Climateurope2

Key Messages on standardisation of climate services

Climateurope2 third synthesis report

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Introduction

Over the course of Climateurope2 (CE2), we have found that established definitions of climate services do not always reflect how such offerings operate in practice. We have observed that many offerings across Europe could be described as drawing on scientific knowledge of climate conditions to support decision-making or organisational needs, regardless of how they are labelled or the form they take. This working description is not intended to be normative, nor does it imply a shared understanding across the climate services community. On the contrary, one of the central findings synthesised in this report is the continued lack of a common interpretation of what constitutes a climate service in practice.

This lack of shared understanding is reflected in the European climate services landscape, which is highly heterogenous and characterised by limited coordination and coherence. A significant share of climate services activity continues to take place within externally funded research projects, with academic and research organisations forming a well-connected core of providers. Alongside these actors, National Hydrometeorological Services and a highly diverse set of private providers are becoming increasingly important contributors to the provision of climate-related information and services.

However, coordination across these communities remains limited. Private providers in particular play an increasingly prominent role, yet they typically lack shared coordination structures and continue to operate in a highly fragmented landscape. Moreover, many organisations providing climate-related information and advice do not identify their work as “climate services”, instead referring to it through other market-driven labels and service categories, such as climate risk assessment, climate analytics, climate intelligence, sustainability services, or climate disclosure services. At the same time, the term “climate services” is sometimes applied very broadly, encompassing activities that are not primarily concerned with drawing on knowledge of climate conditions, such as emissions accounting or energy efficiency measures.

Within this diverse ecosystem, some providers focus primarily on the collection, synthesis, analysis and reanalysis of climate data and information. Others derive their value from being close to the users and decision processes, or from meeting specific sectoral and regulatory demands. Some may refer to the former as upscale climate services providers and the latter as downscale providers. In practice, however, most actors operate across multiple parts of the climate services value chain, often through partnerships that connect upstream data infrastructures with downstream sectoral expertise and user engagement. Upstream providers frequently collaborate with intermediaries to better understand user needs, while downstream providers rely on upstream data and scientific foundations to ensure credibility, robustness, and legitimacy. Together, this institutional fragmentation and conceptual ambiguity contribute to ongoing challenges in developing a shared understanding of what constitutes a climate service, complicating efforts to coordinate provision, assess quality, and support standardisation.

Against this background, the CE2 consortium placed special focus during 2025 on climate services provision beyond academia, particularly services designed for real-world decision contexts of clients or users. In-depth case studies and a series of sectoral workshops addressing the delivery of climate services in sectors critical for Europe's resilience have enabled the consortium to better understand what is needed to build the coherence and uniformity required for meaningful standardisation. We have structured this analysis through the lenses of the climate services components previously identified by CE2.[1] These four components are: understanding the decision context, the ecosystem of actors and co-production processes, the diverse knowledge systems, and the delivery mode and evaluation, together covering the full value chain of climate services. In the previous edition of the Climateurope2 Key Messages, we highlighted technical, procedural and performance aspects of climate services as a foundation for standardisation.[2] In this edition, we deepen this approach by making these components more granular. Specifically, the project has worked to identify sub-components that provide a structured and replicable framework across diverse types of climate services, clarify standardisable elements, and ensure consistency while avoiding excessive homogenisation.

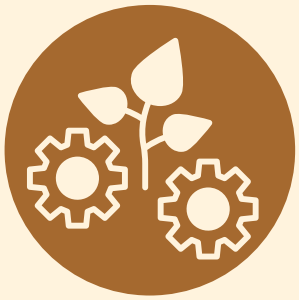
The key messages that follow emerge from an in-depth analysis of how three different public and private providers, each delivering climate services in non-research contexts, address these four components and the relative importance they assign to different elements within each. During 2025, CE2 partners engaged in dialogue with Copernicus Climate Change Service (C3S), Europe's most important public provider of climate information. Partners also worked with a spin off consultancy services organisation linked to a parent research institute that provides climate services focused on flood risk, one of Europe's most significant climate hazards. Further insights were drawn from engagement with a private provider delivering climate services to support sustainability reporting needs, particularly under the EU Taxonomy.

The key messages also draw on outcomes from the first meeting among leading private climate service providers in Europe, where participants shared insights on current practices, challenges, and differences across organisational types and market segments.[3] Additional findings emerge from a workshop focused on climate services for the health sector[4] and a workshop with specialists at the interface of climate services, insurance, reinsurance and finance. These sectors, where climate service provision has reached different levels of maturity, offer important lessons for developing salient, effective and context-sensitive services tailored to concrete decision needs.

Building on previous synthesis exercises and ongoing project work, CE2 has identified an initial set of principles, requirements, and recommendations for ensuring the salience, quality, effectiveness and performance of each climate services component. During 2025, project partners further evaluated these lessons learned and their implications for standardisation. The key messages presented below reflect this work by disaggregating the components into smaller sub-components and providing a preliminary identification of core standardisable elements at this level of detail. Finally, these key messages also draw on wider project outputs from 2025.

1 Europe's climate services landscape is diverse, fragmented, and unevenly connected across research, public institutions and private providers

The European climate services landscape encompasses a wide range of institutions, with academic actors continuing to play a prominent role. A mapping exercise identified over 646 climate services-related projects registered in the CORDIS database, which may be indicative of the extent to which climate services activity remains strongly shaped by EU-funded research initiatives.[5] Academic and research organisations involved in these projects form a relatively well-connected network, while other types of institutions appear to engage more sporadically in collaborative arenas.[6] At the same time, demand for climate services is increasing, with a growing number of spins offs from research organisations and an expanding community of private providers delivering services to real-world clients and decision contexts. This provision remains highly heterogeneous, spanning upstream data infrastructures and downstream sector-specific applications, often linked through intermediaries or knowledge brokers. Despite the fragmentation of the current landscape, there is broad support for standardisation. This could help connect a diverse ecosystem of climate services providers.[7]



#CLIMATE SERVICES LANDASCAPE

2 Copernicus Climate Change Service (C3S) plays a central role as Europe's core climate data infrastructure, but sustained investment and stronger user partnerships are needed

C3S plays a central role as Europe's core climate data infrastructure, with growing relevance beyond Europe. It can be considered an upstream climate services provider of quality-assured data, tools, and applications under a free and open-use license, designed to stimulate the development of downstream climate services. C3S excels at transforming Europe's extensive climate data resources into accessible and decision-relevant information. It shows clear awareness of the importance of user engagement, including collaboration with sectoral intermediaries, support mechanisms and training activities, and the development of a substantial library of user requirements. Nevertheless, quality assurance remains strongest for data and science, while approaches to interaction, co-production, and context-specific tailoring are more uneven. C3S products are deeply embedded within EU policy and regulatory frameworks, which gives them high visibility and credibility. At the same time, this orientation can reduce responsiveness to more localised, bottom-up, or non-policy decision contexts, and may risk reinforcing a compliance-driven focus over broader innovation and usability. Ensuring the long-term sustainability of C3S will require continued investment, sustained recognition of its societal value, and strengthened partnerships that support flexibility and relevance across diverse user communities.

#COPERNICUS CLIMATE CHANGE SERVICE

3 The growing community of private climate service providers seeks a more connected, transparent, and user-centred market in Europe

Private providers operating across the climate services value chain are increasingly important actors. Their services are often offered as part of broader packages addressing climate or environmental risks, supporting activities such as adaptation planning, investment decision-making, or regulatory reporting. Regulatory compliance is a major driver of demand, with many providers acting as "compliance translators" who connect climate information to evolving disclosure and reporting requirements. Many private providers emphasise that the provision of climate data alone does not constitute a climate service. In their view, effective services require interpretation, contextualisation, and guidance tailored to specific decision contexts, often delivered through consultancy, advisory support, and iterative client interaction.[8] Co-design with users, accountability, and technical rigour are widely recognised as critical factors shaping trust and uptake. There is also strong interest among providers in expanded networking opportunities, capacity-building for both users and service developers, and the development of inclusive standards, assurance mechanisms, and certification schemes to support a resilient and trustworthy European climate services market.[9]

#PRIVATE PROVIDERS

4 Effective standardisation requires a flexible and layered approach that establishes common requirements while allowing sufficient flexibility for sectoral practices and regulatory obligations

Many climate services in Europe are highly specialised, serving distinct domains such as health, insurance, or finance. These sectors differ significantly in their decision contexts, levels of service maturity and regulatory drivers. For example, climate services for health often integrate climate, environmental, and epidemiological information to support prevention, preparedness, and long-term adaptation, while services for insurance and finance are strongly shaped by reporting requirements and the translation of climate hazards into financial exposure and asset risk. Across sectors, there is broad agreement on the importance of shared baseline requirements for standardisation, including scientific robustness, appropriate metadata and documentation, transparency around methods and uncertainty, data security and provenance, and a clear understanding of the service's decision-making context. At the same time, standardisation must remain flexible and thus sensitive to sector-specific constraints. Different sectors use distinct vocabularies, modelling practices, and accepted forms of evidence, and standards will need to ensure interoperability with dominant tools such as catastrophe models in re/insurance or epidemiological models in health. Effective standardisation will therefore require a layered approach. Standards that are too generic risk irrelevance, while those that are too sector-specific risk fragmentation, making modularity essential.[10]

#SECTORAL RELEVANCE

5 Standardisation of climate services requires a high degree of granularity, with sub-components providing a practical basis for defining clear, benchmarkable, and auditable requirements

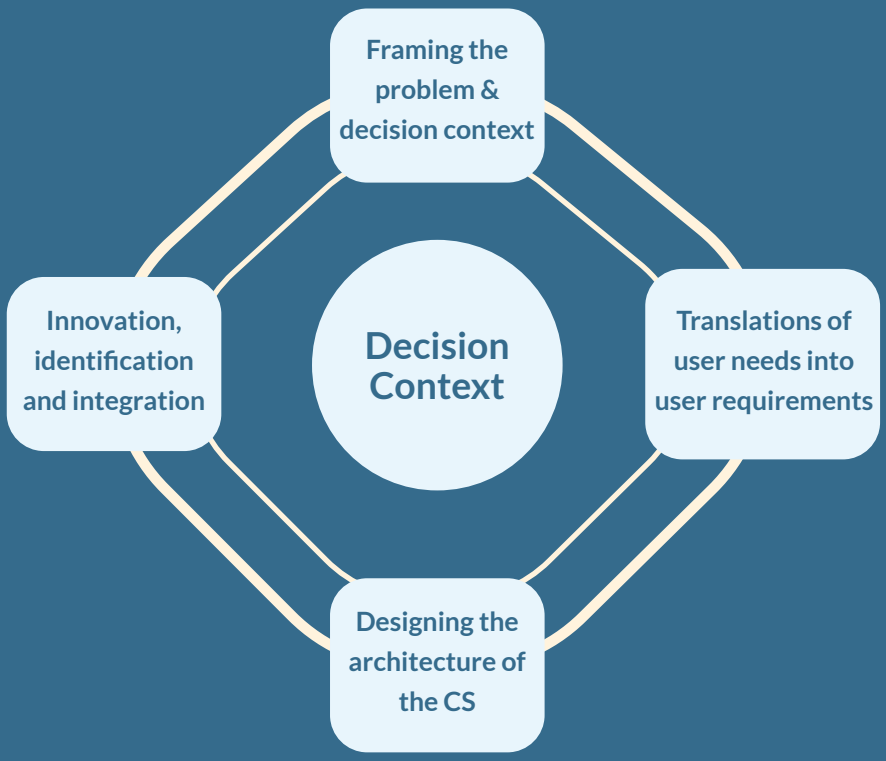
The search for an effective strategy for standardising climate services highlights their inherent complexity. Climate services combine multiple types of data, information and knowledge, involve diverse processes and delivery modes, and are often produced through actors and partnerships across organisations operating at different points along the value chain. At the same time, many of these concepts are interpreted differently across communities, and the term climate services itself remains unfamiliar or inconsistently used among many providers and potential users.[11] In addition to addressing technical, procedural and performance characteristics, standardisation is best supported through a high degree of granularity.[12] Identifying components and sub-components of climate services provides a structured and replicable framework for guiding the identification of requirements across diverse service types and decision contexts. This approach supports the standardisation of processes for design, development, delivery and evaluation, ensuring services are not only scientifically robust but also relevant, accessible, and actionable. Sub-components provide a basis for developing benchmarkable and auditable requirements while maintaining flexibility and avoiding excessive homogenisation across sectors and contexts. This level of granularity also helps clarify which elements of climate services can realistically be standardised and which should remain adaptable.[13]

6

Sub-components of the decision-making context provide a foundation for procedural requirements in climate service standardisation

Understanding the decision-making context of a climate service is fundamental for its effective design, delivery and implementation. Climate information does not become usable or actionable in isolation. Rather, its relevance emerges through the geographical, social, political, regulatory, and institutional settings in which it is applied. These conditions shape what types of knowledge are required, what forms of uncertainty and quality assurance are considered legitimate, and how providers, intermediaries, and users interact in practice.[14] Greater granularity in this area helps translate broad principles of good practice into concrete procedural requirements for standardisation.[15] Identifying sub-components within this area makes it possible to clarify the steps through which climate services are designed and embedded within real decision environments. Key sub-components include framing the problem and the decision context in which the service is intended to operate; translating user needs into user requirements; designing an appropriate architecture for the climate service; and identifying opportunities for innovation and integration within service design.

#SUB-COMPONENTS OF THE DECISION CONTEXT

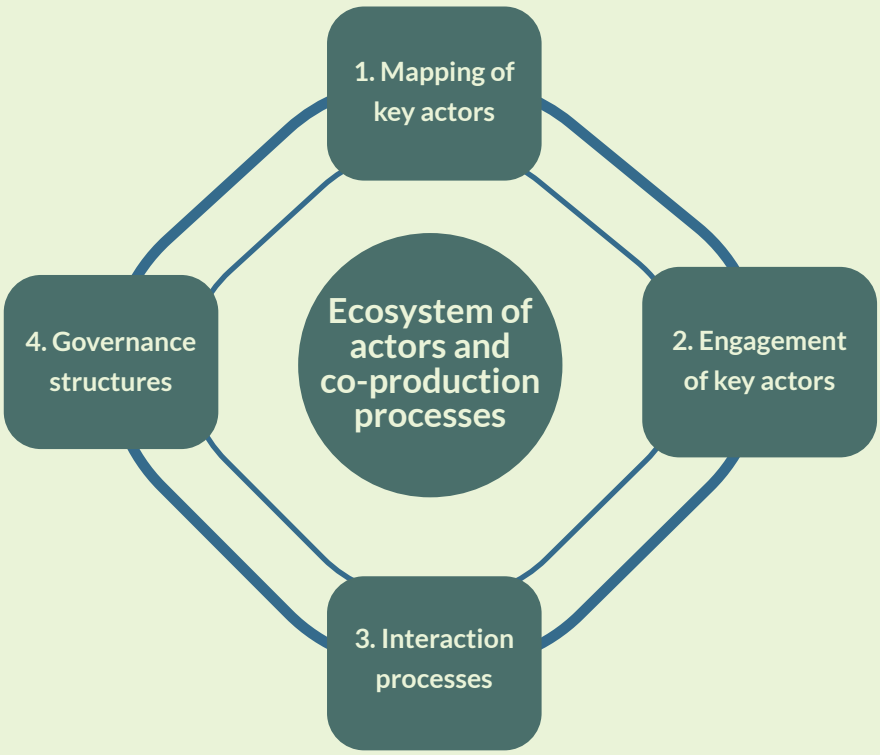


Together, these sub-components guide the identification of procedural requirements for standardisation that ensure climate services are not only scientifically robust, but also socially embedded, operationally viable, and aligned with real-world decision-making processes.

7 Mapping of key actors, engagement methods, assessment of interaction processes, and governance structures are essential sub-components shaping climate services development

A widely recognised feature of effective climate services is that they depend not only on climate information itself, but also on the ecosystem of actors involved in producing, translating, and using that information. Climate services are rarely created in isolation. Instead, they emerge through dynamic and iterative processes that involve providers, intermediaries, users, and stakeholders from different scientific, sectoral, and institutional communities. The impact of a climate service is therefore strongly shaped by the quality of relationships among these actors, including trust, legitimacy, and the capacity to co-produce knowledge that reflects diverse needs and decision contexts. Greater granularity in this area helps translate broad principles of co-production into more concrete procedural requirements for standardisation.[16] Key sub-components include the mapping of relevant actors; identifying appropriate engagement methods throughout the lifecycle of the service; the assessment of interactive processes; and identification of governance structures that enable coordination.

#SUB-COMPONENTS OF ECOSYSTEM OF ACTORS & CO-PRODUCTION

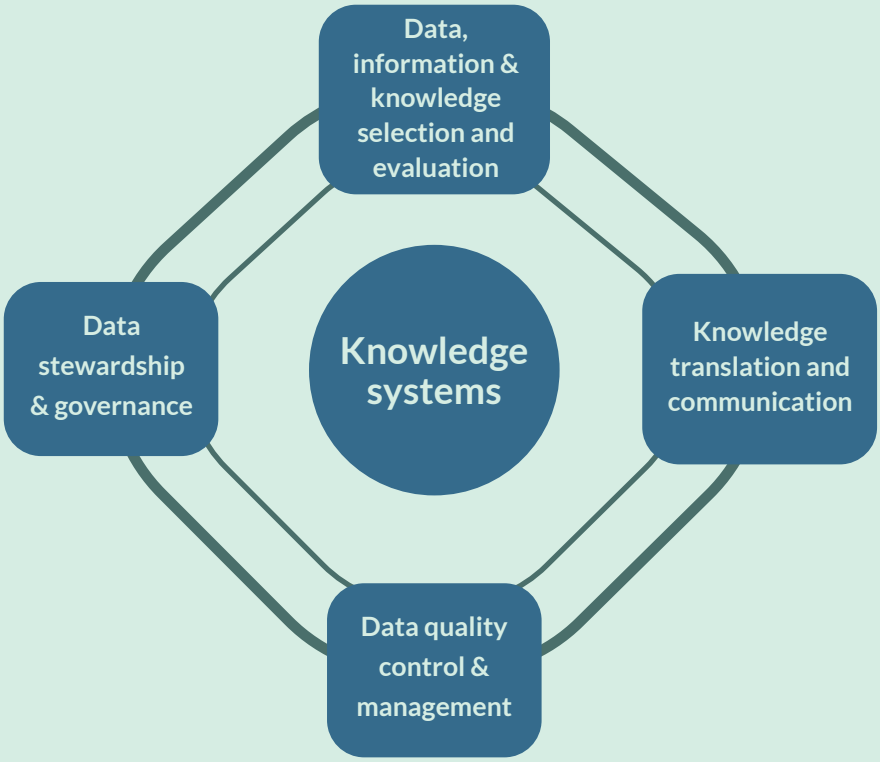


Together, these sub-components guide the standardisation of climate services and identification of requirements such that they support services to be transparent, inclusive, and responsive to user needs throughout their life cycle.

8 Systematic assessment of knowledge inputs, effective translation into actionable advice, quality control, and responsible governance are essential sub-components for credible and impactful climate services

Climate services draw on multiple knowledge traditions beyond climate science, combining scientific and applied knowledge with indigenous, local, experiential, governance, and socio-cultural knowledge, depending on the decision context in which a service is intended to operate. This diversity of knowledge is essential for ensuring that climate services can support adaptation, resilience, and risk management in ways that are meaningful for real-world users and institutions. Granularity in this area helps guide the development of auditable requirements for standardisation. Identifying key sub-components clarifies how different forms of knowledge are selected, translated and managed within the development of a climate service. Key sub-components include the selection and evaluation of relevant data, information and knowledge; the translation and communication of knowledge; data quality assurance and management; and data stewardship and governance.[17]

#SUB-COMPONENTS OF KNOWLEDGE SYSTEMS

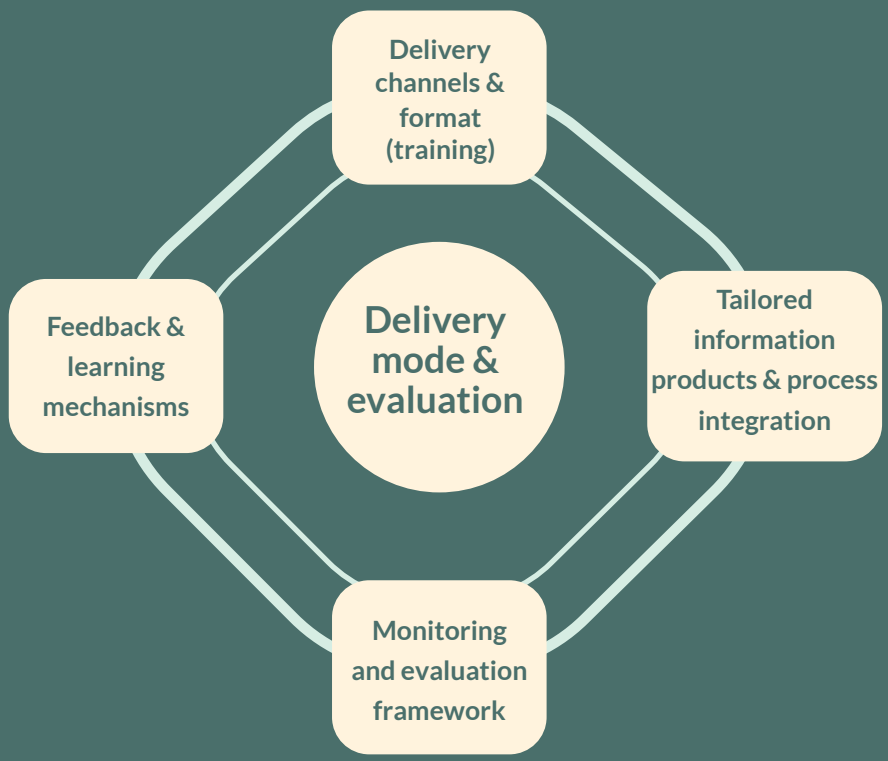


Together, these sub-components ensure the knowledge foundations of a climate service are not only scientifically robust, but also usable, trustworthy, and appropriately governed. Standards addressing all these elements can support climate services that are credible, contextually appropriate, and capable of delivering sustained decision value.

9 Appropriate delivery channels, tailored products, process integration, monitoring and evaluation, and feedback mechanisms are essential sub-components shaping climate services development

The delivery mode and evaluation component of a climate service encompasses the ways in which climate information is communicated, accessed, and embedded within user decision processes, as well as the mechanisms used to evaluate service performance over time. Even scientifically robust information will have limited value if it is not delivered in forms that are accessible, usable, timely, and actionable within a specific decision-making context. Great granularity in this area helps guide practical requirements for standardisation. Identifying key sub-components clarifies how climate services are delivered, integrated into user workflows and continuously improved through evaluation and learning. Key sub-components include delivery channels and formats, including capacity building and training to support uptake; the development of tailored information products and their integration into existing workflows; monitoring and evaluation mechanisms; and feedback and learning processes that enable iterative improvement.[18]

#SUB-COMPONENTS OF DELIVERY MODE & EVALUATION



Together, these sub-components are fundamental to ensure the fitness-for-purpose of climate services. They support climate services to remain responsive to evolving needs and provide a basis for transparent, inclusive, and auditable standards for delivery and impact.

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[5] See Checchia, P., Doblas-Reyes, F.J., Carrascosa, A., Terrado, M. Exploring the European Climate Services Landscape: can we make it more equitable? Manuscript in preparation. See also, The European Climate Services Landscape.

[6] See also Joint Industry Statement from Europe's private providers on the future of climate services — Climateurope2. It is important to note that some sectors and some European regions are more connected than others.

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[11] See Cuevas-Garcia, C. et al. (2025). D5.3 - Review of best practices guidelines and criteria for science policy interactions to support the standardisation of CS. Available at Public deliverables — Climateurope2.

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[15] See Gonzalez, C. et al. (2025). D3.3 - Recommended approach to the application of assessment methods, and pilot applications case studies; and Jaiyeola, A. and Cattoire, P. (2025). D4.7 - Report on needs assessment and market-stimulating services design. All available at Public deliverables — Climateurope2.

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