Evaluation and Quality Control for the Copernicus Seasonal Forecast Systems

Jonas Bhend, Paco Doblas-Reyes,
and the QA4Seas Team

Climate Change

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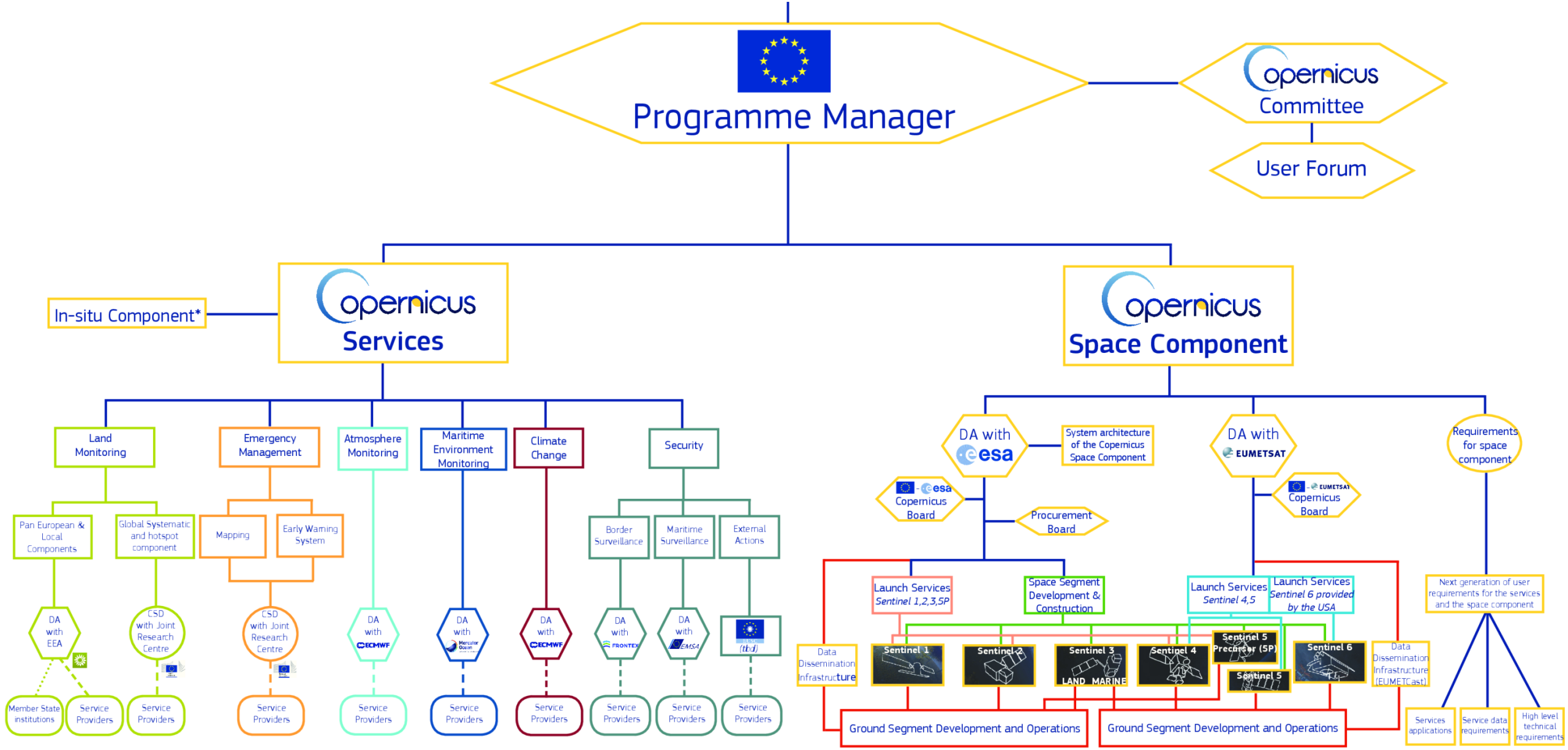
Programme Manager
Copernicus Committee
User Forum
In-situ Component*
Copernicus Services
Land Monitoring
Emergency Management
Atmosphere Monitoring
Maritime Environment Monitoring
Climate Change
Security
Pan European & Local Components
Global Systematic and hotspot component
Mapping
Early Warning System
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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Copernicus Space Component
DA with esa
System architecture of the Copernicus Space Component
esa Copernicus Board
Procurement Board
DA with EUMETSAT
EUMETSAT Copernicus Board
Requirements for space component
Launch Services Sentinel 1,2,3,5P
Space Segment Development & Construction
Launch Services Sentinel 4,5
Launch Services Sentinel 6 provided by the USA
Next generation of user requirements for the services and the space component
Data Dissemination Infrastructure
Sentinel 1
Sentinel 2
Sentinel 3
LAND MARINE
Sentinel 4
Sentinel 5 Precursor (5P)
Sentinel 5
Sentinel 6
Data Dissemination Infrastructure (EUMETCast)
Ground Segment Development and Operations
Ground Segment Development and Operations
Services applications
Service data requirements
High level technical requirements

Vision:

- Be an authoritative source for climate information in Europe
- Build upon massive European investments in science and technology
- Enable the market for climate services

Copernicus Climate Change Service (C3S)

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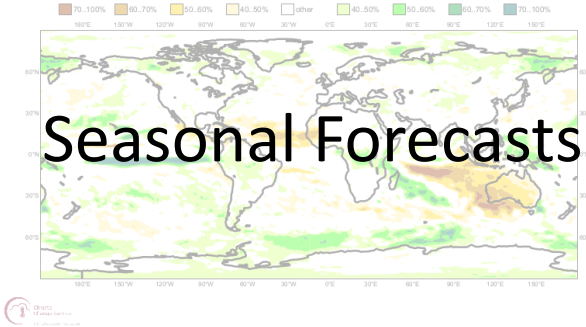
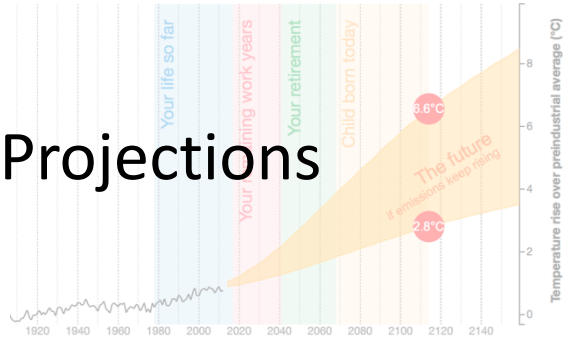
How is climate changing?

Observations Reanalysis



Seasonal Forecasts

How will it change in the future?



Projections

How will it impact society?

Sectoral Information System

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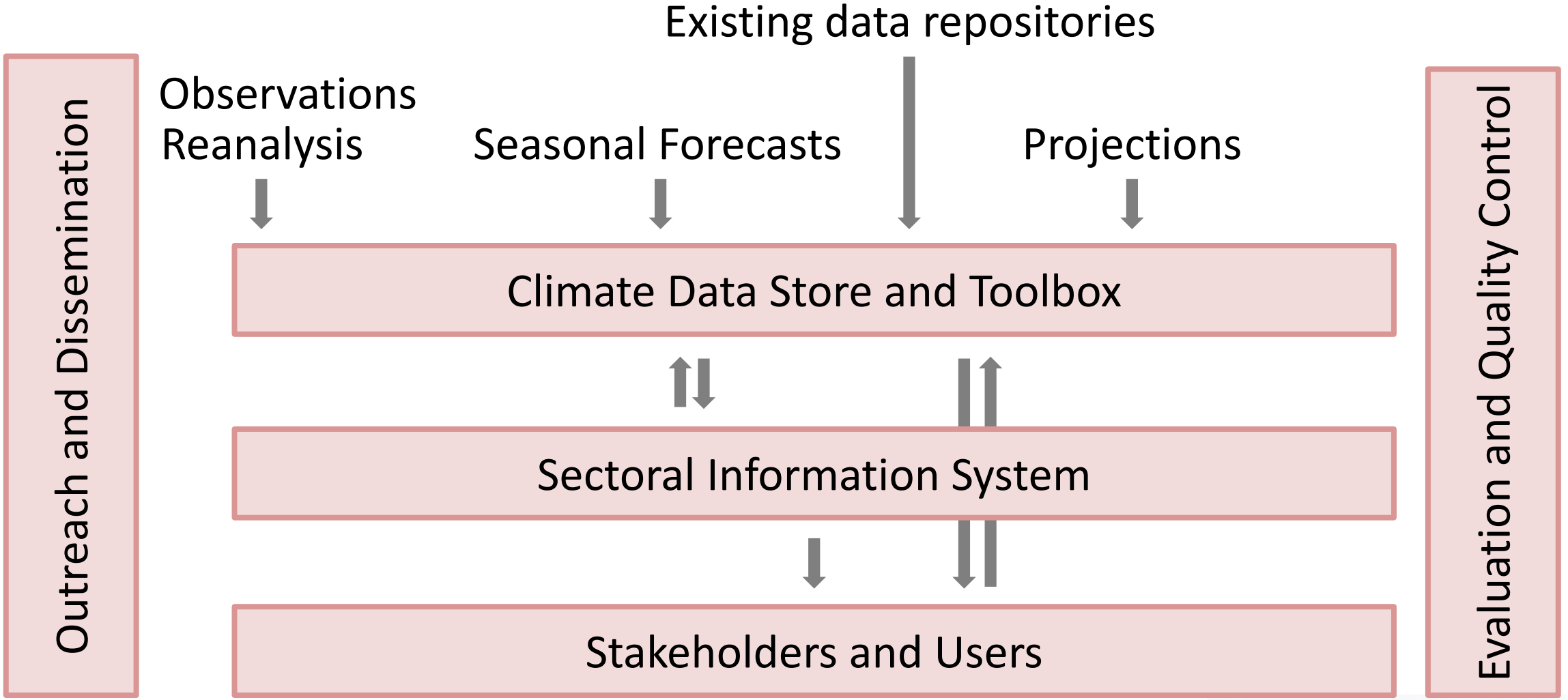

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C3S Seasonal Forecasts

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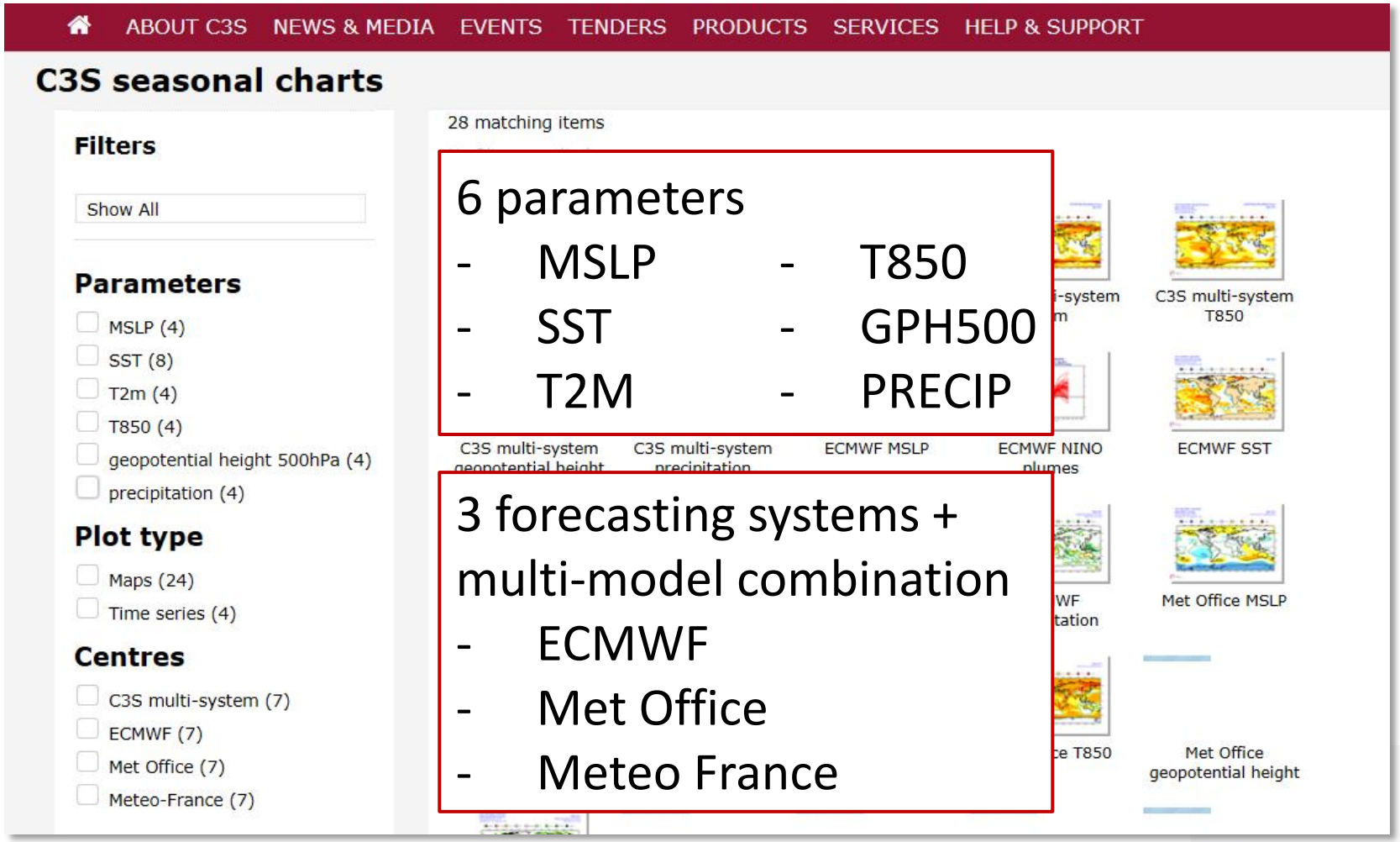
- C3S seasonal forecasts are being published since 10/2016
  http://climate.copernicus.eu/seasonal-forecasts



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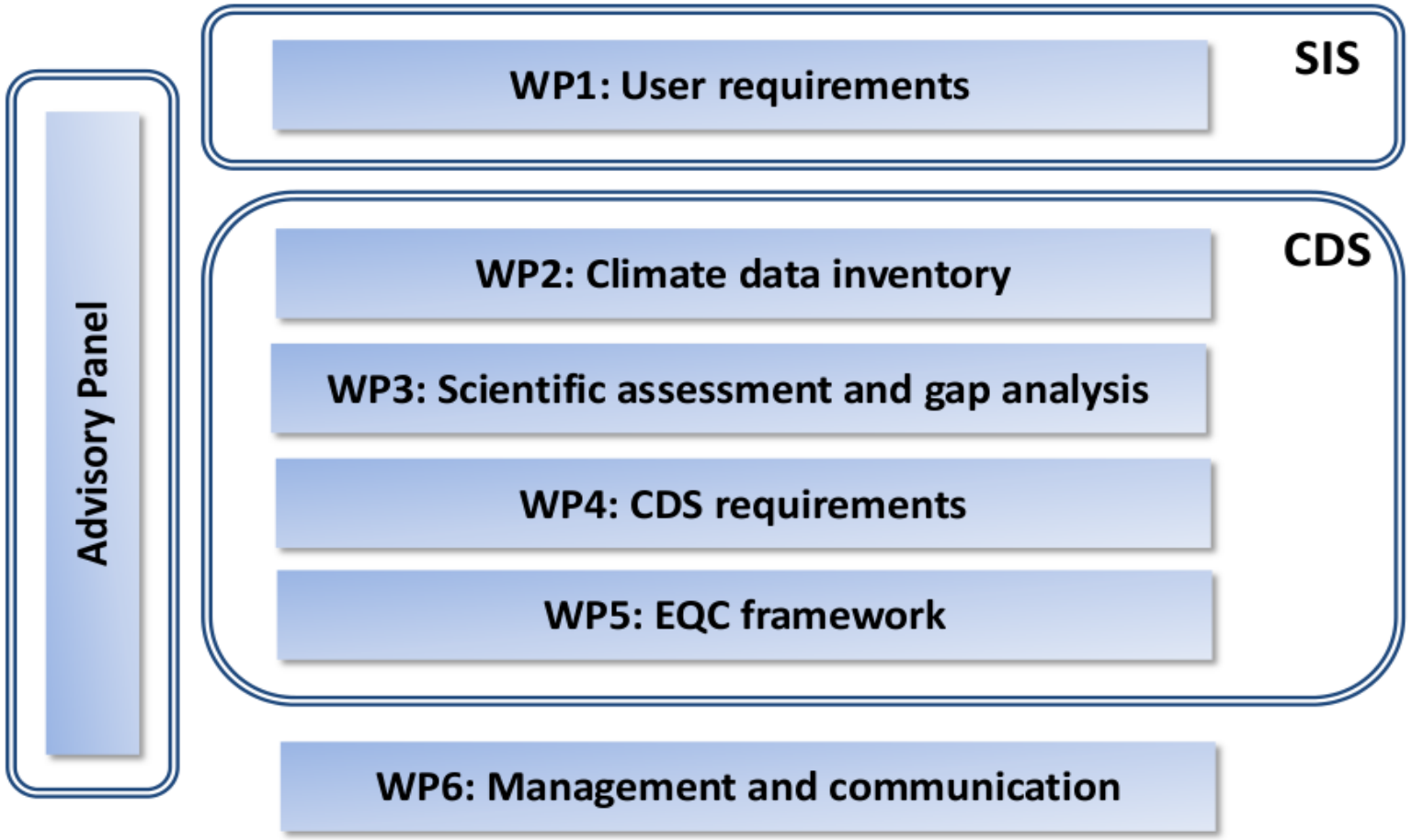
QA4Seas: EQC for seasonal forecasts

Consortium lead by the Barcelona Supercomputing Centre (BSC)



BSC

UNIVERSITY OF EXETER

UC UNIVERSIDAD DE CANTABRIA CSIC

predictia

UNIVERSITY OF LEEDS

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

MeteoSwiss

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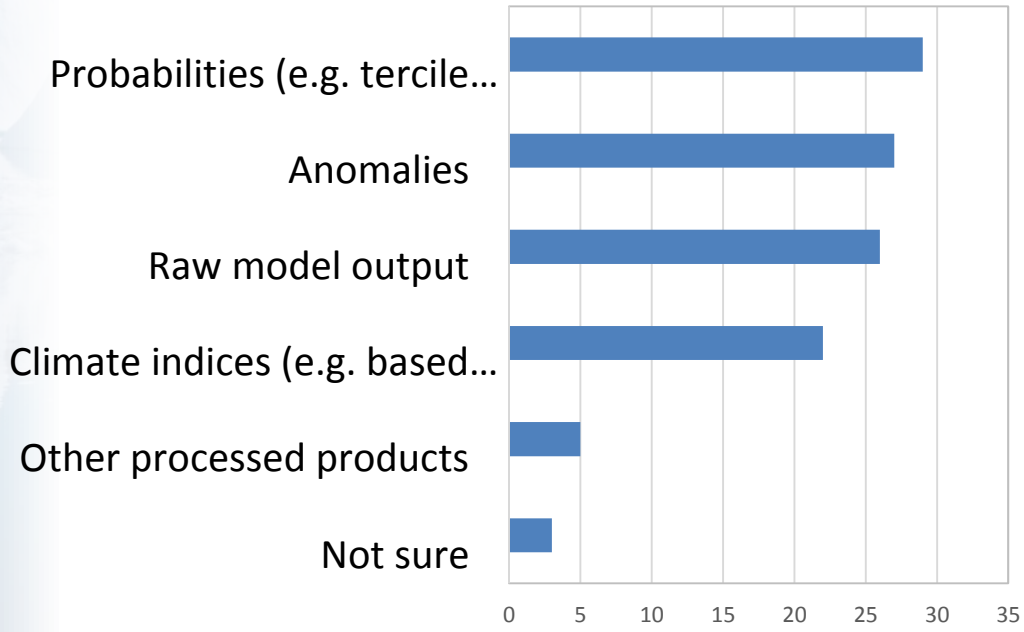
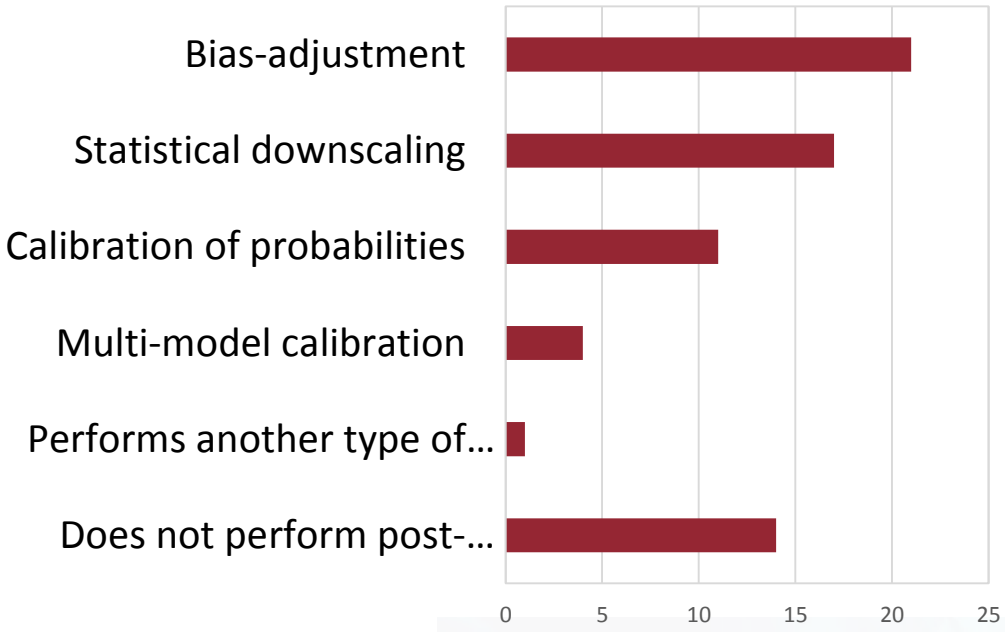
User Needs

Results from a survey where 42 out of 53 respondents receive seasonal forecast information, with a large majority of NMHSs.

"What kind of data from global seasonal forecast models do you use?"



"What type of adjustment post-processing do you perform on the SCF data before using it?"

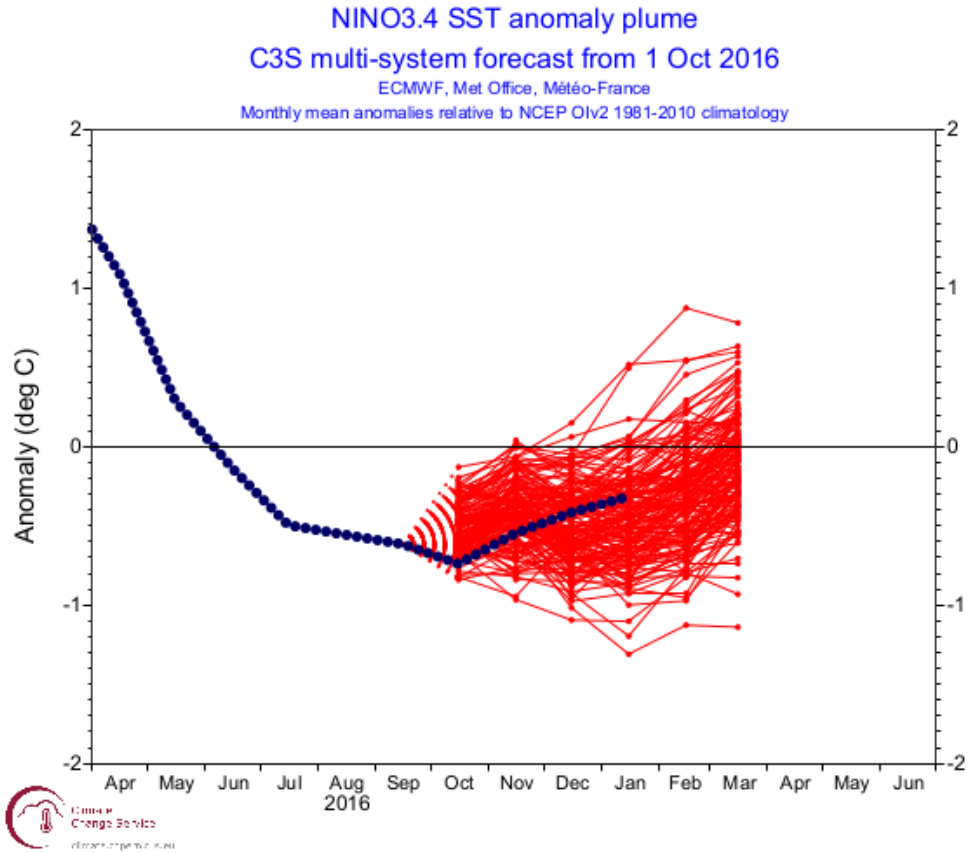


M. Soares, A. Taylor (Univ. Leeds)

CDS requirements and EQC framework

How to identify data/products to ensure a minimum quality?

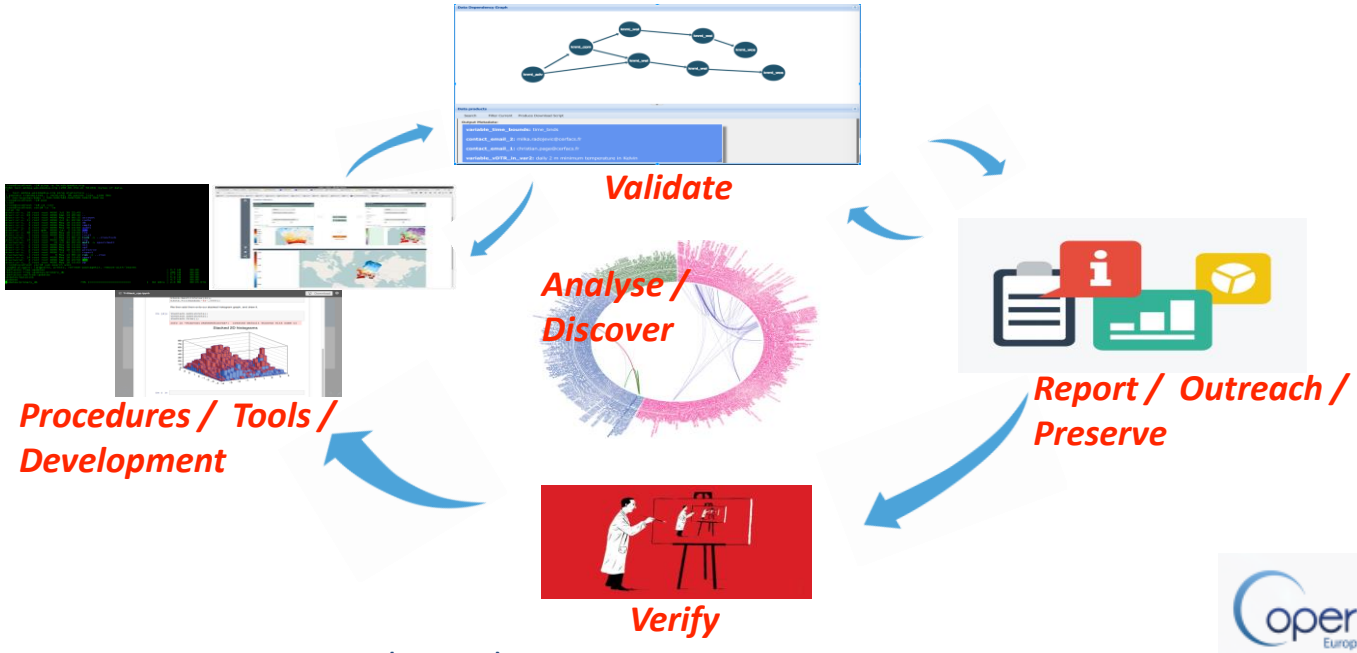
- Reproducibility: ability of an entire process to be duplicated.
- Traceability: ability to verify the history, location, or application of an item by means of documented recorded identification.



CDS requirements and EQC framework

How to identify data/products to ensure a minimum quality?

- Generalised metadata and provenance information are key elements of all the components of the service.
- Two approaches for product provenance are under discussion: S-PROV and Resource Description Framework (RDF).



Meta Data Schema

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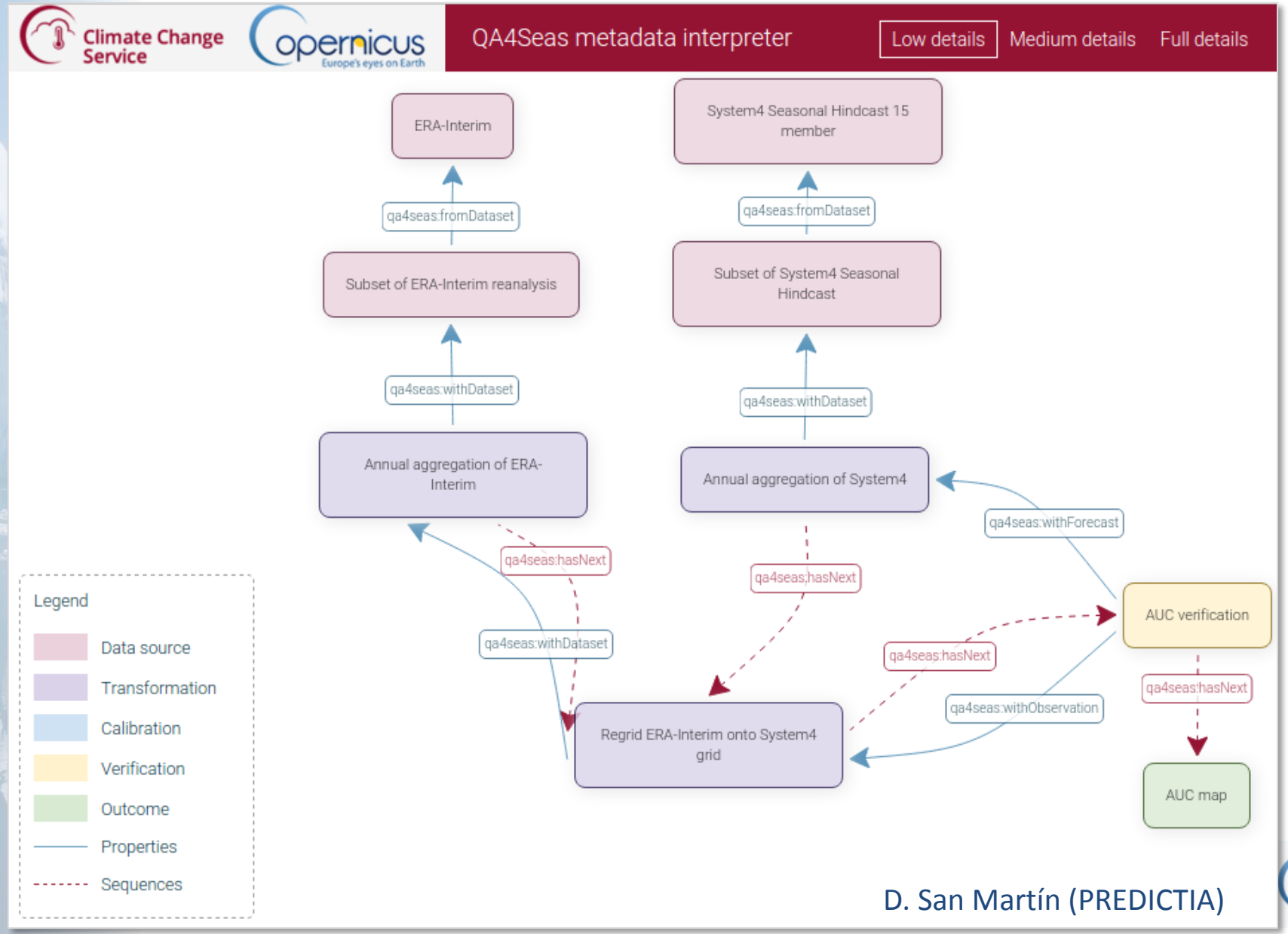

D. San Martín (PREDICTIA)

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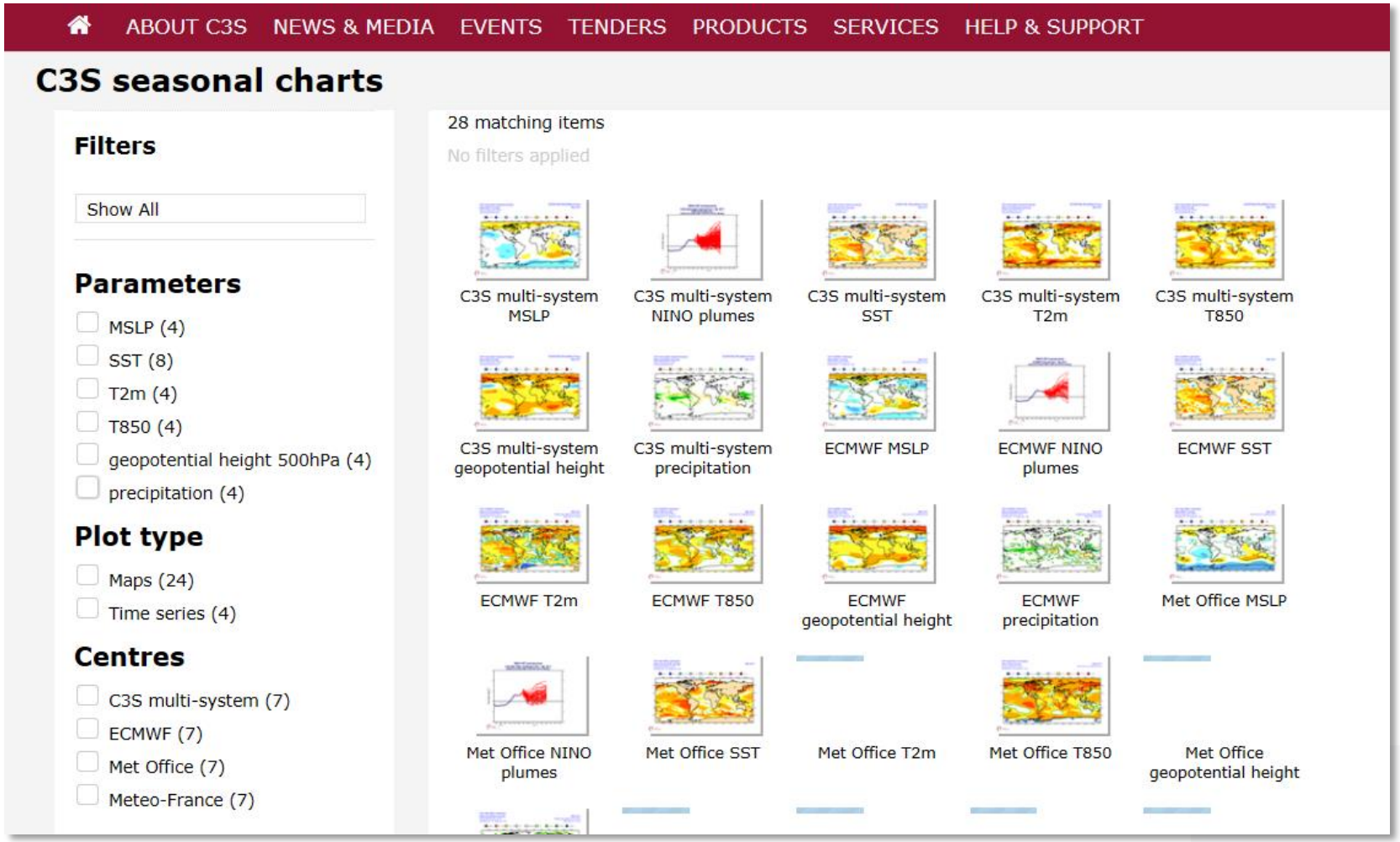
CDS requirements and EQC framework

Provenance and metadata challenges:

- Engage the (expert) users.
- Define the level of granularity to describe the objects.
- Inform about and display different levels of abstraction.
- Define the curation of elements other than raw data.
- **Which components of the C3S are involved and where does the governance reside?**

- C3S seasonal forecasts are being published since 10/2016
  http://climate.copernicus.eu/seasonal-forecasts



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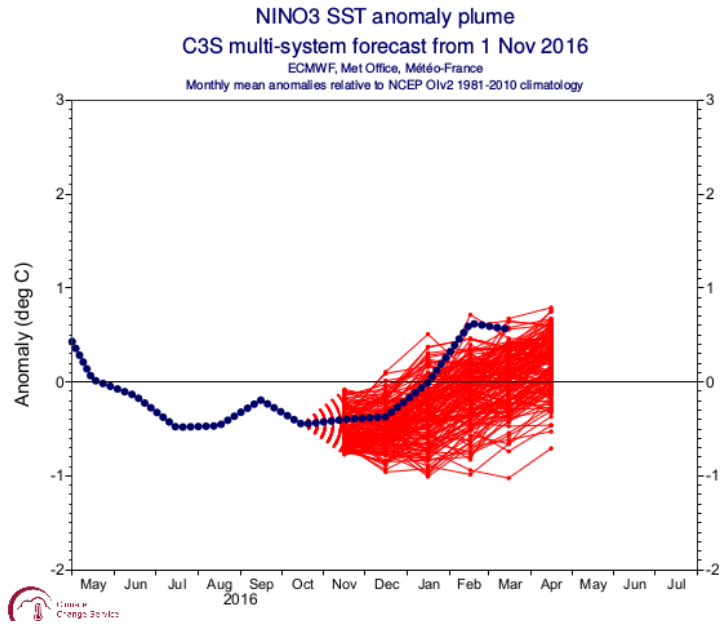
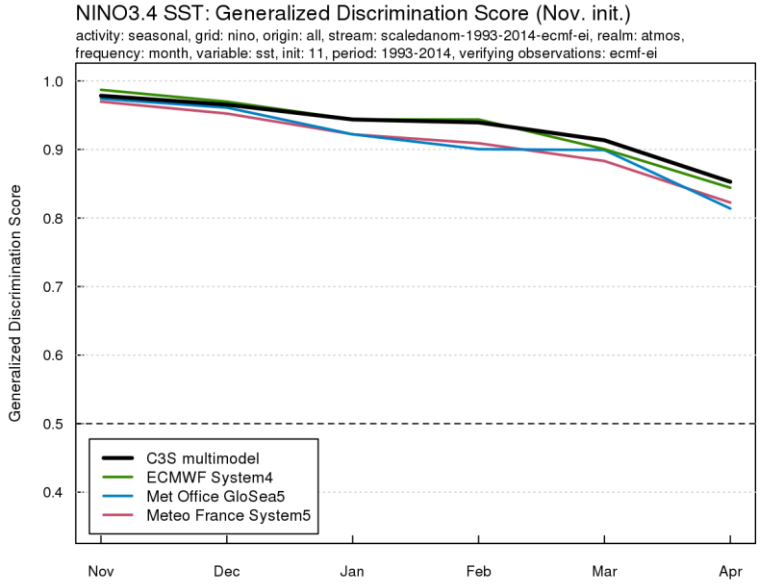
Scientific Assessment

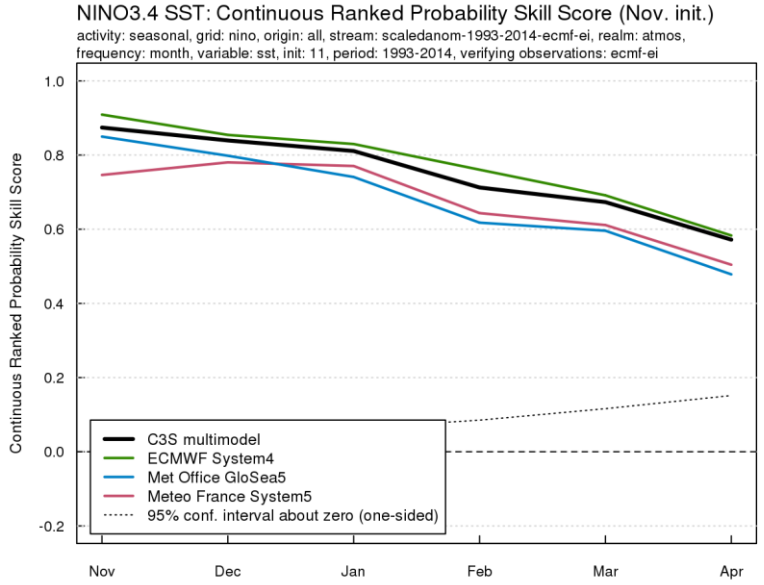
- C3S seasonal forecasts are being published since 10/2016 http://climate.copernicus.eu/seasonal-forecasts

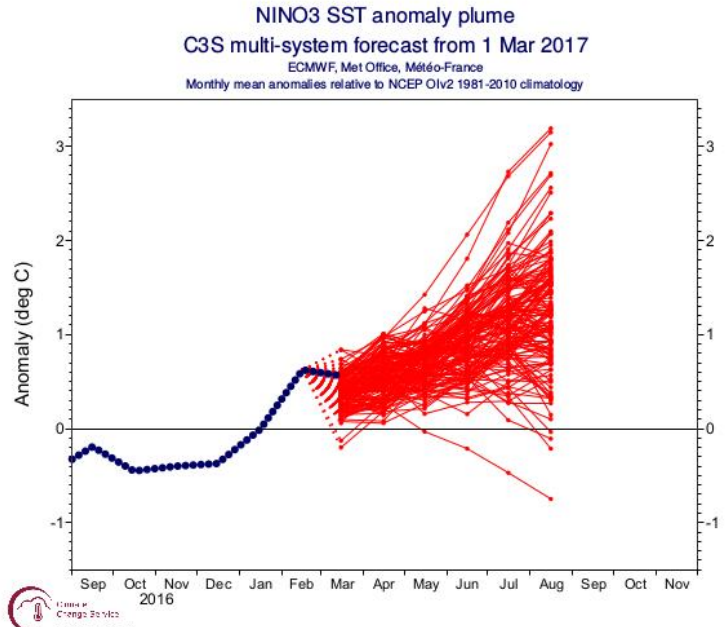
- Assess currently available forecast products
- Explore skill of forecasts of monthly averages
- Reduced set of scores (CRPSS / RPSS / BSS, 2AFC / ROC, Correlation)

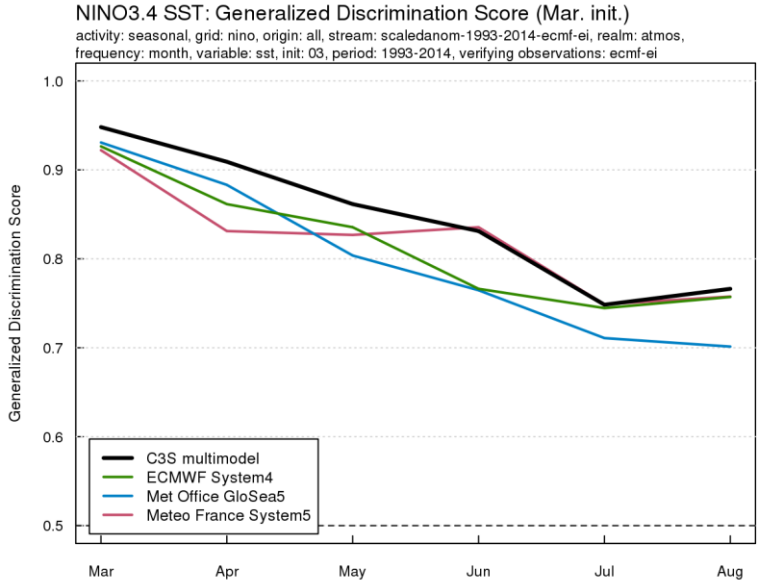
Preliminary assessment: NINO plumes

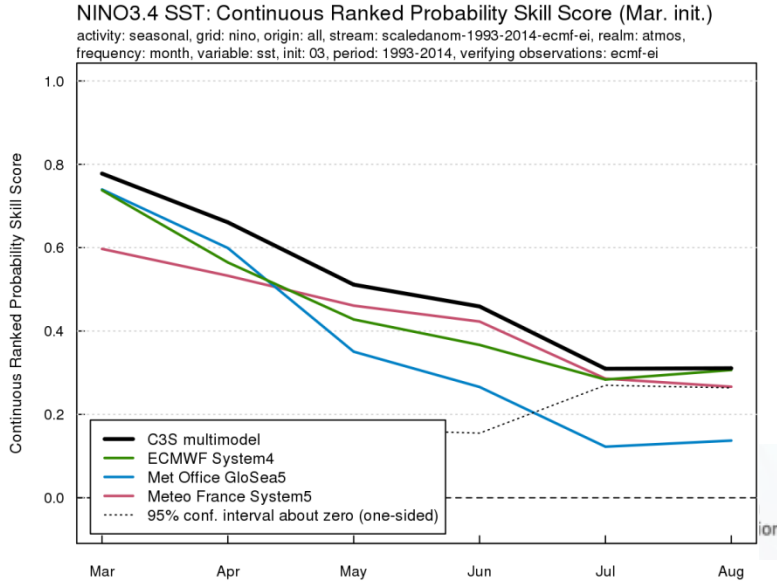












Preliminary assessment: global maps

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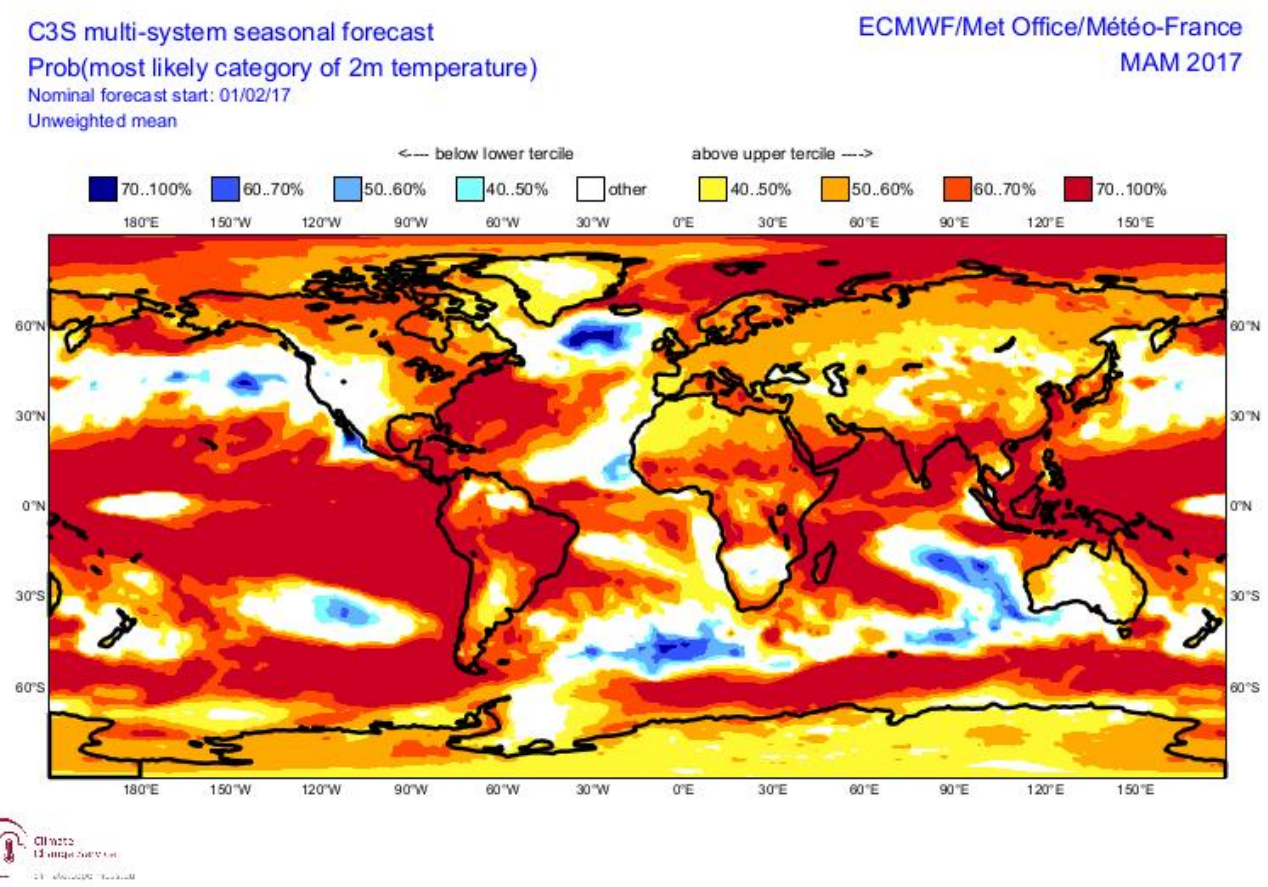

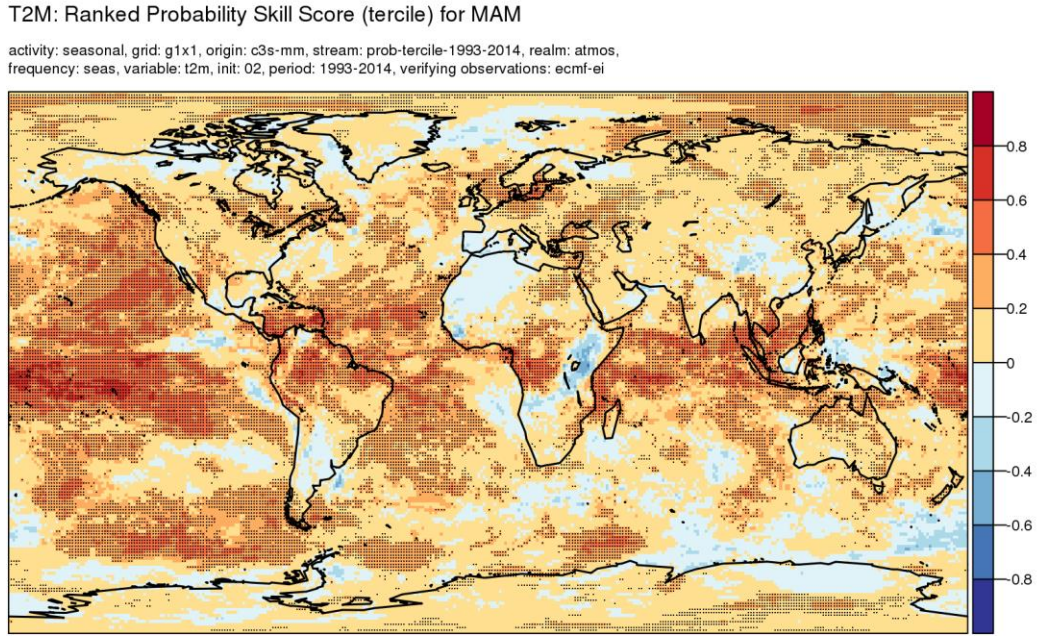

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Preliminary assessment: global maps

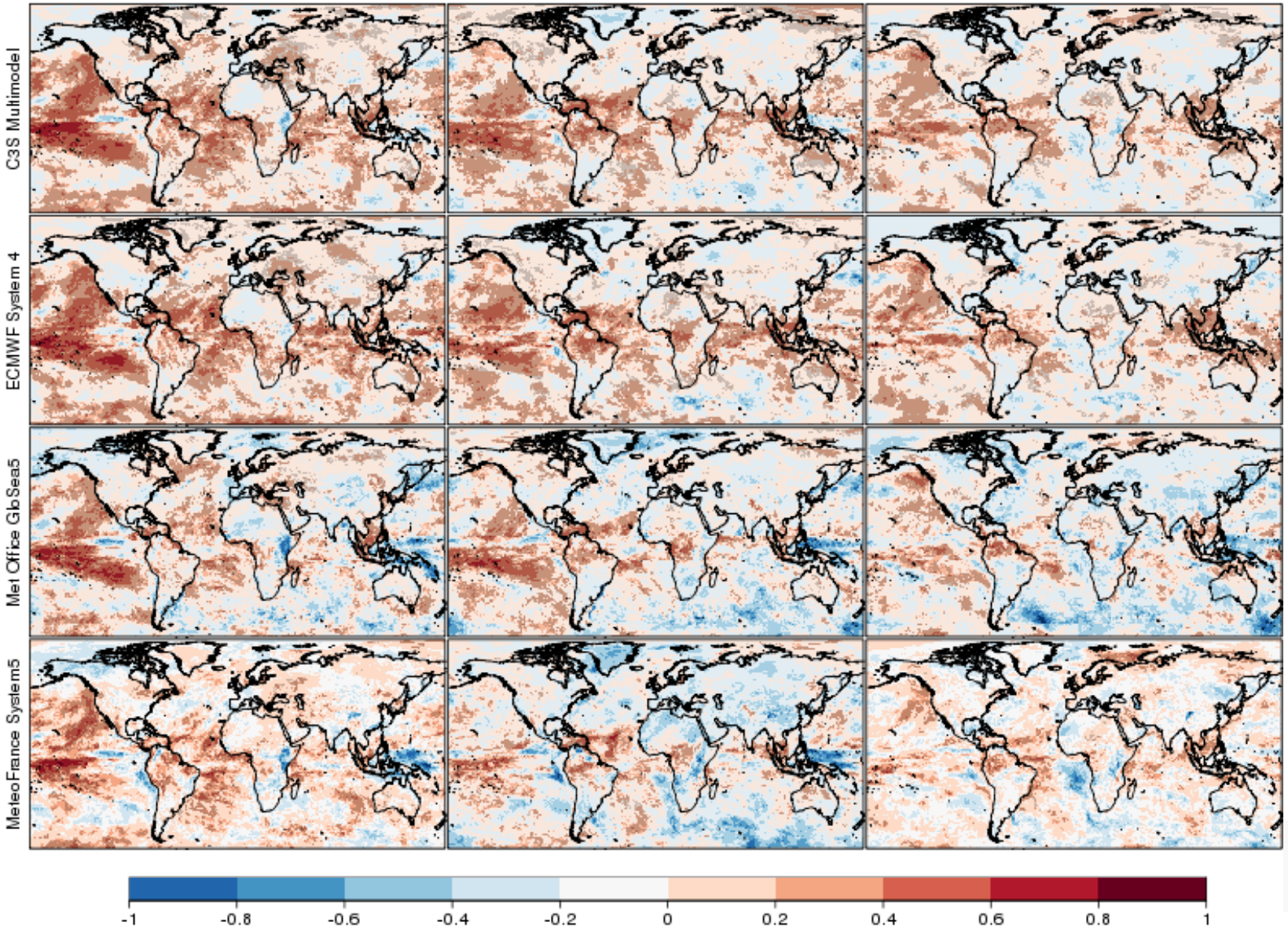
Feb. init.

March

April

May

C3S MM



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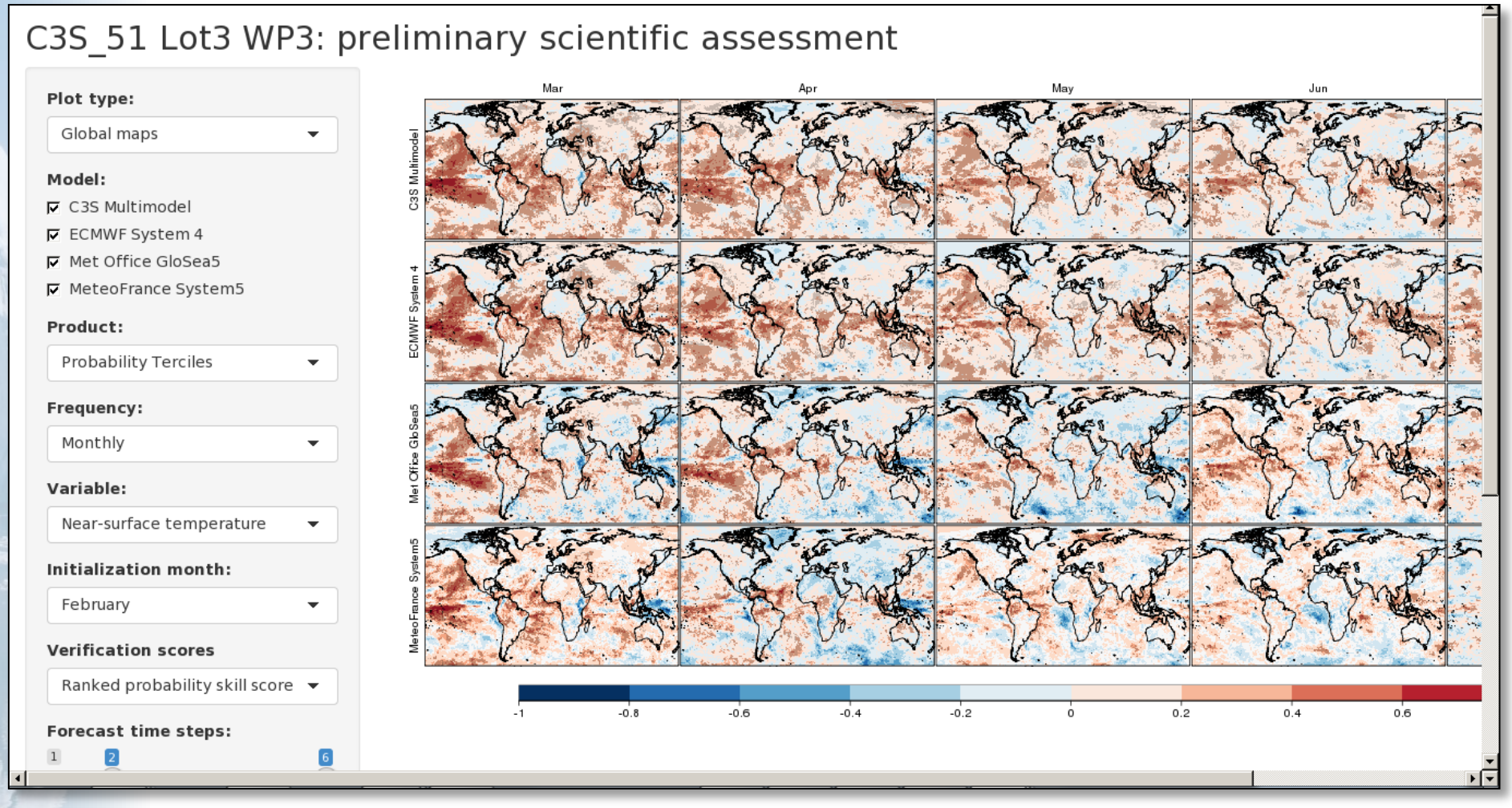
Interactive web interface



Publicly available version for ECMWF System4 only: https://meteoswiss-climate.shinyapps.io/skill_metrics

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Scientific assessment: Open Questions

- Interpretation of results from preliminary assessment
  - What can be skillfully forecast?
  - Is the multi-model always better?
  - What are meaningful regions to aggregate / summarize skill?
- Selection / recommendation of verification metrics to be used
- Multi-model methods
- Calibration and downscaling
- Observation uncertainty

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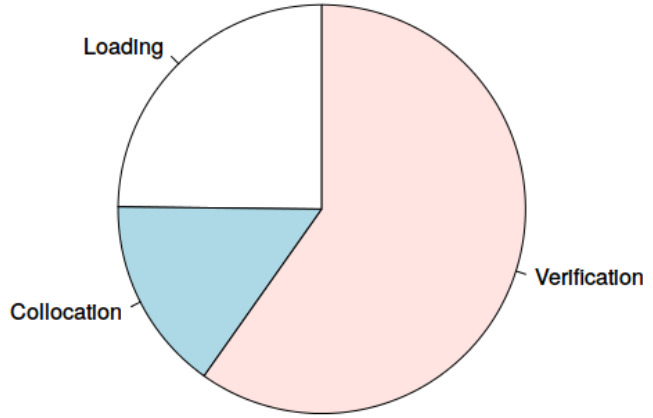
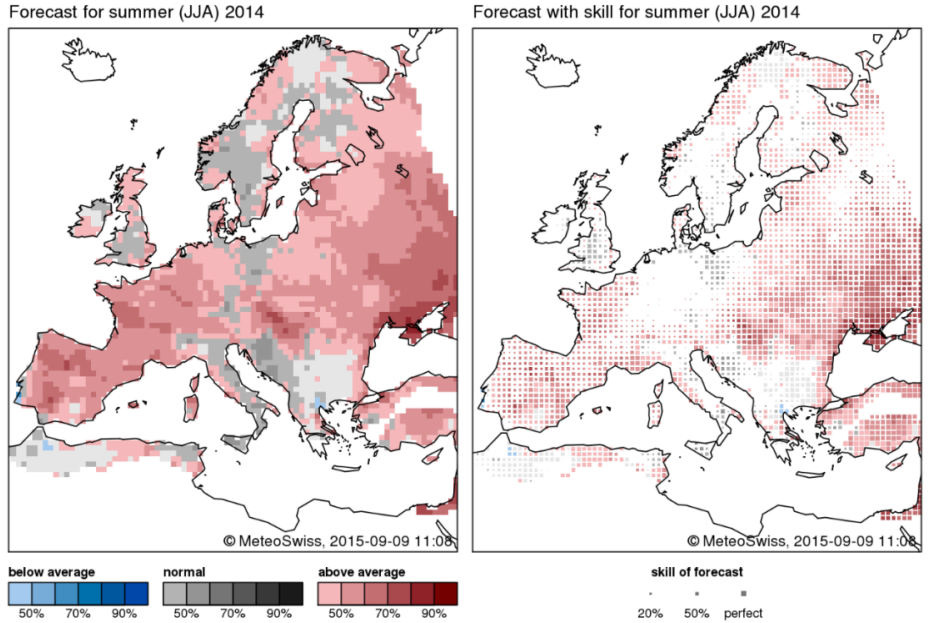
Additional ongoing and future work

- Framework for collaboration with other C3S EQC projects
- Assessment of bias correction / calibration and downscaling for seasonal forecasting
- Performance testing
- Development of prototype verification system
- Develop recommendations on visualization and uncertainty communication





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Summary

- EQC is user driven, but not all users are feeding in yet
- Data inventories help to identify gaps
- Existing software packages are an invaluable source of solutions, but should be considered within a framework.
- Handling metadata and provenance information require a generic, common approach for all of C3S.
- Scientific assessment serves as the foundation to expand the service.