

# The Copernicus Climate Change Service: State of Play-20160929

C3S team @ ECMWF





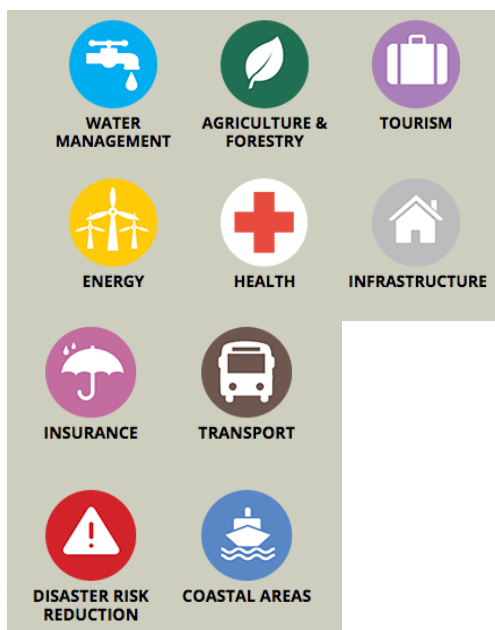
### Climate Data Store

### Sectoral Information System

### Evaluation and Quality Control

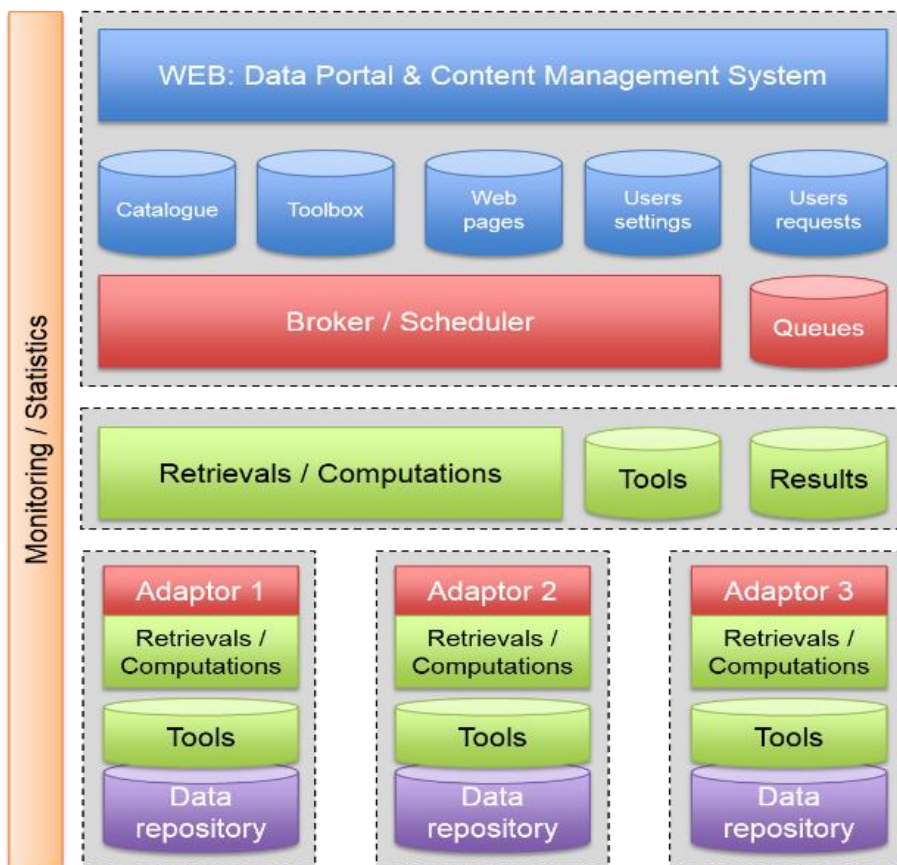
### Outreach and Dissemination

- ECVs past, present and future
- Observed, reanalysed and simulated
- Derived climate indicators
- Tools to support adaptation and mitigation at global and European level



- Monitors quality of C3S products and services
- Ensures C3S delivers state-of-the-art climate information to end-users
- Identifies gaps in service provision
- Bridges Copernicus with the research agenda in Europe (e.g. H2020, national research projects)

- Web content
- Public outreach
- Coordination with national outreach
- Liaison with public authorities
- Conferences, seminars
- Training and education



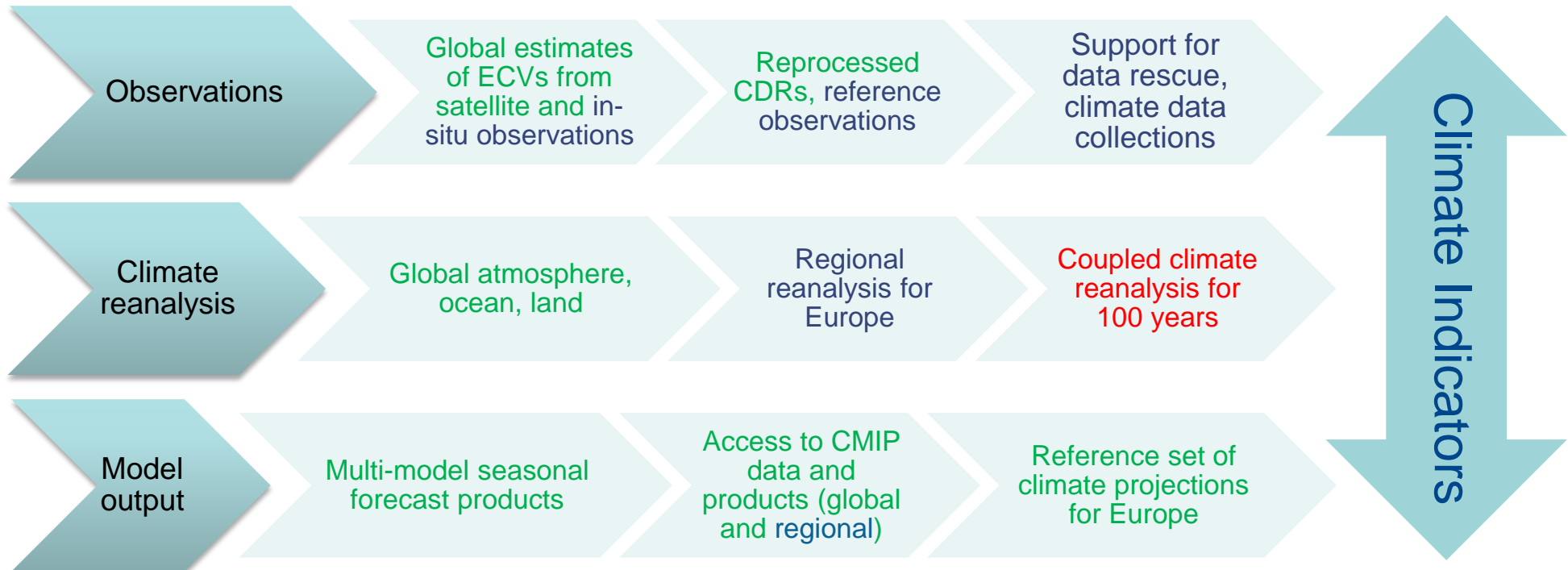
- ★ **Data repositories (distributed)**
  - ★ Located at different data providers, seamlessly available via CDS
  - ★ May implement basic **tools** to perform analytics on **local data**
- ★ **Web portal (centralised)**
  - ★ Content Management System (articles, news, events)
  - ★ **Browsing/searching** CDS product catalogue, tools catalogue, ...
  - ★ Manages users' **data retrieval** and **computation requests**
- ★ **Broker/Scheduler**
  - ★ **Dispatches** data retrieval and computation requests to the relevant data repositories (including from other services)
  - ★ Implements **quality of service**

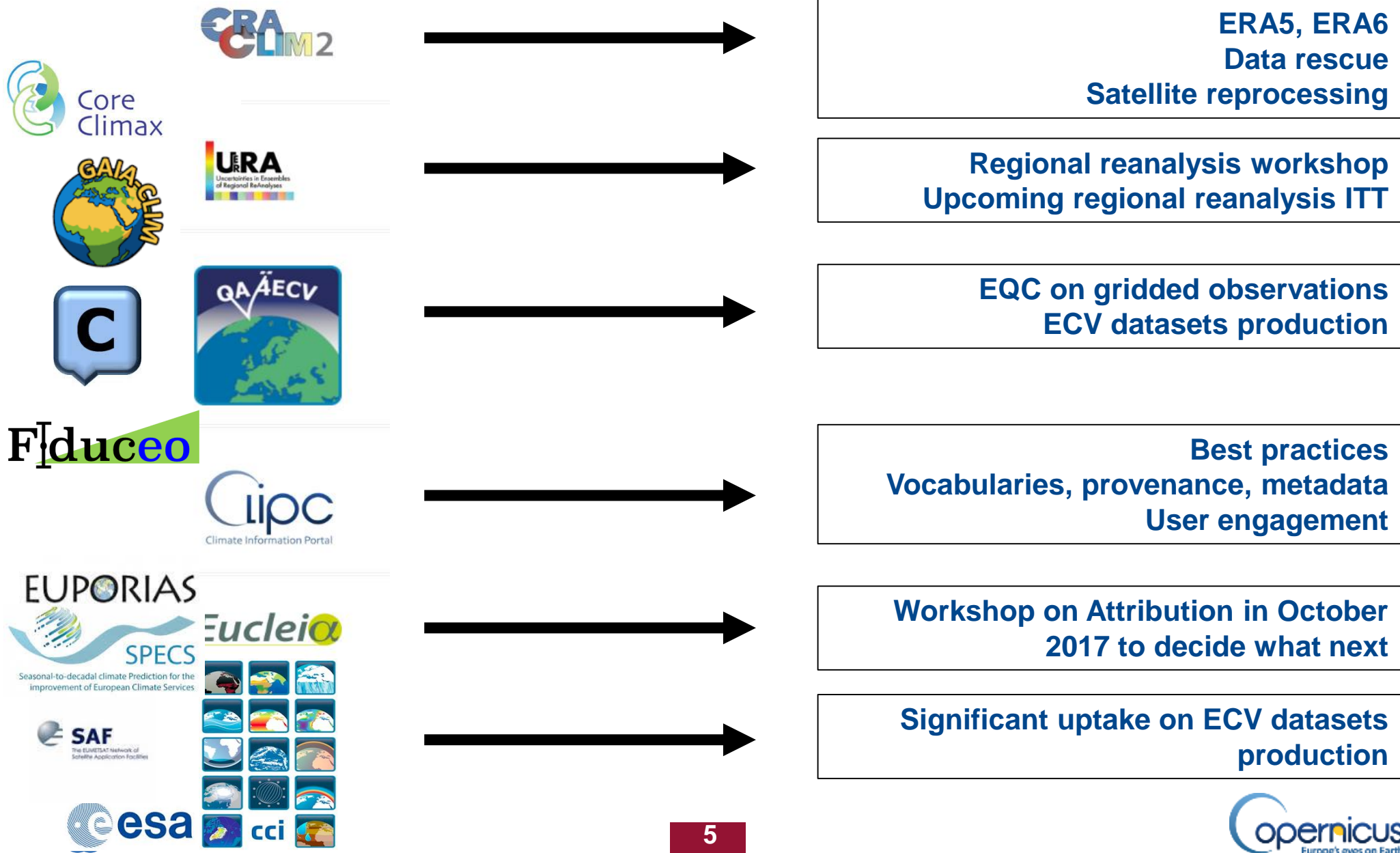
- CDS development has started 1 July 2016 (alpha version available in January 2017)
- CDS toolbox development has started 1 September 2016
- CAMS to benefit from CDS infrastructure early 2018
- To be discussed: Strategy for the DIAS (EUMETSAT/MERCATOR/ECMWF)



### Scientific basis:

- Essential Climate Variables as defined by GCOS
- GCOS Status Report (GCOS-195)
- IPCC, CMIP




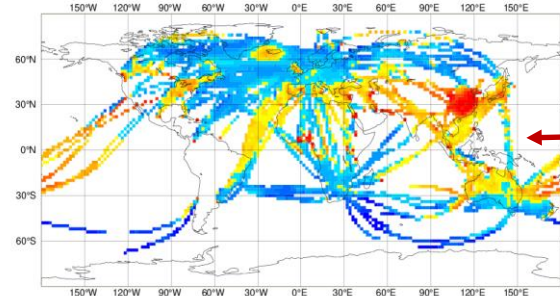
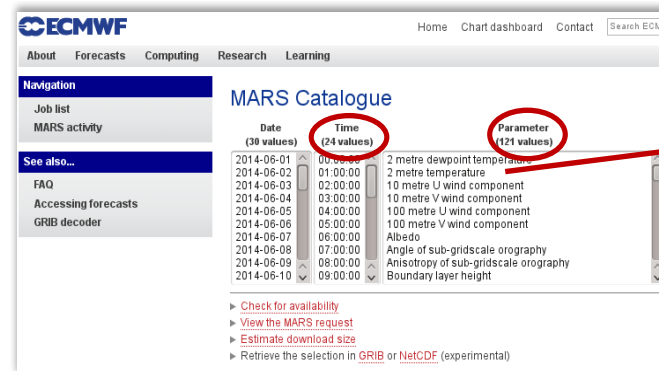




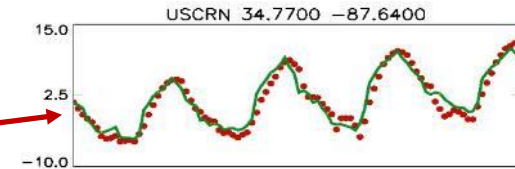
- 32km global resolution
- Uncertainty estimates
- Improved use of observations
- Newly reprocessed satellite data
- Hourly data from 1979-NRT
- Access to all input observations

## Regional reanalysis: reprocessing activity

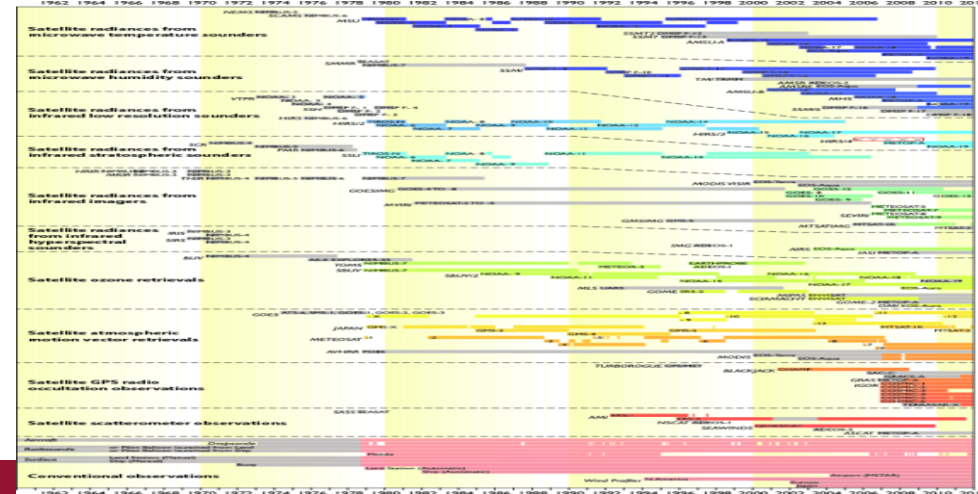
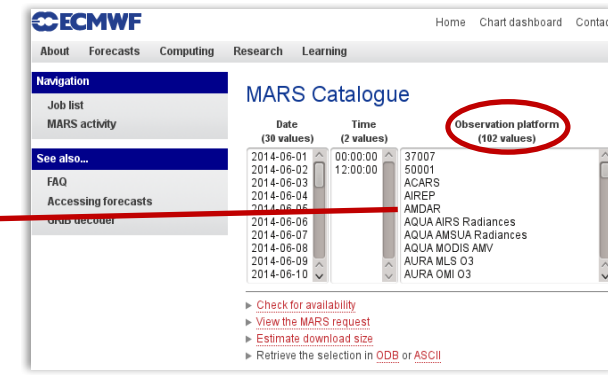
- European domain
- Higher spatial resolution
- Workshop organised 2016 Q2
-  Competitive call by 2016 Q4



### ERA5 2-metre temperature compared to independent data



## Observation feedback archive



ERA5 is now in production



Improvement from 1980 to 2000 comes mainly from better forecasting systems

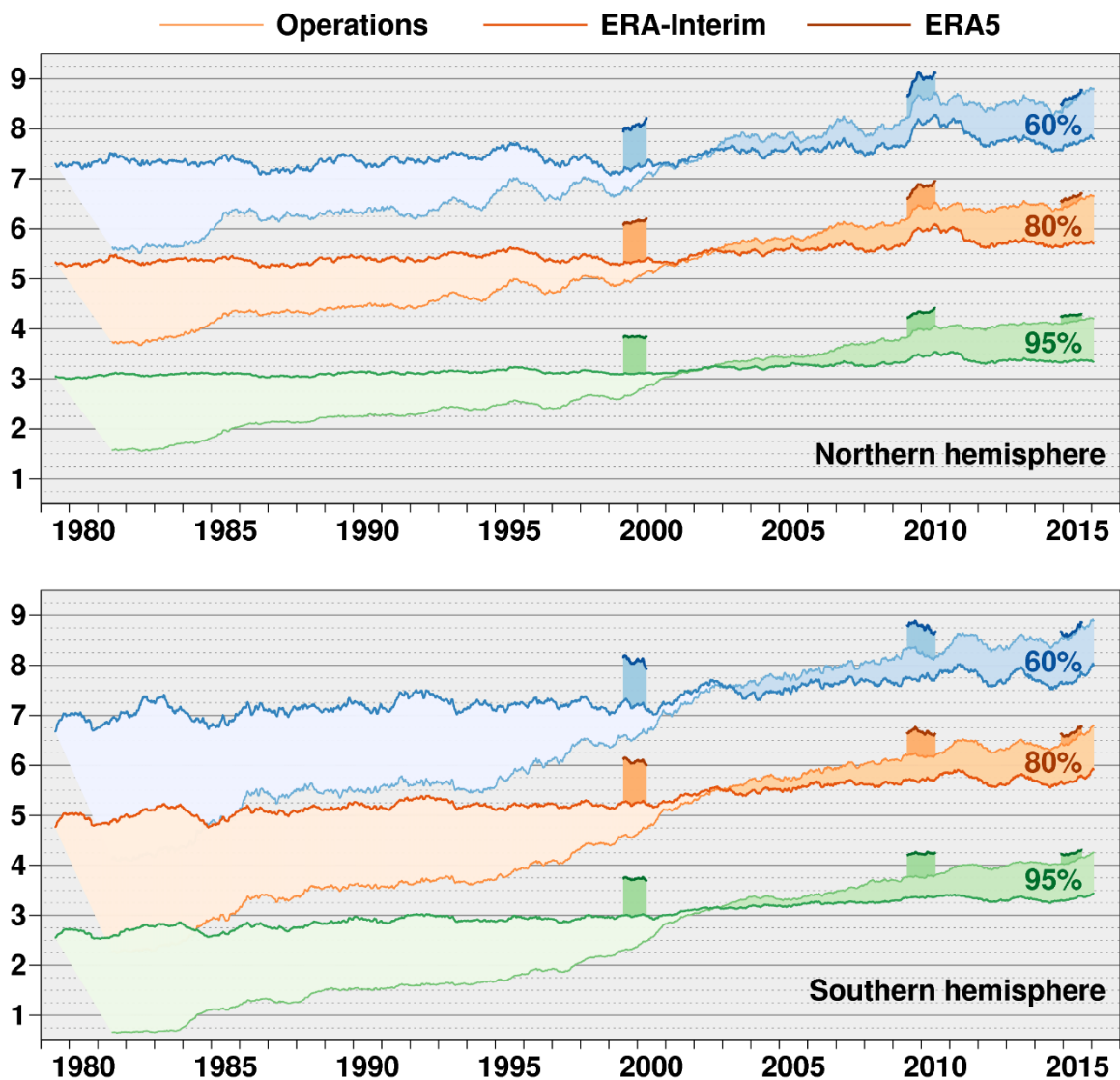
Improvement since 2000 comes from better forecasting systems and better observations

The ERA-Interim system was fixed in 2006 - some newer types of data are not used

ERA5 uses data an extra six hours into the future, but has lower horizontal resolution than current operations

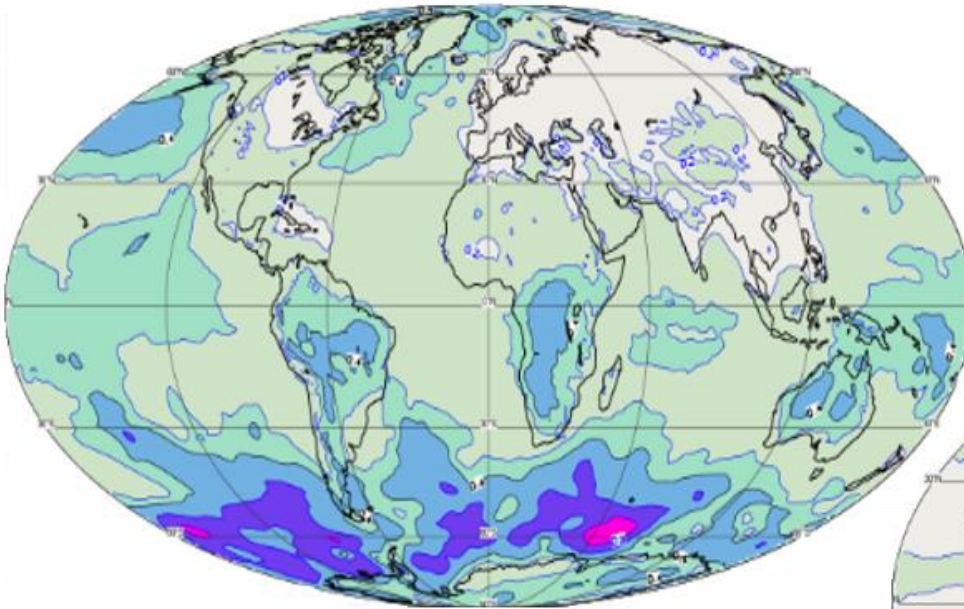
ERA5's forecasts improve more than ERA-Interim's from 2000 onwards, likely due to better and more extensive use of satellite data

Range (days) when 365-day mean 500hPa height AC (%) falls below threshold

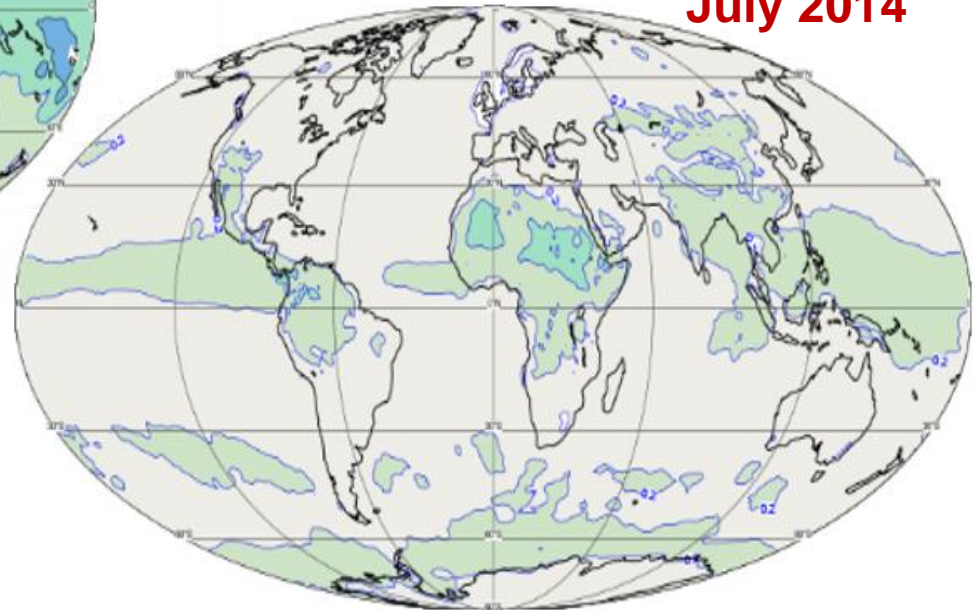


## Spread in Surface Pressure (hPa)

January 1979



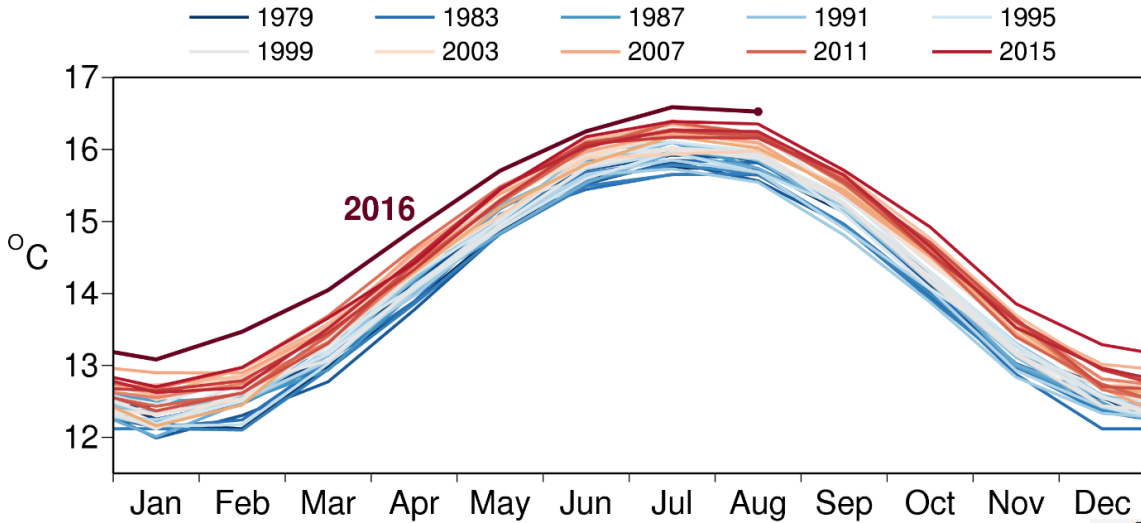
July 2014







## Production of ERA-interim has been accelerated to feed a monthly State of Climate



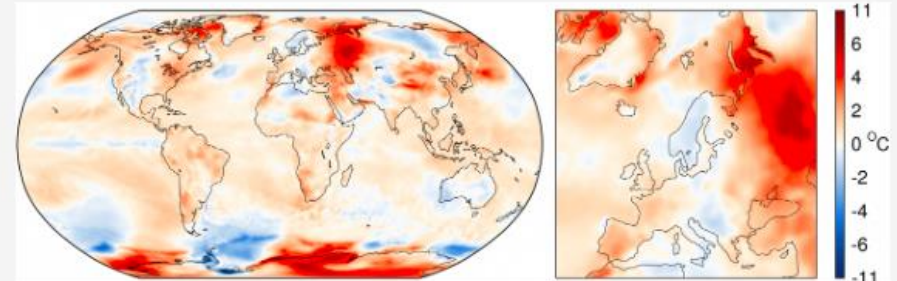
Combining  
models and  
observations

16 warmest years on record: 1998 and  
2001-2015

the latest 15-months beat a record for  
each month

**Copernicus brings the near real time  
dimension**

### Average surface air temperatures for August 2016

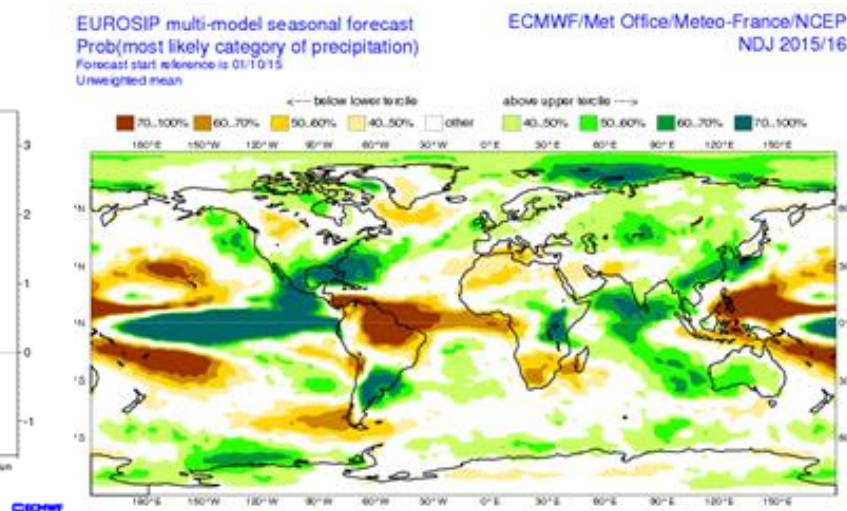
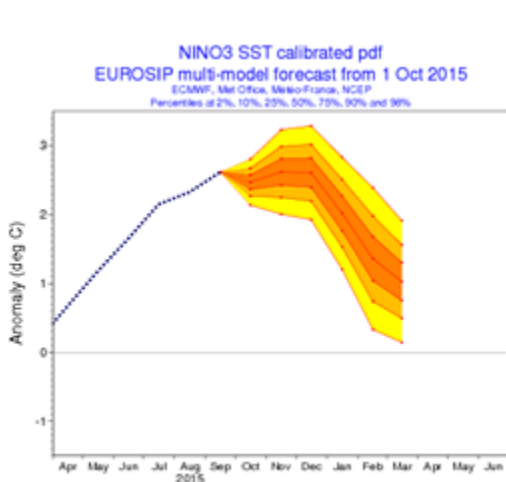


Surface air temperature anomaly for August 2016 relative to the August average for the period 1981-2010. Source: ERA-Interim. (Credit: ECMWF, Copernicus Climate Change Service)

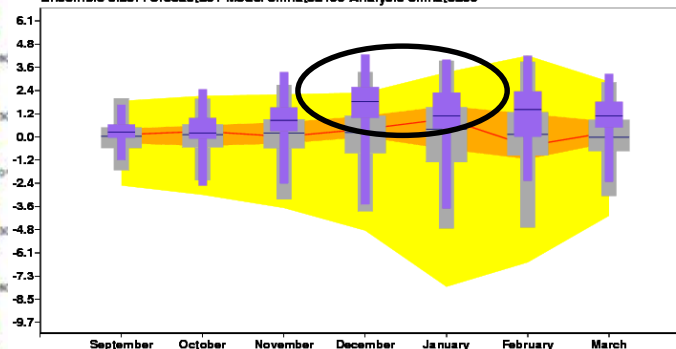
Aim: to generate multi-model seasonal forecast products based on the best information available, to an operational schedule, and make them publicly available.

### Components of the seasonal service:

- ★ Forecast data: a list of atmosphere (and ocean) variables, on 1x1 degree grid, at daily or sub-daily resolution, from 6-month forecasts
- ★ Graphical products (e.g. time series for indices, maps, climagrams)



Northern Europe; from September 2015  
2m temp. anomalies (K) latitude= 65.0 to 50.0 longitude= -10.0 to 30.0  
Forecast initial date: 2015 901  
Ensemble size: Forecast=51 Model climate=450 Analysis climate=30



- ★ Processed data (e.g. indices, probabilities, inputs for SIS)
- ★ First set of products will be available starting Q4 2016

The service is based on a **multi-system** framework (ECMWF, Met Office, Météo France, CMCC, DWD) .

Progress to date:

- *Data* is being collected from core providers.
- *Prototype service* is under development (in C3S seasonal team); first generic products due in October (graphics and data), based on forecasts from core providers.
- *Developments at the contributing centres* are progressing according to plan.
- Work is under way to define *data standards and formats* for products.
- *Collaboration started with SIS developers* (including data provision) on the seasonal components of their prototypes (e.g. EDgE).

**Evaluation and quality control** (EQC) function for seasonal forecast products contracted with consortium led by Barcelona Supercomputing Centre (BCS) – project QA4SEAS. Includes:

- assessment of *user needs* and the degree to which the product portfolio addresses them
- *usability* of service and products (from technical perspective)
- recommendations for *bridging identified gaps*
- *prototype* for on-demand user evaluation of seasonal information.

Started in July 2016; progress so far is excellent in all work packages.



### Global projection-related service

- ★ **Lot 1: Provision of support to one Earth System Grid Federation (ESGF) node in Europe – to facilitate access to and manipulation of global climate projections from the CMIP5 archive.** The solution sought is subject to specific technical and scientific requirements.
- ★ **Lot 2: Multi-model product generation**
  - ★ definition of **metrics for quantifying the fidelity** of models in simulating historical climate, to be **translated into quality** for specific applications.
  - ★ a set of **interactive tools** for generic products (e.g. maps of intra-ensemble variability for different models and scenarios), and tailored products for several economic sectors (including energy and water)
- ★ **Lot 3: Roadmap towards a reference set of climate projections for Europe (EUCP):** studies on how well CMIP6/MIPs address sectoral needs, to guide requirements for the operational phase of C3S. Areas of interest:
  - ★ the benefit of **ensemble size versus resolution** for global models, in relation to the specific needs of different economic sectors.
  - ★ the benefit of **initialised projections** for the first half of the 21<sup>st</sup> century, from the perspective of sectoral applications (links to relevant FP7/H2020 projects and CMIP5/CMIP6 simulations are required).

### Regional climate projection service

The goal

- ★ to facilitate access to and manipulation (via the CDS) of output of regional climate projections over Europe and boundary conditions from GCM simulations needed for future regional projections.
- ★ to define, agree and complete a matrix of global/regional model combinations and scenarios, from available and/or forthcoming climate projections, which allows robust assessment of the uncertainties arising from these factors in a multi-model set of regional projections.

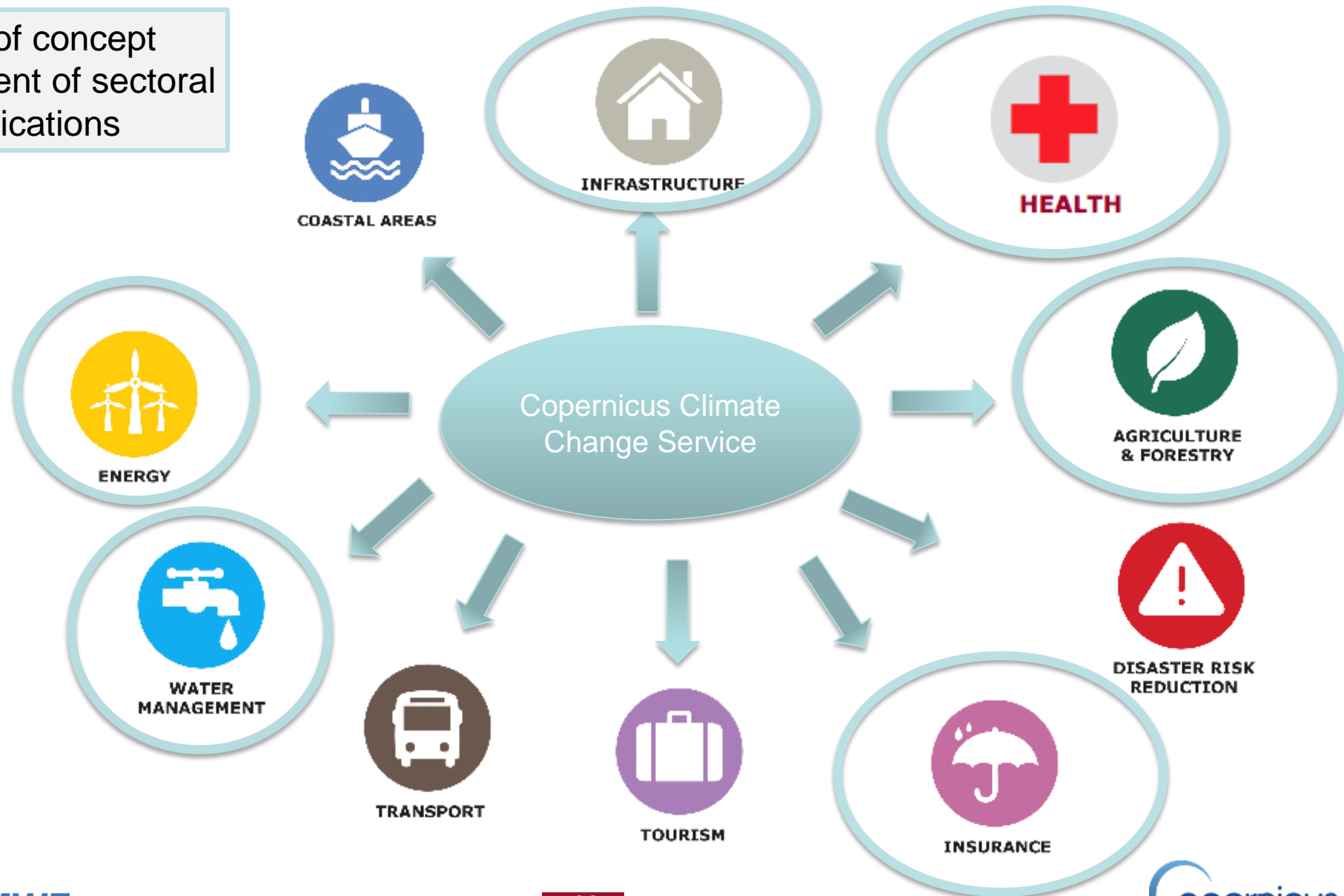
**ITT published!**

### EQC component for climate projection-based services





Proof of concept development of sectoral applications





## Seven proof of concept SIS contracts have been awarded:

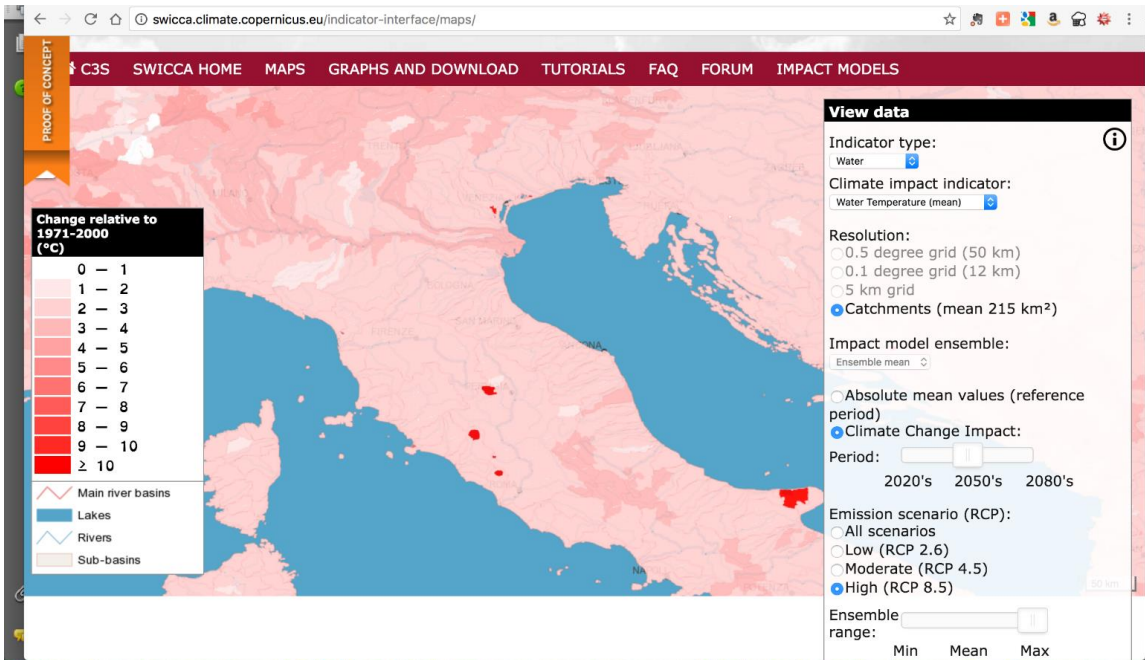
- SIS water management:
  - SWICCA (Service for Water Indicators in Climate Change adaptation) – **lead SMHI (Sweden)**
  - EDgE (End-to-End demonstrator for improved decision making in the water sector in Europe) – **Lead CEH (UK)**
- SIS energy:
  - CLIM4ENERGY (Climate for Energy) – **Lead CEA (France)**
  - ECEM (European Climatic Energy Mixes) – **Lead UEA (UK)**
- SIS others:
  - AgriCLASS (Agriculture Climate Advisory Services) – **Lead Telespazio – Vega (UK)**
  - WISC (Windstorm Information Service) – **Lead CGI (UK)**



- No noticeable delays in the deliverables (...so far).
- Quality of the output generally high.



## Highlights



- Significant user consultation and involvement into the definition of the ECVs, CIIIs and the user interface for all contracts
- User-relevant parameters (which were not available anywhere so far) are being made available through some of the POCs.

## Strategic discussion about an operational SIS

### Main Functions:

- ★ Generate engagement with users by solving problems (and identify gaps) that can be addressed by C3S.
- ★ Generate a library of sector-relevant examples/ solution to user needs. These examples need to be reproducible with the openly available script/recipes and the data available on the CDS
- ★ It should provide support to the users of CDS data, tools and other C3S resources in the context of their sectors.
- ★ It should support secondary providers (e.g. EEA) in providing support for EU sector strategies.
- ★ Provide climate (gridded?) impact indicators relevant to specific sectors.

### Desirables:

- ★ provide visibility to C3S.
- ★ Generate examples that can feed into GFCS exemplars

**SIS Workshop (17-18-19 October)**  
**will be key to debrief lessons**  
**learnt from PoC projects and**  
**shape future SIS design**



| EQC  | CDS content   |
|--|---|
| Yes: EQC for gridded ECV products<br>C3S_511 (PIN out – EQC on observations<br>and reanalyses) | Gridded EO ECV products<br>In-situ observations<br>Reprocessed satellite observations |
| C3S_511 (PIN out – EQC on observations<br>and reanalyses)                                      | Global and regional reanalysis  |
| Yes:   | Seasonal forecasts  |
| Yes:   | Global and Climate Regional projections   |
|  | Sectoral Information System   |
| PIN and ITT to be (re) issued  | EQC framework   |
| Yes: SECTEUR – University of Leeds   | Cross-sector user requirements and gap<br>analysis                                    |



| year | Events   |
|------|--|
|      |  |
| 2016 | Regional reanalysis workshop (March 2016)<br><br>SIS Workshop (October 2016)   |
|      |  |
| 2017 | C3S first General Assembly (March 2017)<br><br>EQC workshop (June 2017)<br><br>Attribution Workshop (October 2017)<br><br>International Conference on reanalysis (November 2017) |


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# climate.copernicus.eu

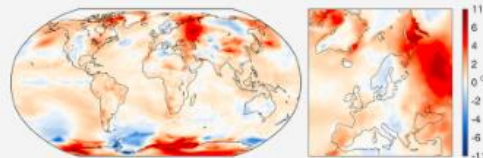
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## MONTHLY MAPS



Average surface air temperatures for August 2016

August 2016

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