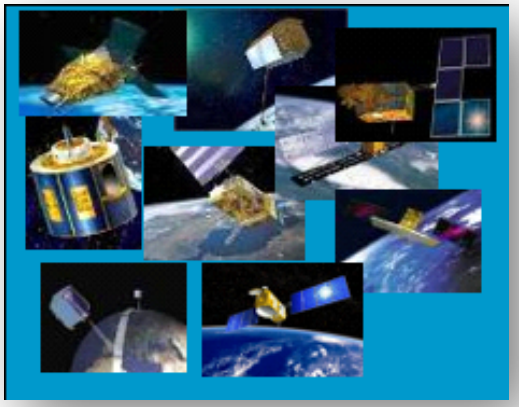
European Commission

Copernicus Climate Change Service

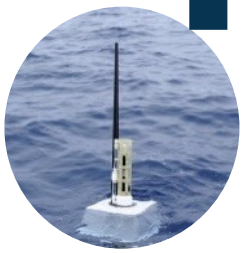
C3S

6 services use Earth Observation data to deliver …



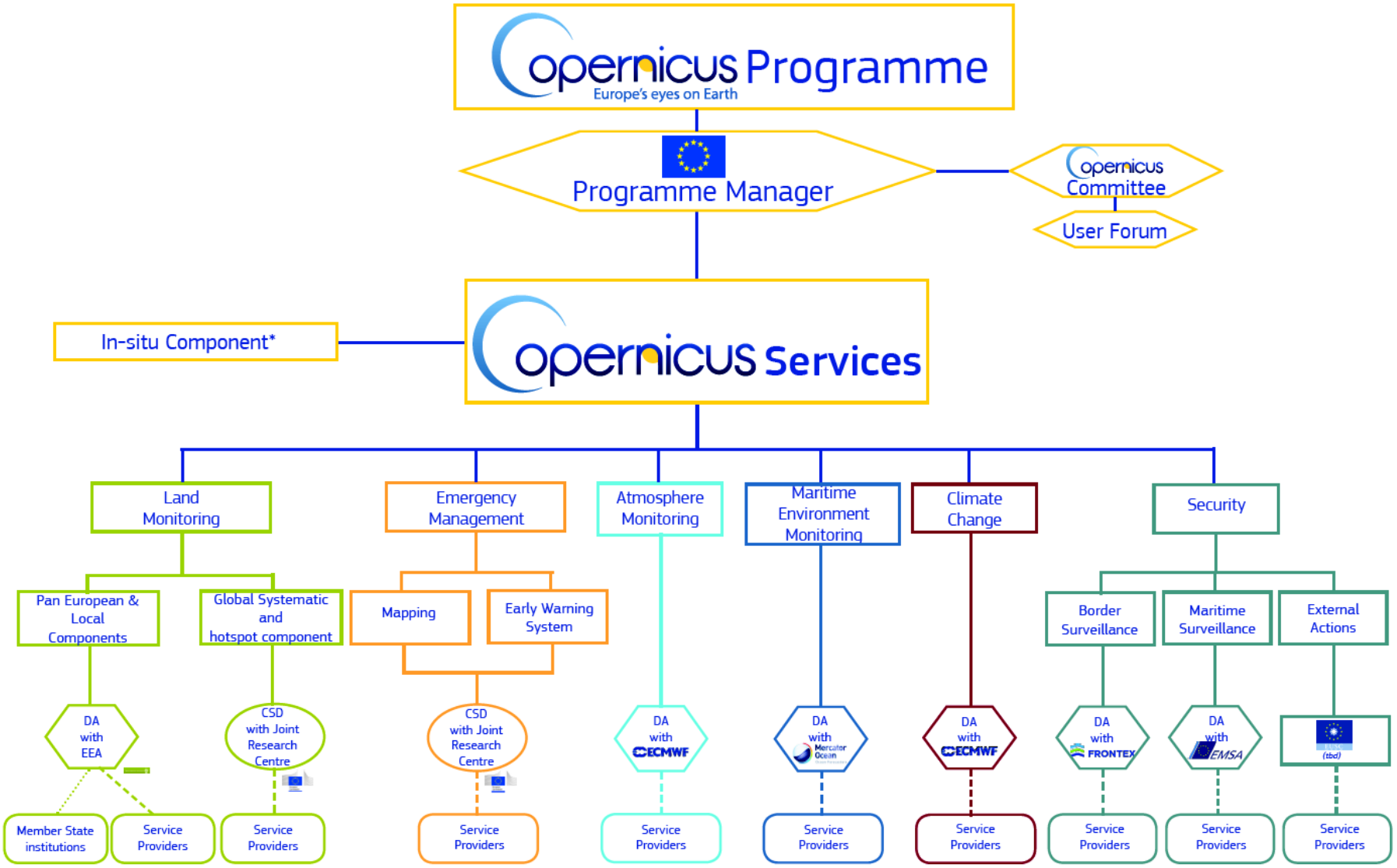
Sentinels

Contributing missions



…added-value products

in-situ


Copernicus Programme
Europe's eyes on Earth
Programme Manager
Copernicus Committee
User Forum
In-situ Component*
Copernicus Services
Land Monitoring
Emergency Management
Atmosphere Monitoring
Maritime Environment Monitoring
Climate Change
Security
Pan European & Local Components
Global Systematic and hotspot component
Mapping
Early Warning System
Border Surveillance
Maritime Surveillance
External Actions
DA with EEA
CSD with Joint Research Centre
CSD with Joint Research Centre
DA with ECMWF
DA with Mercator Ocean
DA with ECMWF
DA with FRONTEX
DA with EMSA
(tbd)
Member State institutions
Service Providers
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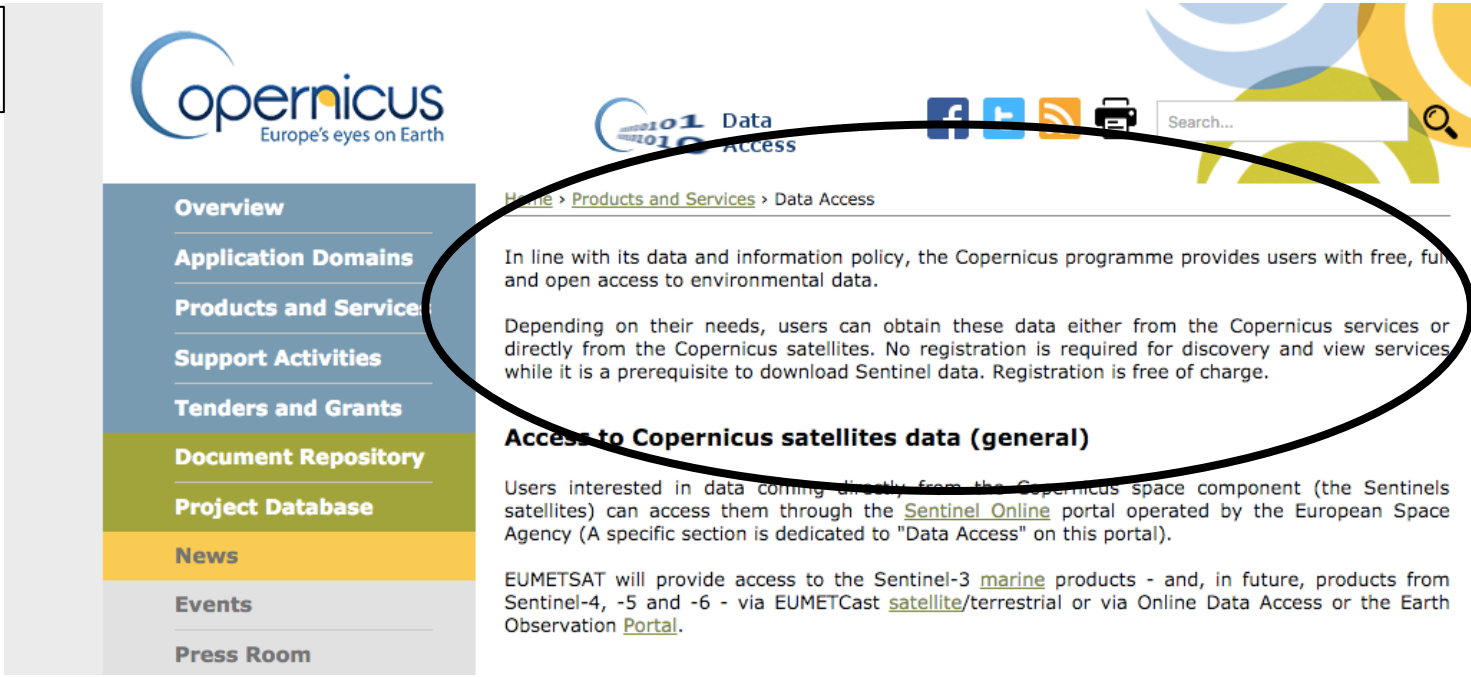
Service Providers
Legend:

From the Copernicus Website:



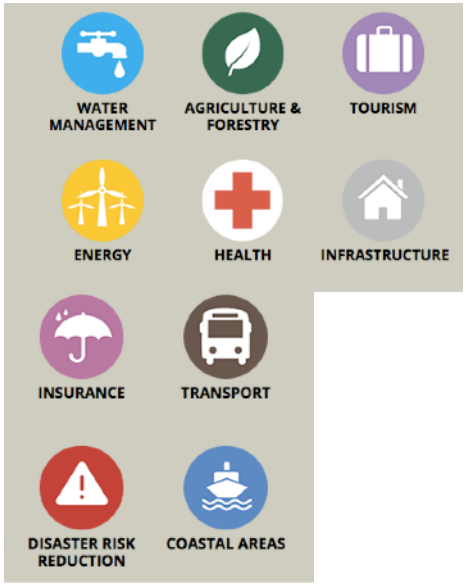
From the Copernicus regulation (EU) 377/2014:

"the Climate Change service shall provide information to increase the knowledge base to support adaptation and mitigation policies. It shall in particular contribute to the provision of Essential Climate Variables (ECVs), climate analyses, projections and indicators at temporal and spatial scales relevant to adaptation and mitigation strategies for various Union's sectoral and societal benefit areas."

Climate Data Store

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

Sectoral Information System



Evaluation and Quality Control

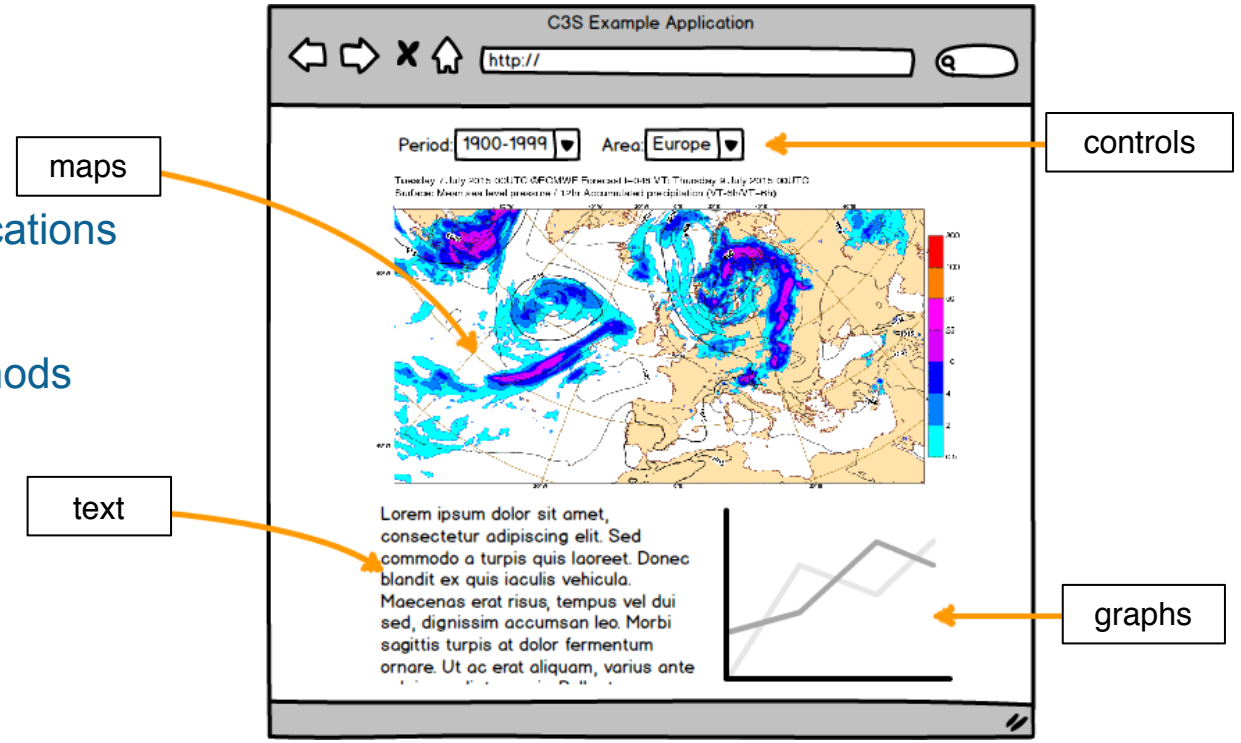
- Monitors quality of C3S products and services
- Ensures C3S delivers state-of-the-art climate information to end-users
- Identifies gaps in service provision
- Bridges Copernicus with the research agenda in Europe (e.g. H2020, national research projects)

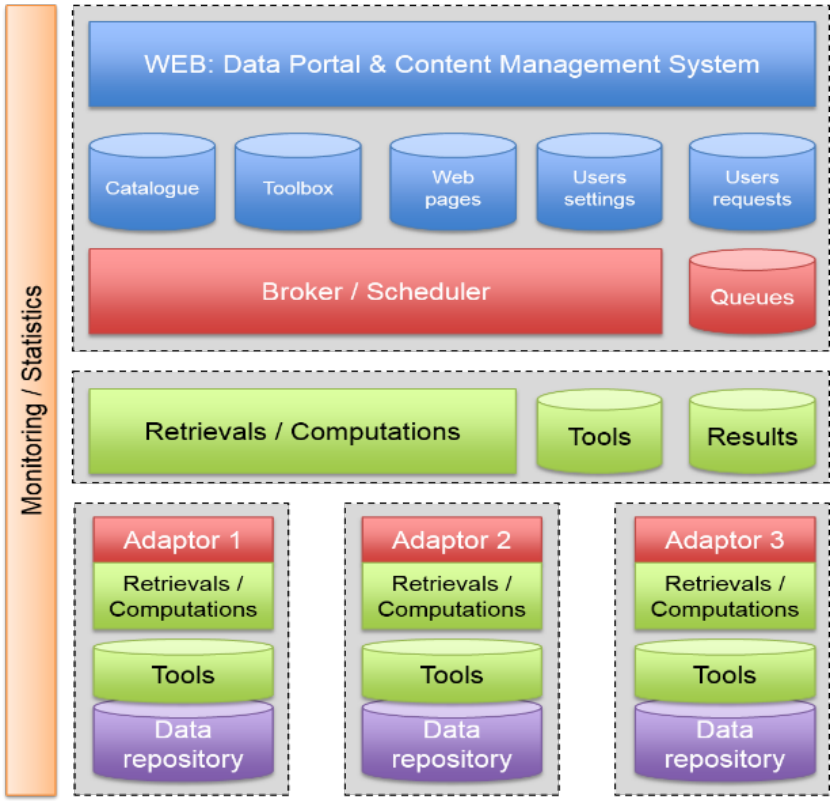
Outreach and Dissemination

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

Technical challenges:

- Diversity of users
- Diversity of data sets
- Very large data volumes
- Data residing at different locations
- Interoperability, efficiency
- User-defined workflows
- Variety of presentation methods
- Need for interactivity
- Access via API
- User management
- Performance monitoring





- ★ 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

Action engaged

In preparation (PIN or ITT out)

Not started

Observations

- Global estimates of ECVs from satellite and in-situ

Climate reanalysis

- Global atmosphere, ocean, land

Model output

- Multi-model seasonal forecast products
- Access to CMIP data and products (global and

Climate Indicators

ERA5, ERA6
Data rescue
Satellite reprocessing

Regional reanalysis workshop
Upcoming regional reanalysis ITT

EQC on gridded observations
ECV datasets production

Best practices
Vocabularies, provenance, metadata
User engagement

Workshop on Attribution in October 2017 to decide what next

Significant uptake on ECV datasets production

Global reanalysis:

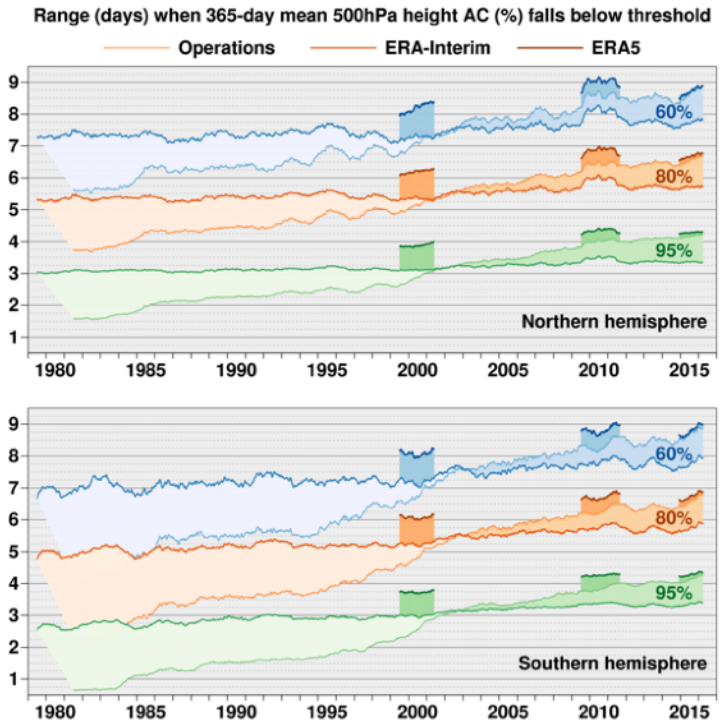
ERA5 is now in production (3 streams)

- 32km global resolution
- Uncertainty estimates
- Improved use of observations
- Newly reprocessed satellite data
- Hourly data from 1979-NRT
- Access to all input observations (via the Observation Feedback Archive)

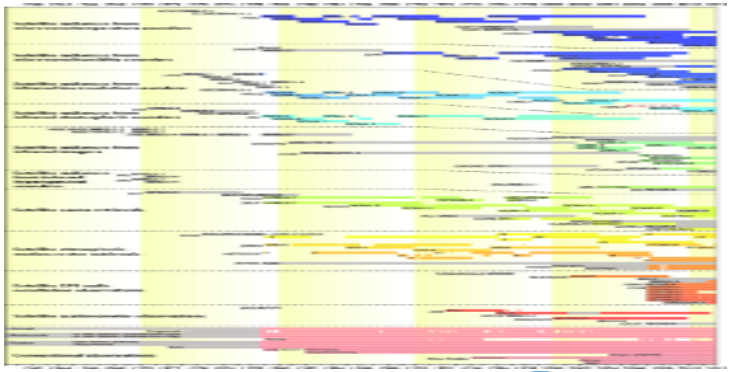
Development of a Climate Monitoring Facility

Regional reanalysis:

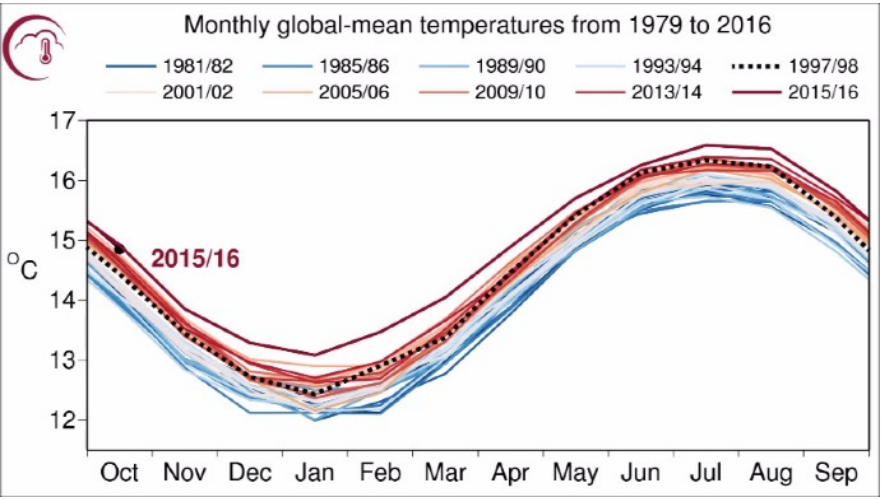
- European domain (including Arctic?)
- Higher spatial resolution
- Workshop organised 2016 Q2
- Competitive call by 2016 Q4



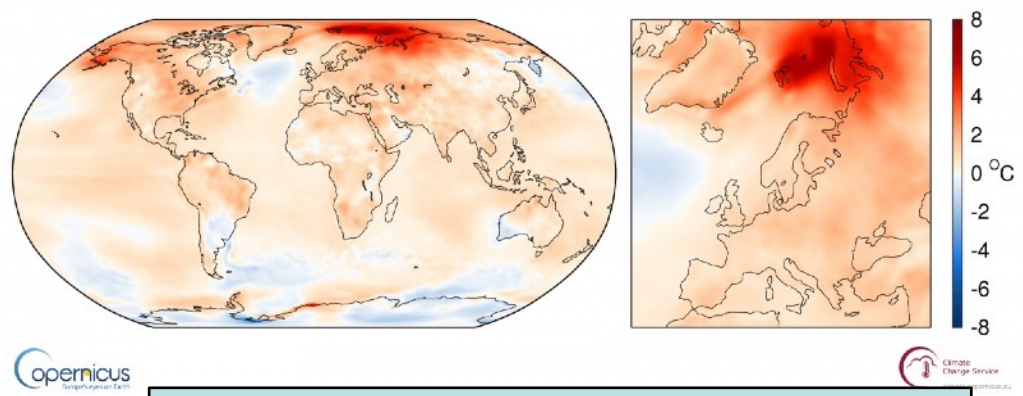
EUMETSAT reprocessing activity



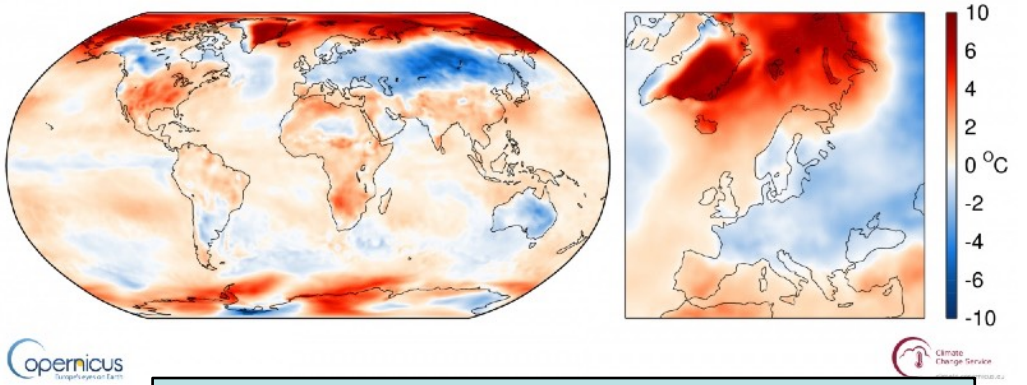
Production of ERA-interim has been accelerated to feed a monthly State of Climate



16 warmest years on record:
1998 and 2001-2015



Average surface air temperature anomalies for the last 12 months (201511 to 201610)

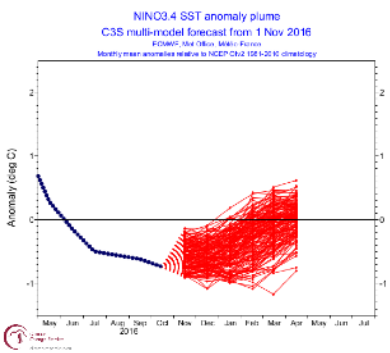


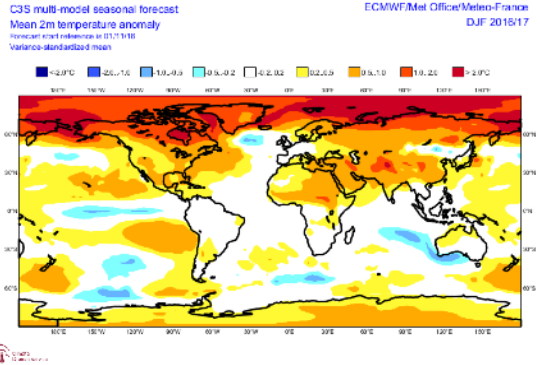
Average surface air temperature October 2016

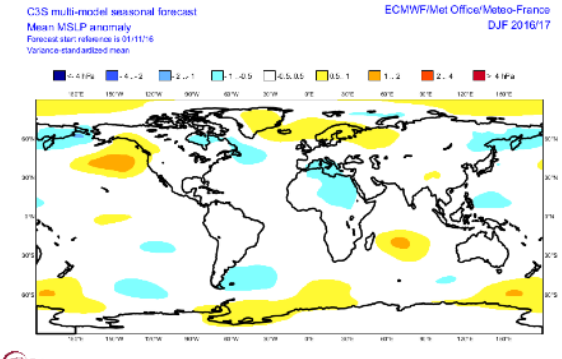
The service is based on a **multi-system** framework (ECMWF, Met Office, Météo France, CMCC, DWD) .

Products (graphics and data) will be publicly available, to an operational schedule.

(Prototypes are under development; initial release similar to examples below)







"Raw" data: atmosphere & ocean variables, 1x1 degree grid, at [illegible] om 6-month forecasts.

Products are also developed, in collaboration, for the C3S Sectoral Information System demonstrators.

Evaluation and quality control (EQC) function for seasonal forecast products; includes:

- assessment of *user needs* and the degree to which the product portfolio addresses them
- recommendations for *bridging identified gaps*
- *prototype* for on-demand user evaluation of seasonal information.

Global projection-related service

- **Provision of support to one Earth System Grid Federation (ESGF) node in Europe –** solution for access to and manipulation of global climate projections from the CMIP archive, consistent with the requirements of climate services.
- **Multi-model product generation**
  - **metrics for fidelity** of models in simulating historical climate, to be **translated into quality** for specific applications
  - **interactive tools** for generic products (e.g. maps of intra-ensemble variability for different models and scenarios), and **tailored products** for several economic sectors
- **Roadmap towards a reference set of climate projections for Europe:** studies on how well climate projections 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, and the benefit of **initialised decadal predictions,** in relation to the specific needs of different economic sectors.

Regional climate projection service

The goal

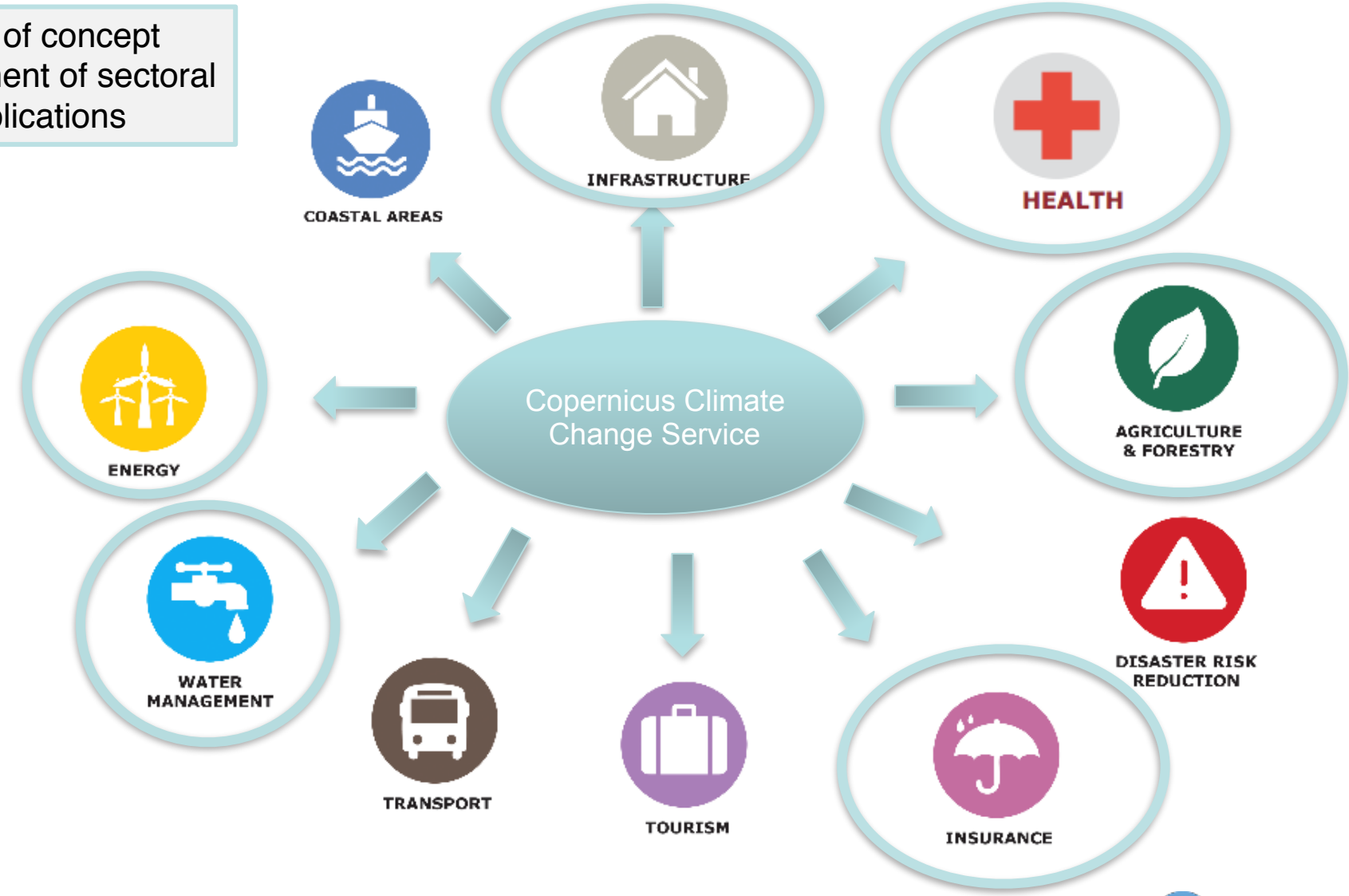
- to facilitate access to and manipulation (via the CDS) of output of regional climate projections over Europe and boundary conditions from GCM simulations needed for future regional projections.
- to define, agree and complete a matrix of global/regional model combinations and scenarios, which allows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

The Invitation to Tender has recently been published

Evaluation and quality control component for climate projection-based services –

similar in concept to the equivalent activity for the seasonal forecast service; started in September.

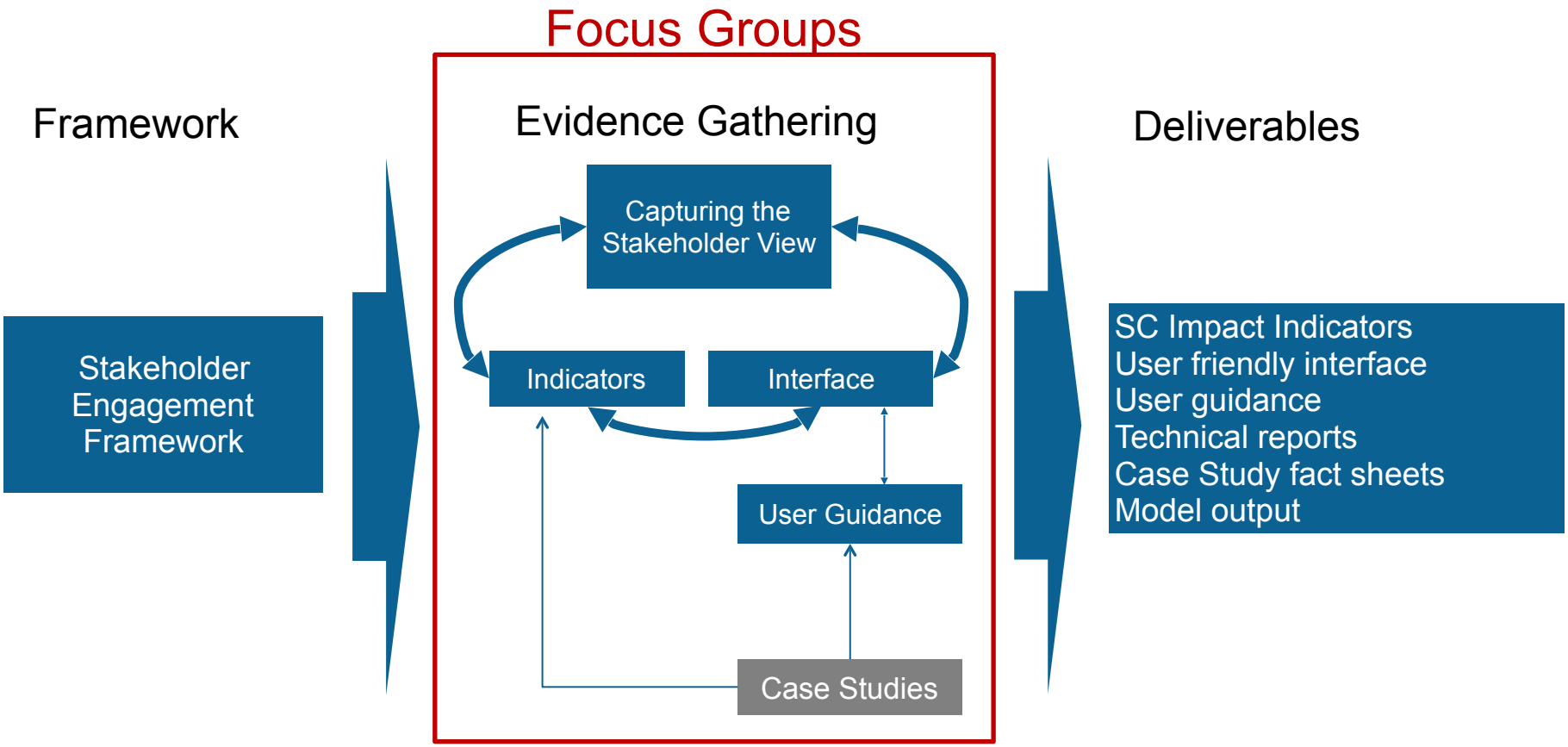
Proof of concept development of sectoral applications



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)**
  - URBAN-SIS (touching health, infrastructure,..) – **Lead SMHI (Sweden)**

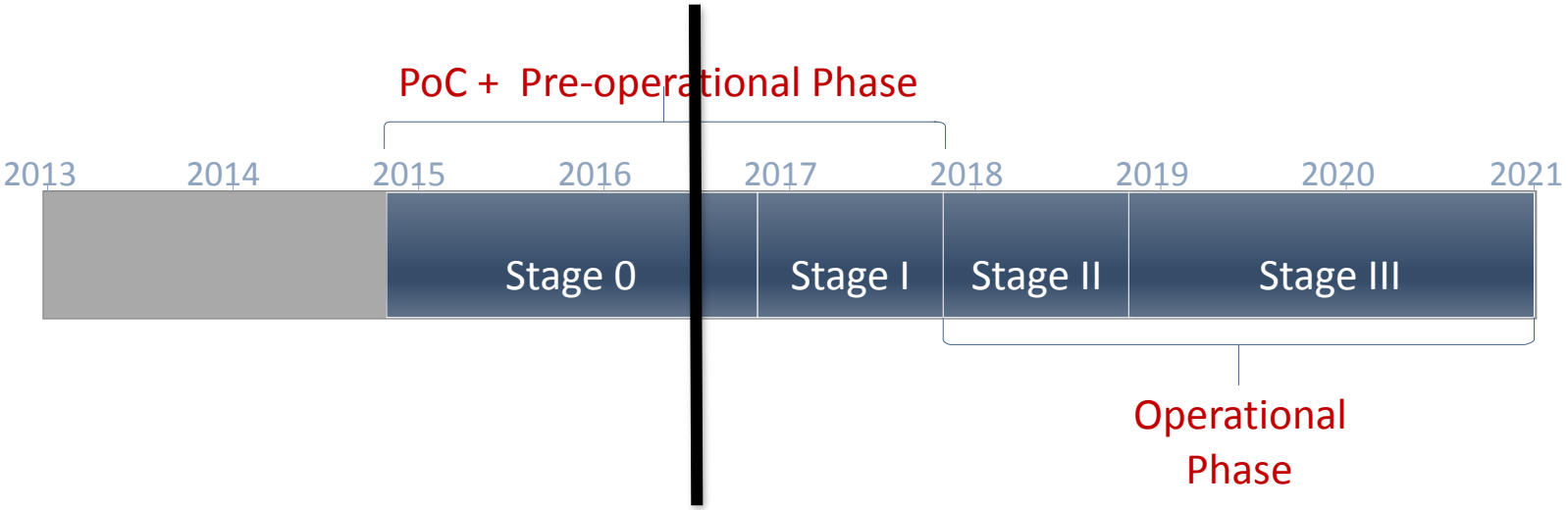
- No noticeable delays in the deliverables (…so far).
- Quality of the output generally high.


Focus Groups
Framework
Evidence Gathering
Deliverables
Stakeholder Engagement Framework
Capturing the Stakeholder View
Indicators
Interface
User Guidance
Case Studies
SC Impact Indicators
User friendly interface
User guidance
Technical reports
Case Study fact sheets
Model output

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

Timeline

Stage 0/1 - Proof of Concept/Pre-operational
Stage II - Operational ~20 ECVs, ~5-6 Sectors
Stage III - Operational ~30 ECVs, ~10 Sectors



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The Copernicus Climate Change Service (C3S) will combine observations of the climate system with the latest science to develop authoritative, quality-assured information about the past, current and future states of the climate in Europe and worldwide.

climate.copernicus.eu

IN FOCUS

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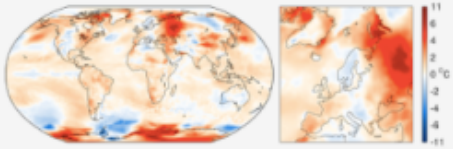
13 Sep 2016

MONTHLY MAPS



Average surface air temperatures for August 2016

August 2016

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