EuroGEO

CLIMATE

Analysing the pattern dynamics in Earth Observation Research & Innovation

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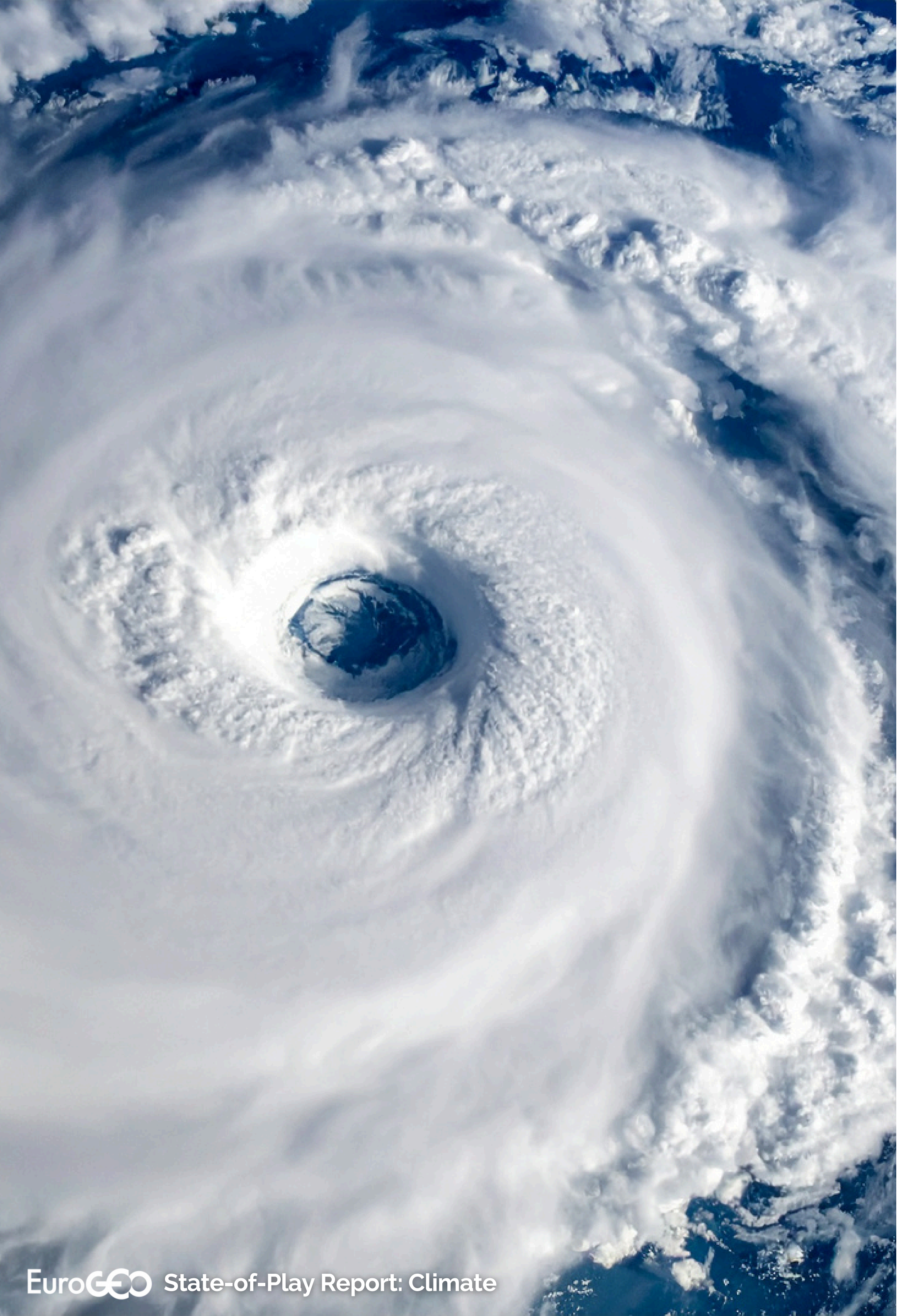
COMBINE, COORDINATE, COOPERATE



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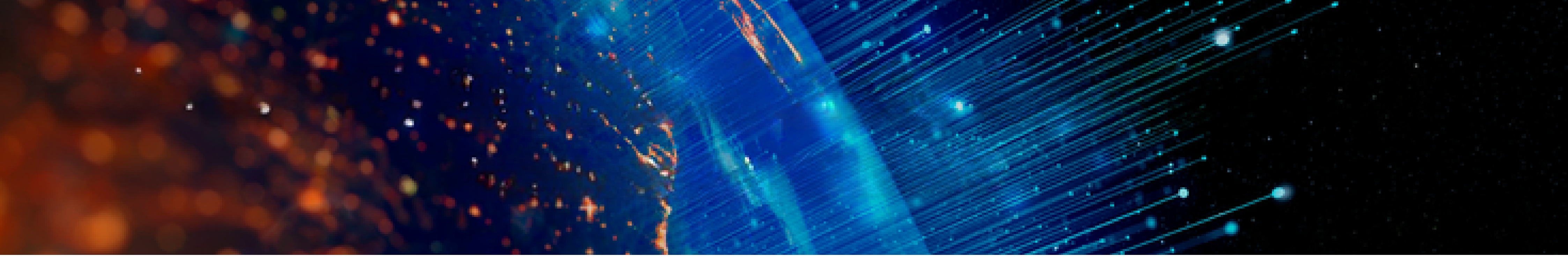


Introduction

In recent years, there has been an **increasing uptake of Earth Observation** (EO) as a tool in support of the implementation of various policies and the execution of a wide range of operational tasks. Users across the value chains of different sectors can utilise EO-based solutions in support of their work, **realising significant benefits** (economic, environmental, societal, etc.). Market demand for such solutions is driven by policies and sector-specific needs. Technological advances have the potential to enable solutions that match the specific needs.

EuroGEO, Europe's part of the Group on Earth Observation, stands at the intersection of research, policy, and markets. This **strategic position** allows it to identify and monitor relevant developments and trends, to engage stakeholders, and to assess the evolving EO landscape in Europe and beyond. Capturing insights relevant for the different stakeholders allows EuroGEO to document the current state of play of EO, its trajectory, and the required steps for broader adoption and increased benefits.

With the support of the ***EuroGEOSec* project**, and with the aim of **maximising the impact of Research and Innovation** (R&I), a dedicated effort has been made to establish the **R&I Observatory for Earth Observation** (RIO). This includes a team of analysts and an online tool to monitor and analyse past and ongoing R&I in EO in order to identify trends and support strategic decisions on future R&I activities. Relying on the RIO, the so-called **R&I State-of-Play Reports** are created presenting a concise overview of the policy context, technological perspectives, and market trends within the thematic areas covered by the **EuroGEO Action Groups** (AG). This present report focuses on analysing patterns in the **climate segment**. Research has been complemented by multiple other reports and studies, including studies performed by and for EuroGEO's Climate AG.

The aim of this report is to **support EuroGEO and its stakeholders in decision-making** regarding future work programmes and strategic innovation agendas (such as those of the Knowledge Centre on Earth Observation – KCEO), inform the review of the **EuroGEO Implementation Plan**, and contribute to the production of institutional outputs.

The following EuroGEO **Action Groups** develop application pilots/conduct other actions foreseen in the EuroGEO roadmap: Agriculture, Land Cover and Land Intelligence (LC&LI), Urban, Disaster Resilience and Health, Energy, Biodiversity, ecosystems and geodiversity (BEG), Climate, Climate, and Green Deal Data Spaces.

Methodology

The browser-based tool of the **R&I Observatory for Earth Observation** (RIO) allows retrieving relevant information from a variety of sources, including project information (e.g., descriptions, partners, budgets, results, timelines) for the majority of relevant European R&I programmes. Sources include information related to e.g., Horizon Europe (HE) and its predecessors, the LIFE programme, the Connecting Europe Facility, Eurostars, COSME, the European Defence Fund, and the European Defence Industrial Development Programme. Additional sources are being incorporated as part of the continuous development of the RIO.

The RIO structures the information into a standardised format for the uniform documentation of R&I activities. Functions of search, bookmarking, filtering, visualisation, and export allow the processing and analysis of the pre-curated information.

The focus of the analysis is on **mapping R&I efforts across segments** by analysing data on projects, core applications, budgets, and timelines. The full list of the analysed projects, filtered from the database of projects and mapped against segment-specific EO applications can be found in the original deliverable . The segment's **core applications** have been identified and mapped based on the most prominent and important themes, as determined by the Action Group and tits leads. They are derived from **AG expert studies** and further validated by sector experts such as AG leads. See the classification below:

- Climate Research
- Disaster Risk Reduction & Preparedness
- Attribution, Prediction & Projection

To address the research questions – i.e., to identify trends in EO-related R&I for Climate applications and the drivers behind them – the following **limitations or simplifications** were applied:

Data Processing

- Project information sourced from the RIO (including acronym, title, coordinators, topic, programme, pillar, objectives, work programme, status, start and end dates, budget, grant, and links) has been filtered using segment-specific keywords to ensure that only relevant projects are included and no projects are overlooked. This relies on full-text search in existing descriptions and meta data, along with the use of consistent terminology. Where data might be missing or unexpected terminology is used, certain projects may have been missed.
- The filtered list of projects considered relevant has been extracted (i.e., exported into a spreadsheet) for processing.
- Data has been manually checked for relevance and further cleaned accordingly, then augmented by segment-specific categorisation for more detailed analysis.

Methodology

Timeframe

In order to restrict the analysis to relevant activities while drawing from a significant enough sample size, a (roughly) **10-year timeframe** is used, covering the period **from 2014 to 2024** (i.e., only projects that have started before 2025 and have not ended before 2014 have been analysed). This timeframe is used to capture long-term trends, technological developments, and measurable outcomes of concluded projects. It also ensures that typical project lifecycles, such as those in Horizon Europe, are included. It coincides with the launch of the first Sentinel-1 satellite in 2014, the free and open data of Copernicus being considered as one driver of EO-related R&I, which has been attempted to confirm through the analysis.

Sample Size

The sample data is limited to the sources **currently included in the RIO**, expected to cover relevant European R&I projects to a large extent, but with further potentially relevant projects not included in the analysis where the data source has not been included yet. It is further limited to the keywords and queries applied (see data processing above) and timeframe selected (see timeframe above).

Budget allocations per application

Breaking down budgets of projects that address more than one segment-specific application and dividing them across these applications has been done following a simplified approach assuming an (unlikely) even distribution. Therefore, budget sizes per application can only **reflect trends** and may not be fully accurate.

To interpret and complement the findings from the RIO tool, **desk research** has been conducted across reports and studies, including:

- European Space Agency (ESA) application or industry articles
- European Commission (EC) documents, e.g., Climate factsheets, Reports on uptake barriers of EU space services
- EUSPA EO and Global Navigation Satellite System (GNSS) 2024 Market Report
- Stocktaking Reports from related Group on Earth Observations (GEO) initiatives
- Horizon Europe's Strategic Research and Innovation Agendas
- Segment-specific as well as EO-related strategic research and innovation agendas including outcomes of the Horizon 2020 (H2020) project *FIRE*
- EuroGEO Workshop Reports
- **EuroGEO Climate AG Expert Study**

These **sources** were carefully reviewed to extract relevant content that addressed the questions raised during the analysis. They were particularly useful in identifying gaps and barriers in each segment, as well as R&I trends and technologies that are (or can be) applied to address these issues.

Climate Overview

Climate change is now an immediate risk to societies, economies, and ecosystems. While the **Paris Agreement** set global direction, focus has shifted to **measuring adaptation progress**. An ESA study finds satellite Earth Observation can track adaptation at nearly all stages, using long-term climate data to map hazards, assess vulnerability, and evaluate results.

In Europe, climate policy is tightly connected to Earth Observation. The **Green Deal** and **EU Climate Law** target climate neutrality by 2050, and the Adaptation Strategy calls for smarter, faster, systemic adaptation using better climate intelligence. A large share of EU funding supports Green Deal goals, and ESA and DG CLIMA are linking Copernicus and other space data directly to climate action and related laws.

This report's climate segment covers three areas: **climate research**, **disaster risk reduction and preparedness**, and **attribution, prediction and projection**. Climate research uses long-term data records for detection, modelling, and carbon-cycle studies. Disaster risk work uses EO to track hazards like floods and fires, often in real time. Attribution and prediction combine EO with models to improve forecasts and future scenarios.

Project data show Europe is **investing more** in these areas. From 2014–2025, projects grew sharply across climate research, disaster risk reduction, and attribution, prediction and projection. Meanwhile, EO climate-environment revenues were about €700m in 2022 and are forecast to exceed **€1bn by 2031**, growing over **4% annually**. Europe holds nearly half this market and has 100+ EO firms in climate applications.

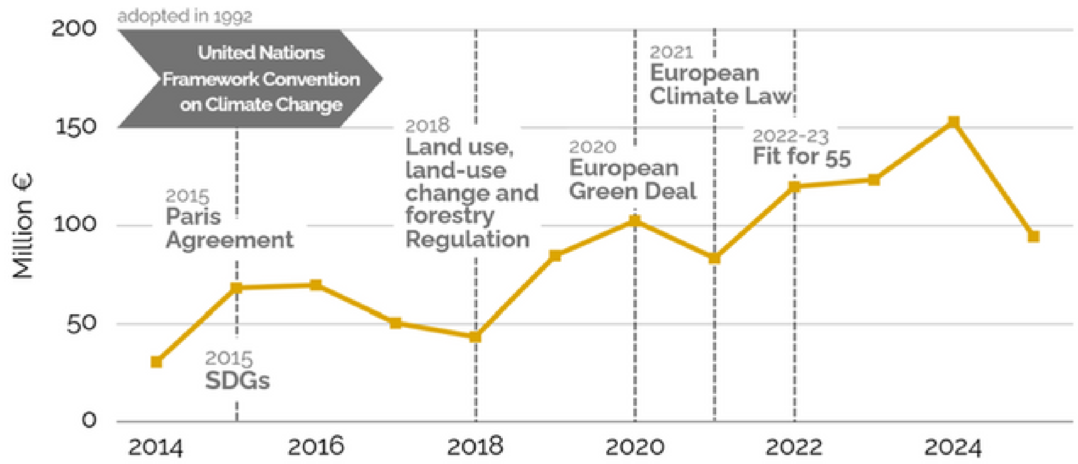
EO innovation is key to meeting policy and market goals. Copernicus Sentinels 1–3 offer open, systematic land, ocean, and cryosphere data for climate services, risk monitoring, and forecasting, supported by in situ networks, aerial surveys, and modelling tools like C3S and the DestinE digital twin.

The climate segment is fully integrated into **GEO**, whose Post-2025 Strategy promotes "Earth Intelligence for All" through user co-production, combining EO with socio-economic data, and leveraging AI and cloud technologies. **EuroGEO's Climate Action Group** aims to turn European EO and Copernicus data into practical services, but progress is limited by low engagement, poor scaling, and informal governance.

Policy Context

EO solutions, particularly those based on satellite remote sensing, are crucial for understanding the climate, its dynamics and drivers, and for predicting and mitigating the impact of climate change. These solutions are essential for enhancing greenhouse gas (GHG) accounting in both land-based and maritime sectors, ensuring effective climate action and informing strategies. EO enables high-resolution, continuous assessment of carbon sinks and sources, ecosystem changes, and land-atmosphere interactions. It supports evidence-based policymaking, enhances reporting transparency, and informs both mitigation and adaptation planning.

Fig. 1: Evolution of EO R&I Climate Budget (€M) and Key Policy Shifts



In this context, European and international policies are increasingly **leveraging EO to meet climate commitments**, and to promote environmental sustainability. As reflected in the budget allocation of related research and innovation (R&I) activities within EU-funded programmes, these policies are fostering a growing uptake of EO data, tools, and services to support climate-related objectives. This is illustrated in the graph above, generated with the help of the R&I Observatory (RIO).

Figure 1 depicts the fluctuations in budgets for EO-related R&I efforts in the climate segment, generated with the sampled data of 336 European-funded projects extracted from the RIO online browser tool. This data has been mapped against the specific EO applications within climate domain and complemented with annotations of relevant policy implementations or changes to analyse the potential correlation between the two. Thus, there are indications of **increased investment** over time, and a potential **correlation** (here inconclusive) **of the investment with key policy drivers** discussed below.

EO contributes to climate research by supplying critical inputs for monitoring GHG concentrations, detecting climate trends, and modelling environmental change. Long-term EO datasets are used to reconstruct temperature and precipitation records, assess changes in sea ice extent and forest cover, and track ocean-atmosphere interactions. These data provide the evidence base for high-level climate assessments and global negotiations.

The **Paris Agreement** and its parent treaty the **United Nations Framework Convention on Climate Change (UNFCCC)** highlight the importance of science-based targets and require countries to report emissions and removals using robust methodologies. EO enables transparency in this process, supporting the Monitoring, Reporting and Verification (MRV) of Nationally Determined Contributions (NDCs) and informing the Global Stocktake process. At the European level, the **European Climate Law** legally enshrines the commitment to climate neutrality by 2050 and relies on EO-derived indicators to monitor progress. Similarly, the **2030 Climate Target Plan** and **European Green Deal** give an important role to EO by demanding data-driven assessments of sectoral transformations across energy, transport, and land use. 227 of the analysed EO R&I projects with a combined budget of €2.4m address **Climate Research**. Scientific initiatives like the Global Climate Observing System (GCOS) or the Intergovernmental Panel on Climate Change (IPCC) depend on EO to deliver Essential Climate Variables (ECVs) that are necessary for model validation, trend analysis, and scenario generation. The **EU Taxonomy Regulation** and climate-related investment frameworks also use EO to ensure that land-use activities and industrial processes are aligned with sustainability criteria.

EO also plays a vital role in disaster risk reduction by enabling continuous monitoring of climate-related hazards, such as floods, heatwaves, wildfires, and droughts, and their impacts on ecosystems and infrastructure. Real-time satellite data allow for early warnings, impact mapping, and vulnerability assessments, which are essential for emergency response, planning, and long-term adaptation. 93 of the analysed EO R&I projects with a combined budget of about €2.3m address **Disaster Risk Reduction and Preparedness**. The **Sendai Framework for Disaster Risk Reduction** directly calls for the integration of EO and geospatial data into risk governance and preparedness systems. At the EU level, the **EU Adaptation Strategy** emphasises the need to build resilience across key sectors, including agriculture, infrastructure, and biodiversity. EO contributes to this objective by identifying high-risk zones, tracking climate exposure over time, and providing baseline data for adaptation measures.

Policy Context

Global treaties such as the **UN Convention to Combat Desertification (UNCCD)** further promote the use of EO to track land degradation, monitor drought progression, and support sustainable land management practices. The **Integrated EU Policy for the Arctic** underscores the importance of EO in monitoring environmental transformations in the polar regions, where warming is occurring at accelerated rates. Reinforcing this, the **Fit for 55 Package** indirectly supports the uptake of EO through policy reforms aimed at reducing systemic vulnerabilities in energy and transport. For example, EO is used to monitor the climate risks to critical infrastructure, inform urban planning, and support investment in nature-based solutions. As climate extremes become more frequent and severe, EO provides the spatial intelligence required for effective risk reduction and preparedness.

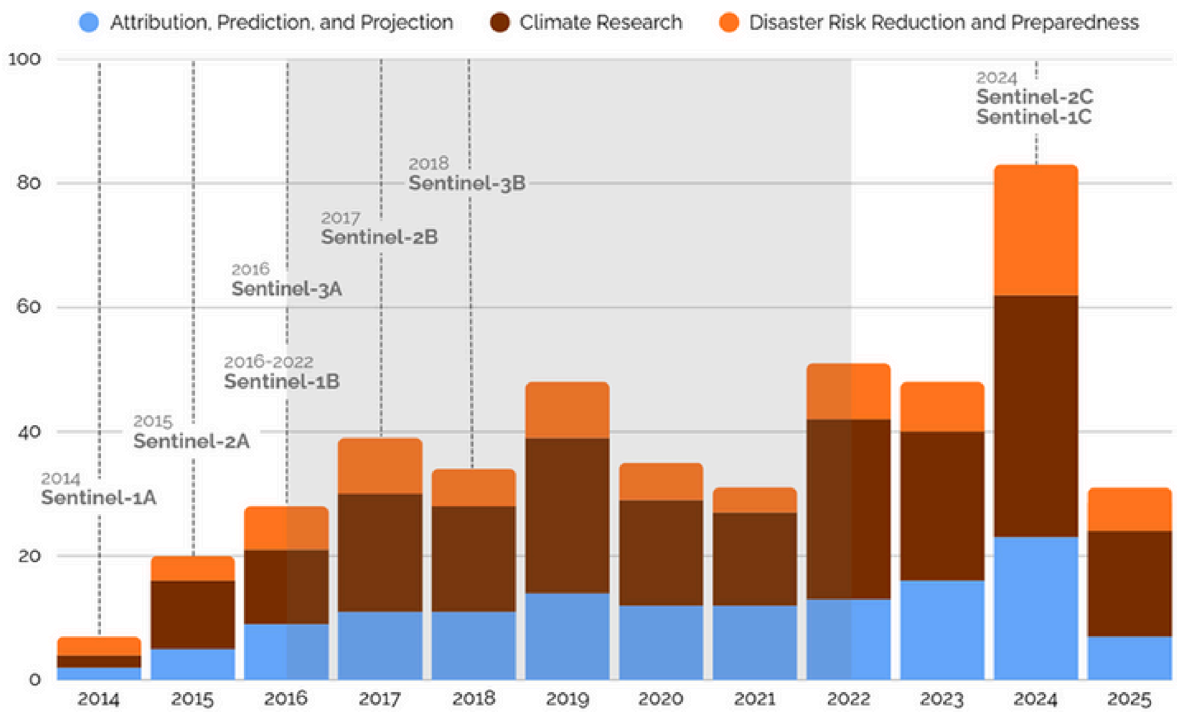
EO is increasingly crucial for linking climate events to human causes (attribution), forecasting near-term conditions (prediction) – and modelling long-term trajectories (projection) – supporting planning, policy, and climate litigation. Of 135 analysed EO R&I projects (€1.9m total), many focus on these functions. EU regulations – like **LULUCF** for carbon sinks, the **Effort Sharing Regulation** for GHG reductions, and the **Mid-Century Zero Emissions Strategy** – rely on EO for monitoring, reporting, and scenario analysis. EO also guides renewable energy siting, climate-dependent potential, and infrastructure risk mitigation. Globally, the **Paris Agreement**'s adaptation goals depend on EO-based predictions and integrated models. As **EU climate policies** advance, demand for predictive, spatial, and interoperable climate data will grow – with EO providing the essential infrastructure for foresight, risk planning, and resilient investments.

Finally, the **United Nations Sustainable Development Goals (SDGs)** provide a complementary global framework that reinforces the uptake of EO technologies across climate-related domains. EO contributes directly to **SDG 13 (Climate Action)** by supporting mitigation, adaptation, and resilience strategies; to **SDG 11 (Sustainable Cities and Communities)** through urban risk mapping and infrastructure planning, and to **SDG 15 (Life on Land)** and **SDG 2 (Zero Hunger)** via land degradation monitoring, sustainable agriculture, and ecosystem protection. By providing open-access, high-quality data, EO empowers countries to track progress toward these goals, fill data gaps in vulnerable regions, and implement more targeted, effective climate and sustainability policies.

To conclude, **EO is integral to the investigation of Earth's climate systems** and supports a vast number of international and European policies aimed at understanding, mitigating, and adapting to **climate change**. Frameworks such as the Paris Agreement, European Climate Law, or the 2030 Climate Target Plan all depend on the continued development and integration of EO capabilities. As climate policies evolve to address more granular targets and sector-specific actions, EO technologies will remain essential to **providing the data foundation for informed and adaptive climate governance**.

Technological Perspectives

Fig. 2: Climate Project Count Timelines by Application & Sentinel Missions



The climate segment is one of the most **technically mature EO** domains in Europe. Decades of satellite records, operational Copernicus services and a dense research community have created a robust foundation, but there are still notable gaps in last-mile service provision and integration with users' decision processes.

From a data infrastructure perspective, Europe is in a good position. ESA's Climate Change Initiative (CCI) provides satellite-derived **climate data records for numerous Essential Climate Variables** (ECVs), while the climate facilities of the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and C3S offer **reanalyses, seasonal forecasts, and sectoral climate information** products. These data streams support most of the Climate Research analysed projects, such as GlobalMass, TiPACCs, AtlantOS, LANDMARC, RESTORE4Cs and many of the atmospheric and cryosphere-related projects. They also feed into the emerging DestinE digital twin, where high-resolution simulations will be integrated with EO and in situ observations.

The Copernicus Sentinel constellation is central to this technological landscape. **Sentinel-1**, a couple of C-band radar satellites launched in 2014 and 2016, provides all-weather, day-and-night imagery with revisit times of a few days, allowing for continuous mapping of **sea-ice**, **marine** conditions, **land surface** motion and **emergency** situations such as floods or landslides. **Sentinel-2**, operational since 2015–2017, delivers high-resolution multispectral images optimised for **vegetation, soils and coastal zones**, crucial for land-based mitigation and adaptation, from forest carbon projects to drought and crop monitoring. **Sentinel-3**, launched from 2016 onwards, measures **sea-surface** topography, **ocean colour** and land and sea-surface **temperature**, feeding into ocean reanalyses, sea-level studies and marine climate services.

The timing of these missions aligns with the growth in climate-segment R&I. As Sentinel-1 and Sentinel-2 became fully operational after 2015, the number of Disaster Risk Reduction and Preparedness projects increased from single digits to more than twenty by 2024, many of them using radar and optical imagery for flood mapping, wildfire monitoring and coastal risk assessments (for example SAFERS, HARMONIA, EARTHPULSE, UPGRADE, I-REACT). Similarly, Climate Research project count expanded once Sentinel-2 and Sentinel-3 data, combined with CCI records and C3S products, became widely accessible. By 2024, these projects accounted for the largest share of the portfolio. Attribution, prediction, and projection projects, such as EXPECT, CONFER, CityCLIM, WATERAGRI, WARMM and MeDiTwin, increasingly exploit EO-constrained reanalyses and models to improve seasonal forecasts and long-term projections.

AI and ML are increasingly used in the EO pipeline. GEO's strategy promotes AI, digital twins, and advanced sensors, while several projects apply AI to pattern detection, downscaling, and risk assessment. Though mostly research, these efforts lay the groundwork for near real-time climate services.

Technological Perspectives

Beyond Copernicus, ESA and the European Commission's joint initiative on climate action from space seeks to improve monitoring, reporting and verification of greenhouse-gas emissions, deforestation and other Green Deal-relevant indicators, and to develop tailored tools such as the Green Transition Information Factory. This complements national and regional EO platforms and the growing ecosystem of cloud-based data spaces that offer AI-ready access to Sentinel and Copernicus products.

Despite this strong technological base, several **gaps** are apparent when viewed from the segment's applications. Climate research today is not hindered by a lack of data, but rather by the difficulty of turning abundant, complex information into **practical climate intelligence** that people can actually use. Many **projects remain upstream** and fall short of becoming reliable services that complement Copernicus and serve a broader range of users. In disaster risk reduction, Sentinel-based hazard mapping is advanced but heterogeneously **integrated into national systems**, with pilots struggling to upscale due to governance, language and funding barriers. Europe's leading **climate-modelling capabilities** remain **underutilised**. Seasonal forecasts and attribution tools could inform the regular decisions of farmers, planners and operators, but currently they are mostly niche resources rather than being part of routine risk management. A cross-cutting gap remains: **consistently** bringing together **EO with socioeconomic insights**, indigenous knowledge and on-the-ground experience. GEO's Earth Intelligence framing stresses that **EO alone is not sufficient**; decisions depend on understanding exposure, vulnerability and behaviour. Some of the projects in the portfolio – for example those working with local communities in the Arctic (CRiceS) or on agricultural risk and insurance (InsurFarm) – experiment with this integration, but it is not yet standard practice.

Looking ahead, several technological developments are especially promising for closing these gaps. DestinE's **digital twin** should make it easier to explore climate scenarios interactively at local scale, using EO for both initial conditions and model evaluation. **AI and cloud-based processing** will continue to lower the barrier for complex analyses, helping smaller organisations tap into satellite-driven climate services. **New sensors** – including hyperspectral and higher-resolution thermal missions – will improve monitoring of urban heat, soil moisture, evapotranspiration and methane, all of which are highly relevant for mitigation and adaptation services flagged by EUSPA and ESA. The real question is no longer about whether the technology will be there, but **how we organise, fund and shape** it so that it effectively meets users' needs.

Fig. 3: Budget Distribution for EO-Related R&I in Climate

In the context of intensifying climate impacts and growing demands for resilience, EO technologies are playing an increasingly strategic role in supporting science-based responses to climate-related risks. EO enables continuous monitoring of the Earth system, supporting research, emergency preparedness, and predictive modelling at global and local level. These capabilities support effective climate policies, early warning systems, and adaptation strategies.

Global EO revenues across climate-related applications are projected to grow significantly, with total market value expected to increase from more than €700 m in 2023 to nearly €1.2 bn in 2033. Applications relevant to **climate research and climate forecasting** represent a significant portion of this value.

EO supports **climate research** by providing long-term, globally consistent datasets for essential climate variables such as temperature, greenhouse gas concentrations, and land surface changes. These datasets are key inputs for model validation, trend analysis, and emissions tracking. Several research initiatives and public programmes, including Copernicus **Climate Change Service (C3S)** and EU-funded **R&I projects**, use EO to advance understanding of climate dynamics. Demand for such is confirmed by almost 68% of the projects identified and analysed for this report addressing aspects of climate research, with shares generally increasing over time.

In **disaster risk reduction**, EO enables real-time monitoring and early warning for hazards such as floods, wildfires, droughts, and landslides. EO applications improve risk mapping, support emergency response coordination, and strengthen community resilience. For the analysed period, multiple funded projects have leveraged EO for emergency management, or disaster monitoring, enabling services for insurance and humanitarian support. Nearly 28% of the identified and analysed project are related to disaster resilience.

Market Trends

EO also supports **climate attribution, prediction, and projection** by providing high-resolution input data for regional and global climate models. EO-derived observations improve the accuracy of seasonal forecasting and help attribute extreme events to anthropogenic influences. These applications are increasingly relevant for policy, litigation, and financial risk assessments. More than 40% of the identified and analysed projects address such applications. EO data combined with Artificial Intelligence and High Performance Computing also fuels digital twin capabilities for climate forecasting, with several EU initiatives, including **Destination Earth (DestinE)**, driving further development and enabling new business based on open-source data and models, and advanced analytics.

Emerging commercial demand for EO-based climate intelligence is also being driven by Environmental, Social & Governance (ESG) disclosure requirements, the rise of **climate risk analytics**, and the growing need for **infrastructure resilience**. EO technologies enable integration of environmental and climate data into risk dashboards, investment decision tools, and public policy frameworks.

By leveraging EO for climate science, forecasting, and resilience-building, Europe can consolidate its leadership in sustainable innovation while meeting critical goals under the **European Green Deal** and the **Climate Adaptation Strategy**. Targeted support for EO-enabled services in these domains will be key to unlocking further economic and societal value.

Using the RIO as a source, we have identified key stakeholder groups driving innovation in the development of R&I EO solutions for climate in order to assess the uptake and awareness maturity of the sector. We found that academia is by far the most prevalent stakeholder group in R&I, followed distantly by Small and Medium-sized Enterprises (SMEs).

Projections

Combining policy direction, market signals and technological trends, the trajectory of the climate EO segment becomes clearer.

On the policy side, the European Green Deal, the Climate Law and the strengthened Adaptation Strategy guarantee that **monitoring of climate mitigation** and adaptation will remain a major public priority. The new adaptation indicator framework under the Paris Agreement's Global Goal on Adaptation will demand **globally consistent, long-term datasets**, where EO is instrumental to provide. ESA's adaptation-focused work explicitly urges that EO be embedded in these indicators "from the outset", learning from the slower uptake within the Sustainable Development Goals framework.

EUSPA market analyses suggest that EO data and services for **climate, environment and biodiversity** will continue to grow steadily, with revenues **expected to exceed €1bn** around 2031 and Europe holding a leading share. Demand will come not only from traditional public users but also from financial institutions, infrastructure owners, utility companies, agricultural businesses, and city networks – organisations that increasingly need robust climate-risk analytics, support for adaptation, and reliable evidence to meet reporting requirements such as the **Corporate Sustainability Reporting Directive (CSRD)**.

Technological advances, including the mature Sentinel missions, long climate records, DestinE digital twins and AI-powered analytics, are set to move the **emphasis from observation to the integration** of this intelligence into practical decisions. In this context, **Climate Research** will remain foundational, but more of its outputs will be packaged as operational "Earth intelligence" services, such as sector-specific climate indicators or resilience metrics for infrastructure and ecosystems. **Attribution, prediction, and projection** is expected to grow fastest, as seasonal and decadal outlooks, event attribution, and scenario analysis become routine inputs for planning, insurance and climate-finance decisions. **Disaster Risk Reduction and Preparedness** will increasingly combine near-real-time hazard monitoring with climate projections, enabling multi-hazard early-warning and resilience planning services that align with GEO's focus on weather, hazard and disaster resilience.

By addressing the gaps identified earlier – particularly around last-mile service design, integration with socio-economic information, open and cloud-based infrastructures, and sustainable funding models – the European climate EO sector can shift from generating vast amounts of data to creating and **Earth Intelligence system** that truly drives meaningful impact.

EuroGEO Contribution

As seen in the **Climate AG Expert Study**, this group aims to demonstrate end-user impact through dedicated climate services, based on C3S data, while avoiding duplication of core climate production. They focus on practical, user-driven applications, especially seasonal forecasts and other forms of operational climate advice, so that adaptation becomes a **routine part of practitioners' work**, rather than something done only occasionally as a strategic exercise.

Over the last period, the Climate AG has been associated with around 25 demonstration services, developed mainly under the Horizon 2020 **e-shape** project, the Copernicus user-uptake programme FPCUP and the **Arctic PASSION** project. These demonstrations include examples like urban heat islands, providing seasonal forecast-based services for tourism and agriculture, co-developing local Arctic services for sea ice and permafrost, and offering applications related to air quality, lake ice, and wildfire risk. They span all three applications in this report: Climate Research, Disaster Risk Reduction and Preparedness, and Attribution, prediction, and projection.

However, both the Expert Study and the EuroGEO Workshop 2024 report highlight significant challenges. **Participation** in the original Climate AG workspace declined once project-specific activities ended, moving from project pilots to operational services remains uncommon, and governance structures have generally been quite informal. The study therefore recommends anchoring the Climate AG in the **C3S National Collaboration Forum** – which convened for the first time in June 2024 – and strengthening links with other European climate networks such as the **Joint Programming Initiative on Climate**, the **European Climate Research Alliance** and the **Space for Climate Observatories** (SCO) .

The EuroGEO Workshop 2024 went a step further, introducing the Action Groups as potential "**agents of change**" that can bridge the "grand distance" between data and intelligence and support a continuous innovation "conveyor belt" from Research and Innovation to Operations and the Market (R2O)., For the climate segment, EuroGEO Climate AG will **support where the projects show the most momentum** – i.e. Climate Research-driven services that are close to operational, fast-growing attribution and prediction services, and the recent surge of Disaster Risk Reduction and Preparedness projects. They will likewise **support in co-designing services** with specific user communities, thus making systematic use of Copernicus, DestinE and AI. And finally, they are set to work with the European Commission and Member States on **sustainable funding models**, e.g. usage-based schemes presented in the Expert Study, so that climate services remain free for users while providers are fairly rewarded when their services help with policy monitoring and implementation.

Climate Research remains the backbone of the segment, with Attribution, Prediction, and Disaster Risk Reduction becoming increasingly operational. EuroGEO can bridge European EO infrastructures, the GEO Earth Intelligence vision, and users who rely on climate intelligence, helping turn Europe's EO assets into a coherent, user-focused climate service ecosystem.

Glossary

AG	Action Group
AI	Artificial Intelligence
bn	Billion
C3S	Copernicus Climate Change Service
CCI	Climate Change Initiative (ESA)
CEMS	Copernicus Emergency Management Service
C-band	Frequency band used in radar remote sensing (e.g., Sentinel-1)
CSRD	Corporate Sustainability Reporting Directive
DG CLIMA	Directorate-General for Climate Action (European Commission)
DestinE	Destination Earth
ECVs	Essential Climate Variables
EO	Earth Observation
ESG	Environmental, Social & Governance
ESA	European Space Agency
ESR	Effort Sharing Regulation
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
EUSPA	European Union Agency for the Space Programme
EU	European Union
FPCUP	Framework Partnership Agreement on Copernicus User Uptake
GHG	Greenhouse Gas
GCOS	Global Climate Observing System
GEO	Group on Earth Observations
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
MRV	Monitoring, Reporting and Verification
NDCs	Nationally Determined Contributions
R&I	Research and Innovation
RIO	Research and Innovation Observatory
SCO	Space for Climate Observatory
SDGs	Sustainable Development Goals
SMEs	Small and Medium-sized Enterprises
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
AG	Action Group
AI	Artificial Intelligence
bn	Billion
C3S	Copernicus Climate Change Service

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Disclaimer: This report is based on research from the prototype Research & Innovation Observatory (RIO), and complemented by expert input where available, it may not fully represent the positions of the Climate EuroGEO Action Group,

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