Copernicus Climate Change Service – C3S

Overview and plans for user engagement

Dick Dee, ECMWF

Acknowledgements: Jean-Noël Thépaut, Adrian Simmons

Copernicus
Europe's eyes on Earth

Funded by
the European Union

Implemented by ECMWF

Copernicus Climate Change Service: C3S Vision

To be an authoritative source of climate information for Europe

To build upon national investments and complement national climate service providers

To support the market for climate services in Europe

How is the climate changing?

- Earth observations
- Reanalyses

Will climate change continue, accelerate?

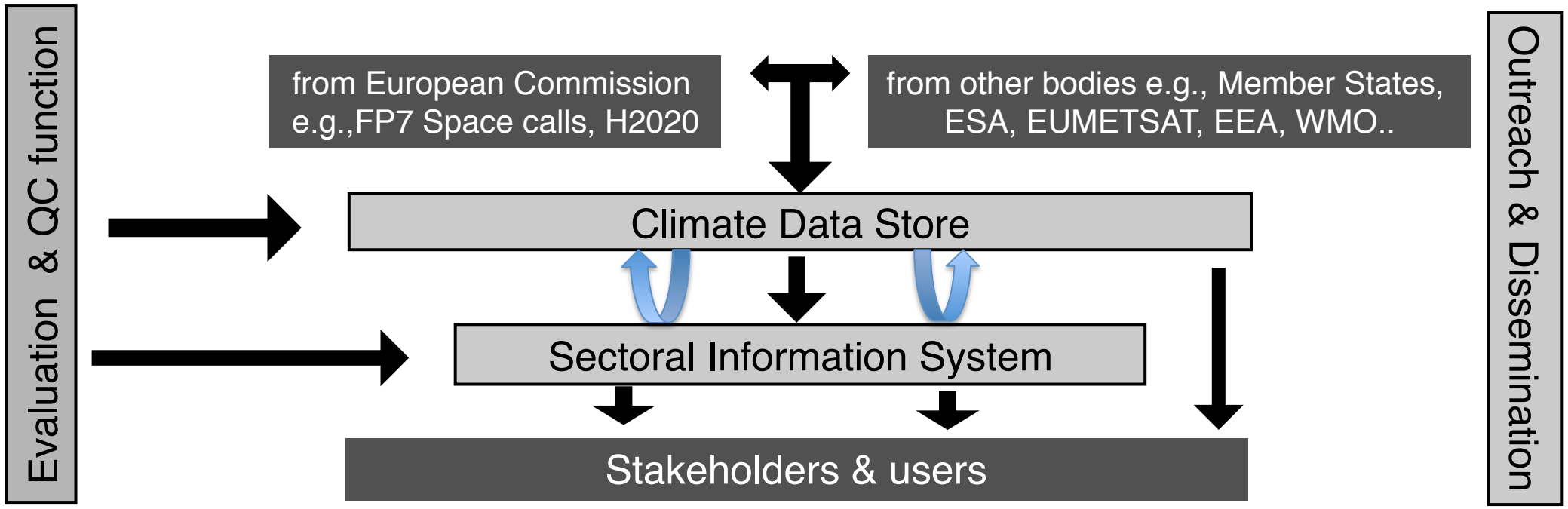
- Predictions
- Projections

What are the societal impacts?

- Climate indicators
- Sectoral information

C3S in a nutshell

organisation

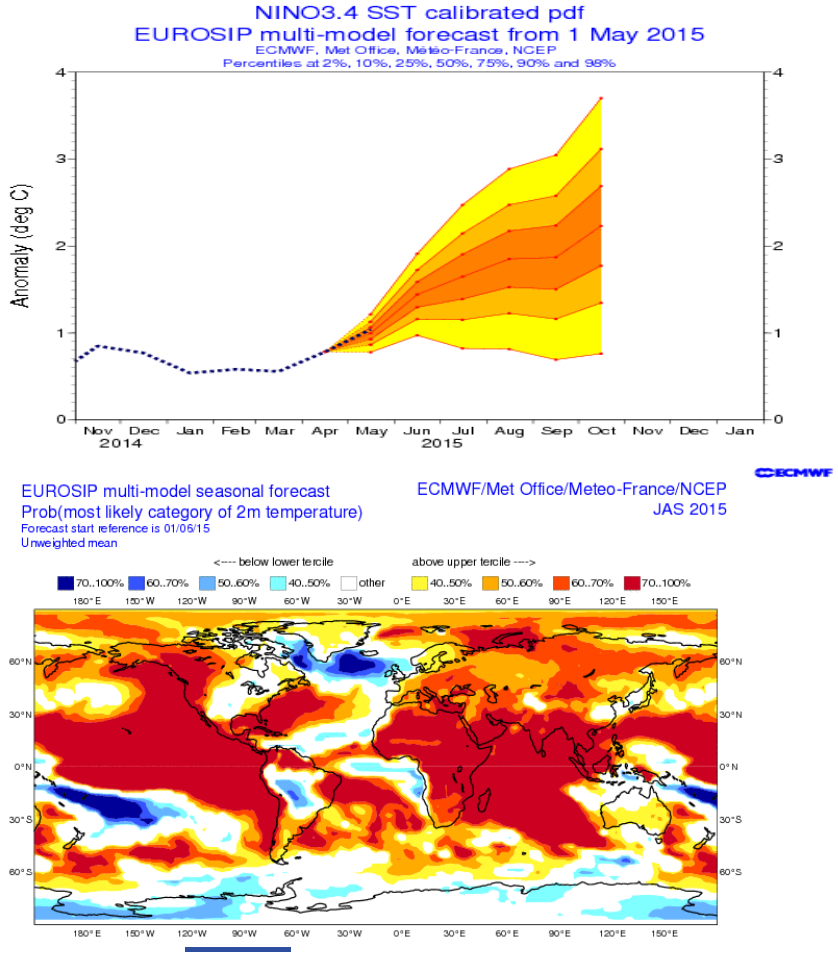


C3S Service elements: Climate Data Store

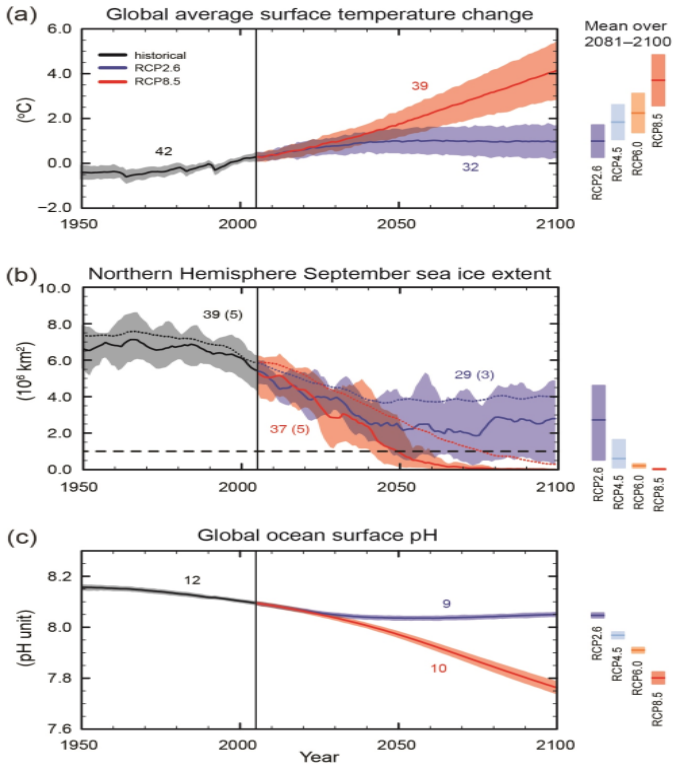
A wealth of Essential Climate Variables and Climate Indicators

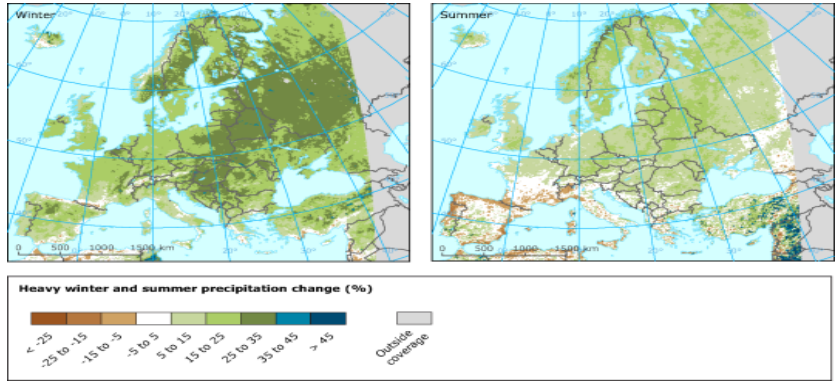
- Observed, reanalysed and **simulated**
- Relevant to support adaptation/mitigation policies at European level and wider

Multi model seasonal forecast products



Climate projections





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ECMWF

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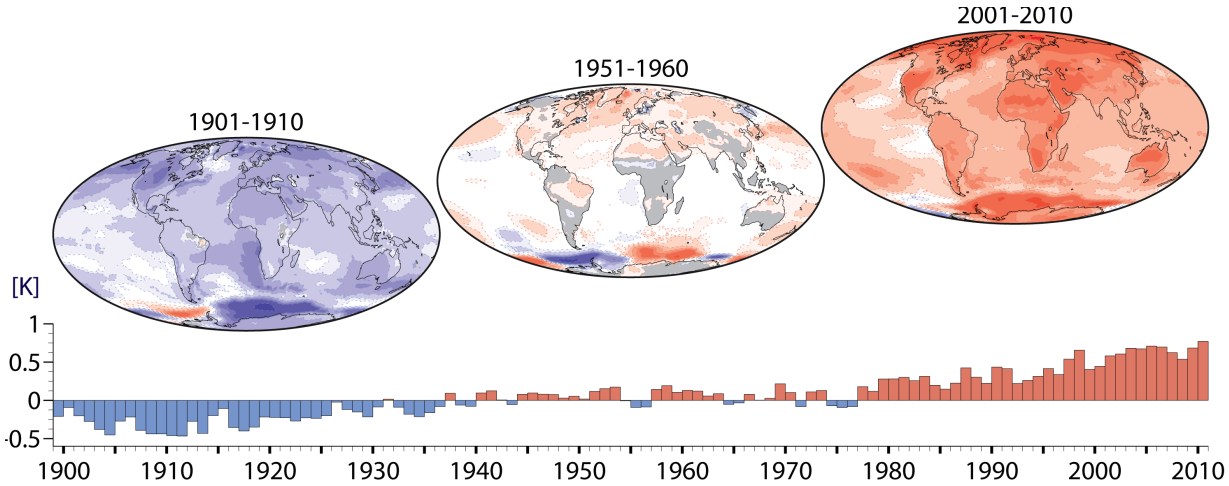


Reanalyses

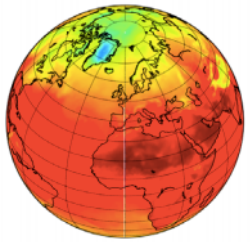


Figure 1: ERA-Interimanalysis of the 2m-temperature.

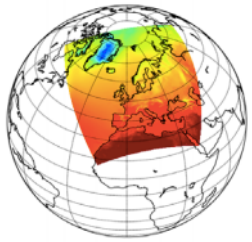
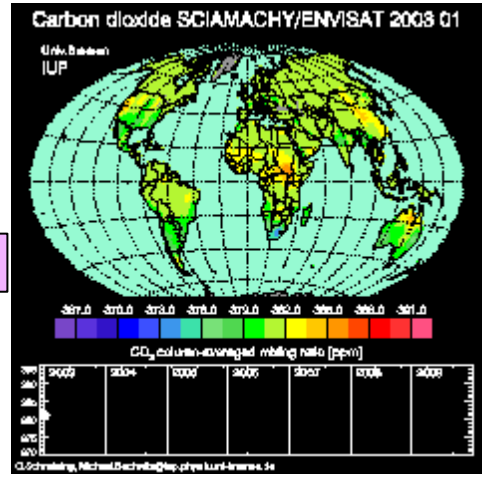


Figure 2: HIRLAM 2m-temperature using ERA-Interim analysis on the borders and as a large scale constraint.

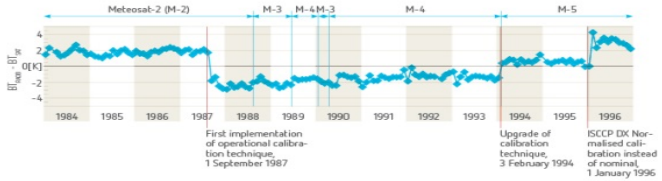
Credit: Euro4m



Credit: ESA-CCI

Earth Observation based ECV datasets

Data collection and data rescue



Data reprocessing

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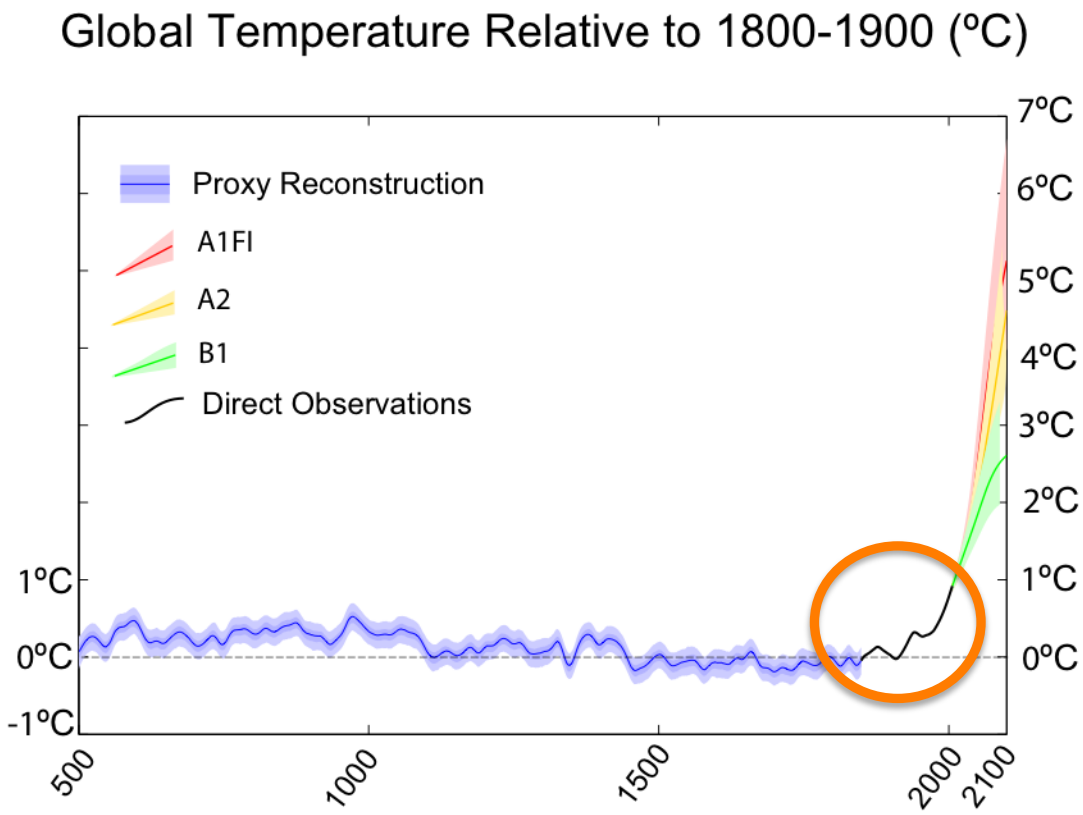
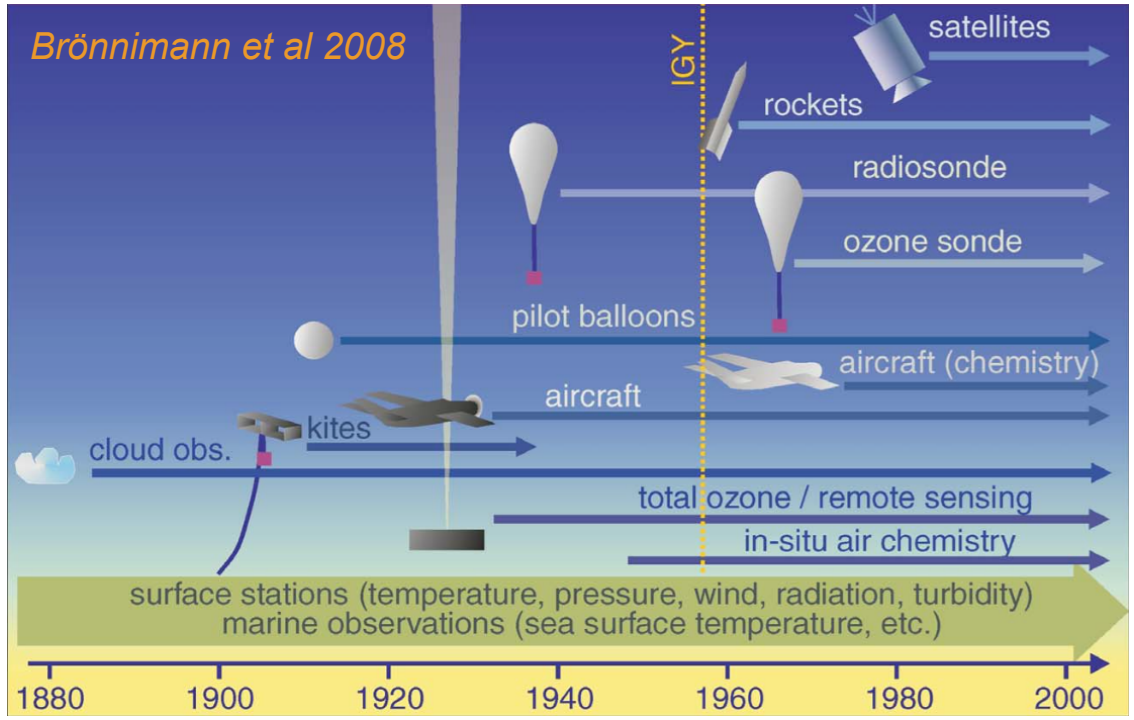
C3S Climate Data Store: *Access to information from climate observations*



The Copenhagen Diagnosis, 2009



Reanalysis combines data from different observing systems into a consistent view of the global climate

What is reanalysis and how is it used?

Reanalysis uses modern forecasting tools to re-analyse observations from the past:

- It produces a complete reconstruction of the recent climate based on observations
- It assimilates a large variety of data from in-situ and satellite instruments
- It produces long time series of gridded ECVs that are physically consistent
- It generates very large data volumes: many terabytes, soon petabytes

ECMWF's ERA-Interim reanalysis:

- Free and open data policy
- Serving > 20,000 registered users
- Cited in > 4,000 scientific papers
- Used in many sectoral applications
- Products are updated continuously

ECMWF releases global reanalysis data for 2014

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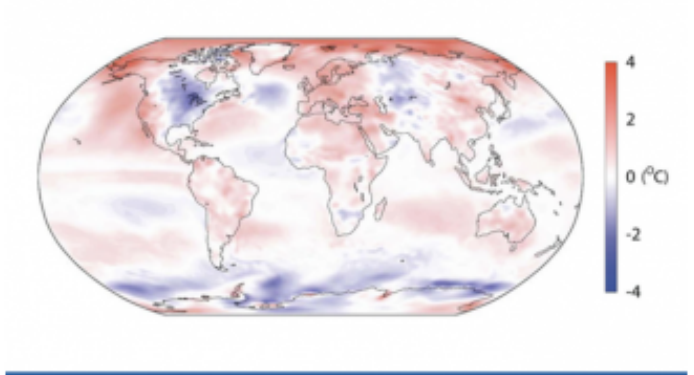
16 January 2015



2014 TEMPERATURES

ECMWF has released global reanalysis data for the year 2014 on its public data server. ECMWF's approach to reanalysis combines measurements of temperature and other meteorological variables with a global weather model to provide a complete picture of the regional patterns of climate.

Every day, ECMWF uses the latest observations from weather stations, aircraft, satellites and many other sources to produce up-to-date global estimates of surface air temperature. These estimates are needed along with other data to determine starting conditions for its weather forecasts. A few days later, the data are reanalysed using a global weather model that has been applied consistently to observations made from 1979 onwards. Combining observations with information from ECMWF's global forecast model produces a comprehensive, consistent and up-to-date record of the recent climate, unavoidably also carrying a degree of uncertainty. Results for the final two months of 2014 from this widely used "ERA-Interim" reanalysis have now been released on ECMWF's public data server.

The map below presents the estimated change in average surface air temperature for 2014 relative to the thirty-year average from 1981 to 2010. It shows that most of the globe was warmer than the 1981-2010 average, but for example Antarctica was cooler. It more specifically illustrates the following variations:

2014 globally the warmest year on record – or not?

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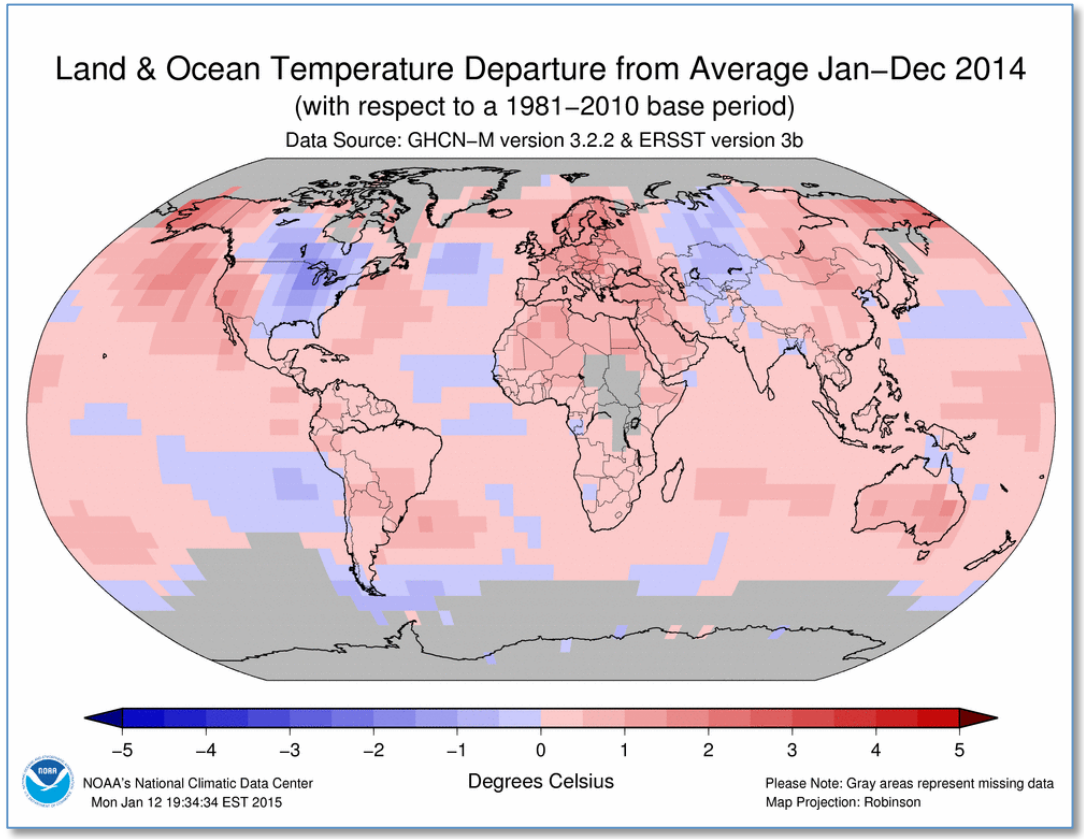
Science & Environment

2014 warmest year on record, say US researchers

By Mark Kinver
Environment reporter, BBC News

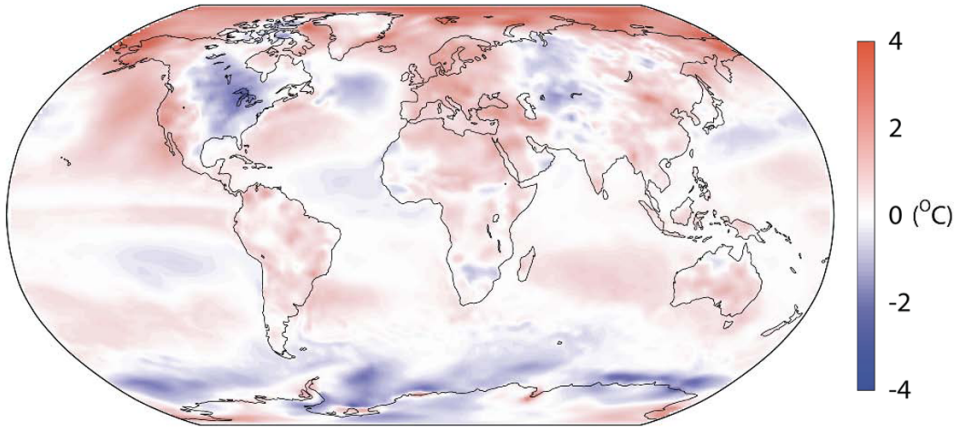
16 January 2015 | Science & Environment

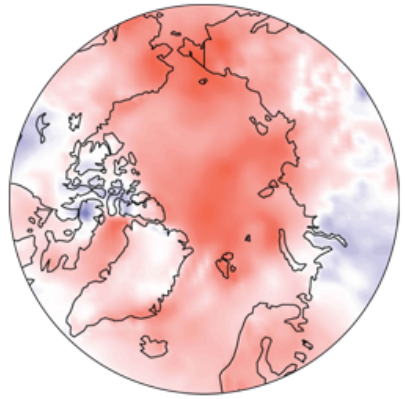
A sculpture called "We're fryin' out here" at a beach in Sydney



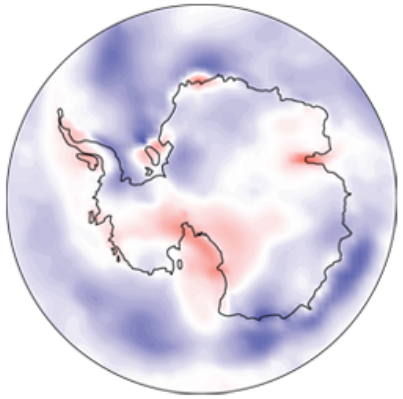
Estimates based on station data alone do not account for variability at high latitudes

Reanalysis provides a complete global picture …





Arctic pattern of temperature anomalies



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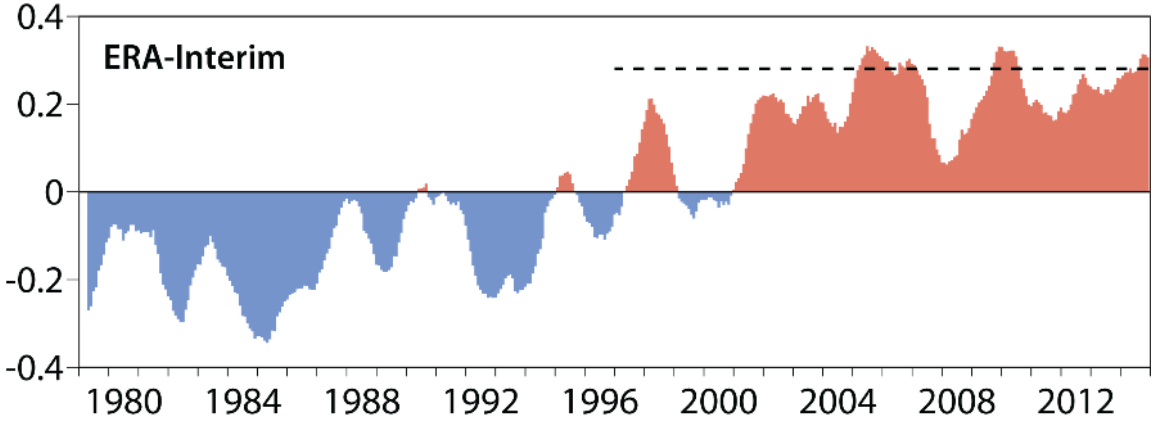

- ERA-Interim estimates for 2014 are slightly cooler than those from station data alone
- Mainly due to the Antarctic
- Consistent with independent observations of sea-ice extent

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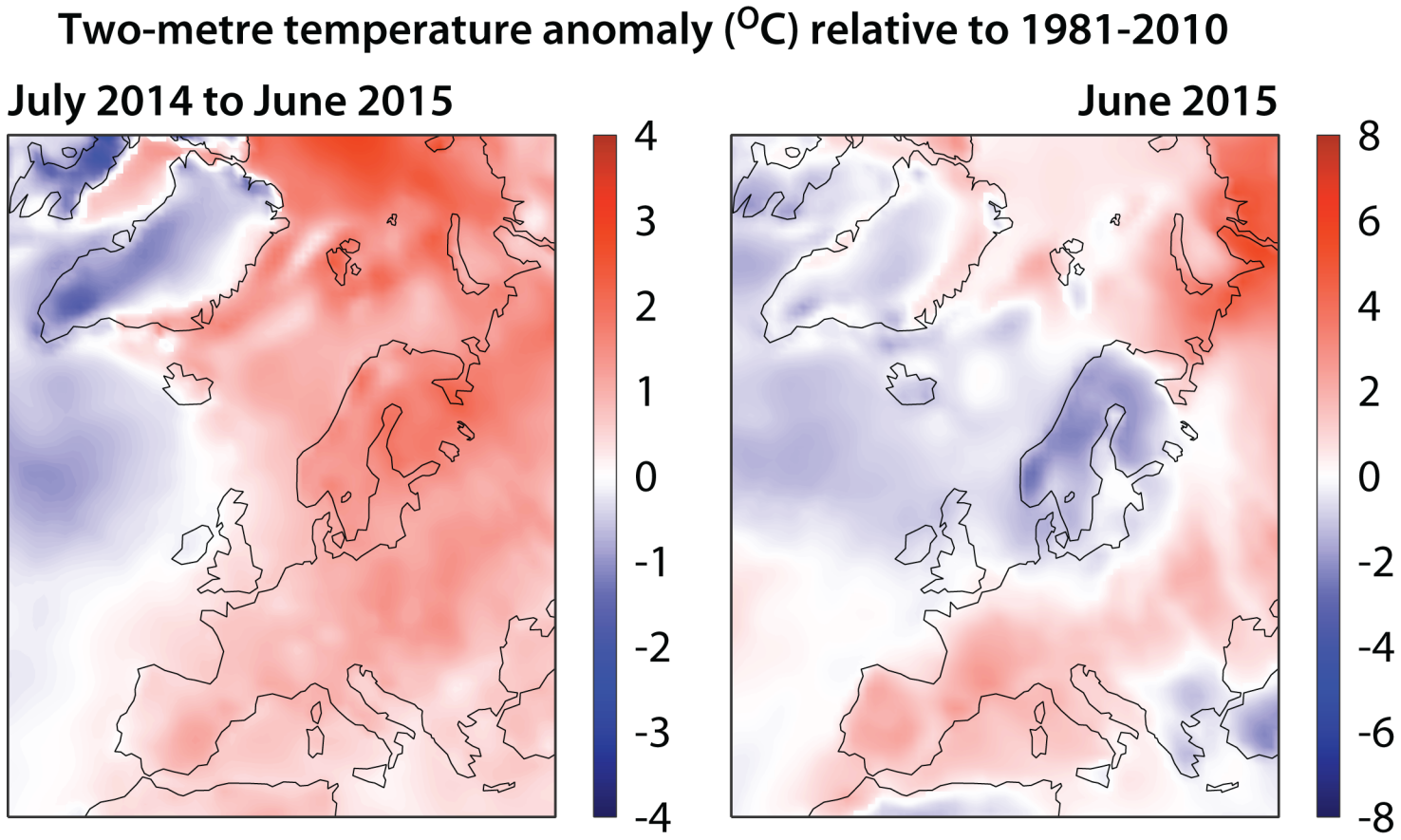
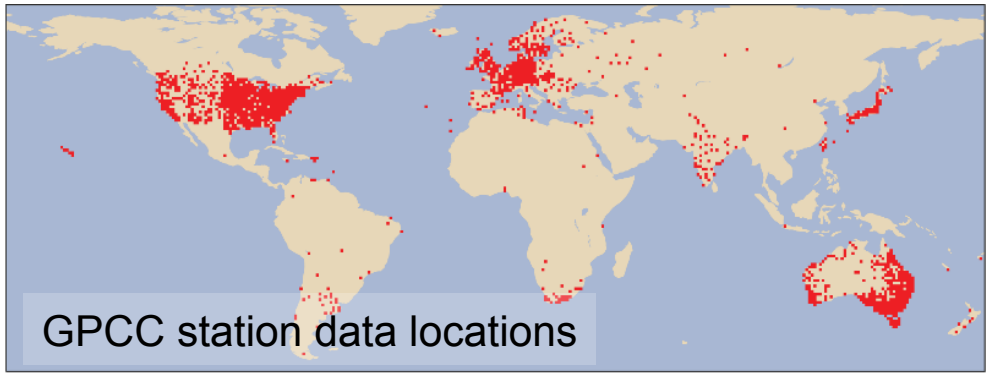
ECMWF

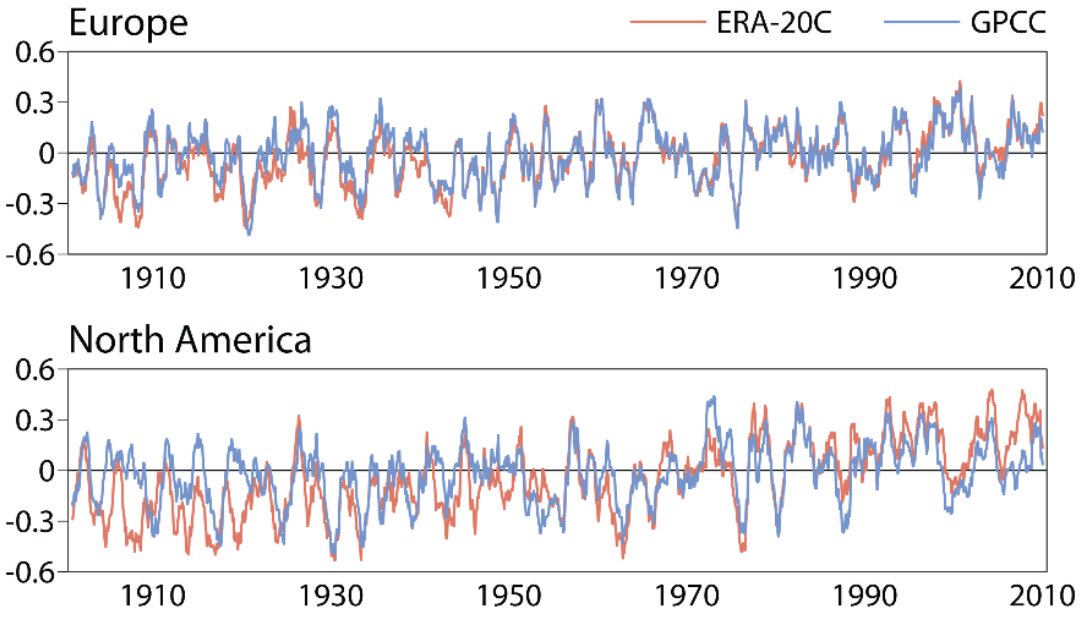
Reanalysis can be produced close to real time *(ERA-Interim, 3 July 2015)*

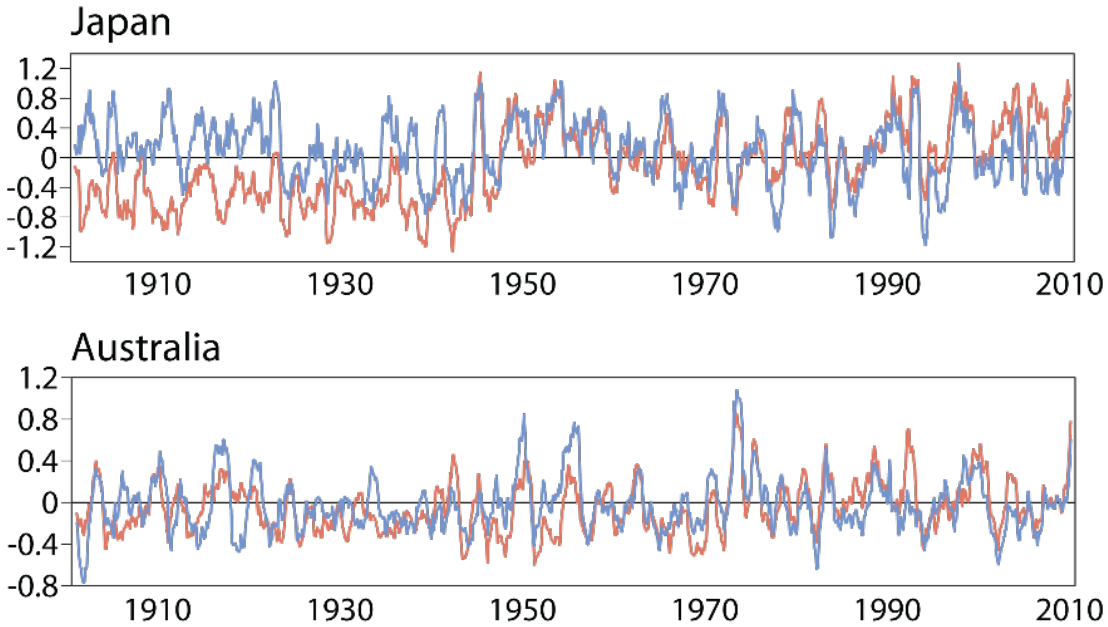


Reanalysis can estimate many climate variables over long time periods



- Changes in rainfall during the 20th century from reanalysis (ERA-20C) and from station data (GPCC)
- 12-month running means; anomalies computed relative to 1961-1990





Regional reanalyses (part of the Climate Change Service Portfolio)

Met Office

Adding detail to Global

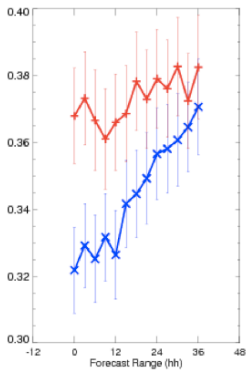
resolution

assimilation

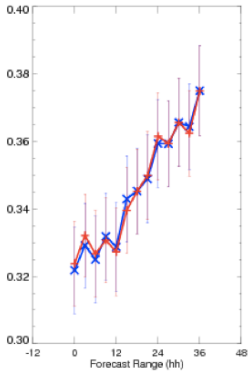
Met Office

Impact of cloud assimilation

rms error cloud fraction

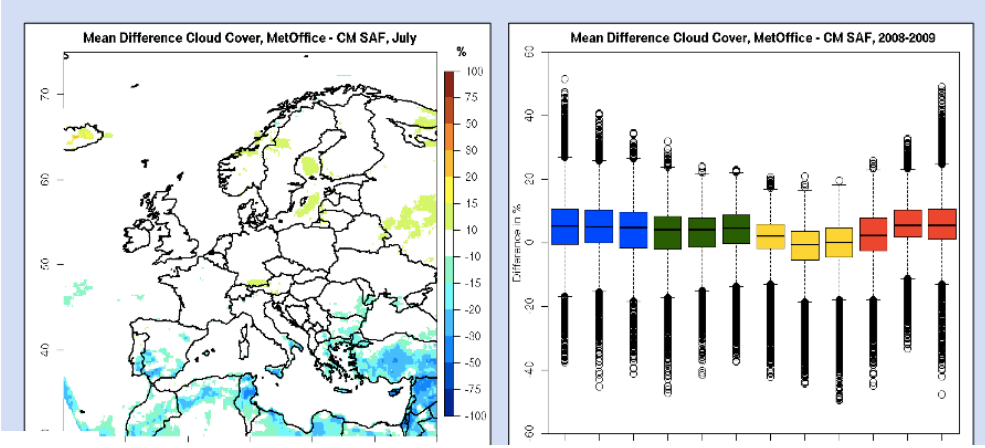


sat + surface v no cloud



sat + surface v sat

Mean differences, cloud cover, MetOffice - CM SAF (AVHRR), July 2008/9

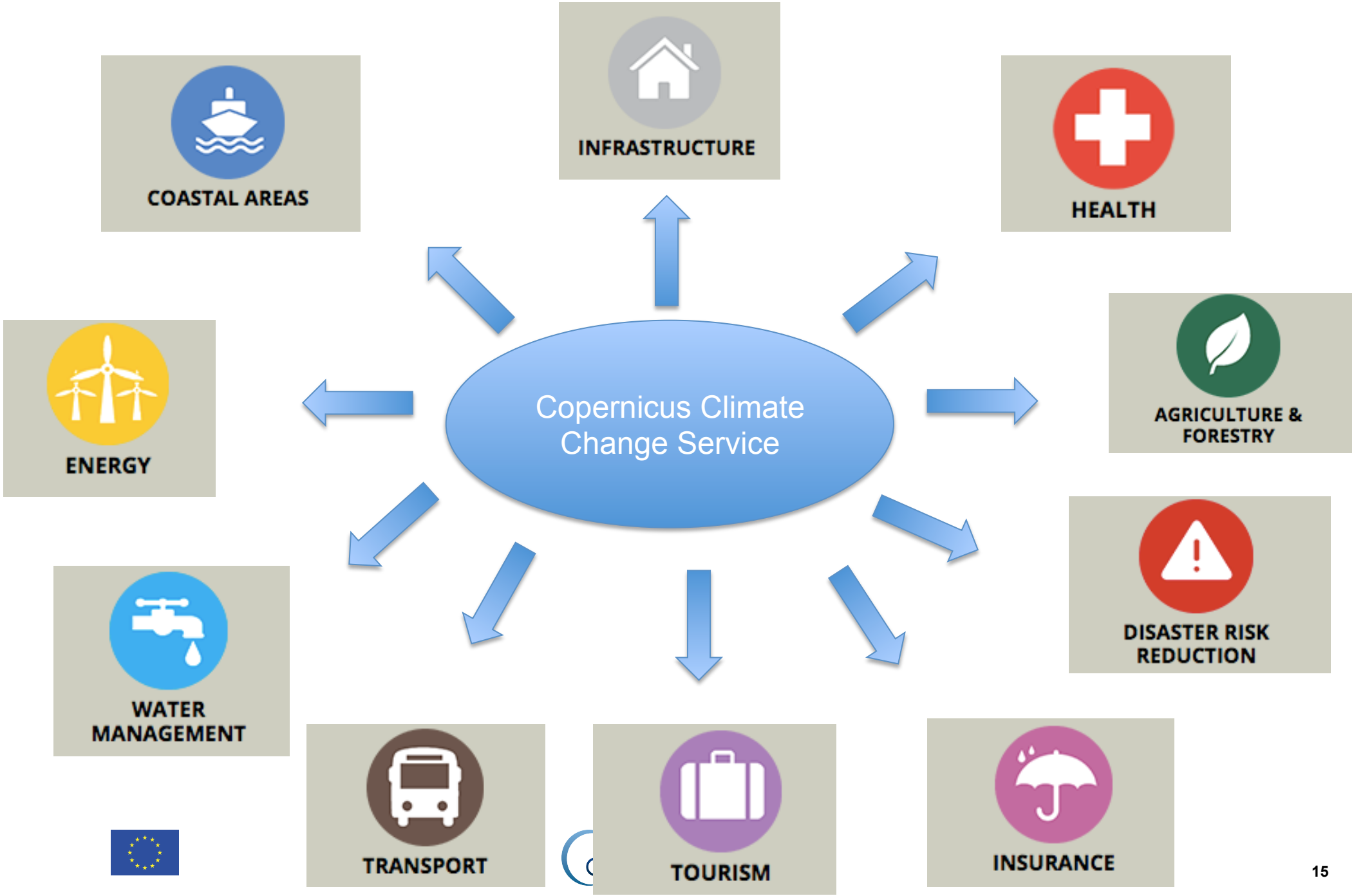


validation

Credit: R. Renshaw, MetOffice, and Euro4M project

Reanalysis and the Copernicus Climate Change Service

- Reanalysis (global or regional) combines models with observations to provide a comprehensive description of the observed climate
- Modern reanalyses can be used for climate analysis and for monitoring changes in Essential Climate Variables, but with caution – information about uncertainty and appropriate use must be provided
- Reanalyses of the atmosphere, ocean and land surface are needed for numerous applications, as well as for seasonal prediction, attribution of extreme events, evaluation of climate models
- There is great potential for further improvements in reanalyses and an equally great need for research directed at meeting this potential


Copernicus Climate Change Service
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Copernicus Climate Change Service

C3S brings a unique pan-European dimension to Climate Services

Build upon, complement and add value to the current capabilities in Europe

Provide a “one-stop-shop” access to quality assured climate information, tools and good practices

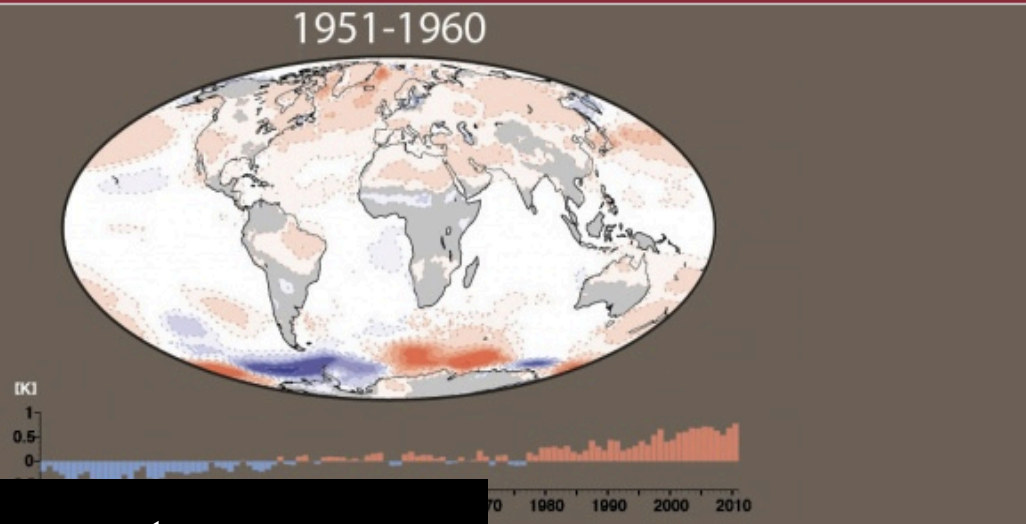
Facilitate uptake and growth of the climate service market

Cross-cutting role and exploit synergies with other Copernicus Services

Copernicus
Climate Change Service

NEWS EVENTS TENDERS RESOURCES CONTACT US

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.



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News

01 Jul 2015 ECMWF Copernicus Services at "Our Common Future under Climate Change"

30 Jun 2015 Copernicus Observations Workshop underway

19 Jun 2015 How to "professionalise" climate change communication

27 May 2015 Copernicus Observations Workshop registration still open

05 May 2015 Copernicus workshop focuses on climate projections

More News

In Focus: ECMWF Copernicus Services at "Our Common Future under Climate Change"

Paris 7-10 July 2015

The conference is the largest forum for the scientific community to come together ahead of the UNFCCC's COP21, which will take place also in Paris in December.

As the operator of the Climate Change Service and the Atmosphere Service of the EU-flagship Copernicus Programme, ECMWF will be present over the week, and specifically in the shape of two events, one focusing on **The Copernicus Climate Change Service: a European answer to Climate Change Challenges**, to take place on 9 July at the UNESCO building, and the other on **Monitoring atmospheric composition in a changing climate: a pathway to informed actions** to take place at the Ballon de Paris, also on the 9 July. *More details including how to attend here.*