Policy Brief: Using Earth Observation Data and Climate Information to Enhance Climate Adaptation in European Cities and Regions

EARSC – European Association of Remote Sensing Companies

About the VALORADA project

The VALORADA project (2023–2026) brings together 14 European partners under Horizon Europe to strengthen climate adaptation and resilience at regional and local levels, supporting the EU mission of 150 climate-resilient regions by 2030. Demonstrators include Gabrovo and Burgas (Bulgaria), Přerov and Mladá Boleslav (Czech Republic), Occitanie (France), Central Greece, and Molise (Italy).

VALORADA assesses the data baseline for adaptation by identifying priority climate risks, evaluating the accessibility and usability of European climate and non-climate data, and co-developing a framework that links socioeconomic, demographic, Earth Observation, and climate datasets. The project develops and showcases prototype data-manipulation tools, co-creating guidelines to build *resilience-information catalogues*, generating climate-risk indicators, and enabling customisable integration of diverse datasets for decision-making. To maximise impact, VALORADA ensures its tools follow the FAIR principles, are interoperable with existing repositories, and support capacity building across demonstrators.

Summary

Local and regional authorities across Europe face a complex set of challenges in leveraging data for climate adaptation. Although data-driven approaches are now essential for effective adaptation, **fragmented datasets, limited accessibility, and technical barriers** hinder their integration into actionable knowledge on societal risks and viable adaptation pathways. This policy brief identifies and addresses these challenges and proposes practical approaches for making use of satellite-based Earth Observation (EO) and climate projections to meaningfully support local climate adaptation decisions.

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Main Messages

- **Harmonisation of data and open standards across different datasets from the EO data sector to climate information should be promoted.** Embedded in the Common European Data Spaces and linked to the EU Mission on Adaptation framework, data harmonisation is important to foster the progress towards 150 climate-resilient regions by 2030. Fragmentation, data silos, and other barriers preventing the full potential of data uptake, especially at the local level, should be avoided.

- **Data accessibility and sharing in line with existing EU policy frameworks should be supported.** Despite the vast amounts of EO, climate, and socio-economic data collected at the national level, local adaptation decision-makers often lack timely access to these resources. Strong collaboration across governance levels (national, regional, and local) is critical to ensure that processed, decision-ready datasets reach cities and regions when needed. Trusted intermediaries operating under clear rules can play a pivotal role in bridging these gaps and enabling evidence-based adaptation measures.

- **Co-design should be embedded in climate services and policymaking.** Process-oriented approaches and an active involvement of municipalities and regions in defining requirements and validating outputs are crucial steps enabling EO and climate data providers to deliver actionable, trusted tools for climate adaptation. The same principle applies to the policy framework - including local and regional authorities in the policymaking process contributes to a better understanding of local needs and challenges and better-tailored solutions.

- **Targeted visualisation solutions and clear communication of uncertainties should be fostered to support the knowledge at the local level.** Using interactive dashboards or other tools featuring clear adaptation indicators and uncertainty ranges makes climate risks understandable and actionable for local authorities.

Introduction

Cities and regions are already at the frontline of climate impacts, ranging from droughts and floods to extreme heat, and they are well-positioned to serve as hubs for future, integrated climate action. [1] It is widely recognised that EO data and climate information are essential tools supporting the role of local and regional authorities in climate adaptation, offering a comprehensive picture of climate impacts when combined with in-situ, real-time, or socio-economic data.

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[1] Cities and Climate Action: World Cities Report 2024. UNEP. https://unhabitat.org/sites/default/files/2024/11/wcr2024_-_full_report.pdf

However, as identified by the VALORADA project, **integration of these diverse data sources encounters challenges** that become even more critical locally, where data should provide evidence-based input for decision-making. First, the brief argues there is room for improvement as regards data harmonisation. Second, it advocates for initiatives fostering data sharing and accessibility, as the existing data often doesn't reach the local level. Third, it outlines existing technical barriers and the need for clear uncertainty communication. Fourth, it advocates for a process-oriented approach, co-design measures, and an active involvement of local and regional authorities. The brief proposes a way to better tackle the challenges and integrate the key data domains based on the experience of VALORADA, contributing to the local climate adaptation decisions.

Addressing these challenges should be a priority, as high-quality data and fit-for-purpose climate services are essential to facilitate and support local and regional climate adaptation efforts. Furthermore, these services should be easily accessible and user-friendly. This is in line with the **EU Adaptation Strategy**, which emphasises the importance of smart, fast, and systemic adaptation measures and climate services, enabling end users to make climate-smart decisions. [2] [3]

The process-oriented approach of VALORADA

The VALORADA project has, throughout its duration, developed several frameworks and tools to **strengthen local and regional capabilities** through a process-oriented approach designed to make climate risks visible and actionable for stakeholders. This approach included:

- Co-development of the Local Climate Information Profile (LCIP): A self-assessment tool to document climate impacts, data governance structures, and data maturity.
- Collective development of 10 Climate Impact Chains (CICs): CICs map how climate hazards evolve into risks by considering exposure, vulnerabilities, and adaptive capacity.
- Co-generation of risk indicators: These indicators help stakeholders interpret and measure climate risks in ways that reflect local priorities.

The process **culminated in interactive dashboards featuring visualisations of risks** in which EO data and climate information (both historical and projected) reinforce each other. Such tools allow past and present impacts to be contextualised within climate projections, supporting informed decision-making. This is a crucial step – while satellite-based EO data provides high-resolution and frequently updated information, which enables rapid assessments of local spatial impacts, climate projections are essential to complement EO by offering insights into potential scenarios and supporting long-term assessment.

[2] EU Adaptation Strategy. European Commission. https://climate.ec.europa.eu/eu-action/adaptation-and-resilience-climate-change/eu-adaptation-strategy_en
[3] Climate Services. Climate-Adapt. https://climate-adapt.eea.europa.eu/en/knowledge/adaptation-information/climate-services/climate-services

Data harmonisation

Integration of EO data, climate information, and socio-economic datasets is one of the crucial factors in maximising the effectiveness of climate projections for climate adaptation. However, data silos can prevent end users from exploiting existing capabilities to their fullest extent. To realise the potential in this sector, there is a need for a common understanding of standards and processes together with mechanisms that actively involve end users in defining requirements and validating outputs. Innovative approaches that demonstrate the value of local data in supporting climate adaptation are crucial as well. Without such harmonisation, the uptake of EO-based climate services across regions might remain limited. [4]

Therefore, policy efforts should focus on breaking down barriers, fostering common standards, and minimising the effects of data silos. Harmonisation would benefit both the end users of climate services and the EO services industry. The **Vision for the European Space Economy** could be one of the policy tools in this effort, as it outlines the aims to simplify regulatory frameworks, foster cross-sectoral demand for space data, increase the uptake of EO data in decision-making processes, and reduce the burden for the use of space data in the climate services sector. [5] The Vision also foresees the creation of space data spaces and labs to support secure sharing of satellite data. Together with the European Commission's goal of deploying sectoral data spaces and supporting interoperable digital public services, this could contribute to the effective uptake of EO data in the climate services sector. [6]

> ### Satellite-based EO Data and Climate Services
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> Satellite-based Earth Observation (EO) is the process in which information and data about the Earth's surface, land, water, and atmosphere are gathered through satellite remote sensing platforms. [7]
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> Climate services refer to the transformation of climate-related data to provide tailored climate information, knowledge, tools, and products to support individual and organisational decision-making in climate-sensitive contexts.
>
> VALORADA focuses on combining climate projections, EO data, and local socioeconomic and territorial data to characterise climate risks in various contexts.

In the implementation of these initiatives, as well as in the context of policy frameworks such as the **European Data Union Strategy**, [8] the core considerations should involve **EO and climate information interoperability, the integration of EO data into existing architectures, and the simplification of existing environments.** Additionally, these efforts should adhere to the FAIR Principles, making data findable, accessible, interoperable, and reusable.

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[4] Based on the experience and findings of VALORADA's technical partners.

[5] Vision for the European Space Economy. European Commission. https://defence-industry-space.ec.europa.eu/vision-european-space-economy_en

[6] Work Programme 2025-2027 of the Digital Europe Programme. European Commission. https://digital-strategy.ec.europa.eu/en/library/work-programme-2025-2027-digital-europe-programme-digital

[7] What is Earth Observation? EUSPA. https://www.euspa.europa.eu/eu-space-programme/copernicus/what-earth-observation

[8] European Data Union Strategy. European Commission. https://digital-strategy.ec.europa.eu/en/policies/data-union

Data sharing and accesibility

The experience of the local partners in VALORADA shows that several local demonstrators faced similar challenges embodied in the lack of access to relevant open data at a suitable scale. This is accompanied by the need for expertise, guidance, and processing. If left untackled, relevant EO and other types of data will not fully reach the end users who could benefit from them. Additionally, concerns about data privacy and legal aspects (including the case of in-situ observations and socio-economic data) often hinder the exchange of information across EU, national, regional, and local levels. This prevents the full exploitation of existing datasets and capabilities. [9]

Therefore, it is crucial to **support, foster, and mainstream data-sharing initiatives** through institutionalised cooperation between different data providers. To achieve this, **clear rules, incentives, and trusted intermediaries** are needed to enable public bodies, researchers, and companies to share data with confidence. This approach aligns with the goals of the **European Data Governance Act** to foster data-sharing to combat climate change through data intermediation services, data altruism, and common European data spaces, [10] and with the call to action in the **EU Data Act** for the definition of clear rules for public sector bodies to access and use data. [11] It also falls in line with the **INSPIRE Maintenance and Implementation Work Programme** (MIWP) for 2025-2026, which aims to define *INSPIRE crown jewels* (priority datasets), simplifying technical requirements and transitioning to a digital ecosystem for environmental and sustainability data. [12]

In this regard, VALORADA has advanced two key contributions. First, the project's **Data Valuation Framework** [13] is designed to support decision-makers in local administrations to tap into the climate value of the extensive datasets they already use, to generate knowledge for climate-risk reduction from existing data, and to apply it in practice. The framework reflects key conceptual areas important for climate-risk reduction, such as relevance (contribution to knowledge generation), strategic value (alignment with policy agendas), usability (efficiency in terms of resources), and quality (data provenance and accuracy).

Second, **VALORADA's Resilience Information Catalogue** integrates datasets used by local governments with guidance for use through resilience indicators. The catalogue includes basic information about indicators, their requirements, and calculation methods, as well as a classification of the generic data types needed for these indicators. These examples illustrate how tools can help bridge gaps, foster common standards, and reduce data silos, enabling better alignment between diverse datasets.

[9] Based on the experience and findings of VALORADA's technical partners.

[10] European Data Governance Act. European Commission. https://digital-strategy.ec.europa.eu/en/policies/data-governance-act

[11] Data Act. European Commission. https://digital-strategy.ec.europa.eu/en/policies/data-act

[12] INSPIRE Knowledge Base. European Commission. https://knowledge-base.inspire.ec.europa.eu/overview/maintenance-and-implementation_en

[13] VALORADA Climate-data Valuation Framework. VALORADA Documentation. https://valorada.github.io/documentation/data-valuation-framework/

Barriers related to climate projection uncertainties

Integrating climate projections into local adaptation planning remains a major challenge. Climate models provide a range of possible future scenarios, based on assumptions about concentrations of greenhouse gases or socio-economic trends. However, aligning long-term projections with EO and socio-economic data **requires clear communication of uncertainties**, otherwise, local decision-makers risk misinterpreting, underestimating, or overestimating climate risks.

To address these barriers, **improved tools (guidelines or training) that convey best practices, uncertainty transparency, and capacity-building initiatives** are needed to help local administrations integrate climate projections effectively in adaptation strategies. For example, to realise the potential of climate projections in the urban adaptation planning context, inherent scientific challenges need to be addressed, including characterising uncertainties, the mismatch in scale between the global (or regional) climate models and local needs, and significant socio-economic and institutional barriers. Without proper consideration, such limitations can hinder effective, meaningful adaptation strategies in cities.

The need to involve local and regional authorities to support data uptake

VALORADA's experience has shown that even if data exists, **it is often difficult to access, navigate, or integrate for the local and regional authorities** due to its volume or insufficient pre-processing. This places a burden on them, as they may lack the expertise or resources to make full use of the data. Clear documentation and user guidance would greatly improve the usability and uptake of these datasets. Overall, it should be ensured that **cities and regions have access to data at the scale they require** (if available), an **understanding of its limitations and uncertainties**, and access to **climate science expertise** when interpreting climate data. Besides that, availability of multiple models and scenarios should be ensured, and ensemble approaches to increase their reliability should be applied.

Means to address these challenges have already been incorporated into EU efforts and policy frameworks, including the establishment of single information points to act as interfaces for users who wish to reuse data, [14] the aim of increasing user uptake of EO data through cooperation with national administrators and National Collaboration programmes, [15] or the provision of information such as Copernicus Climate Change Service (C3S) climate indicators [16] to deliver a multi-source reference for policymakers and the public (including the local level). As regards C3S datasets, VALORADA has showcased their value, evaluated the advantages and limitations of different downscaling approaches, and summarised the project experiences in practical guidelines for applying downscaled climate data.

[14] European Data Governance Act. European Commission. https://digital-strategy.ec.europa.eu/en/policies/data-governance-act
[15] Vision for the European Space Economy. European Commission. https://defence-industry-space.ec.europa.eu/vision-european-space-economy_en
[16] About the Climate Indicators. Copernicus Climate Change Service. https://climate.copernicus.eu/climate-indicators/about-climate-indicators

However, technical and policy initiatives alone will not solve the problem. **Co-design with local and regional authorities, capacity-building efforts, dialogues, and collaboration** between different communities are essential. Positive examples of actions in this regard include joint training programmes co-developed by EO specialists, climate modellers, and local authorities, the creation of common toolkits and templates, and cross-community exchanges through hackathons or projects that specifically promote EO and climate partnerships. This goes in line with the perceived role of local authorities and cities as acknowledged in the **EU Agenda for Cities** from 2025. This initiative views cities as crucial elements for sustainable growth, tackling challenges faced by the EU, and driving progress in various areas, and aims to engage in a high-level political dialogue as well as targeted technical consultations with them. [17]

Conclusion

Throughout its duration, the VALORADA project **has highlighted climate risks and made them actionable for stakeholders, making use of synergies between EO data and climate information.** The project has developed practical tools with regional demonstrators such as risk indicators that integrate diverse datasets to assess vulnerability or a replicable methodology to strengthen regional awareness and capacity. This work identified both the challenges of integrating EO and climate information, including their use in climate projections, and the opportunities to overcome them through policy action.

Overall, the main concerns do not stem from the lack of data, but rather from insufficient mechanisms to ensure that the data reaches and is accessible to those who need it most. More specifically, the identified challenges included data silos and the lack of data harmonisation, missing tools and standards, a lack of uncertainty communication, and limited access to processed, relevant data at a suitable scale.

To overcome these issues, co-creating solutions with end users, such as city planners and regional authorities, is essential to fully leverage EO, climate, and socio-economic data for climate adaptation. Additionally, the future EU policy and regulatory developments should prioritise support for data governance, incentives for data sharing, and fit-for-purpose services co-designed with local authorities. Closing this gap is critical for preparing Europe's regions and citizens to face accelerating climate risks.

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[17] EU Agenda for Cities 2025. European Commission. https://ec.europa.eu/regional_policy/information-sources/publications/communications/2025/eu-agenda-for-cities-2025_en