THE EUROPEAN LANDSCAPE ON CLIMATE SERVICES

A short note with focus on Climate Service initiatives promoted by or with the support of the European Commission
The World Meteorological Organisation (WMO) launched the process for developing the Global Framework for Climate Services (GFCS) at the World Climate Conference 3 (WCC-3) in September 2009. The vision was to turn scientific information from climate monitoring, research and modelling into operationally available information and services that would help society to better cope with climate variability and change. The GFCS seeks to enable "better management of the risks of climate variability and change and adaptation to climate change, through the development and incorporation of science-based climate information and prediction into planning, policy and practice on the global, regional and national scale."

The initial four priority areas of the GFCS are: (1) Agriculture and food security, (2) Disaster risk reduction, (3) Health, and (4) Water. The regional focus is on Africa. It now consists of five components: (1) observations and monitoring, (2) research, modelling, and prediction, (3) Climate Services Information System (CSIS), (4) User Interface Platform (UIP) and (5) Capacity Development (CD), which cuts across all the other four components.

At European level, the development of Climate Services preceded GFCS. The main initiative is the Copernicus programme, which will provide Europe with an advanced satellite and ground-based observation system and will develop a continental operational climate service. Copernicus is entering the operational phase and cooperates with the European Space Agency (ESA) and EUMETSAT for the space infrastructure and with EEA for the in-situ component. Copernicus core services will be provided by EU institutions, pan-European organisations and Member State institutions under management of the European Commission. Its operational services are based on past and current research promoted under ESA GSE (GMES Service Element under the ESA’s Living Planet programme), FP7, and will develop and evolve with support of Horizon 2020 research and innovation activities.

A conceptual scheme representing the relationships among various actors and initiatives is reported in figure 1 at the end of this note. Copernicus and Horizon 2020, as main sources of funding for the operational and the research & innovation aspects of Climate Services in Europe, are placed in the centre of this scheme, but key knowledge and competences are distributed into several "boxes" which only graphically may look peripheral.

The research component for Climate Services is still very important, since the capacity of providing trustworthy climate information at high level of resolution and for seasonal-to decadal time frames is still very limited. Key European projects have been launched in FP7 by the Environment and by the Space themes, and will be a key element of the Horizon 2020 (H2020) programmes of Societal Challenge 5 (Climate action, environment, resource efficiency and sustainable supply of raw materials, SC5) and to a lesser extent of the Space activities within the Leadership in Enabling Industrial Technologies pillar (LEIT).

Already in the short-term, the Work Programme for 2014-15 for SC5 and for the Space component of the “Leadership in Enabling and Industrial Technologies” programme will launch key activities in support to the development of climate services.

Still under H2020, also the European Institute of Innovation and Technology (EIT) will continue supporting the Climate Knowledge and Innovation Community (Climate KIC) which has the development of climate services among its main research / innovation / entrepreneurship education objectives.

ESA’s Climate Change Initiative, a dedicated 75M Euro programme, aims at generating a subset of the Essential Climate Variables (ECVs) as defined by GCOS using space EO data and archives and coordinates this activity through a dedicated subgroup of the Committee of Earth Observation Satellites (CEOS) with all major space agencies. This Initiative is today
supporting massive data re-processing activities that should provide added value to the huge mass of existing data generated by past space observation activities.

National (and sub-national) Climate Service Centres are growing in Europe, mostly – but not only - based on existing national or regional weather forecast institutions.

Member States are cooperating in research for climate services through the Joint Programming Initiative on Climate (Climate JPI) and through the CIRCLE-2 ERA-Net (ending in 2014), which deals mainly with adaptation issues.

The provision of reliable climate information is as well the core activity of the Climate- Adapt portal, managed by the European Environment Agency (EEA), which collects and distribute information from key research projects, case studies and best practices in support to the EU Adaptation Strategy.

International cooperation activities in support to the development of climate services – in particular for Africa - are as well on-going supported by the European Commission (DG RTD, DEVCO and JRC) in cooperation with ESA, EUMETSAT and in the GEO context.

The business sector initiatives on climate services are still sporadic, exception made for the re-insurance sector which since long time has built a considerable internal capacity of cross analysing climate and disasters information. It has to be noticed the growth of a good number of new consultancy groups offering various kinds of climate information services, frequently participated by climate researchers – still active in research institutions - who are diversifying their activity.

The research and innovation component of Climate Services will even increase in importance with the operationalization of Copernicus, the growth of National Climate Service Centres and of a new business area in this field, triggered by the better definition of new users' needs and by the improvement in observations, in data management, in modelling and in the computing infrastructure.

A more detailed analysis of the main European Commission initiatives on climate services is reported below.

**ACTIVITIES LAUNCHED OR SUPPORTED BY THE EUROPEAN COMMISSION IN THE FIELD OF CLIMATE SERVICES**

**GMES and Copernicus**

- The Global Monitoring for Environment and Security (GMES) was the EU initiative aimed at streamlining activities and funds in the field of Earth observation to providing reliable and independent information concerning the state of the environment and security. In 2012 GMES became 'Copernicus', the European Earth Observation Programme. Copernicus will provide a broad range of Earth observation data and will deliver operational services in six thematic areas: land, marine, atmosphere, climate change, emergency management and security. They support a wide range of applications, including environment protection, management of urban areas, regional and local planning, agriculture, forestry, fisheries, health, transport, climate change, sustainable development, civil protection and tourism.
- Copernicus is the European contribution to GEO/GEOSS.
- Copernicus will ensure that EU Earth observations finally result in geospatial information and services available for policy makers, researchers and citizens. The
The overall concept is based on a space component (design, manufacture and launch of relevant Earth Observation satellites, including ground segments, storage and dissemination of satellite data), an in situ component (dealing with the infrastructure needs to gathering in-situ observations in order to verify/complement the satellite information), and a service component (delivering operational products and services to various European stakeholders). The services, in line with the original GMES approach, are organized along Earth compartments (land, oceans and atmosphere) and cross-cutting priorities (climate change, emergency response and security). Since 2012 land services are operated in an operational mode, whereas atmosphere and marine services are still running in a pre-operational version. With Copernicus climate services becoming gradually operational from 2014 onwards, its R&D funding line will be reduced, while the operational part of the programme will be strengthened. However, the success of the operationalization of Copernicus Climate Change Services will strongly depend on the interlink with research and innovation activities supported in particular by Horizon 2020.

FP7 / Horizon 2020 Research and Innovation Activities (Climate Change, GEO, Research Infrastructures)

- Over the past decades the EC through its Framework Programmes (FPs) for Research and Technological Development has made huge investments in Earth system science to better understand and predict the evolution of the climate system. Thanks to the pioneering work of projects such as DEMETER (FP5) and ENSEMBLES (FP6) the EU has established a climate modelling capacity on which an operational climate service at national and European level can be built on.

- Under the FP7 Environment, SPACE and Infrastructure programmes, first steps have been undertaken to establish and support the implementation of a European operational climate services system in a more systematic way. Traditionally climate research focused on observations and monitoring and on modelling and prediction. The Environment Programme, however, went one step further and launched two calls for proposals (2010 and 2012), which included specific topics on the provision of climate information focusing on end-users needs. Two successful projects (ECLISE and CLIM-RUN) took first steps towards the realisation of climate services. They involve stakeholders of various sectors from energy to water, coastal defence and tourism in vulnerable regions of Europe to assess their information needs. The final goal of the projects is to develop tailored, user oriented concepts to support management decisions and to train end-users on how to use climate information. Three more projects have been selected in 2012 (NACLIM, SPECS, EUPORIAS) to satisfy societal demands for reliable short term climate information. They together implement an integrated observation, modelling and service programme to improve the European capacity to deliver seasonal to decadal predictions. A fourth project, IMPACT2C is focusing on climate change impacts under different socio-economic scenarios. These actions are complemented by three (still on-going) projects (EUCLIPSE, COMBINE and EMBRACE) which address various critical aspects of climate modelling.

All these activities are integrated via the ECOMS (European Observation, Modelling and Service) initiative. ECOMS has provided to the Commission in March 2013 a report on "Priorities and research needs for climate modelling and climate services within Horizon 2020".

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In parallel, the Capacities Programme (Infrastructures) supports the logistics of climate modelling, such as data management and protocols, high performance computing etc. (projects IS-ENES, IS-ENES2).

Finally GMES (now Copernicus) focused on the development of pre-operational climate services via core projects such as GEOLAND (land applications), MYOCEAN (marine applications) and the MACC series (atmospheric service) which all provide information relevant for climate applications and services. GEOLAND, for instance, offers information on vegetation cover and the hydrological cycle; MYOCEAN supplies, among others, information on ocean currents and winds; and MACC delivers key information on the aerosol load of the atmosphere. These projects are running in a quasi-operational mode and their continuation over time is secured. In addition, re-analyses projects, such as EURO4M, form the backbone of any operational climate service.

The Joint Research Centre of the European Commission

The Joint Research Centre (JRC) of the European Commission carries out its own specific programme within H2020 in support to the EU policy making process. In the field of climate change monitoring and climate services, JRC supports the requirements of the World Meteorological Organization (WMO) and its Global Framework for Climate Services, which aims to promote better climate risk management through the development and incorporation of science-based climate information and forecasts into planning, policy and practice on the global, regional and national scales. The JRC focuses in particular on the quality control and provision of the essential climate variables that are required to build a full picture of the impacts of climate change in all compartments of the Earth System (atmosphere, oceans, biosphere and cryosphere). The JRC thereby contributes to the Commission’s efforts to sustain and enhance an observational infrastructure that can lead to an EU climate service in close collaboration with Copernicus. In addition, JRC plays a key role in the areas of extreme weather events and the impact of climate change, and the economic impacts of climate change. In particular on the latter, the JRC supports through focused modelling activity the design of EU climate policies.

The Climate JPI and CIRCLE-2 ERA-NET

JPI-Climate is a Joint Programming initiative launched in 2011 aiming at aligning national research priorities of 14 EU Member States according to a jointly agreed Strategic Research Agenda (SRA). The SRA is composed of four main modules, ad two of them, namely Module 1 "Moving towards decadal climate predictions" and Module 2 "Climate Services research" are oriented towards the development of Climate Services. The main objective of JPI-Climate is to provide integrated climate knowledge for societal innovation with the goal of responding to the needs of policy and decision makers and the European society at large.
JPI climate intends to produce science-based client-oriented information about projected regional climatic changes and regional and sectoral impacts. It intends to base on the good understanding of the stakeholder needs, and provide easy access to up-to-date information and expertise regarding specific policy or research questions. Strengths, limitations and uncertainties about current knowledge will be adequately communicated, in support of robust decision-making. JPI-Climate will facilitate the interaction between the emerging national climate services and European initiatives.

Within the H2020 societal challenge 5, the European Commission includes in close collaboration with the JPI Climate, a major ERA-Net in the field of Climate Services to support the development and implementation of a coordinated approach between EU Member States in this area (see Document 3).

- CIRCLE 2 "Climate Impact Research and Response Coordination for a Larger Europe" is an FP7 ERA-Net (2010-2014) which has the objective of contributing to the coordination of European transnational research funding on Climate Change Impact, Adaptation and Vulnerability and to facilitate the research outcomes that European and national decision makers need to design effective adaptation initiatives and strategies.

  CIRCLE-2 Network includes 34 institutions from 23 countries committed to fund research and share knowledge on climate adaptation and the promotion of long-term cooperation among national and regional climate change programmes. CIRCLE-2 has been actively supporting discussions around the theme of Climate Services through focused activities and contributes to a range of other related initiatives such as the development of support tools (CLIMATE-ADAPT and CIRCLE-2 Adaptation INFOBASE) and user interface/needs such as on-going or planned activities on the topic of National Adaptation Strategies development.

  CIRCLE 2 expertise and capabilities developed within the project will offer a significant impulse to the development of Climate Services in Europe.

  CIRCLE 2 is now reaching the end of their activities and is at the moment discussing with the EC and the Climate JPI the optimum way to use its legacy to further support the coordination of European research in the field of adaptation.

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The Climate KIC of the EIT

- The Climate-KIC is one of the first three Knowledge and Innovation Communities (KICs) established by the European Institute of Innovation and Technology (EIT) in 2010. Its mission is to drive innovation in Europe related to the transition to a low-carbon economy through high-quality innovation projects, education courses and entrepreneurship programmes. The Climate-KIC community currently involves more than 200 organisations, including a number of the leading academic, corporate and public bodies in Europe.

  Climate-KIC through its Climate Adaptation Services (CAS) Challenge Platform aims at increasing the adaptation capacity and resilience of societies, infrastructure, and cities through services and products. Climate-KIC will focus on translating climate
knowledge to concrete services and solutions further downstream to make a real impact. To address its goals, the Climate-KIC is engaged in:

- Supporting relevant use of climate information by society and business;
- Developing services and products for various economic sectors on adaptation to climate change;
- Promoting a climate service entrepreneurship and the growth of spin-offs offering high added-value services to different users;
- Reducing time to action on adaptation by decision makers and long term investors.

**The EEA and Climate Adapt**

- The European Climate Adaptation Platform (CLIMATE-ADAPT) is an interactive web-based tool on adaptation to climate change. It is hosted and managed by the European Environment Agency. Climate-ADAPT aims to support Europe in adapting to climate change by helping users to access and share best practices and information on: 1) Expected climate change in Europe, 2) Current and future vulnerability of regions and sectors, 3) National and transnational adaptation strategies, 4) Adaptation case studies and potential adaptation options, 5) Tools that support adaptation planning.

In 2014, the platform will be extended by an online visualization tool for observations and projections for a set of climate change parameters and indicators based on European state-of-the-art climate models. As a climate knowledge intelligent portal, it can be considered as a sort of climate service platform.