Report from Day 1:
Uncertainty in the context of climate services
5xFP7/ 2xH2020 Copernicus Climate Change projects

- Following the workshop at GERICS (Hamburg), Feb 2016

- <u>Aim</u>: convergence on how to specify, assess and deal with uncertainty in a way that builds confidence for decision making processes

- Is all about communication, using not only hard skills, but also soft skills

3 observational projects

- FIDUCEO: metrology of Earth Observation (quantify and propagate each error source for satellite sensor families)

- QA4ECV: quality assurance and assessment framework for ECVs including metrological traceability (uncertainty as a quality indicator)

- GAIACLIM: metrology of comparisons with reference ground-based measurements (co-location uncertainty)

Why metrology?

*To maximize the value of data from EO space assets for climate science and policy*

- Trustworthiness and transparency
  - Uncertainty information needs to be believed
- Scientific integrity
  - Not fooling ourselves
  - Consistent uncertainty information across scales
- Better data
  - Can reduce (not only quantify) uncertainty through insight gained
  - Use of disciplinary analysis tools, harmonisation

University of Reading

FIduceo

Need to extend metrology concepts

- 3 projects adopt metrological conventions and practices for the expression of uncertainty in measurements and for validation purposes

- FIDUCEO: in moving from lab to EO imagery, some concepts need to be extended

- Q: more to be extended when moving to reanalysis and to climate change projections? …and even more moving further to applications in other sectors?

2 reanalysis projects: ERA-CLIM and UERRA

- Underestimating uncertainty (in particular in model space)
- Ensemble of realizations > concept also applied to observations to communicate uncertainty
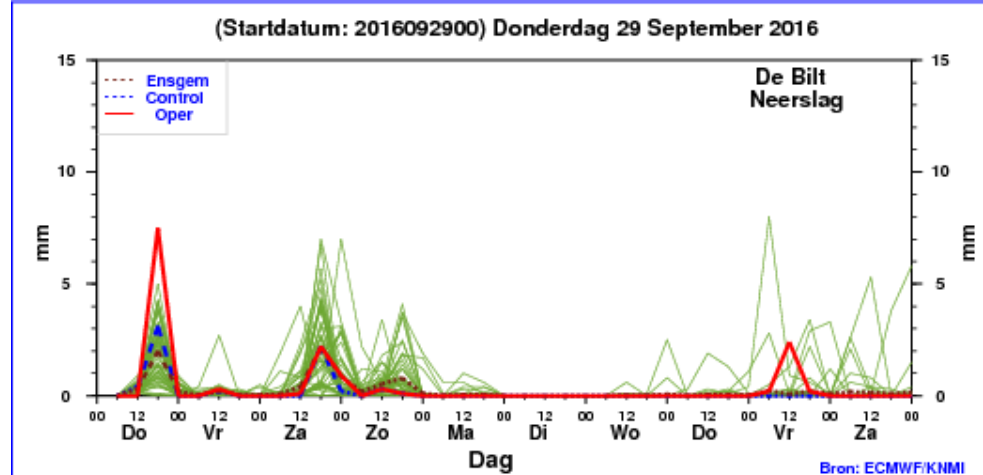
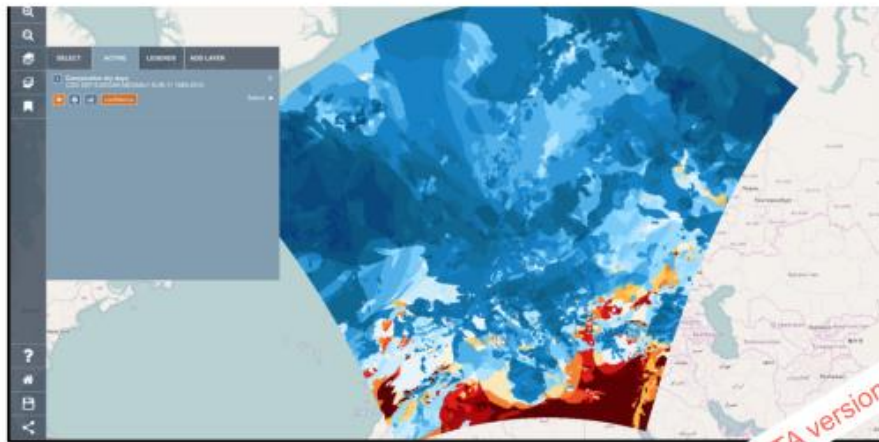- Learn from weather forecasts (NWP)
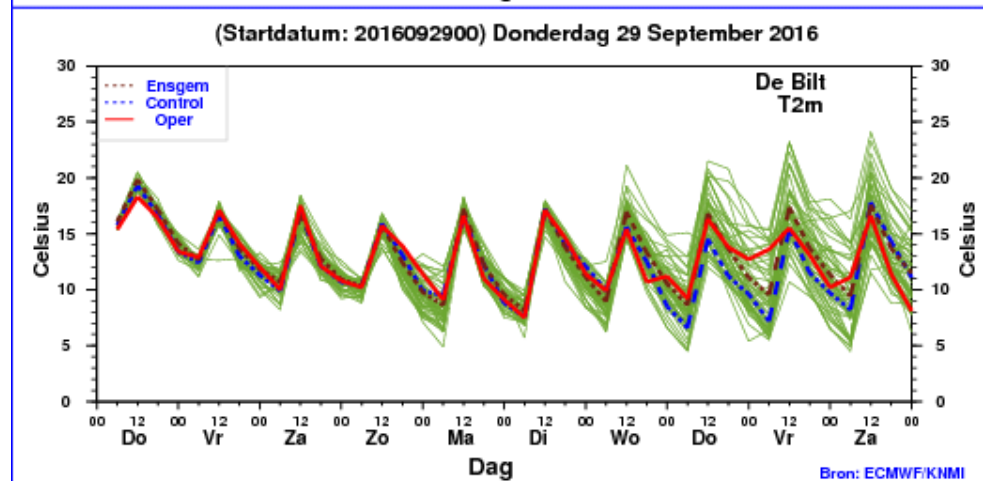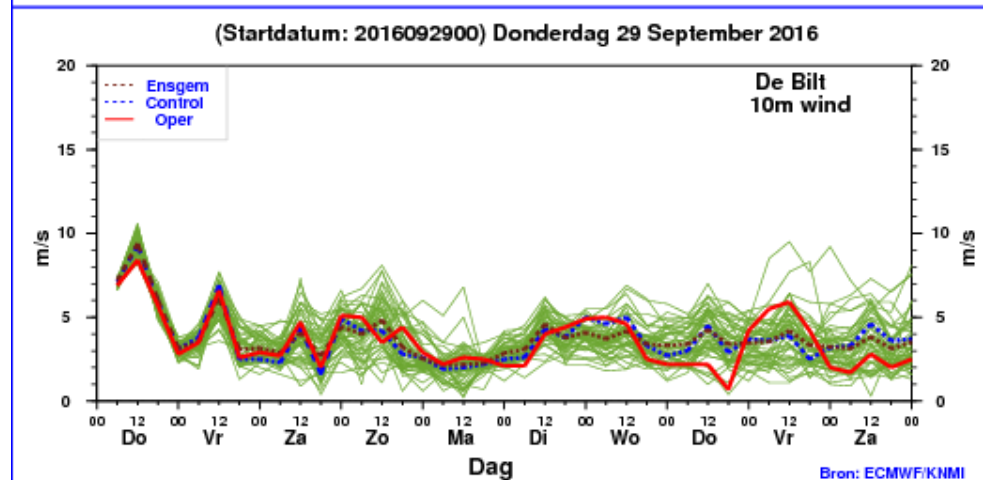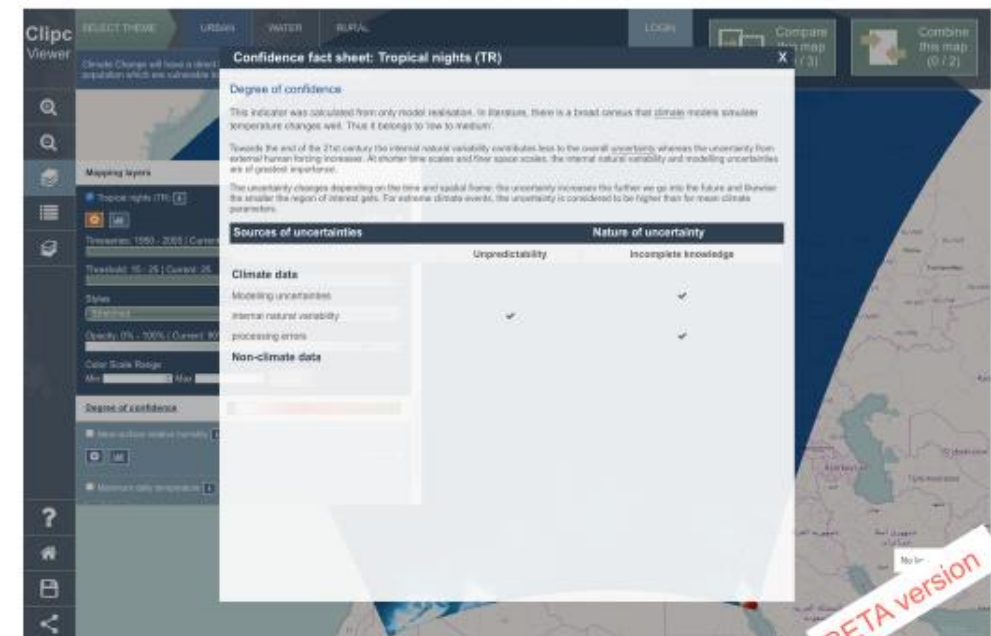
2 climate change projects: CLIPC and EUCLEIA

- climate data dissemination to users, including meta-data and metrics relating to quality / uncertainty
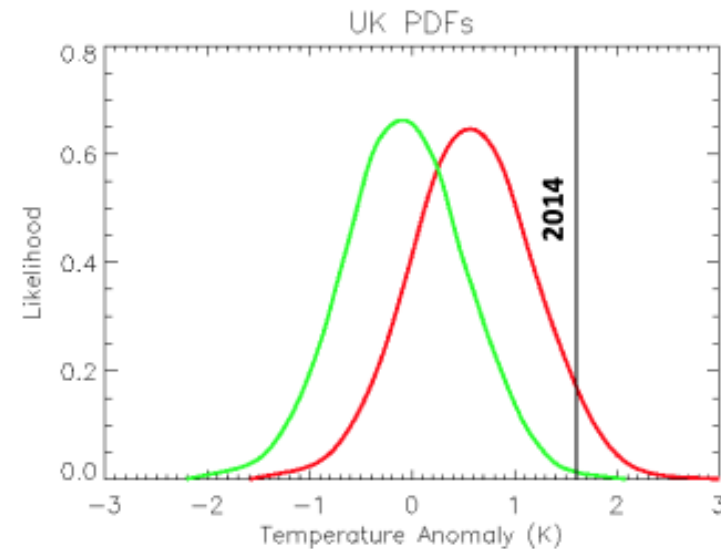
Climate change context

- FAR: fraction of attributable risk

Eucleiα
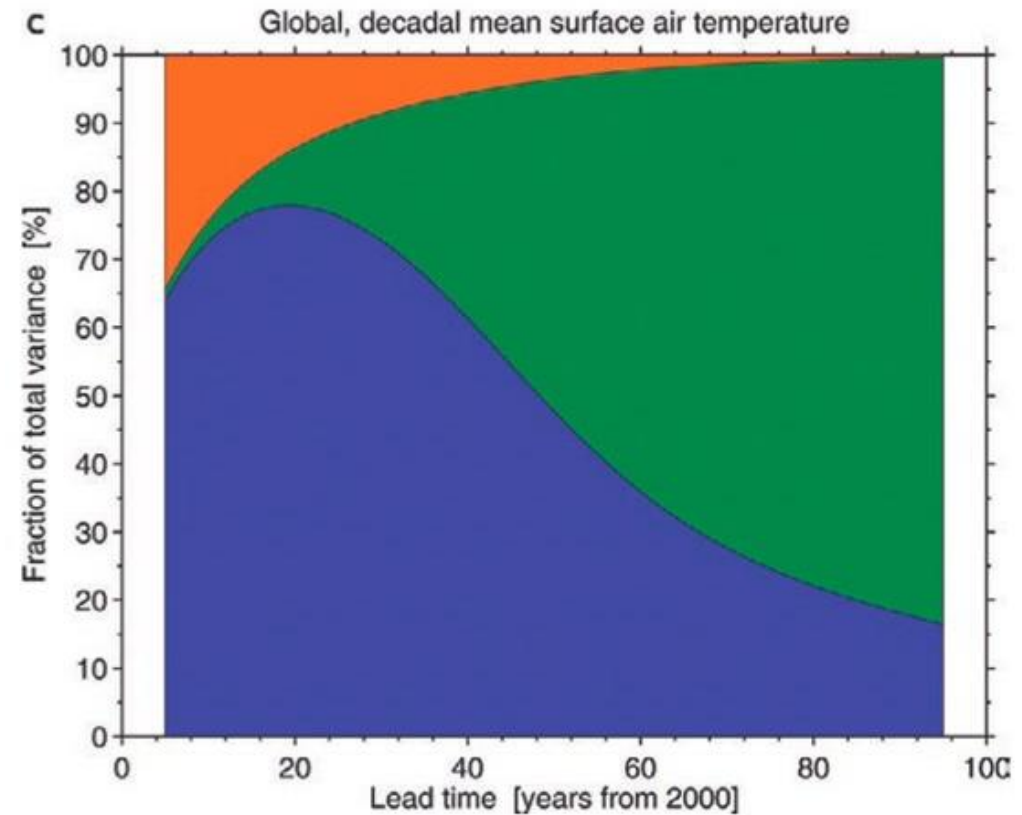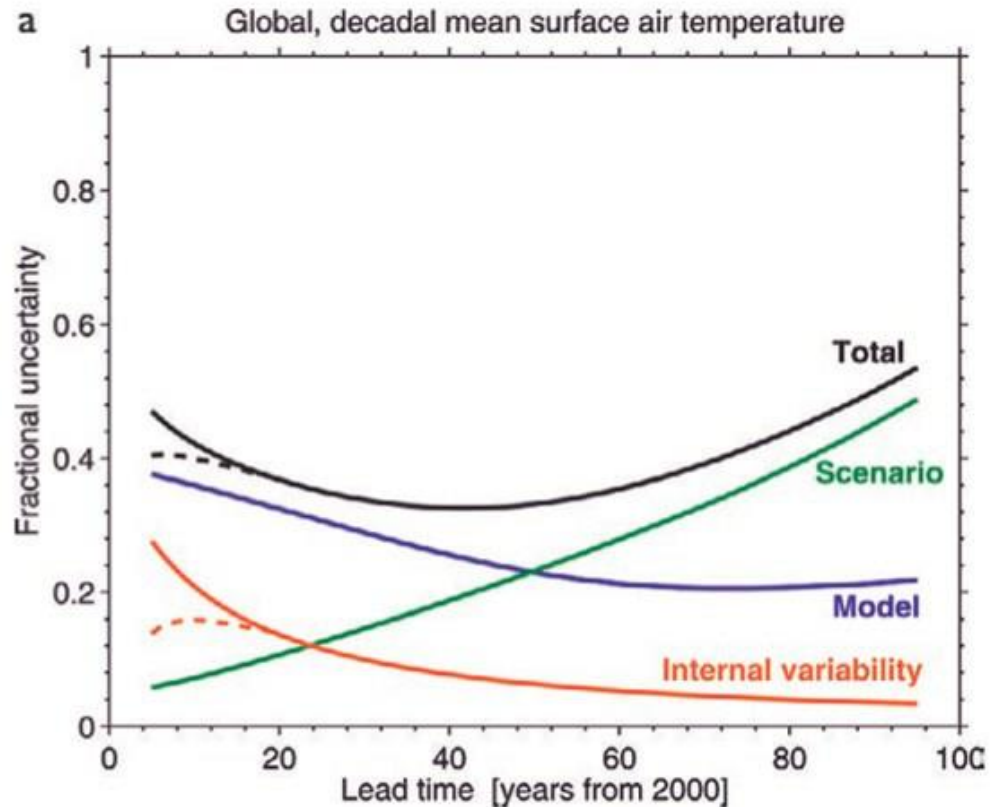

UK temperatures of 2014

UK PDFs

Human influence has also made breaking the current UK temperature record about ten times more likely (FAR = 0.9)

Climate change context

- Hawkins and Sutton, BAMS, 2009

Going beyond hard skills

- More to it than agreed common terminology (VIM/GUM), harmonized calculation and quality assurance procedure, interoperable tools, automated validation server, etc.

- Interaction with users is key, about paradigms, perception of uncertainties and risks, user feedback, governance, trust in data (authoritative source), etc.

The 'chain' of providers and users
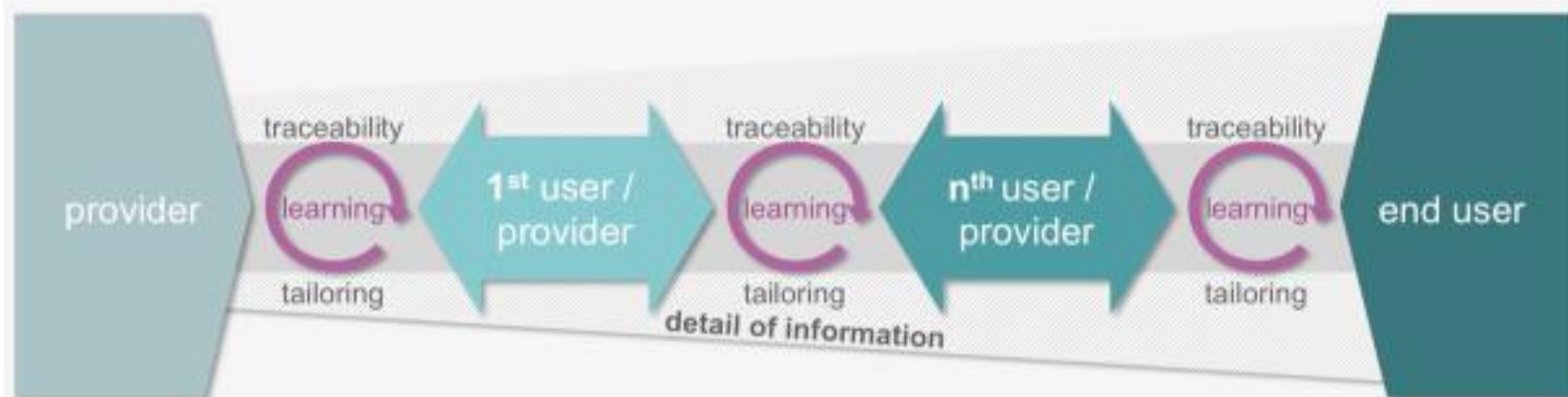
| MEASUREMENTS / SIMULATIONS	CLIMATE DATA PROCESSING	CLIMATE INFORMATION	PRODUCTS
• satellite, airborne and ground-based observations • climate simulations • data assimilation (re-analyses)	• climate data records (observational and re-analyses) • ensemble simulations/ post-processing/ analyses • impact modeling	• confidence analysis • extracting decision relevant knowledge • co-development of prototypes	• application of user-tailored products by decision makers, public, media

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

Otto & CiCS author team, BAMS in print

IPC
Climate Information Portal

GERICS
Climate Service Center Germany

Link to C3S-EQC

- "monitors quality of C3S products and services which ensures C3S delivers state-of-the-art climate information to users"
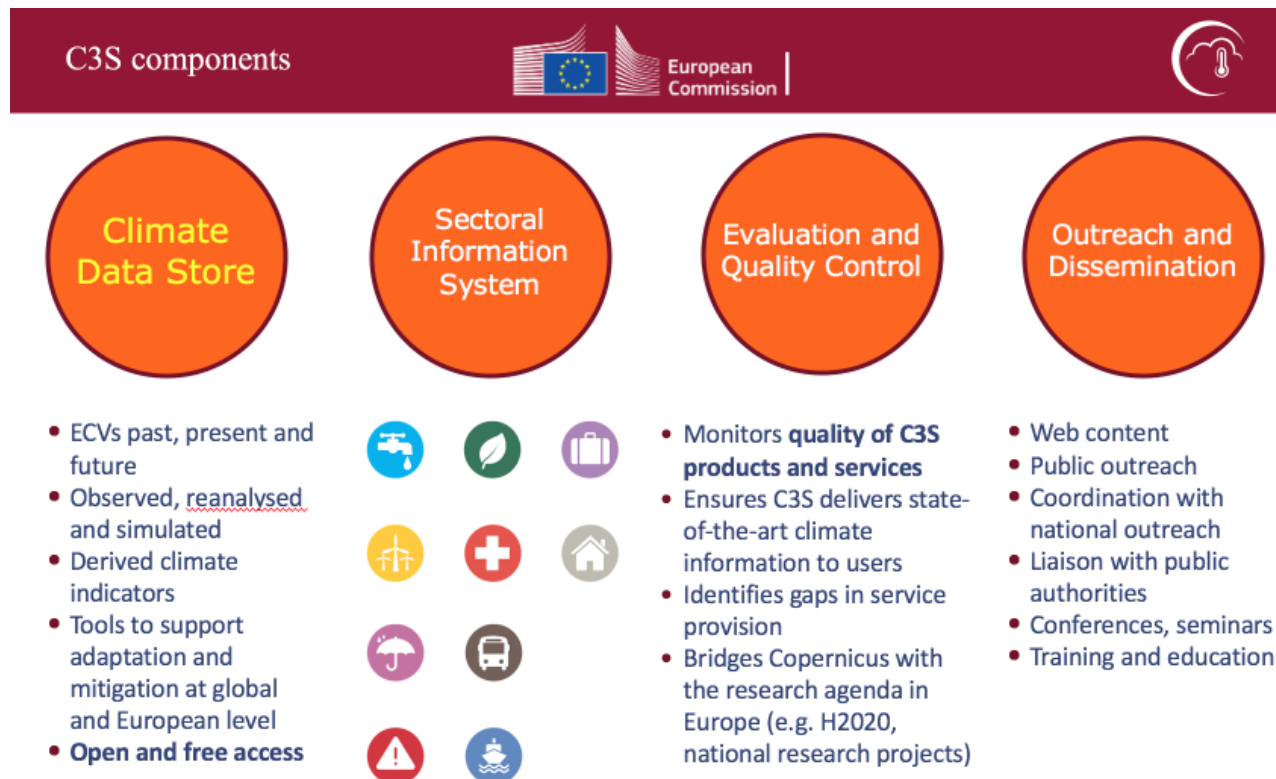
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- Agreed to produce a workshop report building on the BAMS paper by Otto et al. (in press) which describes a general framework

- Presentations and relevant links made available on the web