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Towards a leading role on climate services in Europe: A research and innovation roadmap

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ABSTRACT

The European Commission established an *ad hoc* Expert Group to develop a framework for action towards growing a strong and flourishing climate service sector across Europe. The growth of this sector is seen as essential to meeting the challenges associated with building resilience and sustainability across Europe and in member states, and for enhancing their capacities to deliver climate services in a global market. The resulting research and innovation roadmap articulates an agenda and shared approach that are based on building on enhancing existing investments, focusing on solution-oriented activities and specific actions that are using Horizon 2020 (and other funding programmes) as a bridge between users and the science. This short communication provides a personal overview by one of the members of the Expert Group on the thinking that guided the development of the Roadmap for climate services and provides insights on how it is being taken forward.

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The report, published in March 2015, 'A European Research and Innovation Roadmap for Climate Services',[1] is intended to offer a coherent and focused framework for prioritising actions to be implemented through Horizon 2020 and other funding programmes to 2020 and beyond. It is not a European Commission document, but is recognised by the Commission as a significant contribution to their plans for investment in research and innovation to facilitate the development of a market for climate services that provides social and economic benefits across Europe.

The Roadmap is the result of the work of an *ad hoc* Expert Group,[2] established by the European Commission, and which benefitted from the involvement of a larger supportive group of experts and on input from focused stakeholder consultations. In realising this Roadmap, the intention was that the suggested framework for action will be able to leverage existing initiatives at EU and national levels, and stimulate and enable initiatives within the private sector, towards growing a strong and flourishing climate services sector across Europe and beyond.

This short communication is intended to offer a personal commentary, as a member of the Expert Group, on the thinking behind the development of the Roadmap and insight on the ideas and reasoning which guided its development.

When initiating the Roadmap, clarity and agreement on the vision was fundamental. The focus on growing the market was seen as a means for building resilience and sustainability in the context of climate change across Europe and member states, and for enhancing their capacity to deliver climate services within the global market.

The Roadmap clearly gives primacy to a service perspective on climate services – user-driven and science informed. This means beginning with users' needs based on an understanding of how decisions are made and existing and potential uses of climate services in the decision making processes. The vision also embraces an approach to research and innovation based on co-design, co-development and co-evaluation of climate services, and on the

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[1] 'A European Research and Innovation Roadmap for Climate Services', European Commission, Directorate-General for Research and Innovation, European Union 2015, Print: ISBN 978-92-79-44341-1, doi:10.2777/702151, KI0614177ENC; PDF: ISBN 978-92-79-44342-8, doi:10.2777/750202, KI0614177ENN. http://bookshop.europa.eu/en/a-european-research-and-innovation-roadmap-for-climate-services-pbKI0614177/.

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Geesthacht, Hamburg
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demonstration of the value to decision making as the basis for growing the climate service market.

As part of the vision, clarity on how climate services are defined was critical. For the scope of the Roadmap, a broad meaning for the term 'climate services' is used:

The transformation of climate-related data – together with other relevant information – into customised products such as projections, forecasts, information, trends, economic analyses, assessments (including technology assessments), 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, climate services in the context of the Roadmap include data, information and knowledge that support adaptation, mitigation and disaster risk management.

Translating this vision into a research and innovation roadmap in support of climate services required an understanding of the nature and scope of the decisions being made and thereby the potential demand for climate services. The difficulty is that the demand for climate services is relatively unknown and fragmented. Furthermore, there is anecdotal evidence that suggests that people are often using climate services without labelling it as such.

It is clear that the current demand for climate services is less than what is required to deliver the benefits reflected in the vision and that the potential market is largely untapped. This suggests that there is a need to better understand the existing and potential demand (i.e. market potential), but also to understand why the demand is relatively unknown and fragmented at present. Reasons identified for the lack of demand are that the community and infrastructure needed to support climate services is insufficient for the task at hand and that the services available are primarily supply-driven and to some degree user-informed. As such, delivering on the vision will require addressing these shortcomings.

Climate services stakeholders' perspectives were sought as a means of further informing the development of the Roadmap. This was achieved through an online consultation process and a focused user-oriented survey and follow-up interviews involving current and potential end-users and intermediary organisations (purveyors) who are taking the information and adding value to it before moving it on.

Their perspectives were critical to informing the translation of the vision into the challenges and activities. Stakeholders identified drivers or reasons encouraging the use of climate services (e.g., economic and corporate social responsibility benefits, and responding to policy); constraints in using climate services (e.g., integration into existing decision framings and processes, and translating implications into economic terms); and attributes and modes of required services (e.g., reliability, fit-for-purpose, usability, trust, and the balance between freely available services and services for a fee). They also identified priorities that would require action within the Roadmap:

- A strong focus on the demand side and on the provider/user interface;
- Multi-disciplinary approach and innovation – prioritising of research efforts and the co-design, co-delivery of innovation towards fit for purpose services;
- Building capacities and communities of practice – supporting the innovations and including those who work at the user–provider interface;
- Further requirements – quality control, standards, certification, reinforcing relationships and building trust;
- Integrating climate information with multiple data sources;
- Being consistent with the users' existing decision making framing and practices;
- Improving regional modelling capabilities, and the capacity to provide regional and sector-based assessments on relevant timescales.

Delivering on the vision required that the Roadmap also reflects and builds on the existing initiatives both within Europe and internationally: the climate services landscape (see Fig. 1).

Taking account of these considerations in light of the vision for the Roadmap led to the development of three overarching challenges: enabling market growth; building the market framework; and enhancing the quality and relevance of climate services. Delivering on these challenges will provide evidence, knowledge and innovations that will identify and deliver opportunities for fuelling market growth. The challenges are also seen as the means of providing a viable and vibrant climate services community (both demand and supply) across Europe that is central and critical to growing the climate services market.

Each of the challenges (and associated activities) begins with understanding users' needs and capabilities and then bridging these with today's capabilities and tomorrow's possibilities for meeting these needs. The use of transdisciplinary approaches (e.g., co-design, co-delivery, co-production, and co-evaluation) when delivering research and innovation is critical. Similarly, fundamental to growing the market is the ability to demonstrate the added value of using climate services from the perspective of the users.

Challenge 1: enabling market growth

This first challenge is to develop a comprehensive understanding of the demand and supply side of the climate services market across Europe; providing an initial snapshot of the market, the potential for growth and the support required to grow that market. True to the vision, and fundamental to identifying the potential for growth, is building the demand for such services and the capacities to use and provide climate services. In the case of the former, the Roadmap is calling for activities demonstrating and promoting the added value of climate services for decision-making and the resulting decisions from the users' perspectives – an essential element to growing the demand.

Critical to enabling market growth are the synergistic relationships between the players on the supply-side. Although competition will always be important to drive the market, there also needs to be a supportive and collaborative community. Activities and specific actions under this challenge have been included to provide opportunities for collaborations among those providing climate services (e.g., the COPERNICUS Climate Change Service, national climate services, and private sector providers and purveyors) to support and strengthen the required growth. The requirement is for a vibrant, healthy market dynamic. This includes a balance between a broad and consistent layer of public, free, open access climate services plus customised high added-value services available for a fee. Both are as essential to fuelling market growth.

Challenge 2: building the market framework

The second challenge reflects the need to build and support the sustainability of a vibrant and viable European climate services community, engaging users, providers, purveyors, innovators and researchers. It also reflects the need to improve on the current community model to deliver the vision. Activities are intended to provide a platform for engagement that enables and empowers the community to work together on issues and challenges associated with growing the climate services market. This begins with demonstrating the value of engagement within the community and delivering benefits for all engaged. It includes providing fora to build and expand the capacity of those using, developing and delivering climate

services across Europe; fora in which trust can be built across the community and within which credibility and quality of services can be demonstrated.

Also important is building and providing for the development of the computing and IT infrastructure that can support the climate service market and its growth. This is a critical element of building the framework as it is the efficient flow of data, information and knowledge that is at the heart of climate services. The infrastructure is needed to support co-design, co-development, co-delivery and co-evaluation of climate services by addressing the associated big data challenges.

Activities under this challenge are also intended to sustain the community beyond Horizon 2020 time frames. Sustaining the growing market is essential to realising the benefits behind the development of the Roadmap. As such, these activities are designed to build a community that will become self-sustaining, building on investments under Horizon 2020, but also working with other European and global initiatives. Specific collaboration with the international climate services community is included within the Roadmap as many of the decisions for which climate services are needed have international dimensions, and it is recognised that there is a need to contribute to and learn from activities beyond Europe.

Challenge 3: enhancing the quality and relevance of climate services

The third challenge addresses the need to advance the climate services on offer through research and innovation. As with the other challenges, the activities begin with engaging users, providers, purveyors *and researchers* in this process of identifying the improvements and innovations needed to better inform decision-making processes and the decisions themselves. It starts with understanding users' needs, capabilities and decision framings and then, through transdisciplinary research and innovations, enhances the quality and relevance of climate services to support the growth of the market.

A critical element of this challenge is that the engagement should also lead to foresight into the evolution of users' needs and capabilities to inform science advancements, including those being developed and undertaken in other research fora. This information is critical when identifying priorities for investment in science and innovation; investments that promote and support a transdisciplinary approach, that trigger the innovative and out-of-the-box thinking required to develop fit-for-purpose and cutting-edge climate services and decision-making solutions.

Of course, decisions are not made on climate information alone. As reflected in how the Roadmap perceives climate services – *transformation of climate-related data together with other relevant information* – enhancing the quality and relevance of climate services means that the integration and framing of data and information to support decision making will require particular attention. This area of innovation was also identified as a stakeholder priority. As such, this challenge includes understanding and demonstrating how to draw on and integrate physical, land use, socio-economic and other non-physical data and information and how to frame them to support decision making.

One area under this challenge that became apparent following discussions with those using and providing climate services was the need for research and innovation that would lead to appropriate framing of the associated uncertainties such that they support decision making. This framing should be developed with users to clearly understand and demonstrate how uncertainties across the different data and information sources can be integrated to better inform decisions.

Towards Roadmap implementation

The Roadmap's value is that it articulates an agenda and shared approach that are based on adding value to existing investments in the various programmes already underway (e.g., Copernicus Climate Change Service (C3S), Global Environmental Monitoring

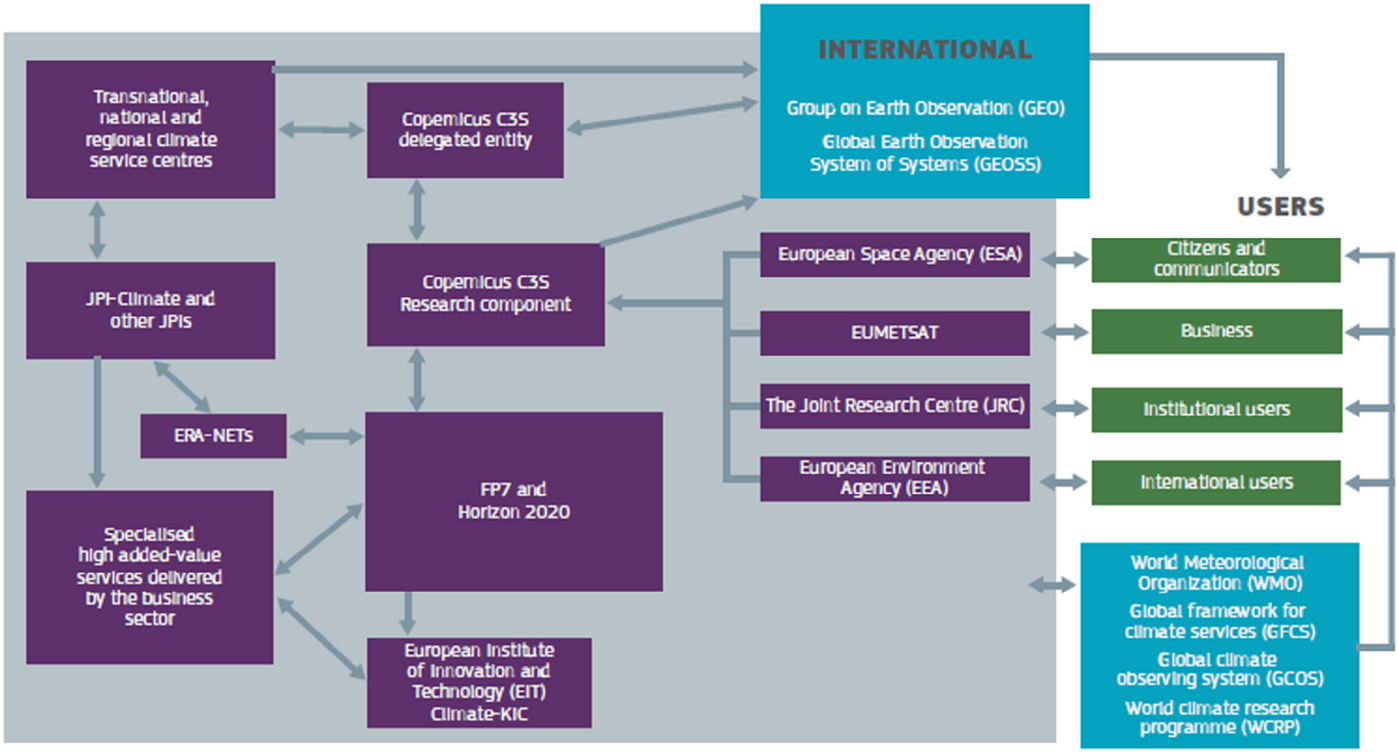

Fig. 1. Relationships within the European climate services landscape (from the Roadmap; see Footnote 1).

System (GEMS), Global Earth Observation System of Systems (GEOSS) and the European Climate Adaptation Platform (Climate-ADAPT)). It is also looking towards enhancing the impacts of those investments, to supporting the development of national climate service initiatives and to growing the associated business sectors; focusing on the solution-oriented investments with Horizon 2020 acting as a bridge between users and the science.

Delivery of the Roadmap is seen through three time frames: short-term 2015–2017, medium-term 2017–2020, and also in the long term, recognising that investments now will facilitate benefits from the Roadmap beyond 2020. In the short-term, there is a need for some foundational activities that contribute to growing the market and others that will establish the basis for activities needed to sustain and continue that growth. Building the capacity and viability of the European climate services community is seen as paramount to achieving the longer-term objectives of a sustainable and viable climate service market beyond the anticipated Horizon 2020 investments.

Where are we with respect to implementation? Late in 2014 the European Commission undertook a call for ideas for demonstration and pilot projects in the climate services domain. Over 60 replies were received which were then used to shape the call for proposals issued in autumn 2015.

The Horizon 2020 Work Programme 2016–2017 in the area of Climate action, environment, resource efficiency and raw materials includes calls under climate services as reflected in the Roadmap. These are:

- Exploiting the added value of climate services (SC5-01-2016-2017); includes a call for proposals on the *Demonstration of climate services* (an innovation action) and another focusing on *From climate service concepts to piloting and proof-of concept* (a research and innovation action);
- Integrated European regional modelling and climate prediction system (SC5-02-2017, a research and innovation action);
- Climate service market research (SC5-03-2016) comprising a call entitled *Defining the European and international climate service market characteristics and foresight into market growth*, and another on *Climate services market barriers and enabling conditions* (both are research and innovation actions;
- Towards a robust and comprehensive greenhouse gas verification system (SC5-04-2017, a research and innovation action);
- A 1.5 million year look into the past for improving climate predictions (SC-5-05-2016, a coordination and support action).

The implementation of the Roadmap will require close coordination of those actors working at the national, EU and international levels. To support this, the climate services initiative team at the Directorate-General for Research and Innovation of the European Commission has set up an informal Working Group to guide and promote the implementation of the Roadmap. This Working Group, with members drawn from key institutional actors across the climate services field, has been tasked to act on four main lines:

- information sharing;
- development of a rolling implementation plan;
- promotion and coordination of roadmap and roadmap-relevant actions;
- feedback from experiences and new ideas for updating the Roadmap.

The Group will be in place for the duration of the Horizon 2020 programme, steering, monitoring and reporting on implementation as it develops. By providing regular updates to the Roadmap, the Group will help ensure the Roadmap remains a viable and useful framework to inform the definition of future research and innovation actions to support a vibrant and growing climate services market.

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