affecting soils and groundwater levels [a][n][w] Risk of longer wet periods and extreme events affecting harvests [a] Risk of lower crop yields [a]	Higher risk of drinking water shortage [ci][h][w] Higher flooding and hailstorm risk [a][ci] Higher risk of pathogens in water & disseminated by flooding [a][ce][h][n][w] Higher risk of allergens,	https://klimaatadaptatienederland-nl.translate.goog/kennisdossiers/

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	accessibility [ce][ci][w]	linked to CO2 increase, or longer allergy periods [h] Higher risk of heatwaves[h]	from hotter waters [n	Longer wet periods and modified climate patterns increasing diseases, mosquitoes and pests [a][h][n]	infectious bacteria and mosquitoes [a][h][n]	
West-Nederland	Longer heatwaves, higher energy consumption Risk of more frequent and intense extreme events (wind, storms, rainfall) affecting electricity provision and infrastructur	More frequent droughts [n][w] Higher flooding risk [ci] Risk of exposure to water-borne pathogens from flooded streets [ce][h] Higher risk of pollen	Decrease of freshwater availability [ci][n] Risk of coastal erosion shrinking natural areas [n] Higher risk of salinization, drinking water shortage [a][ci][h][n][w] Possible deterioration of bathing water quality	Risk of droughts affecting soils and groundwater levels [a][n][w] Risk of longer wet periods and extreme events affecting harvests [a]	Higher risk of drinking water shortage [ci][w] Higher flooding and hailstorm risk [a][ci] Higher risk of pathogens in water & disseminated by flooding [a][ce][h][n][w] Higher risk of allergens,	https://klimaatadaptatienederland-nl.translate.goog/kennisdossiers/

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	e accessibility [ce][ci][w] Higher risk of salinization of drinking water [ci][w]	allergy linked to CO2 increase, or longer allergy periods [h] Higher risk of heatwaves [h]	[h] Higher flooding risk [ci] *Migration of fish species from hotter waters [n]*	Risk of lower crop yields [a] Longer wet periods and modified climate patterns increasing diseases, mosquitoes and pests [a][h][n]	infectious bacteria and mosquitoes [a][h][n]	
Zuid-Nederland	Longer heatwaves, higher energy consumption Risk of more frequent and intense extreme events (wind, storms, rainfall) affecting	More frequent droughts [n][w] Higher flooding risk [ci] Risk of exposure to water-borne pathogens	n/a	Risk of droughts affecting soils and groundwater levels [a][n][w] Risk of longer wet periods and extreme events	Higher risk of drinking water shortage [ci][w] Higher flooding and hailstorm risk [a][ci] Higher risk of pathogens in water & disseminated	https://klimaatadaptatienederland-nl.translate.goog/kennisdossiers/

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	electricity provision and infrastructure accessibility [ce][ci][w]	from flooded streets [ce][h] Higher risk of pollen allergy linked to CO2 increase, or longer allergy periods [h] Higher risk of heatwaves [h]		affecting harvests [a] Risk of lower crop yields [a] Longer wet periods and modified climate patterns increasing diseases, mosquitoes and pests [a][h][n]	by flooding [a][ce][h][n][w] Higher risk of allergens, infectious bacteria and mosquitoes [a][h][n]	

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
POLAND: **National adaptation priorities/fields (climate adapt): [af] Agriculture and fishing, [bf] Biodiversity and forest management, [cz] Coastal zones, [e] Energy security, [h] Health, [sc] Spatial management and**						

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
construction,[t] Transport, [w] Water management						
Dolnośląskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	n/a	Regulations to reduce emissions [af][bf][e][h][sc][t] Extended vegetation cycles [af][bf] Migration of alien species [af][bf] Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2 020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]		
Kujawskopomorskie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	[af][bf][e][h][w]			on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]		
Łódzkie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms	n/a	*Regulations to reduce emissions* *[af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species*	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w]	https://www.imgw.pl/sites/default/files/2 020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w]	[e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w]		*[af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of urban flooding [cz][e][sc][t][w]	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Lubelskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	Higher risk of gales [e]			[af][cz][w] Impact of higher temperature on animal health and production [af]		
Lubuskie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions* *[af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species* *[af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2 020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]		
Małopolskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding	n/a	*Regulations to reduce emissions* *[af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species* *[af][bf]* Higher risk of extreme events	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding	https://www.imgw.pl/sites/default/files/2 020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w]	[cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w]		[af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	[cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w]	
Mazowieckie	Higher risk of heatwaves [e][h][sc]	Higher risk of heatwaves [e][h][sc]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]*	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemyklimatu-polski.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w]	Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of landslides [cz][e][sc][t]		*Extended vegetation cycles [af][bf]* *Migration of alien species* *[af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w]	and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of landslides [cz][e][sc][t]	https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				Impact of higher temperature on animal health and production [af]		
Opolskie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]		
Podkarpackie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w]	n/a	*Regulations to reduce emissions* *[af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species* *[af][bf]* Higher risk of extreme events	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2 020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	[cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]		[af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]		
Podlaskie	Higher risk of heatwaves [e][h][sc]	Higher risk of heatwaves [e][h][sc]	n/a	*Regulations to reduce emissions* *[af][bf][e][h][sc][t]*	Higher risk of heatwaves [e][h][sc]	https://www.imgw.pl/sites/default/files/2 020-08/imgw_wspolczesne-problemyklimatu-polski.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]		*Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal	Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				health and production [af]		
Pomorskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of flooding	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of flooding (sea) [cz][e][sc][t][w]	Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of landslides [cz][e][sc][t] Higher risk associated with sea level rise [af][cz][e][sc][t][w]	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	(sea) [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e] Higher risk of landslides [cz][e][sc][t] Higher risk associated with sea level rise [af][cz][e][sc][t][w]		Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of landslides [cz][e][sc][t] Higher risk associated with sea level rise [af][cz][e][sc][t][w]	
Śląskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w]	n/a	*Regulations to reduce emissions* *[af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species* *[af][bf]* Higher risk of extreme events	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding	https://www.imgw.pl/sites/default/files/2 020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]		[af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	[cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of gales [e]	
Świętokrzyskie	Higher risk of heatwaves [e][h][sc]	Higher risk of heatwaves [e][h][sc]	n/a	*Regulations to reduce emissions* *[af][bf][e][h][sc][t]*	Higher risk of heatwaves [e][h][sc]	https://www.imgw.pl/sites/default/files/2 020-08/imgw_wspolczesne-problemyklimatu-polski.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]		*Extended vegetation cycles [af][bf]* *Migration of alien species* *[af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on	Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of gales [e]	https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				animal health and production [af]		
WarmińskoMazurskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of flooding	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e] Higher risk of landslides [cz][e][sc][t] Higher risk associated with sea level rise [af][cz][e][sc][t][w]	*Regulations to reduce emissions* *[af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species* *[af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	(sea) [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]			Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of landslides [cz][e][sc][t] Higher risk associated with sea level rise [af][cz][e][sc][t][w]	
Wielkopolskie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions* *[af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species* *[af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2 020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	Higher risk of gales [e]			on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]		
Zachodniopomorskie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w]	Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w]	*Regulations to reduce emissions* *[af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species*	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w]	https://www.imgw.pl/sites/default/files/2 020-08/imgw_wspolczesne-problemyklimatu-polski.pdf https://publikacje.pan.pl/Content/119782/ PDF/14_Prandecki_Wrzaszcz.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e]	Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e]	Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e]	*[af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e]	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
SLOVAKIA **National adaptation priorities/fields (climate adapt): [a] Agriculture, [b] Biodiversity and natural environment, [ei] Energy, industry, [f] Forestry [g] Geology, [h] Health, [re] Residential environment, [ri] Risk management, emergency management, [sc] Spatial management and construction, [to] Tourism, [tr] Transportation, [w] Water management**						
Bratislavský kraj	Higher demand for energy in summer season [ei] Increased risk of stormrelated electricity distuptions (e.g. caused by floods) [ei][w]	Overheating of buildings [ei][h][re] Higher demands on water consumption [w] Deterioration of traffic safety and flow [ei][h][re][ri][sc][tr] Disruption in supplies of energy, damage of equipment [ei][tr][w] Deterioration of general health (asthma, allergies, respiratory diseases) [h] Increased risk of	n/a	Fewer precipitations [a][b][w] Soil erosion [a][b] Decrease of soil moisture in Slovak lowlands - desiccation and salinization of soil [a][b][w]	Increased risk of extreme events - higher incidence of relatively longer droughts and relatively shorter heavy rain episodes [a][b][ei][re][ri][tr][w] More winter floods due to the unstable snow conditions [b][ri][to][tr] Increased risk of landslides [ei][g][re][ri][tr] Higher risk of forest fires [f][h][ri]	https://www.iea.org/articles/slovakrepublic-climate-resilience-policy-indicator https://climate- adapt.eea.europa.eu/repository/11273729 .pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		infectious diseases caused by polluted water and food [a][ei][h][w]				
Stredné Slovensko	Higher demand for energy in summer season [ei] Increased risk of stormrelated electricity disruptions (e.g. caused by floods) [ei][w]	Overheating of buildings [ei][h][re] Higher demands on water consumption [w] Deterioration of traffic safety and flow [ei][h][re][ri][sc][tr] Disruption in supplies of energy, damage of equipment [ei][tr][w] Deterioration of general health (asthma, allergies,	n/a	Northern Slovak Republic will likely experience the highest increase in annual precipitation [a][b][w] Soil erosion [a][b]	Increased risk of extreme events - higher incidence of relatively longer droughts and relatively shorter heavy rain episodes [a][b][ei][re][ri][tr][w] More winter floods due to the unstable snow conditions [b][ri][to][tr] Increased risk of landslides [ei][g][re][ri][tr] Higher risk of forest fires [f][h][ri]	https://www.iea.org/articles/slovakrepublic-climate-resilience-policy-indicator https://climate- adapt.eea.europa.eu/repository/11273729 .pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		respiratory diseases) [h] Increased risk of infectious diseases caused by polluted water and food [a][ei][h][w]				
Východné Slovensko	Higher demand for energy in summer season [ei] Increased risk of stormrelated electricity disruptions (e.g. caused by floods) [ei][w]	Overheating of buildings [ei][h][re] Higher demands on water consumption [w] Deterioration of traffic safety and flow [ei][h][re][ri][sc][tr] Disruption in supplies of energy, damage of equipment [ei][tr][w] Deterioration of general health	n/a	*Extension of the growing period (43 more days) [a]* Northern Slovak Republic will likely experience the highest increase in annual precipitation [a][b][w] Decrease of soil moisture in Slovak lowlands - desiccation and	Increased risk of extreme events - higher incidence of relatively longer droughts and relatively shorter heavy rain episodes [a][b][ei][re][ri][tr][w] More winter floods due to the unstable snow conditions [b][ri][to][tr] Increased risk of landslides [ei][g][re][ri][tr]	https://www.iea.org/articles/slovakrepublic-climate-resilience-policy-indicator https://climate- adapt.eea.europa.eu/repository/11273729 .pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		(asthma, allergies, respiratory diseases) [h] Increased risk of infectious diseases caused by polluted water and food [a][ei][h][w]		salinization of soil [a][b][w] Soil erosion [a][b]	Higher risk of forest fires [f][h][ri]	
Západné Slovensko	Higher demand for energy in summer season [ei] Increased risk of stormrelated electricity disruption's (e.g. caused by floods) [ei][w]	Overheating of buildings [ei][h][re] Higher demands on water consumption [w] Deterioration of traffic safety and flow [ei][h][re][ri][sc][tr] Disruption in supplies of energy, damage of equipment [ei][tr][w]	n/a	Fewer precipitations [a][b][w] Soil erosion [a][b] Decrease in water resources [a][b][w]	Increased risk of extreme events - higher incidence of relatively longer droughts and relatively shorter heavy rain episodes [a][b][ei][re][ri][tr][w] More winter floods due to the unstable snow conditions [b][ri][to][tr] Increased risk of landslides [ei][g][re][ri][tr]	https://www.iea.org/articles/slovakrepublic-climate-resilience-policy-indicator https://climate-adapt.eea.europa.eu/repository/11273729 .pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		Deterioration of general health (asthma, allergies, respiratory diseases) [h] Increased risk of infectious diseases caused by polluted water and food [a][ei][h][w]			Higher risk of forest fires [f][h][ri]	

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
SPAIN **National adaptation priorities/fields (climate adapt): [a] Agriculture, livestock, fisheries, aquaculture, food, [b] Biodiversity and protected areas, [cm] Coasts and the marine environment, [cu] City, urban planning and building, [e] Energy, [fi] Finance and insurance, [fo] Forestry, desertification, hunting and inland fishing, [hl] Health, [hr] Heritage (cultural and natural), [i] Industry and services, [mt] Mobility and transport, [to] Tourism, [w] Water resources**						

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Andalucía	More frequent heatwaves [cu][e][hl] More frequent droughts [a][b][cu][e][fi][fo][hl][hr][to][w]	Risk of water scarcity [a][cu][hl][to][w] More frequent heatwaves [cu][e][hl]	Risk of sea water intrusions [a][b][cm][w] Risk of sea level rise [a][b][cm][cu][fi][hr][i][mt][to]	Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr] [to][w] Higher evaporation and decrease of productivity [a][fo][w] Erosion and soil degradation [a][cm] Risk of sea water intrusions [a][b][cm][w] Risk of sea level rise [a][b][cm][cu][fi][hr][i][mt][to]	Higher risk of heatwaves [cu][e][hl] Higher risk from allergies and germs [a][hl]	http://www.conama9.conama.org/conama 9/download/files/CTs/2644_JM%E9ndez.p df
Aragón	More frequent heatwaves [cu][e][hl] More frequent droughts, water	More frequent droughts, water quality and quantity concerns	n/a	Biodiversity threats [b][hl][hr] More frequent droughts, water quality and	Higher risk of heatwaves [cu][e][hl] Higher risk from infectious diseases [a][hl]	https://www.aragoncambioclimatico.es/w p-content/uploads/Estrategia-Aragonesa- Cambio-Climatico-2-19.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	[a][cu][e][fi][fo][hl][to][w]		quantity concerns [a][cu][e][fi][fo][hl][to][w] Risk from extreme events [a][b][cm][fi][fo][hr] Risk of pest and disease increase [a][fo][hl]		
Canarias	More frequent heatwaves [cu][e][hl] More frequent droughts [a][b][cu][e][fi][fo][hl][hr][to][w] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt] [w] Higher risk of tropical storms and heavy rainfall	More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w] Higher heat island effect [cu][hl][hr][to] Higher flooding risk (sea level rise) [a][cm][cu][e][fi][hl][i][mt][w]	Risk of saltwater intrusions [a][b][cm][w] Risk of sea acidification and oxygen loss [a][b][cm] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w]	Biodiversity threats [b][hl][hr] More frequent heatwaves [cu][e][hl] More frequent droughts [a][b][cu][e][fi][fo][hl][hr] [to][w] Higher forest fire risk [b][fo][hl][hr][to]	Higher risk of heatwaves [cu][e][hl] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk from allergies and germs [a][hl] Higher forest fire risk [b][fo][hl][hr][to]	https://www.gobiernodecanarias.org/medioambiente/descargas/Cambio_climatico/Informacion-Publica/20220207_BORRADOR_ECAC.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Risk of pest and disease increase [a][fo][hl] *Tropicalisation [a][fo]*		
Cantabria	More frequent heatwaves [cu][e][hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	Higher risk of marine submersion (most of the population lives near the coast) [cm][cu][e][fi][hr][i][mt][t o] Higher flooding risk from ocean storms [a][cm][cu][e][fi][i][mt][w]	Higher risk of marine submersion (most of the population lives near the coast) Higher flooding risk from ocean storms [a][cm][cu][e][fi][hl][i][mt][w]		Higher risk of heatwaves [cu][e][hl] Higher forest fire risk [b][fo][hl][hr][to]	(FIHAC - Horizon Europe proposal under evaluation)
Castilla y León	-	-	n/a	Loss of agricultural production [a][fi]	Higher forest fire risk [b][fo][hl][hr][to]	

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				Higher forest fire risk [b][fo][hl][hr][to] Higher risk of soil erosion [a][cm][hr]		
Castilla-La Mancha	More frequent heatwaves [cu][e][hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	More frequent heatwaves [cu][e][hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	n/a	Higher forest fire risk [b][fo][hl][hr][to] Increased thermal stress (semi-arid areas) [a][b][fo][hr][w] Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr] [to][w]	Higher risk of heatwaves [cu][e][hl] Higher forest fire risk [b][fo][hl][hr][to] Higher risk from infectious diseases [a][hl] Higher risk from allergies and germs [a][hl] Higher forest fire risk [b][fo][hl][hr][to]	https://www.castillalamancha.es/gobierno /desarrollosostenible/estructura/dgecocir/ actuaciones/impactos-del-cambioclim%C3%A1tico-en-castilla-la-mancha
Cataluña	-	More frequent heatwaves, pollution increase [cu][e][hl]	Higher flooding risk [a][cm][cu][e][fi][hl][i][mt	Biodiversity threats [b][hl][hr]	Higher risk of heatwaves [cu][e][hl]	https://cads.gencat.cat/web/.content/Doc uments/Publicacions/tercer-informesobre-canvi-climatic-catalunya/Sintesis/CC_SintesiCASTELLA_web.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	][w] Higher risk of coastal erosion [b][cm][cu][fi][hr][to] Higher risk of toxic algae	More frequent heatwaves [cu][e][hl] More frequent droughts [a][b][cu][e][fi][fo][hl][hr] [to][w] Higher forest fire risk [b][fo][hl][hr][to]	Higher risk from infectious diseases [a][hl] Higher forest fire risk [b][fo][hl][hr][to]	
Comunidad de Madrid	More frequent heatwaves [cu][e][hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	More frequent heatwaves [cu][e][hl] Higher heat island effect [cu][hl][hr][to] Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr] [to][w] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w]	n/a	Biodiversity threats [b][hl][hr] Higher forest fire risk [b][fo][hl][hr][to]	Higher risk of heatwaves [cu][e][hl] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher forest fire risk [b][fo][hl][hr][to]	https://www.madrid.es/UnidadesDescentr alizadas/Sostenibilidad/EspeInf/EnergiayCC /04CambioClimatico/4bVulnera/Ficheros/I nfVulneraCC2015VerWeb.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Comunidad Foral de Navarra	-	More frequent heatwaves [cu][e][hl] Higher heat island effect [cu][hl][hr][to] Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr] [to][w] Increased air pollution [a][cu][hl][hr][mt][to]	n/a	Higher transpiration and water stress [a][b][fo][hl][hr][w] Risk from heatwaves on livestock [a] Risk of pest and disease increase [a][fo][hl]	Higher risk of heatwaves [cu][e][hl] Higher risk from infectious diseases [a][hl] Higher risk from allergies [a][hl]	http://www.navarra.es/NR/rdonlyres/AE5E B2EC-64A8-4B0E-8584-D683B3E5CE2D/409037/hojarutamar19.PD F
Comunitat Valenciana	-	More frequent heatwaves [cu][e][hl] Higher heat island effect [cu][hl][hr][to] Higher risk of droughts	Higher risk of coastal erosion [b][cm][cu][fi][hr][to]	Higher risk of soil erosion [a][cm][hr] Biodiversity threats [b][hl][hr] Higher forest fire risk	Higher risk of heatwaves [cu][e][hl] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher forest fire risk	https://agroambient.gva.es/va/web/cambi o-climatico/2020-2030

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		[a][b][cu][e][fi][fo][hl][hr] [to][w] Increased air pollution [a][cu][hl][hr][mt][to]		[b][fo][hl][hr][to] Risk of pest and disease increase [a][fo][hl]	[b][fo][hl][hr][to] Higher risk from infectious diseases [a][hl] Higher risk from allergies [hl]	
Extremadura	-	More frequent heatwaves [cu][e][hl] Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr] [to][w]	n/a	Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr] [to][w] Higher evaporation and decrease of productivity [a][fi][fo] More frequent heatwaves [cu][e][hl] Higher forest fire risk [b][fo][hl][hr][to]	Higher risk of heatwaves [cu][e][hl] Higher risk from infectious diseases [a][hl] Higher forest fire risk [b][fo][hl][hr][to] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of landslides [cu][e][fi][i][mt]	http://extremambiente.juntaex.es/files/bib lioteca_digital/Mapa%20de%20Impactos% 20del%20Cambio%20Climatico%20en%20E xtremadura%20web.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				Risk of pest and disease increase [a][fo][hl]		
Galicia	More frequent heatwaves (loss of heat dissipation) [cu][e][hl] More frequent droughts, impacts on hydroelectricity [cu][e][w]	Higher risk of water stress for local communities [a][cu][hl][yo][w] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of severe droughts [a][cu][e][w] Higher risk of changing water quality [a][cu][hl][w] Higher risk from infectious diseases [a][hl]	Higher risk of sea water acidification [a][b][cm] Higher risk of disruptions in the composition of fisheries (new species and migration of others) [a][cm] Higher risk of affecting endorrheic ecosystems such as lakes, ponds, rivers and streams of high mountains [a][b]	Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr][to][w] Higher risk of desertification and erosion [a][b][fo][hr][w] Higher demand for irrigation [a][w] Appearance of new pests and diseases in plants and animals [a][fo][hl] Shorter crop maturation due to higher average temperatures and lower production [a]	Rising temperatures and prolonged periods of heat waves will increase the problems of railway buckling [mt] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of damage to roads [cu][mt] Higher risk of strong winds affecting branches and trees on roads [mt]	https://cambioclimatico.xunta.gal/c/document_library/get_file?folderId=86590&name=DLFE-54555.pdf

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				Biodiversity threats [b][hl][hr]		
Illes Balears	Risk of overloading existing sanitation and drinking water supply facilities [cu][fi][hl][i][to][w] Higher risk of overloads and flow overflow in waste water treatment plants [cu][fi][hl][i][to][w] Damage to desalination plants [a][cm][cu][w] Less water availability in aquifers and surface water bodies due to a decrease	More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w] Reduction in the availability of drinking water [cu][hl][to][w]	Risk of sea level rise [a][b][cm][cu][fi][hr][i][mt][to] Risk of saltwater intrusions [a][b][cm][w]	Increased risk of hydrological and agricultural drought for irrigated crops [a][w] Decrease in the levels of some aquifers and problems in meeting demands [a][cu][to][w]	Material damage to water catchment infrastructures and desalination plants [a][cm][cu][w]	https://www.caib.es/sites/canviclimatic2/e s/estudios_de_vulnerabilidad/

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	in spillage and consequent increase in the need for use and production of desalination plants [a][b][cu][e][hl][i][to][w]					
La Rioja	-	More frequent heatwaves [cu][e][hl] Degradation of roads and railways [fi][t] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w]	n/a	Higher risk of soil erosion [a][cm][hr] Higher risk of droughts, desertification [a][l][w] Higher risk of crop displacement due to changes in temperature Appearance of new pests and diseases in	-	https://theconversation.com/el-territoriodel-rioja-ante-el-desafio-del-cambio- climatico-117195

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				plants and animals [a][fo][hl]		
País Vasco		More frequent heatwaves [cu][e][hl] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w]	Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of coastal erosion [b][cm][cu][fi][hr][to]	Biodiversity threats [b][hl][hr]	Higher risk of heatwaves [cu][e][hl]	https://bideoak2.euskadi.eus/debates/deb ate_1310/Estrategia_cambio_climatico_cli ma_2050_es.pdf
Principado de Asturias	Reduction in the availability of water for commercial and public use [a][cu][hl][to][w]	Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr] [to][w]	Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of damaging ecosystemic services [b][fo][i] Risk of sea level rise [a][b][cm][cu][fi][hr][i][mt	Risk of soil erosion [a][b][cm][hr] Higher forest fire risk [b][fo][hl][hr][to] Higher vulnerability of mountain ecosystems Biodiversity threats [b][hl][hr]	Higher risk of heatwaves [cu][e][hl] Higher forest fire risk [b][fo][hl][hr][to]	https://medioambiente.asturias.es/docum ents/646140/0/DiagnosticoPrevioCambioCl imaAsturias_para+portal.pdf/95b9334d-76c1-c8ca-2b8c-91022e998fba

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Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
			][to] Higher risk of coastal erosion [b][cm][cu][fi][hr][to] Reduction in the number of sandy beaches [b][cm][hr][to] Higher risk of depletion of water resources due to higher content of nitrates on the water streams [a][cm][cu][hl][to][w]	Risk of pest and disease increase [a][fo][hl]		
Región de Murcia	-	Higher heat island effect [cu][hl][hr][to] More frequent heatwaves [cu][e][hl]	Risk of sea water intrusions [a][b][cm][w] Decreased access to fishing areas due to their displacement to the north [a][cm] Decrease in the	Higher evaporation and decrease of productivity [a][fi][fo] Higher transpiration and water stress [a][b][fo][hl][hr][w]	Higher risk of heatwaves [cu][e][hl] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w]	https://transparencia.carm.es/wres/transp arencia/doc/Organos-colegiados/Consejo_Asesor_Regional_Med io_Ambiente/2020_02_24/Estrategia_cam bio_climatico.pdf

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		Increase in the transmission of infection diseases (Chicunguña and Zika) [a][hl] Increase in allergic reactions to pollen [hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	capacity of carbon storage by the sea due to changes in marine ecosystems [cm]	*Tropicalisation [a][fo]* *Biodiversity displacement and change [b][hl][hr]* Loss of agricultural production [a][fi]	Higher risk from infectious diseases [a][hl] Higher risk from allergies [hl]	

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Annex 3: Survey for mapping EO-based climate services

PROTECT - Survey - Mapping of European EO climate services providers

Are you a European company providing innovative EO services for climate adaptation or mitigation?

Fill in our EU Survey!

Background and objectives of this questionnaire

The European Union funded PROTECT project aims to support urgent action for climate adaptation, mitigation and resilience. The project aims to enable public authorities to use state-of-the-art public procurement approaches in order to identify solutions – climate services based on EO - that best fit the specific and systemic needs of public demand. The initial focus is on five encompassing application domains: Energy and Utilities, Sustainable Urban Communities, Marine and Coastal Environment and Agriculture, Forestry and Other Land Use (including bioeconomy) and Civil Security and Protection.

This project aims to prepare a future European funded Pre-Commercial Procurement initiative (2024). It has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592.

*Learn more about Innovation procurement and its two modalities - Pre-Commercial procurement (PCP) and Public procurement of Innovative solutions (PPI) – **in the attached document below**.*

What_is_Innovation_Procurement.pdf

Context

The project partners are looking for innovative services using EO data addressing the needs of public authorities regarding climate adaptation and mitigation.

The objectives of this survey are :

1. To map European climate services that use EO (EO) data.
2. To give public authorities a snapshot of the state of the art of the market and on-going developments

Your interest in filling in this questionnaire

Each pre-identified provider will have the chance to be referenced by the PROTECT project and might have the opportunity to present their services in front of participating public buyers in the frame of an Open Market Consultation (online pitching sessions) and some of our project activities.

We are looking forward to working with you!

Instructions to fill in this questionnaire

* It is recommended to fill in this form together with the business representative of the your entity.

* If more than one of the company's services are fitting to the scope, the questionnaire should be filled in separately for each service by selecting Service 1 first, filling in all the details for the respective service and after selecting Add another service option, filling in all the information for Service 2 etc. * The information provided will only be used in the context of the PROTECT project. Processing of personal information is fully compliant with data protection regulations in place (learn more about GDPR here).

Do you give your consent for PROTECT project to procees your information?

- ○ I agree – Please fill in the questions below
- ○ I don't agree – **Thank you for your time ! Unfortunately, you won't be able to continue this survey ! Have a wonderful day !**

Personal and Organisation Information

*** 1. Name and surname**

*** 2. Name of the organization**

*** 3. Do you give your consent for PROTECT project to procees your information?**

- ○ I agree
- ○ I don't agree

*** 4. Email**

*** 5. Phone number**

*** 6. Website**

7. Logo

*** 8. Headquarter's country**

- ○ AT - Austria

- BE - Belgium
- BG - Bulgaria
- HR - Croatia
- CY - Cyprus
- CZ - Czechia
- DK - Denmark
- EE - Estonia
- FI - Finland
- FR - France
- DE - Germany
- EL - Greece
- HU - Hungary
- IE - Ireland
- IT - Italy
- LV - Latvia
- LT - Lithuania
- LU - Luxembourg
- MT - Malta
- NL - Netherlands
- PL - Poland
- PT - Portugal
- RO - Romania
- SK - Slovak Republic
- SI - Slovenia
- ES - Spain
- SE – Sweden

*** 9. City**

*** 10. Type of enterprise**

- Micro Enterprises (<10 employees)
- Small Enterprises (10-49 employees)

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- Medium-sized Enterprises (50-249 employees)
- Large Enterprises (>250 employees)
- Public Organization
- Others

*** 11. Company's description (Max. 10 lines) Description of your service**

According to European Union Agency for the Space Programme (EUSPA): "EO refers to the use of remote sensing technologies to monitor land, marine (seas, rivers, lakes) and atmosphere. Satellite based EO relies on the use of satellite-mounted payloads to gather imaging data about the Earth's characteristics. The images are then processed and analysed in order to extract different types of information that can serve a very wide range of applications and industries."

The European Union definition as outlined in the 2015 European Union research and innovation roadmap for climate services reads as follows:

"we attribute to the term a broad meaning, which covers the transformation of climate-related data — together with other relevant information — into customised products such as projections, forecasts, information, trends, economic analysis, assessments (including technology assessment), counselling on best practices, development and evaluation of solutions and any other service in relation to climate that may be of use for the society at large. As such, these services include data, information and knowledge that support adaptation, mitigation an disaster risk management (DRM)."

Service 1

*** A. Please select option:**

☐ Service 1 (S1)

*** S1.1. In which of the following five applications domains is the service delivered?**

- **Agriculture, forestry and other land uses (including the bioeconomy)**

Ex : Agriculture, forestry and other land uses cover a wide range of environments and have great potential for climate services. Unsustainable agricultural and forestry practices (e.g. overexploitation of soils, conversion of forests to agricultural land) generate large amounts of greenhouse gases and disturb the already fragile balance of local ecosystems. **a) Environmental monitoring**

- Carbon capture & content assessment
- Environmental impact monitoring
- Biomass monitoring
- Deforestation/degradation monitoring
- Others

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*** If Others, write which one :**

b) Natural resources monitoring
Biomass monitoring

Crop yield forecasting

Soil condition monitoring

Vegetation monitoring
Forest Inventory monitoring

Forest vegetation health monitoring

Others

*** If Others, write which one :**

c) Operations management Asset monitoring

CAP monitoring

Farm management systems

Pastureland management

Precision irrigation

Variable rate application

Forest asset management

- Forest exploitation certification
- Others

*** If Others, write which one :**

d) Weather services for agriculture

- Snow and ice
  - Climate services for agriculture
  - Weather forecasting for agriculture
  - Others

  *** If Others, write which one :**

Energy and utilities

Ex : Utilities include all activities related to water supply, sewage services, electricity, dams and natural gas.

a) Renewable energy:

Site selection, planning and monitoring for renewable energy

- Renewable energy assessment potential and forecast
- Others

*** If Others, write which one :**

b) Other

- Energy network conditions monitoring
- Power plant design optimisation
- Environmental impact assessment of energy and mineral resources plants

- Pipeline monitoring

- Others

*** If Others, write which one :**

c) Waste

- Climate data and modelling for waste monitoring and management

- Others

*** If Others, write which one :**

- **Marine and coastal environment**

  Ex : Marine environments are aquatic environments with high levels of dissolved salt. They include the open ocean, the deep ocean and coastal marine ecosystems, each with different physical and biological characteristics and therefore representing different ecosystems.

a) Environmental monitoring

- Marine pollution monitoring

- Others

*** If Others, write which one :**

b) Maritime engineering

- Marine surveying and mapping

- Dredging

Others

*** If Others, write which one :**

c) Navigation

- Climate data and modelling for navigation

- Others

*** If Others, write which one :**

d) Ocean services
- Metocean

- Others

*** If Others, write which one :**

e) Ports

- Climate data and modelling for ports

- Others

*** If Others, write which one :**

f) Vessel tracking

- Dark vessel monitoring

- Others

*** If Others, write which one :**

g) Aquaculture

- Climate data and modelling for aquaculture

- Others

*** If Others, write which one :**

h) Fisheries

- Illegal, unreported and unregulated fishing (IUU) control

This project has received funding from the Horizon Europe Framework

- Catch optimisation
- Fish stock detection
- Others

*** If Others, write which one :**

- **Security and civil protection**

Ex : Civil security and protection includes the policies, bodies and mechanisms that a country or region has in place to protect itself against new and urgent threats to the safety of people and/or the functioning of critical infrastructure.

a) Early warning
- Forecast
- Monitoring and warning services
- Others

*** If Others, write which one :**

b) Migration and settlement
- Monitoring and forecasting the climate impact of migration
- Forecasting of climate drivers for migration
- Others

*** If Others, write which one :**

c) Post-event analysis Post-event analysis

Others

*** If Others, write which one :**

d) Preparedness

Preparedness

Others

*** If Others, write which one :**

e) Rapid mapping Rapid mapping

Others

*** If Others, write which one :**

f) Search and Rescue

Beacons for Aviation

Beacons for Land

Situational awareness supporting search and rescue

Others

*** If Others, write which one :**

This project has received funding from the Horizon Europe Framework

g) Infrastructure Planning ○ Permitting

○ Vulnerability Analysis

○ Others

*** If Others, write which one :**

h) Insurance for natural disasters

○ Risk modelling

○ Others

*** If Others, write which one :**

i) Critical infrastructure

○ Construction Operations

○ Monitoring of impact of human activities on infrastructure

○ Infrastructure monitoring

○ Predictive maintenance

○ Emergency assistance

○ Design of infrastructure

○ Others

This project has received funding from the Horizon Europe Framework

*** If Others, write which one :**

Sustainable urban communities

Ex : Green and sustainable urban communities harness their human, natural and financial capital to meet current and future needs in a sustainable manner, with a long-term perspective (ex: heat islands, effects of climate change on the (vulnerable) urban population etc.).

a) Environmental monitoring

- ☐ Air quality monitoring in urban environments
- ☐ Thermal auditing
- ☐ Urban greening
- ☐ Urban heat islands
- ☐ Others

*** If Others, write which one :**

b) Smart cities operations

- ☐ Smart waste management
- ☐ Others

*** If Others, write which one :**

c) Urban planning and monitoring

- ☐ Cultural heritage monitoring
- ☐ Surveying and mapping of urban areas

This project has received funding from the Horizon Europe Framework

☐ Urban modelling, 3D modelling, Digital Twins

☐ Urban planning

☐ Others

*** If Others, write which one :**

d) Urban mobility

○ Climate data and modelling for urban mobility monitoring and forecasting

○ Others

*** If Others, write which one :**

*** S1.2. Service acronym or project name**

(Horizon 2020 projects and similar are being taken into consideration as well) :

*** S1.3. Which technologies are used for the service? (multiple choices)** ☐ Satellites

*** S1.3.1. Describe the typology of EO data you use (Ex: Sentinel 5P, Pléiades, Copernicus atmosphere services etc.) :**

☐ Drones
☐ Aircrafts

☐ Ground sensors

☐ IoT

☐ Artificial Intelligence/Machine Learning

☐ Others

*** If Others, write which one :**

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*** S1.4. Which is the Technological Readiness Level of the solution? The TRL levels for software are described according to the Annex A from ECSS-E-HB-11A which can be find above.**

○ TRL 1

Ex : Preliminary algorithmic stage. Publication of research results.

*** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 2

Ex : Individual algorithms or functions are prototyped.

*** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 3

Ex : Prototype of the main functionalities of the integrated system.

*** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 4

Ex : Alpha version. Preliminary release of non -mature software version; distributed to a community at an early stage of the software development life-cycle; that implements the main functionality of the software and by which preliminary verification and validation activities are archieved.

*** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 5

Ex : Beta version. Preliminary release of non -mature software version; distributed to a community at an early stage of the software life-cycle, that implements the complete functionality of the software and by which preliminary verification and validation activities are archived.

*** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 6

Ex : Ready for use in an operational or production context, including user support, as a building block or a tool.

This project has received funding from the Horizon Europe Framework

*** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 7

Ex : Demonstrator. Building block and tailored generic software product qualified for a particular purpose.

*** S1.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S1.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

○ TRL 8

Ex : System qualified and ready to be applied in an operational environment.

*** S1.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S1.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

○ TRL 9

Ex : Has been applied in the execution of an operational environment.

*** S1.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S1.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

*** S1.5. Explain how your service assists public authorities in climate adaptation or mitigation actions :**

*** S1.6. What kind of data do you lack of to improve your service?**

*** S1.7. What future missions or emerging technologies would help improve your service and make it fit better with market needs?**

*** S1.8. Do you have or do you plan to implement partnerships with other climate services providers to complement you service offer?**

S1.9. Comments

☐ Add another service – see below

Service 2

*** B. If Add another service selected, please select option:**

☐ Service 2 (S2)

*** S2.1. In which of the following five applications domains is the service delivered?**

○ **Agriculture, forestry and other land uses (including the bioeconomy)**

Ex : Agriculture, forestry and other land uses cover a wide range of environments and have great potential for climate services. Unsustainable agricultural and forestry practices (e.g. overexploitation of soils, conversion of forests to agricultural land) generate large amounts of greenhouse gases and disturb the already fragile balance of local ecosystems. **a) Environmental monitoring**

○ Carbon capture & content assessment

○ Environmental impact monitoring

○ Biomass monitoring

○ Deforestation/degradation monitoring

○ Others

*** If Others, write which one :**

b) Natural resources monitoring ○ Biomass monitoring

○ Crop yield forecasting

○ Soil condition monitoring

○ Vegetation monitoring

○ Forest Inventory monitoring

This project has received funding from the Horizon Europe Framework

- Forest vegetation health monitoring
- Others

*** If Others, write which one :**

c) Operations management
- Asset monitoring
- CAP monitoring
- Farm management systems
- Pastureland management
- Precision irrigation
- Variable rate application
- Forest asset management
- Forest exploitation certification
- Others

*** If Others, write which one :**

d) Weather services for agriculture

- Snow and ice
  - Climate services for agriculture
  - Weather forecasting for agriculture
  - Others

*** If Others, write which one :**

- **Energy and utilities**

  Ex : Utilities include all activities related to water supply, sewage services, electricity, dams and natural gas.

  a) Renewable energy:

- Site selection, planning and monitoring for renewable energy
- Renewable energy assessment potential and forecast
- Others

*** If Others, write which one :**

b) Other

- Energy network conditions monitoring
- Power plant design optimisation
- Environmental impact assessment of energy and mineral resources plants
- Pipeline monitoring
- Others

This project has received funding from the Horizon Europe Framework

*** If Others, write which one :**

c) Waste

- Climate data and modelling for waste monitoring and management

- Others

*** If Others, write which one :**

- **Marine and coastal environment**

  Ex : Marine environments are aquatic environments with high levels of dissolved salt. They include the open ocean, the deep ocean and coastal marine ecosystems, each with different physical and biological characteristics and therefore representing different ecosystems.

a) Environmental monitoring

- Marine pollution monitoring

- Others

*** If Others, write which one :**

b) Maritime engineering

- Marine surveying and mapping

- Dredging

- Others

*** If Others, write which one :**

c) Navigation

- Climate data and modelling for navigation

- Others

*** If Others, write which one :**

d) Ocean services

- Metocean

- Others

*** If Others, write which one :**

e) Ports

- Climate data and modelling for ports

- Others

*** If Others, write which one :**

f) Vessel tracking

- Dark vessel monitoring

- Others

*** If Others, write which one :**

g) Aquaculture

- Climate data and modelling for aquaculture

- Others

This project has received funding from the Horizon Europe Framework

*** If Others, write which one :**

h) Fisheries

- Illegal, unreported and unregulated fishing (IUU) control
- Catch optimisation
- Fish stock detection
- Others

*** If Others, write which one :**

- **Security and civil protection**

  Ex : Civil security and protection includes the policies, bodies and mechanisms that a country or region has in place to protect itself against new and urgent threats to the safety of people and/or the functioning of critical infrastructure.

  a) Early warning
  - Forecast
  - Monitoring and warning services
  - Others

  *** If Others, write which one :**

  b) Migration and settlement
  - Monitoring and forecasting the climate impact of migration
  - Forecasting of climate drivers for migration
  - Others

*** If Others, write which one :**

c) Post-event analysis ○ Post-event analysis

○ Others

*** If Others, write which one :**

d) Preparedness

○ Preparedness

○ Others

*** If Others, write which one :**

e) Rapid mapping ○ Rapid mapping

○ Others

*** If Others, write which one :**

f) Search and Rescue

○ Beacons for Aviation

○ Beacons for Land

○ Situational awareness supporting search and rescue

○ Others

*** If Others, write which one :**

g) Infrastructure Planning ○ Permitting

○ Vulnerability Analysis

○ Others

*** If Others, write which one :**

h) Insurance for natural disasters

○ Risk modelling

○ Others

*** If Others, write which one :**

i) Critical infrastructure

○ Construction Operations

○ Monitoring of impact of human activities on infrastructure

○ Infrastructure monitoring

○ Predictive maintenance

○ Emergency assistance

○ Design of infrastructure

○ Others

This project has received funding from the Horizon Europe Framework

*** If Others, write which one :**

○ **Sustainable urban communities**

Ex : Green and sustainable urban communities harness their human, natural and financial capital to meet current and future needs in a sustainable manner, with a long-term perspective (ex: heat islands, effects of climate change on the (vulnerable) urban population etc.).

a) Environmental monitoring

☐ Air quality monitoring in urban environments

☐ Thermal auditing

☐ Urban greening

☐ Urban heat islands

☐ Others

*** If Others, write which one :**

b) Smart cities operations

☐ Smart waste management

☐ Others

*** If Others, write which one :**

c) Urban planning and monitoring ☐ Cultural heritage monitoring

☐ Surveying and mapping of urban areas

This project has received funding from the Horizon Europe Framework

☐ Urban modelling, 3D modelling, Digital Twins

☐ Urban planning

☐ Others

*** If Others, write which one :**

d) Urban mobility

○ Climate data and modelling for urban mobility monitoring and forecasting

○ Others

*** If Others, write which one :**

*** S2.2. Service acronym or project name**

(Horizon 2020 projects and similar are being taken into consideration as well) :

*** S2.3. Which technologies are used for the service? (multiple choices)** ☐ Satellites

*** S2.3.1. Describe the typology of EO data you use (Ex: Sentinel 5P, Pléiades, Copernicus atmosphere services etc.) :**

☐ Drones

☐ Aircrafts

☐ Ground sensors

- ☐ IoT
- ☐ Artificial Intelligence/Machine Learning
- ☐ Others

*** If Others, write which one :**

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*** S2.4. Which is the Technological Readiness Level of the solution? The TRL levels for software are described according to the Annex A from ECSS-E-HB-11A which can be find above.**

○ TRL 1

Ex : Preliminary algorithmic stage. Publication of research results.

*** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 2

Ex : Individual algorithms or functions are prototyped.

*** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 3

Ex : Prototype of the main functionalities of the integrated system.

*** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 4

Ex : Alpha version. Preliminary release of non -mature software version; distributed to a community at an early stage of the software development life-cycle; that implements the main functionality of the software and by which preliminary verification and validation activities are archieved.

*** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 5

Ex : Beta version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software life-cycle, that implements the complete functionality of the software and by which preliminary verification and validation activities are archived.

*** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 6

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Ex : Ready for use in an operational or production context, including user support, as a building block or a tool.

*** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 7

Ex : Demonstrator. Building block and tailored generic software product qualified for a particular purpose.

*** S2.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S2.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

○ TRL 8

Ex : System qualified and ready to be applied in an operational environment.

*** S2.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S2.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

○ TRL 9

Ex : Has been applied in the execution of an operational environment.

*** S2.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S2.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

*** S2.5. Explain how your service assists public authorities in climate adaptation or mitigation actions :**

*** S2.6. What kind of data do you lack of to improve your service?**

*** S2.7. What future missions or emerging technologies would help improve your service and make it fit better with market needs?**

*** S2.8. Do you have or do you plan to implement partnerships with other climate services providers to complement you service offer?**

S2.9. Comments

☐ Add another service - see below

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Service 3

*** C. If Add another service selected, please select option:**

☐ Service 3 (S3)

*** S3.1. In which of the following five applications domains is the service delivered?**

○ **Agriculture, forestry and other land uses (including the bioeconomy)**

Ex : Agriculture, forestry and other land uses cover a wide range of environments and have great potential for climate services. Unsustainable agricultural and forestry practices (e.g. overexploitation of soils, conversion of forests to agricultural land) generate large amounts of greenhouse gases and disturb the already fragile balance of local ecosystems. **a) Environmental monitoring**

○ Carbon capture & content assessment

○ Environmental impact monitoring

○ Biomass monitoring

○ Deforestation/degradation monitoring

○ Others

*** If Others, write which one :**

b) Natural resources monitoring ○ Biomass monitoring

○ Crop yield forecasting

○ Soil condition monitoring

○ Vegetation monitoring

This project has received funding from the Horizon Europe Framework

- Forest Inventory monitoring
- Forest vegetation health monitoring
- Others

*** If Others, write which one :**

c) Operations management

- Asset monitoring
- CAP monitoring
- Farm management systems
- Pastureland management
- Precision irrigation
- Variable rate application
- Forest asset management
- Forest exploitation certification
- Others

*** If Others, write which one :**

d) Weather services for agriculture

- Snow and ice
  - Climate services for agriculture
  - Weather forecasting for agriculture
  - Others

*** If Others, write which one :**

- **Energy and utilities**

Ex : Utilities include all activities related to water supply, sewage services, electricity, dams and natural gas.

a) Renewable energy:

- Site selection, planning and monitoring for renewable energy
- Renewable energy assessment potential and forecast
- Others

*** If Others, write which one :**

b) Other

- Energy network conditions monitoring
- Power plant design optimisation
- Environmental impact assessment of energy and mineral resources plants
- Pipeline monitoring

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- Others

*** If Others, write which one :**

c) Waste

- Climate data and modelling for waste monitoring and management

- Others

*** If Others, write which one :**

- **Marine and coastal environment**

  Ex : Marine environments are aquatic environments with high levels of dissolved salt. They include the open ocean, the deep ocean and coastal marine ecosystems, each with different physical and biological characteristics and therefore representing different ecosystems.

a) Environmental monitoring

- Marine pollution monitoring

- Others

*** If Others, write which one :**

b) Maritime engineering

- Marine surveying and mapping

- Dredging

- Others

*** If Others, write which one :**

c) Navigation

- Climate data and modelling for navigation
- Others

*** If Others, write which one :**

d) Ocean services

- Metocean
- Others

*** If Others, write which one :**

e) Ports

- Climate data and modelling for ports
- Others

*** If Others, write which one :**

f) Vessel tracking

- Dark vessel monitoring
- Others

*** If Others, write which one :**

g) Aquaculture

- Climate data and modelling for aquaculture
- Others

This project has received funding from the Horizon Europe Framework

*** If Others, write which one :**

h) Fisheries

- Illegal, unreported and unregulated fishing (IUU) control
- Catch optimisation
- Fish stock detection
- Others

*** If Others, write which one :**

- **Security and civil protection**

  Ex : Civil security and protection includes the policies, bodies and mechanisms that a country or region has in place to protect itself against new and urgent threats to the safety of people and/or the functioning of critical infrastructure.

  a) Early warning
  - Forecast
  - Monitoring and warning services
  - Others

  *** If Others, write which one :**

  b) Migration and settlement
  - Monitoring and forecasting the climate impact of migration
  - Forecasting of climate drivers for migration

Others

*** If Others, write which one :**

c) Post-event analysis Post-event analysis

Others

*** If Others, write which one :**

d) Preparedness

Preparedness

Others

*** If Others, write which one :**

e) Rapid mapping Rapid mapping

Others

*** If Others, write which one :**

f) Search and Rescue

Beacons for Aviation

Beacons for Land

Situational awareness supporting search and rescue

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- Others

*** If Others, write which one :**

g) Infrastructure Planning
- Permitting
- Vulnerability Analysis
- Others

*** If Others, write which one :**

h) Insurance for natural disasters
- Risk modelling
- Others

*** If Others, write which one :**

i) Critical infrastructure
- Construction Operations
- Monitoring of impact of human activities on infrastructure
- Infrastructure monitoring
- Predictive maintenance
- Emergency assistance
- Design of infrastructure

○ Others

*** If Others, write which one :**

○ **Sustainable urban communities**

Ex : Green and sustainable urban communities harness their human, natural and financial capital to meet current and future needs in a sustainable manner, with a long-term perspective (ex: heat islands, effects of climate change on the (vulnerable) urban population etc.).

a) Environmental monitoring

☐ Air quality monitoring in urban environments

☐ Thermal auditing

☐ Urban greening

☐ Urban heat islands

☐ Others

*** If Others, write which one :**

b) Smart cities operations

☐ Smart waste management

☐ Others

*** If Others, write which one :**

c) Urban planning and monitoring ☐ Cultural heritage monitoring

☐ Surveying and mapping of urban areas

☐ Urban modelling, 3D modelling, Digital Twins

☐ Urban planning

☐ Others

*** If Others, write which one :**

d) Urban mobility

○ Climate data and modelling for urban mobility monitoring and forecasting

○ Others

*** If Others, write which one :**

*** S3.2. Service acronym or project name**

(Horizon 2020 projects and similar are being taken into consideration as well) :

*** S3.3. Which technologies are used for the service? (multiple choices)** ☐ Satellites

*** S3.3.1. Describe the typology of EO data you use (Ex: Sentinel 5P, Pléiades, Copernicus atmosphere services etc.) :**

☐ Drones

☐ Aircrafts

- [ ] Ground sensors
- [ ] IoT
- [ ] Artificial Intelligence/Machine Learning
- [ ] Others

*** If Others, write which one :**

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*** S3.4. Which is the Technological Readiness Level of the solution? The TRL levels for software are described according to the Annex A from ECSS-E-HB-11A which can be find above.**

- ○ TRL 1

Ex : Preliminary algorithmic stage. Publication of research results.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- ○ TRL 2

Ex : Individual algorithms or functions are prototyped.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- ○ TRL 3

Ex : Prototype of the main functionalities of the integrated system.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- ○ TRL 4

Ex : Alpha version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software development life-cycle; that implements the main functionality of the software and by which preliminary verification and validation activities are archieved.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- ○ TRL 5

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Ex : Beta version. Preliminary release of non -mature software version; distributed to a community at an early stage of the software life-cycle, that implements the complete functionality of the software and by which preliminary verification and validation activities are archived.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 6

Ex : Ready for use in an operational or production context, including user support, as a building block or a tool.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 7

Ex : Demonstrator. Building block and tailored generic software product qualified for a particular purpose.

*** S3.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S3.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

○ TRL 8

Ex : System qualified and ready to be applied in an operational environment.

*** S3.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S3.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

○ TRL 9

Ex : Has been applied in the execution of an operational environment.

*** S3.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S3.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

*** S3.5. Explain how your service assists public authorities in climate adaptation or mitigation actions :**

*** S3.6. What kind of data do you lack of to improve your service?**

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*** S3.7. What future missions or emerging technologies would help improve your service and make it fit better with market needs?**

*** S3.8. Do you have or do you plan to implement partnerships with other climate services providers to complement you service offer?**

S3.9. Comments

☐ I have more than 3 services – Please fill in the questionnaire again. Thank you !

Presentation of the results of the survey

The consortium would like to display the results of the mapping on the PROTECT online platform to provide an actionable and readable catalogue of climate services that will be consulted by our community of public procurers.

*** 1. Do you authorise the PROTECT consortium to use your answers to feed into the catalogue of climate services that will be displayed on PROTECT's online platform? (Multiple choices)**

☐ Yes, I agree for all services.

☐ Yes, I agree for Service 1.

☐ Yes, I agree for Service 2.

☐ Yes, I agree for Service 3.

☐ No, I disagree and I wish that PROTECT keeps the results confidential.

*** 2. Do you accept to be contacted by PROTECT team to have additional information after you filled the questionnaire?**

○ Yes, I agree.

○ No, I disagree.

This project has received funding from the Horizon Europe Framework

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

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Annex 4: List of multipliers that supported the dissemination for the survey

#	Organisation	Country
1	Aeronautics and Space Agency of the Austrian Research Promotion Agency (FFG) – 2004 (ASA in 1972)	Austria
2	Belgium Federal Science Policy Office (BELSPO)	Belgium
3	Bizgarden S.R.O.	Czech Republic
4	Brno Space Cluster	Czech Republic
5	Centre D'Estudes Spatiales de la Biosphere	France
6	Climateeurope2	Europe
7	Connect by CNES	France
8	Consiglio Nazionale delle Ricerche (CNR)	Italy
9	Copernicus Challenge	France
10	Croatian Space Agency (CSA) - 2002	Croatia
11	Cyprus Space Exploration Organisation	Cyprus
12	Czech Space Office (CSO) - 2003	Czech Republic
13	DLR	Germany
14	E-SHAPE	Europe
15	EARSC	Belgium
16	ENEA Casaccia	Italy
17	Envision H2020	Europe
18	ESA BIC Austria	Austria
19	ESA BIC Baden-Wurttemberg	Germany
20	ESA BIC Bavaria	Germany
21	ESA BIC Belgium	Belgium
22	ESA BIC Czech Republic	Czech Republic

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#	Organisation	Country
23	ESA BIC Denmark	Denmark
24	ESA BIC Estonia	Estonia
25	ESA BIC Estonia	Estonia
26	ESA BIC Finland	Finland
27	ESA BIC Greece	Greece
28	ESA BIC Hessen	Germany
29	ESA BIC Hungary	Hungary
30	ESA BIC Ireland	Ireland
31	ESA BIC Lazio	Italy
32	ESA BIC Madrid Region	Spain
33	ESA BIC Noordwijk	Netherlands
34	ESA BIC Nord France	France
35	ESA BIC North Rhine-Westphalia	Germany
36	ESA BIC Northern Germany	Germany
37	ESA BIC Portugal	Portugal
38	ESA BIC Sud France	France
39	ESA BIC Sweden	Sweden
40	ESA BIC Turin	Italy
41	Estonian Space Offices	Estonia
42	European Innovation Council	Europe
43	European Space Resources Innovation Centre - ESRIC	Luxembourg
44	Fondazione E. Amaldi	Italy
45	Fundacion para el Conocimiento madri+d	Spain
46	Hellenic Space Center	Greece
47	Hungarian Space Office (HSO) - 1992	Hungary
48	InCubed by ESA	Europe

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#	Organisation	Country
49	Institute for Space Application and Remote Sensing - National Observatory of Athens (ISARS-NOA) - 1955	Greece
50	Italian Space Agency - Agenzia Spaziale Italiana	Italy
51	Latvian Technology in Space	Latvia
52	Lithuanian Space Agency	Lithuania
53	Luxembourg Space Agency	Luxembourg
54	Malta Space	Malta
55	National Center for Space Studies (CNES) - 1961	France
56	National Institute for Aerospace Technology (INTA)- 1942; Center for the Development of Industrial Technology (CDTI)	Spain
57	National Space Institute - Technical University of Denmark (DTU Space) - 2007 (DSRI in 1968)	Denmark
58	NEREUS - Network of European Regions Using Space Technologies	Belgium
59	Netherlandse Space Office	Netherlands
60	Pole Theia	France
61	Romanian Space Agency (ROSA) - 1991	Romania
62	Royal Belgian Institute for Space Aeronomy	Belgium
63	Science and Technology Foundation - Space Office	Portugal
64	Slovak Space Office	Slovakia
65	Slovenia Space Office	Slovenia
66	Space for Climate Observatory	France
67	Space Research Center - Polish Academy of Science (SBK-PAN) - 1977	Poland
68	Space Research in Bulgaria - Bulgarian Academy of Sciences (SRI-BAS) - 1987	Bulgaria
69	Suomen Ymparistokeskus	Finland
70	Swedish National Space Board (SNSB)- 1972	Sweden

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#	Organisation	Country
71	Tartu Science Park	Estonia
72	TNO - Netherlandse Organisation for Applied Scientific Research	Netherlands
73	Turku Science Park	Finland
74	Verhaert	Belgium
75	VTT Technical Research Centre of Finland	Finland

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Annex 5: List of providers to whom the survey was disseminated

#	Organisation	Country
1	+ Association	Portugal
2	3E	Belgium
3	52°North Initiative for Geospatial	Germany
4	52impact	Netherlands
5	AARHUS UNIVERSITY	Denmark
6	AAT	Poland
7	ACRI-ST S.A.S.	France
8	ADELPHI CONSULT GMBH	Germany
9	ADVANCED COMPUTER SYSTEMS A.C.S. S.	Italy
10	ADWÄISEO	Luxembourg
11	AEROVISION	Netherlands
12	Agri Dataservices BioScope BV	Germany
13	AGRIBORA GMBH	Germany
14	AGRICOLUS S.R.L.	Belgium
15	AGROINSIDER	Italy
16	Aguila	France
17	AIOFAR	Portugal
18	AIRMO	Austria
19	AMIGO	Austria
20	AMPHITRITE	Germany
21	ANALYTICS PIKA OY	Italy
22	ARGANS	France
23	ASMAN	France

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#	Organisation	Country
24	Atraksis	France
25	AVIA-GIS NV	Finland
26	Baltic Satellite Service	France
27	BENENATI & EDWARDS GBR	France
28	BIOCONSULT SH	Belgium
29	Biomede	France
30	BLACKSHORE	Belgium
31	Blue Horizon Sàrl	Italy
32	Brockmann Consult	Germany
33	BUSINESS NEATNESS MAGNANIMITY BNM SRL	Italy
34	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	France
35	CGI DEUTSCHLAND B.V. & CO. KG	Ireland
36	CGI IT Czech Republic	Czech Republic
37	COLLECTIVECRUNCH	Italy
38	COMICON	Germany
39	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy
40	Constellr GmbH	Germany
41	CRAT – CONSORZIO PER LA RICERCA NELL'AUTOMATICA E NELLE TELECOMUNICAZIONI	Czech Republic
42	CROWDSPACE	Italy
43	CYBELE	Ireland
44	DEEP BLUE GLOBE	Germany
45	DHI	Poland
46	DIGINOVE	Netherlands
47	DRIFT + NOISE POLAR SERVICES GMBH	Portugal
48	DriveClean	Germany

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#	Organisation	Country
49	DUBLIN OFFSHORE	Belgium
50	E-GEOS	Germany
51	E.RAY EUROPA GMBH	Ireland
52	eLeaf	Poland
53	ENEA ITALIAN NATIONAL AGENCY	Bulgaria
54	EnergyFamily	Austria
55	EnergyHood	Poland
56	eODyn	Italy
57	EOMAP	Germany
58	eOnsight	Finland
59	EXOBOTIC TECHNOLOGIES	Germany
60	Exovision	Belgium
61	EXTREME WEATHER EXPERTISES	Germany
62	EXTREME WEATHER EXPERTISES (EXWEXS)	France
63	FARM TECHNOLOGIES SRL	France
64	FARMEYE	Hungary
65	FIELD DATA ZOOM SRL	Belgium
66	FIELDSENSE	Germany
67	FireDynamo	Bulgaria
68	Forest Owners Consulting Center	Italy
69	FutureWater	Netherlands
70	GEO4A	France
71	GEOAEROSPACE	Germany
72	GEOCLEDIAN GMBH	Germany
73	GEODATA SERVICES LTD.	Greece
74	GEOMATRIX UAB	Lithuania

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#	Organisation	Country
75	GEOPREDICT GMBH	Estonia
76	GEOPROCESSIT TOMASZ TEMPLIN	Poland
77	GeoScan GmbH	Germany
78	Geospatial Enabling Technologies	Netherlands
79	Geosystems Hellas S.A.	Greece
80	GeoVille	Italy
81	GIM	Luxembourg
82	GISAIA	Latvia
83	GlobEye	Germany
84	GMATICS	France
85	GMV	Spain
86	GREENEO UG	Netherlands
87	GREENVENTORY GMBH	Italy
88	Gridfinder	Finland
89	H4RESEARCH S.R.L.	Germany
90	HEADPOWER OY	Finland
91	HERASPACE	Finland
92	HIDROMOD	Germany
93	Hybrid-Airplane Technologies GmbH	Germany
94	HydroClimat	Italy
95	HYDROLOGIC	Germany
96	HYDROLOGIC SYSTEMS	Czech Republic
97	I Clean my Sea	Finland
98	I-EM S.R.L.	France
99	I-SEA	France

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#	Organisation	Country
100	IBISA SARL	France
101	IMDC	Netherlands
102	Institut D'Estudis Espacials de Catalunya	Spain
103	INSTITUT NATIONAL DE RECHERCHE POUR L'AGRICULTURE, L'ALIMENTATION ET L'ENVIRONNEMENT	France
104	Institute for Environmental Solutions	Netherlands
105	INSTITUTE OF GEODESY AND CARTOGRAPHY (INSTYTUT GEODEZJI I KARTOGRAFII)	Portugal
106	INSTITUTO DE SOLDADURA E QUALIDADE	Netherlands
107	ISTITUTO UNIVERSITARIO DI STUDI SUPERIORI (I.U.S.S.) DI PAVIA	Italy
108	Kanopymed	France
109	KAYRROS SAS	Netherlands
110	Kermap	Italy
111	L&F EnviroConsulting	Germany
112	LANZ GMBH	Portugal
113	Latitudo 40	Netherlands
114	LiveEO	Germany
115	Mallon Technology Ltd	Ireland
116	Marple GmbH	Germany
117	MARTIN-LUTHER-UNIVERSITAT HALLE-WITTENBERG	Germany
118	MATEREOSPACE	France
119	MEOSS	France
120	MESH METRICS SP. Z O.O.	Poland
121	MeteoInsight	Italy
122	MidGard	Austria
123	MINES	France
124	Miramap	Netherlands

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#	Organisation	Country
125	MOBYGIS S.R.L.	France
126	MUNDIALIS GMBH & CO. KG	Germany
127	MURMURATION	France
128	NATIONAL CENTER FOR SCIENTIFIC RESEARCH	Greece
129	Nelen & Schuurmans	Netherlands
130	NEO B.V.	Germany
131	NEXLYS LDA	Denmark
132	OHB Systems AG	Germany
133	OPT/NET B.V.	Netherlands
134	Orbio	Netherlands
135	Orbio Earth	Austria
136	OrbitalEOS	Italy
137	OUTDOORACTIVE	Portugal
138	PLANETEK HELLAS	Germany
139	POWORGANIC	Ireland
140	Pratensis	Slovenia
141	PREDICT SERVICES	Portugal
142	PROEKSPERT AS	France
143	PROVEYE	Italy
144	Quantcube technology	Germany
145	Rasmadan GmbH	Germany
146	Reexplorer	Portugal
147	REMOTE SENSING SOLUTIONS GMBH	Germany
148	Research Institute of Water and Environmental Engineering (IIAMA)	Denmark
149	RESILIENCE BV	France
150	SaferPlaces	Portugal

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#	Organisation	Country
151	Satim	France
152	SCIENCE [&] TECHNOLOGY CORPORATION (S[&]T)	Belgium
153	SILEX CLOUDS S.R.L.	Luxembourg
154	SINERGISE	France
155	SITO OY	Germany
156	SkyGeo	Germany
157	Skytek	Ireland
158	SMALLGIS	Netherlands
159	SOBOLT	Ireland
160	SoilWatch	Italy
161	Space4Good	Germany
162	SPACEBEL	France
163	Spaceknow	Netherlands
164	SPACENUS GMBH	Italy
165	SPATIAL BUSINESS INTEGRATION GMBH	Finland
166	Spire Global Luxembourg sàrl	Luxembourg
167	STEADYSUN	Italy
168	STICHTING VU	Netherlands
169	Studiomapp	Italy
170	SUEZ EAU FRANCE - Center Rivages Pro Tech	France
171	SuperVision Earth	France
172	TAMA GROUP GMBH	Netherlands
173	TechWorks Marine	Germany
174	TELESPAZIO Belgium	Belgium
175	Terradue	France
176	TERRAMONITOR (SATELLIO OY)	France

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#	Organisation	Country
177	Terranis	Italy
178	TFE ENERGY	Germany
179	Thales Services Numeriques	Belgium
180	TICINUM AEROSPACE	Ireland

#	Organisation	Country
154	SINERGISE	France
155	SITO OY	Germany
156	SkyGeo	Germany
157	Skytek	Ireland
158	SMALLGIS	Netherlands
159	SOBOLT	Ireland

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160	SoilWatch	Italy
161	Space4Good	Germany
162	SPACEBEL	France
163	Spaceknow	Netherlands
164	SPACENUS GMBH	Italy
165	SPATIAL BUSINESS INTEGRATION GMBH	Finland
166	Spire Global Luxembourg sàrl	Luxembourg
167	STEADYSUN	Italy
168	STICHTING VU	Netherlands
169	Studiomapp	Italy
170	SUEZ EAU FRANCE - Center Rivages Pro Tech	France
171	SuperVision Earth	France
172	TAMA GROUP GMBH	Netherlands
173	TechWorks Marine	Germany
174	TELESPAZIO Belgium	Belgium
175	Terradue	France
176	TERRAMONITOR (SATELLIO OY)	France
177	Terranis	Italy
178	TFE ENERGY	Germany
179	Thales Services Numeriques	Belgium
180	TICINUM AEROSPACE	Ireland
181	TRACK32	Germany
182	Treemetrics	Germany
183	Ubivivo	Slovenia
184	Undersee	Italy
185	UNIVERSIDAD CARLOS III DE MADRID	Spain
186	Uptoearth GmbH	Germany

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187	Vista GEO	Ireland
188	VITO	Ireland
189	VITROCISET BELGIUM	France
190	VITROCISET BELGIUM - New name: Telespazio Belgium	Romania
191	VORTEX	Germany
192	VTT Technical Research Centre of Finland	Finland
193	WALTR	France
194	WASAT SP. Z O.O.	Germany
195	WASDI sàrl	Denmark
196	Water Insight	Netherlands
197	WAVE FOR ENERGY	France
198	WEATHERFORCE CONSULTING	Belgium
199	WITTED SRL	Romania
200	WROCŁAWSKI INSTYTUT ZASTOSOWAŃ INFORMACJI PRZESTRZENNEJ I SZTUCZNEJ INTELIGENCJI SP. Z O.O.	Germany
201	WUUDIS SOLUTIONS OY	Italy
202	YNSAT	Denmark

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Annex 6: Climate Services mapping

#	Organisation	Country
1	+ Association	Portugal
2	3E	Belgium
3	52°North Initiative for Geospatial	Germany
4	52impact	Netherlands
5	AARHUS UNIVERSITY	Denmark
6	AAT	Poland
7	ACRI-ST S.A.S.	France
8	ADELPHI CONSULT GMBH	Germany
9	ADVANCED COMPUTER SYSTEMS A.C.S. S.	Italy
10	ADWÄISEO	Luxembourg
11	AEROVISION	Netherlands
12	Agri Dataservices BioScope BV	Germany
13	AGRIBORA GMBH	Germany
14	AGRICOLUS S.R.L.	Belgium
15	AGROINSIDER	Italy
16	Aguila	France
17	AIOFAR	Portugal
18	AIRMO	Austria
19	AMIGO	Austria
20	AMPHITRITE	Germany
21	ANALYTICS PIKA OY	Italy
22	ARGANS	France
23	ASMAN	France
24	Atraksis	France
25	AVIA-GIS NV	Finland
26	Baltic Satellite Service	France
27	BENENATI & EDWARDS GBR	France
28	BIOCONSULT SH	Belgium
29	Biomede	France
30	BLACKSHORE	Belgium
31	Blue Horizon Sàrl	Italy
32	Brockmann Consult	Germany
33	BUSINESS NEATNESS MAGNANIMITY BNM SRL	Italy
34	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	France
35	CGI DEUTSCHLAND B.V. & CO. KG	Ireland
36	CGI IT Czech Republic	Czech Republic
37	COLLECTIVECRUNCH	Italy
38	COMICON	Germany
39	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy
40	Constellr GmbH	Germany
41	CRAT – CONSORZIO PER LA RICERCA NELL'AUTOMATICA E NELLE TELECOMUNICAZIONI	Czech Republic
42	CROWDSPACE	Italy

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#	Organisation	Country
43	CYBELE	Ireland
44	DEEP BLUE GLOBE	Germany
45	DHI	Poland
46	DIGINOVE	Netherlands
47	DRIFT + NOISE POLAR SERVICES GMBH	Portugal
48	DriveClean	Germany
49	DUBLIN OFFSHORE	Belgium
50	E-GEOS	Germany
51	E.RAY EUROPA GMBH	Ireland
52	eLeaf	Poland
53	ENEA ITALIAN NATIONAL AGENCY	Bulgaria
54	EnergyFamily	Austria
55	EnergyHood	Poland
56	eODyn	Italy
57	EOMAP	Germany
58	eOnsight	Finland
59	EXOBOTIC TECHNOLOGIES	Germany
60	Exovision	Belgium
61	EXTREME WEATHER EXPERTISES	Germany
62	EXTREME WEATHER EXPERTISES (EXWEXS)	France
63	FARM TECHNOLOGIES SRL	France
64	FARMEYE	Hungary
65	FIELD DATA ZOOM SRL	Belgium
66	FIELDSENSE	Germany
67	FireDynamo	Bulgaria
68	Forest Owners Consulting Center	Italy
69	FutureWater	Netherlands
70	GEO4A	France
71	GEOAEROSPACE	Germany
72	GEOCLEDIAN GMBH	Germany
73	GEODATA SERVICES LTD.	Greece
74	GEOMATRIX UAB	Lithuania
75	GEOPREDICT GMBH	Estonia
76	GEOPROCESSIT TOMASZ TEMPLIN	Poland
77	GeoScan GmbH	Germany
78	Geospatial Enabling Technologies	Netherlands
79	Geosystems Hellas S.A.	Greece
80	GeoVille	Italy
81	GIM	Luxembourg
82	GISAIA	Latvia
83	GlobEye	Germany
84	GMATICS	France
85	GMV	Spain
86	GREENEO UG	Netherlands
87	GREENVENTORY GMBH	Italy

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

#	Organisation	Country
88	Gridfinder	Finland
89	H4RESEARCH S.R.L.	Germany
90	HEADPOWER OY	Finland
91	HERASPACE	Finland
92	HIDROMOD	Germany
93	Hybrid-Airplane Technologies GmbH	Germany
94	HydroClimat	Italy
95	HYDROLOGIC	Germany
96	HYDROLOGIC SYSTEMS	Czech Republic
97	I Clean my Sea	Finland
98	I-EM S.R.L.	France
99	I-SEA	France
100	IBISA SARL	France
101	IMDC	Netherlands
102	Institut D'Estudis Espacials de Catalunya	Spain
103	INSTITUT NATIONAL DE RECHERCHE POUR L'AGRICULTURE, L'ALIMENTATION ET L'ENVIRONNEMENT	France
104	Institute for Environmental Solutions	Netherlands
105	INSTITUTE OF GEODESY AND CARTOGRAPHY (INSTYTUT GEODEZJI I KARTOGRAFII)	Portugal
106	INSTITUTO DE SOLDADURA E QUALIDADE	Netherlands
107	ISTITUTO UNIVERSITARIO DI STUDI SUPERIORI (I.U.S.S.) DI PAVIA	Italy
108	Kanopymed	France
109	KAYRROS SAS	Netherlands
110	Kermap	Italy
111	L&F EnviroConsulting	Germany
112	LANZ GMBH	Portugal
113	Latitudo 40	Netherlands
114	LiveEO	Germany
115	Mallon Technology Ltd	Ireland
116	Marple GmbH	Germany
117	MARTIN-LUTHER-UNIVERSITAT HALLE-WITTENBERG	Germany
118	MATEREOSPACE	France
119	MEOSS	France
120	MESH METRICS SP. Z O.O.	Poland
121	MeteoInsight	Italy
122	MidGard	Austria
123	MINES	France
124	Miramap	Netherlands
125	MOBYGIS S.R.L.	France
126	MUNDIALIS GMBH & CO. KG	Germany
127	MURMURATION	France
128	NATIONAL CENTER FOR SCIENTIFIC RESEARCH	Greece
129	Nelen & Schuurmans	Netherlands

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#	Organisation	Country
130	NEO B.V.	Germany
131	NEXLYS LDA	Denmark
132	OHB Systems AG	Germany
133	OPT/NET B.V.	Netherlands
134	Orbio	Netherlands
135	Orbio Earth	Austria
136	OrbitalEOS	Italy
137	OUTDOORACTIVE	Portugal
138	PLANETEK HELLAS	Germany
139	POWORGANIC	Ireland
140	Pratensis	Slovenia
141	PREDICT SERVICES	Portugal
142	PROEKSPERT AS	France
143	PROVEYE	Italy
144	Quantcube technology	Germany
145	Rasmadan GmbH	Germany
146	Reexplorer	Portugal
147	REMOTE SENSING SOLUTIONS GMBH	Germany
148	Research Institute of Water and Environmental Engineering (IIAMA)	Denmark
149	RESILIENCE BV	France
150	SaferPlaces	Portugal
151	Satim	France
152	SCIENCE [&] TECHNOLOGY CORPORATION (S[&]T)	Belgium
153	SILEX CLOUDS S.R.L.	Luxembourg
154	SINERGISE	France
155	SITO OY	Germany
156	SkyGeo	Germany
157	Skytek	Ireland
158	SMALLGIS	Netherlands
159	SOBOLT	Ireland
160	SoilWatch	Italy
161	Space4Good	Germany
162	SPACEBEL	France
163	Spaceknow	Netherlands
164	SPACENUS GMBH	Italy
165	SPATIAL BUSINESS INTEGRATION GMBH	Finland
166	Spire Global Luxembourg sàrl	Luxembourg
167	STEADYSUN	Italy
168	STICHTING VU	Netherlands
169	Studiomapp	Italy
170	SUEZ EAU FRANCE - Center Rivages Pro Tech	France
171	SuperVision Earth	France
172	TAMA GROUP GMBH	Netherlands
173	TechWorks Marine	Germany

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#	Organisation	Country
174	TELESPAZIO Belgium	Belgium
175	Terradue	France
176	TERRAMONITOR (SATELLIO OY)	France
177	Terranis	Italy
178	TFE ENERGY	Germany
179	Thales Services Numeriques	Belgium
180	TICINUM AEROSPACE	Ireland
181	TRACK32	Germany
182	Treemetrics	Germany
183	Ubivivo	Slovenia
184	Undersee	Italy
185	UNIVERSIDAD CARLOS III DE MADRID	Spain
186	Uptoearth GmbH	Germany
187	Vista GEO	Ireland
188	VITO	Ireland
189	VITROCISET BELGIUM	France
190	VITROCISET BELGIUM - New name: Telespazio Belgium	Romania
191	VORTEX	Germany
192	VTT Technical Research Centre of Finland	Finland
193	WALTR	France
194	WASAT SP. Z O.O.	Germany
195	WASDI sàrl	Denmark
196	Water Insight	Netherlands
197	WAVE FOR ENERGY	France
198	WEATHERFORCE CONSULTING	Belgium
199	WITTED SRL	Romania
200	WROCŁAWSKI INSTYTUT ZASTOSOWAŃ INFORMACJI PRZESTRZENNEJ I SZTUCZNEJ INTELIGENCJI SP. Z O.O.	Germany
201	WUUDIS SOLUTIONS OY	Italy
202	YNSAT	Denmark

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