

The European Landscape of Climate Services and Earth System Models

Climate services, providing climate information for use by decision-makers and policy-makers, are at the core of a landscape that is rapidly evolving, both in terms of:

- Awareness and needs of the recipients of such services;
- Knowledge and information that the services are built upon

Climate services are becoming more salient to users thanks to the research and scientific improvements in Earth System Models (ESMs) and climate-related knowledge, and in the ability to provide information and data that can be meaningful and valuable in decision-making, climate services are becoming more salient to users.

At the same time, there is an increasing number of initiatives aimed at providing products and services that, based on scientific knowledge, are applied to many different socio-economic sectors, by different actors (public and private), at diverse geographical scales (global, regional, national and local), and time-scales (months, seasons, years and decades).

The recent developments in the European arena of climate services – the direction in which they are moving, who are the main actors, how users and stakeholders are included, and the applications for decision making – tell us a lot about

how climate research can be integrated in climate services. There is widespread recognition that there is a need to establish stronger links between the providers and users of climate information.

The climate service landscape has grown and evolved rapidly in recent years, particularly since the establishment by the World Meteorological Congress of the Global Framework for Climate Services (GFCS) by the World Meteorological Congress in 2012. However, the different actors in this landscape, whose activities focus on applying scientific knowledge for societal utilization and benefit, often lack a common terminology. Therefore, we should strive to develop and use a common vocabulary and a common agenda.

This policy brief provides a general categorization of the landscape of European climate services, and is based on a more complete report from the Climateurope project (www.climateurope.eu) "[Progress on the integration of climate services and Earth System Modelling](#)". This landscape includes active dialogue between science and society, and between climate scientists, climate service developers and providers, and end-users, in particular decision-makers and policy-makers.

Table of Contents

Climate Service in Europe: a Categorization

Value Chain: from Earth System Models to Climate Services

To a Common Research and Development Agenda

Climate services: providers, purveyors, and end-users

A **purveyor** is a special type of climate service provider that does not necessarily produce their own climate data, but uses that available from other providers and adds value (knowledge and expertise) to provide the information required by the users.

Source: M. Máñez et al. (2014): [Mapping of Climate Service Providers - Theoretical Foundation and Empirical Results: A German Case Study](#)

End-users: a heterogeneous mix of stakeholders from the national, sub-national and community levels. Each user can derive a benefit – potential or actual – in using climate services. (...) An ideal climate service delivery chain includes end-users both at the beginning and at the end of the service production and delivery process.

Source: (2013) WMO [Bulletin Vol 62 - Special Issue](#)

Climate Services in Europe: a categorization

The climate services landscape in Europe is witnessing meaningful transformations on both the supply and demand sides of the services. While the number of initiatives aimed at providing climate services for different socio-economic sectors (including energy management, water management, urban planning,

agriculture, public health, disaster risk reduction and many others) is growing, there is also increasing interest and demand from a diverse group of end-users, comprising public administrations, businesses, and civil society. To develop a concise overview of the European climate modelling, climate research, climate observations

and climate service projects is a challenging task. A first attempt to make a categorization of climate services in Europe identified three main pillars which are: the focus of the climate service (what it is used for), the type of provider or purveyor, and the target groups of the climate service. The Report "[Progress on the](#)

integration of climate services and Earth System modelling" presents a more comprehensive snapshot of the European landscape, including more than 120 projects and initiatives related to various climate services. It encompasses portraits of each existing project, including the description of the product provided, specific functionalities, comments on positive outcomes and future challenges. To summarize such a complex landscape (see Table 1) the following three points have been considered:

- Whether the co-design and co-production of the service between providers and users is applied, or whether a provider-centric model is used for the development of the climate service;
- Whether the service is based on historical climate information for monitoring, and/or climate predictions on seasonal to interannual timescales, and/or climate projections on multi-annual timescales;
- Whether the service is part of an ongoing operational service, or is a one-off service, or is a development or trial service.

FOCUS					
Focus of the climate service product and what it is it used for. The options considered are:					
Understand the climate system and improve/extend information for the past and the future	Enhance the quality of climate data and development of tools for this (e.g. homogenizations, bias correction, model evaluation...)	Develop infrastructure to get access to climate and impact data and information, and for visualization and processing	Climate change adaptation research	Decision support	Assessment of user requirements
PROVIDER/PURVEYOR					
National Meteorological Services	Research Organizations and Universities	International Institutions	Government Agencies / Public Bodies	NGOs	Consultancies/ Private for-profit
TARGET GROUPS					
Group of users to whom the service is directed/delivered					
*According to "Lessons and practice of co-developing Climate services with users", after Kotova et al (2017)					
Research and education	Policy makers NGO, Politicians	Practitioners	General public		
Researchers working on impacts, adaptation and mitigation studies/assessments.	Policy makers may be a rather diverse group, since consultancy and companies may also have many of the roles of policy makers.	Practitioners (e.g. engineers, planners, investment portfolio managers) within local government, industry and business, including financial services providers. They are a diverse and evolving group of users that can use publicly available information, but also are interested in bespoke climate services.	General public and media (interested, but without specific aim).		
Consultancy companies: varying from from companies that do impact/adaptation studies, develop adaptation strategies, up to companies that give information on climate change and/or support to the process of adaptation/mitigation (these can be considered to be climate service providers too, sometimes also called "purveyors").	Politicians and other stakeholders/interest groups (those that want to put or represent climate change within the political or public agenda, or skeptics that want the opposite NGOs, etc).				
Teachers and those developing educational material and curriculum.					

Table 1 Categorization of projects and initiatives related to climate services in Europe. Source: Climateurope publications

Value Chain: from Earth System Models to Climate Services

Earth System Models and Climate Services are part of the "value chain" (Figure 1) between climate information and products. In the middle of this chain there is the transformation of the results of climate science into tools, services, and activities that support society in coping with climate variability and climate change.

There is increasing interest worldwide for climate data and information. Earth System Models are widely used to estimate the state of regional and global climate under a wide variety of conditions. The models describe the climate system and its development in time by a combination of coupled physical and biogeochemical cycles between the atmosphere, hydrology, soil, aerosol and other Earth components.

There are several initiatives that focus on knowledge brokering in an attempt to bridge the gap between science and society, between data providers and end-users, between Earth System Models and their applications in several socio-economic sectors. Some of them are large-scale initiatives, supported by international organizations (such as the World Meteorological Organization and the International Climate Services Partnership; European Commission-supported and related programmes such as Horizon 2020 research programmes, Joint Programming Initiatives, European Research Area network for climate services, the Copernicus Climate Change Service). On a smaller-scale, there is a wealth of national and local projects.

All these initiatives are examples of how the value chain works in different contexts. They also evidence the high level of interdisciplinarity and transdisciplinarity that is involved in the co-development of salient climate services. While connecting the scientific research (including many different disciplines and expertise) and the end-users (comprising different types of professionals, policy makers, businesses, representatives of civil society), increasingly cross sector collaboration and understanding is demanded from the academia and the other actors that are involved in transdisciplinary process.

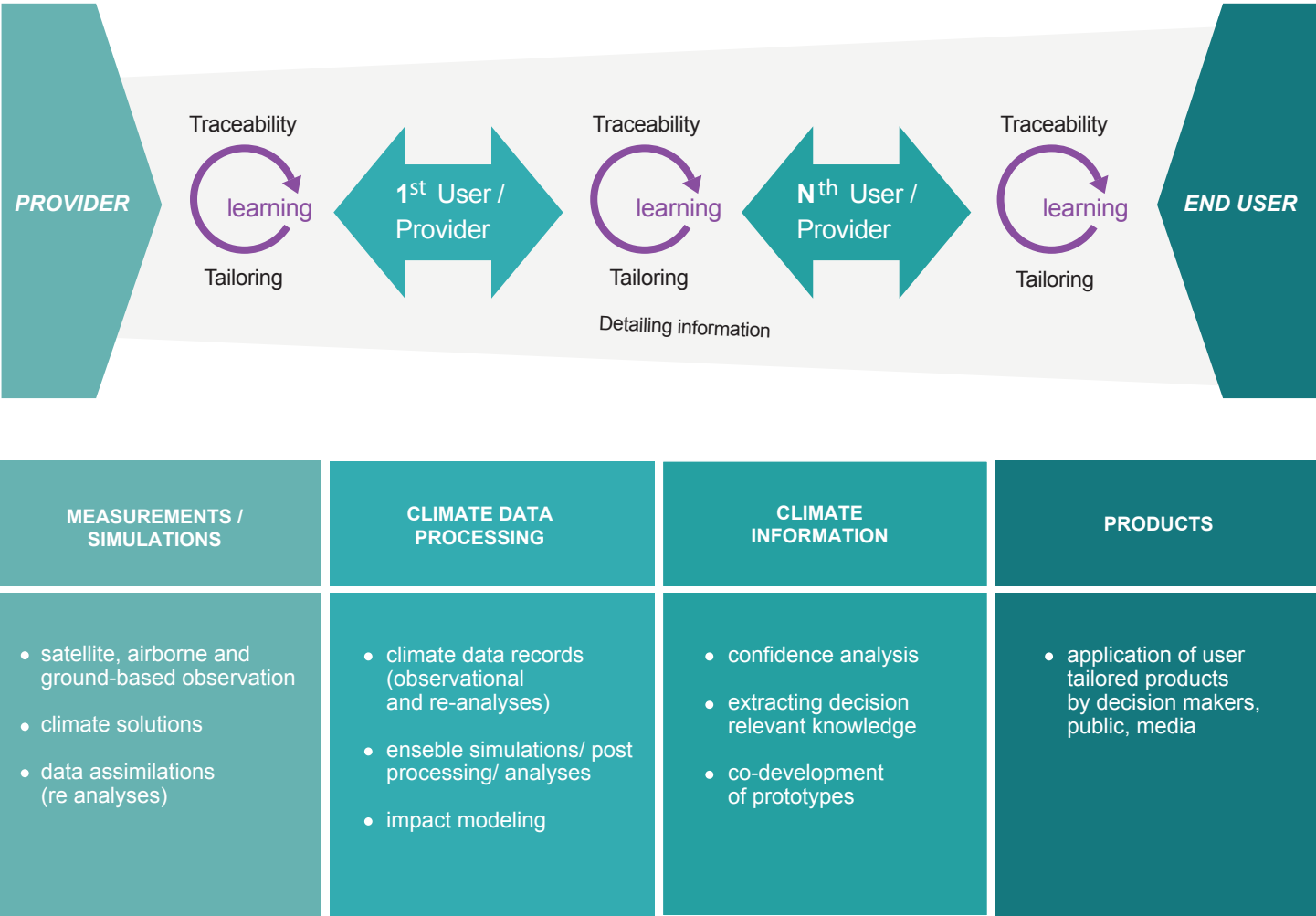


Fig. 1. "Between the provision of data and the application of climate services, a 'chain' of providers and subsequent users/providers exists." (Otto, J., et al. 2016)

This Policy Brief is edited by Mauro Buonocore (CMCC) and Janette Bessembinder (KNMI)

Reviewers: Natalie Garrett (Met Office), Lola Kotova (HZG-GERICS), Chris Hewitt (Met Office), Marta Terrado (BSC) Ilaria Vigo (BSC)

First published December, 2018

The **Climateurope Policy Brief** series:

Policy Brief n.1 – European Earth System Modelling for Climate Services

Policy Brief n.2 – Typology of climate services

Policy Brief n.3 – The European Landscape of Climate Services and Earth System Models

*This Policy Brief is based on and refers to **Progress on the integration of climate services and Earth System modelling. Climateurope, 2018***

Authors: Marta Terrado (BSC), Francisco J. Doblas-Reyes (BSC), Ralf Döscher (SMHI), Helena Martins (SMHI), Erik Kjellström (SMHI), Janette Bessembinder (KNMI), Lola Kotova (HZG-GERICS), Natalie Garrett (Met Office), Chris Hewitt (Met Office), Ralf Toumi (IC), Mauro Buonocore (CMCC), Slobodan Nickovic (RHMS), Aleksandra Krzic (RHMS), Vladimir Djurdjevic (RHMS)

Acknowledgments for review: Annamaria Lehoczy (URV), Carlo Buontempo (ECMWF), David Keller (CDR-MIP), Asun Lera StClair (DNV GL/BSC), Adriaan Perrels (FMI), Pier Luigi Vidale (UoR), Samuel Morin (CNRS), Ilona Mettinen (Uni. Lapland), Chiara Bearzotti (DKRZ), Malcolm Roberts (Met Office)

Climateurope is:

- The Europe-wide network for researchers, suppliers and users of climate information;
- A place to share best practices, gaps and recommendations and discover the state of the art about climate observations, climate modelling and climate services;
- An opportunity to actively interact with users and suppliers of climate information.

Climateurope Partners

Met Office (coordinator) / ANR - National Research Agency / BSC - Barcelona Supercomputing Center, Climate-KIC (UK) Limited / CMCC - Centro Euro-Mediterraneo sui Cambiamenti Climatici / CNRS - Centre National de la Recherche Scientifique / ECMWF - European Centre for Medium-Range Weather Forecasts / HZG-GERICS - Climate Service Center Germany / KNMI - Royal Netherlands Meteorological Institute / RHMS - Republic Hydrometeorological Service of Serbia / SMHI - Swedish Meteorological & Hydrological Institute.

To a common Research and Development Agenda

Among many other sources of information, climate models climate models and climate observations provide data and information that are of utmost relevance for activities which are aimed at identifying mitigation and adaptation solutions and measures to climate change. Their further progress and refinement can enhance the salience of climate services.

Climate scientists and climate service providers may have different backgrounds, do different jobs, and address different audiences, but they share the common aim of providing society with critical information concerning climate variability, climate change and its implications for society. Some of the progress made by the scientific community in the field of Earth System Models on global and regional scales is relevant to enhance the dialogue between climate model developers and climate service providers, and to build a common research and development agenda based on the following points:

- **Uncertainties:** better understand and communicate the cascade of uncertainties from climate models to

climate services products

- **Traceable, relevant information:** climate services need to provide region- and sector-specific information with user relevance, and transparent guidance allowing the traceability to the climate model information and other sources

- **Detailed, user centered information:** users often require improved (higher) resolution in space and time, and user-relevant climate-related variables adapted to their decision-making context

- **Mutual benefits of the dialogue:** a continued exchange of detailed information on the interaction between the physics of climate change, its impacts, the mitigation options and their socio-economic consequences through different time-scales will provide useful outcomes on how climate change data and societal impact assessments are mutually connected. On the other hand, user uptake and requests provides crucial information for climate model developers for the further direction of the model.

REFERENCES

Bessembinder J., 2012 **Guidance to support the identification and assessment of users' requirements**. J Bessembinder, R Street, M Themessl, E Baños de Guisasola, P Delecluse, R Benestad. Concept 2012, 2012

EC (2015) **A European Research and Innovation Roadmap for Climate Services**, European Commission, Directorate-General for Research and Innovation, European Union, Print: ISBN 978-92-79-44341-1, doi:10.2777/702151

Otto, J., et al., 2016 **Uncertainty: Lessons learned for climate services**. Bulletin of the American Meteorological Society, 97 (12). ES265-ES269, pag. S267
<https://doi.org/10.1175/BAMS-D-16-0173.1>

Kotova L., Terrado M., Krzic A., Djurdjevic V., Garrett N., Strachan J., Bessembinder J., Climateurope, **Lessons and practice of co-developing climate services with users**, Climateurope, 2017



Climateurope - Linking science and society is a project funded by the European Union under Horizon 2020 - Project ref. 689029.



www.climateurope.eu
info@climateurope.eu