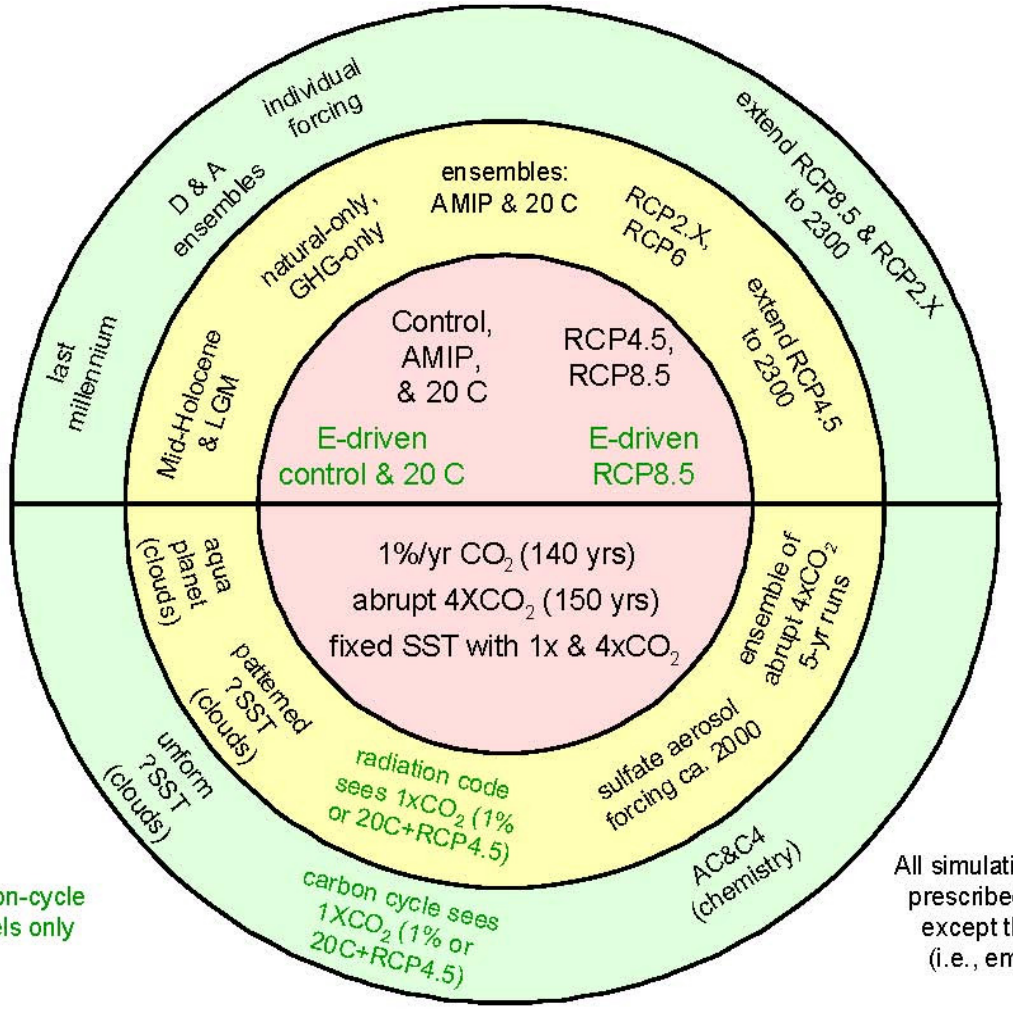
New challenges for climate research

- Higher resolution (horiz, vertical, time)
- Regional climate prediction (e.g. UKCP)
- More physical processes
- Seasonal to decadal prediction
- Use of reanalyses for climate
- Seamless prediction - weather prediction to climate change using same model
- **Metrics developed to evaluate models**
- The way we use observational data is evolving

Proposed CMIP5 model runs



Coupled carbon-cycle climate models only

Satellite data will be used in the evaluation of these results

IPCC AR-5

All simulations are forced by prescribed concentrations except those "E-driven" (i.e., emission-driven).

New challenges for climate research

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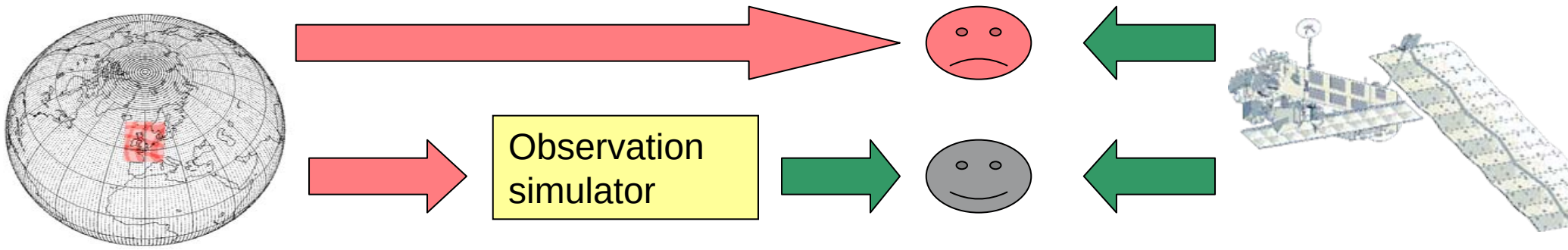
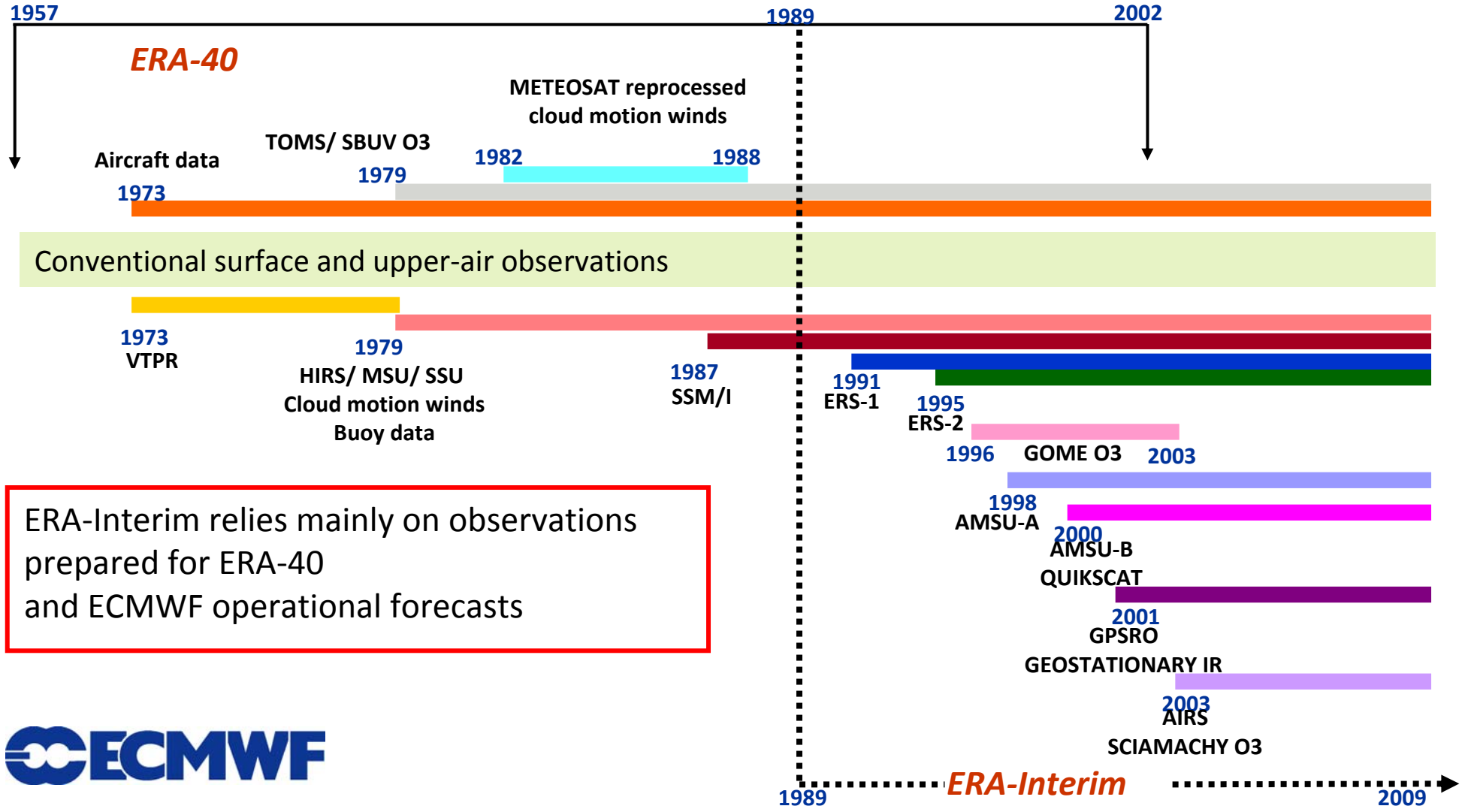
- Seamless prediction - weather prediction to climate change using same model
- Metrics developed to evaluate models – CCI datasets can help here
- **The way we use observational data is evolving**

Use of observations evolving..



- **Forward modelling of measured quantities (radiances, skin SST, radar reflectivities) rather than high-level products (profile retrievals, bulk SST, cloud properties)**
- **Ensures more direct comparison of equivalent model variable with observations**
- **This was the key for use of satellite cloud data**
- **This message is not clearly recognised yet by all the Earth Observation community**

Observing systems used in Reanalyses



ERA-Interim relies mainly on observations prepared for ERA-40 and ECMWF operational forecasts

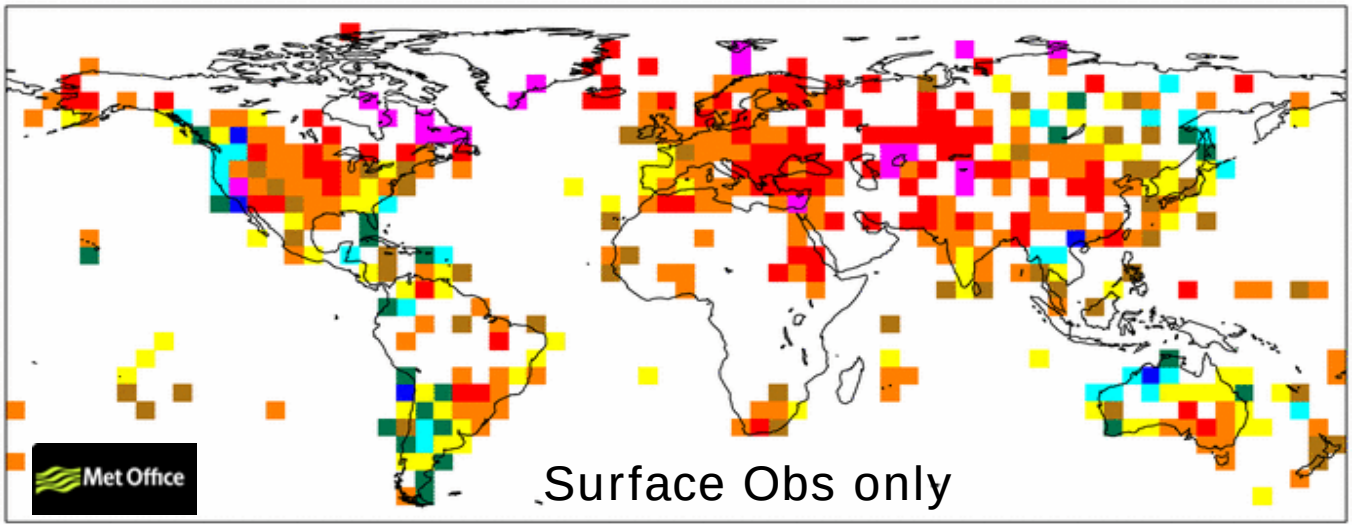
ECMWF

Change in near-surface temperature over recent decades

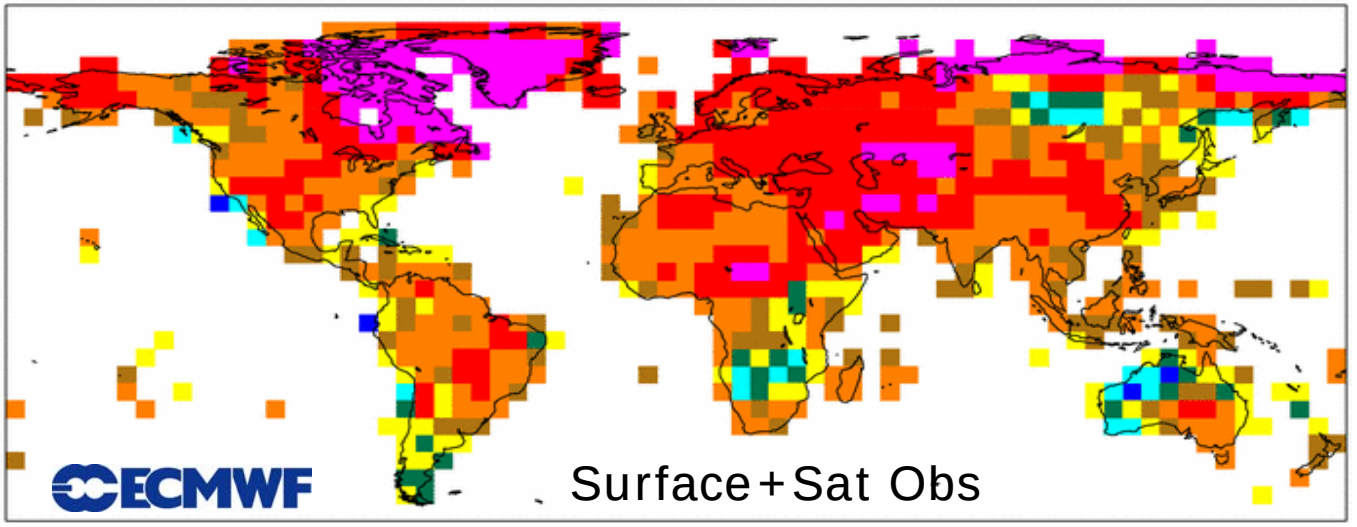
Increase in mean near-surface temperature (K) from (1989-1998) to (2000-2009)

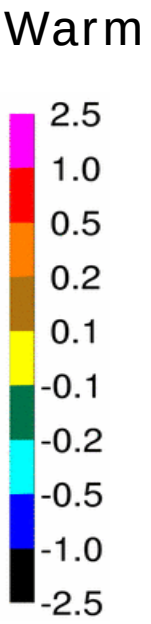
Gridded directly from monthly station anomalies

CRUTEM3 (Brohan *et al.*, 2006) at all points with <7 months missing per decade

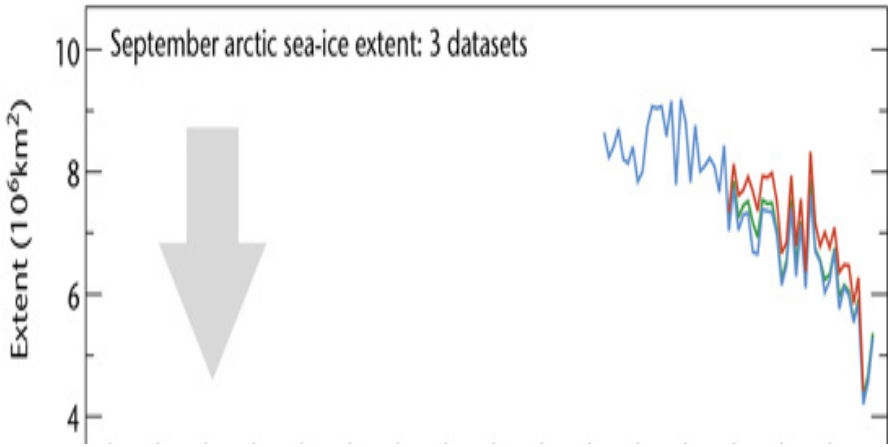


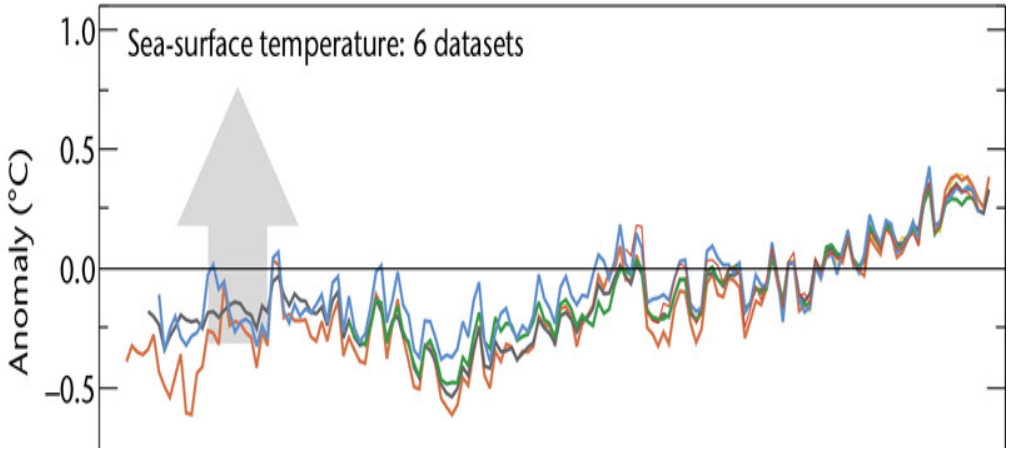
From ERA-Interim reanalysis which uses all data incl satellites



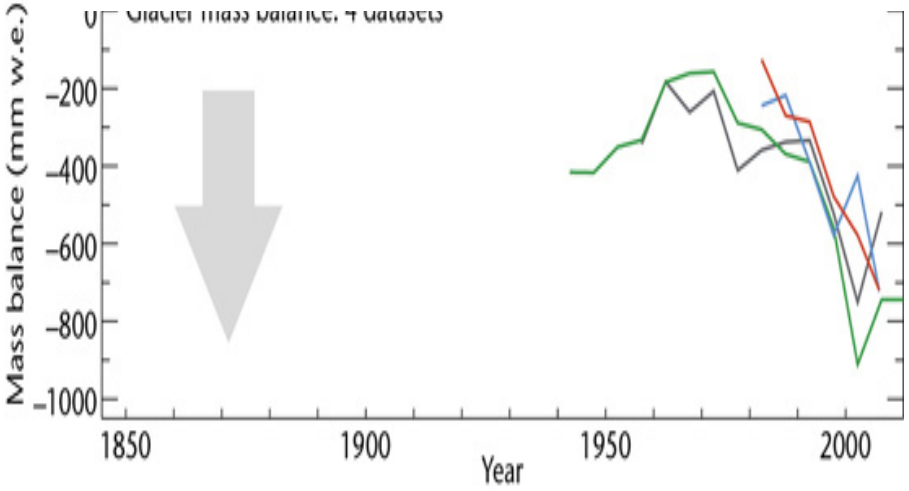


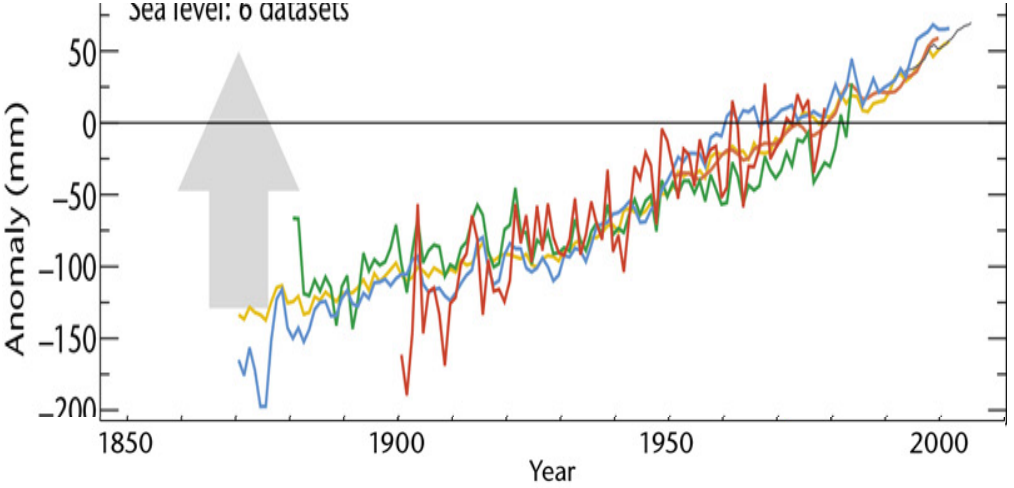
Climate monitoring and attribution



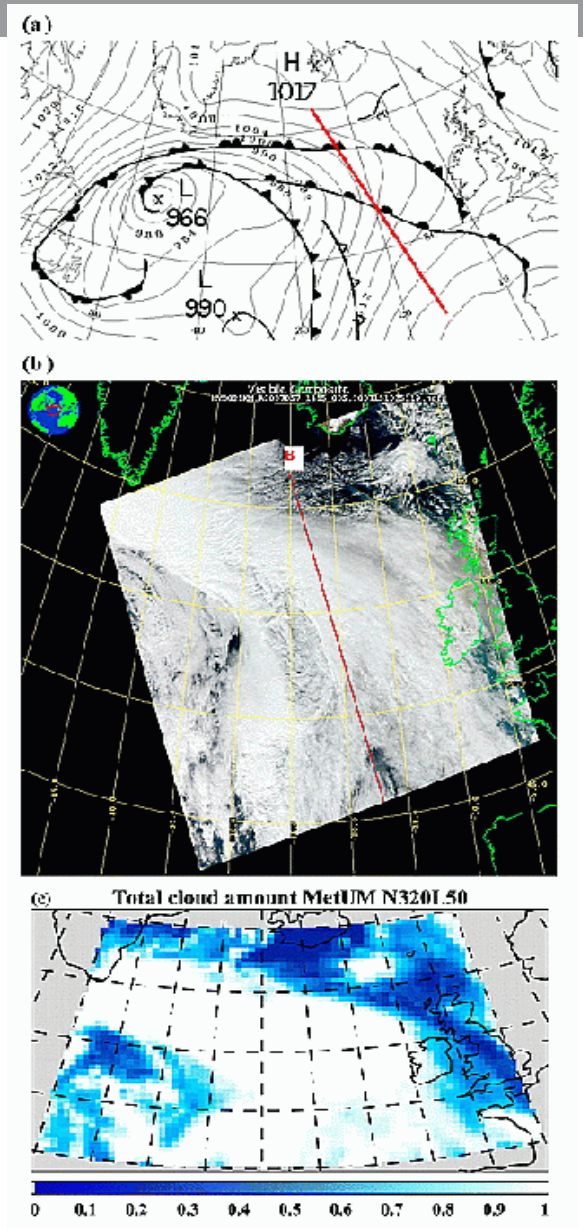


Different groups can produce defensible, but statistically inconsistent estimates of trends. Need for better error characterisation



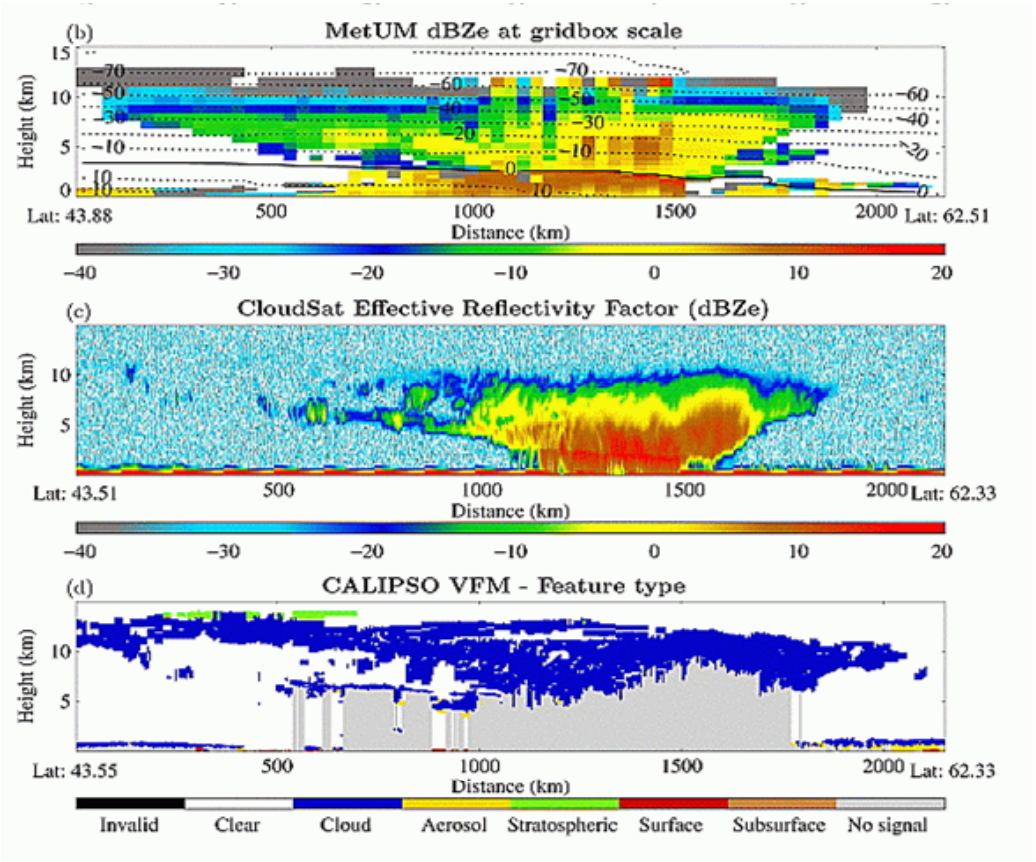


Evaluation of the Met Office global climate model using CloudSat



MODIS

Model cloud amount

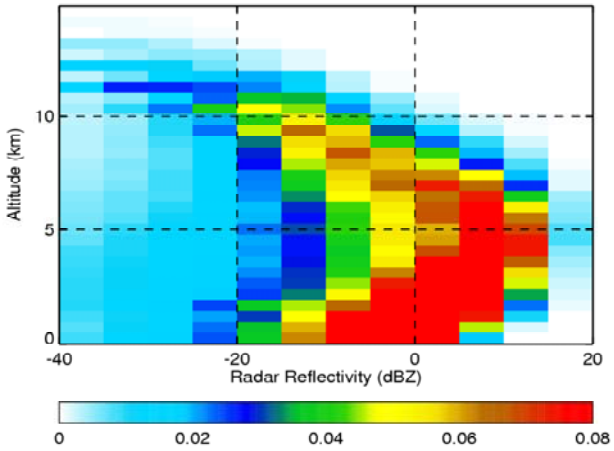


South North

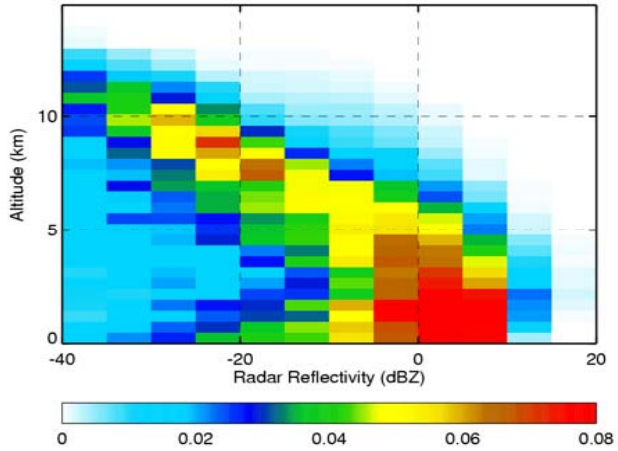
Bodas-Salcedo et al. (2008)

Multi-model analysis using satellite simulators

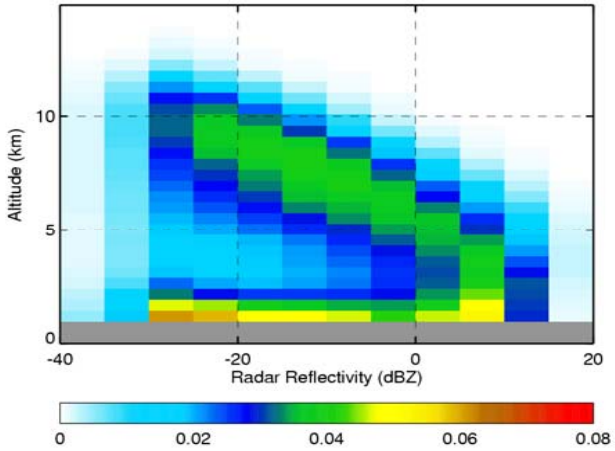
HadGEM1 (MO)



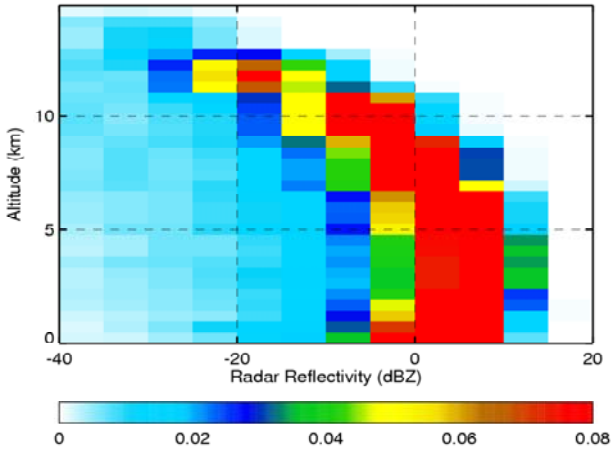
MMF 4km (CSU)



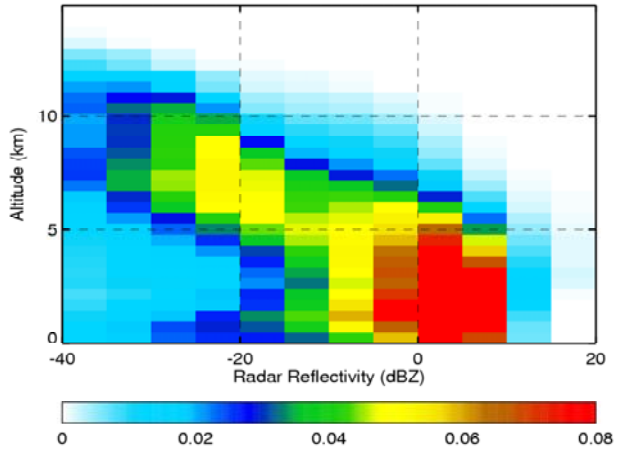
CloudSat



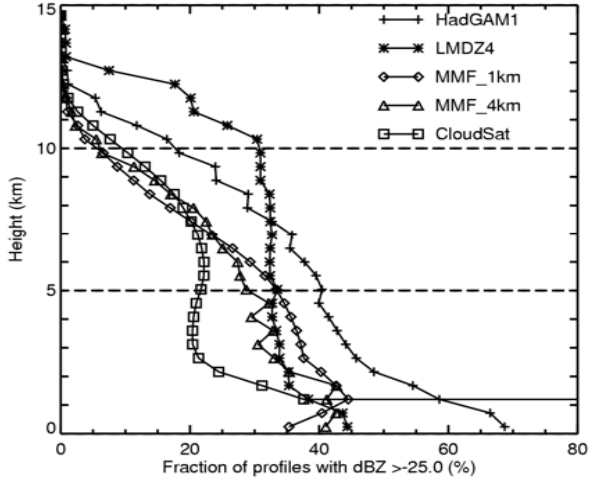
LMDZ (CNRS)



MMF 1km (CSU)



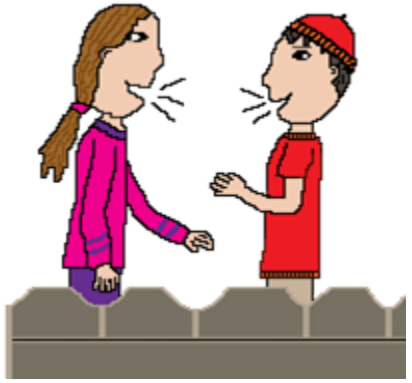
dBZ>-25



(Bodas-Salcedo et al., submitted to BAMS)

Speaking the same language

- **Modellers and observationalists need to understand each other**
- **The definition of variables has in the past been top-down**
- **New communities are more bottom up via internet fora**
- **We need to bridge the language gap between EO data providers and climate modellers**
- **CMOR NetCDF is an example from the climate world which the satellite world should adopt**
- **CMUG has been set up to enable this communication**



Satellite world

Climate world

CMUG Consortium

Met Office Hadley Centre
HadGEM, FOAM, HadISST


Roger Saunders


Mark Ringer


Paul Van Der Linden

ECMWF
IFS, ERA, MACC


Dick Dee


David Tan

MPI-Meteorology
ECHAM, JSBACH


Alex Loew


Silvia Kloster


Stefan Kinne

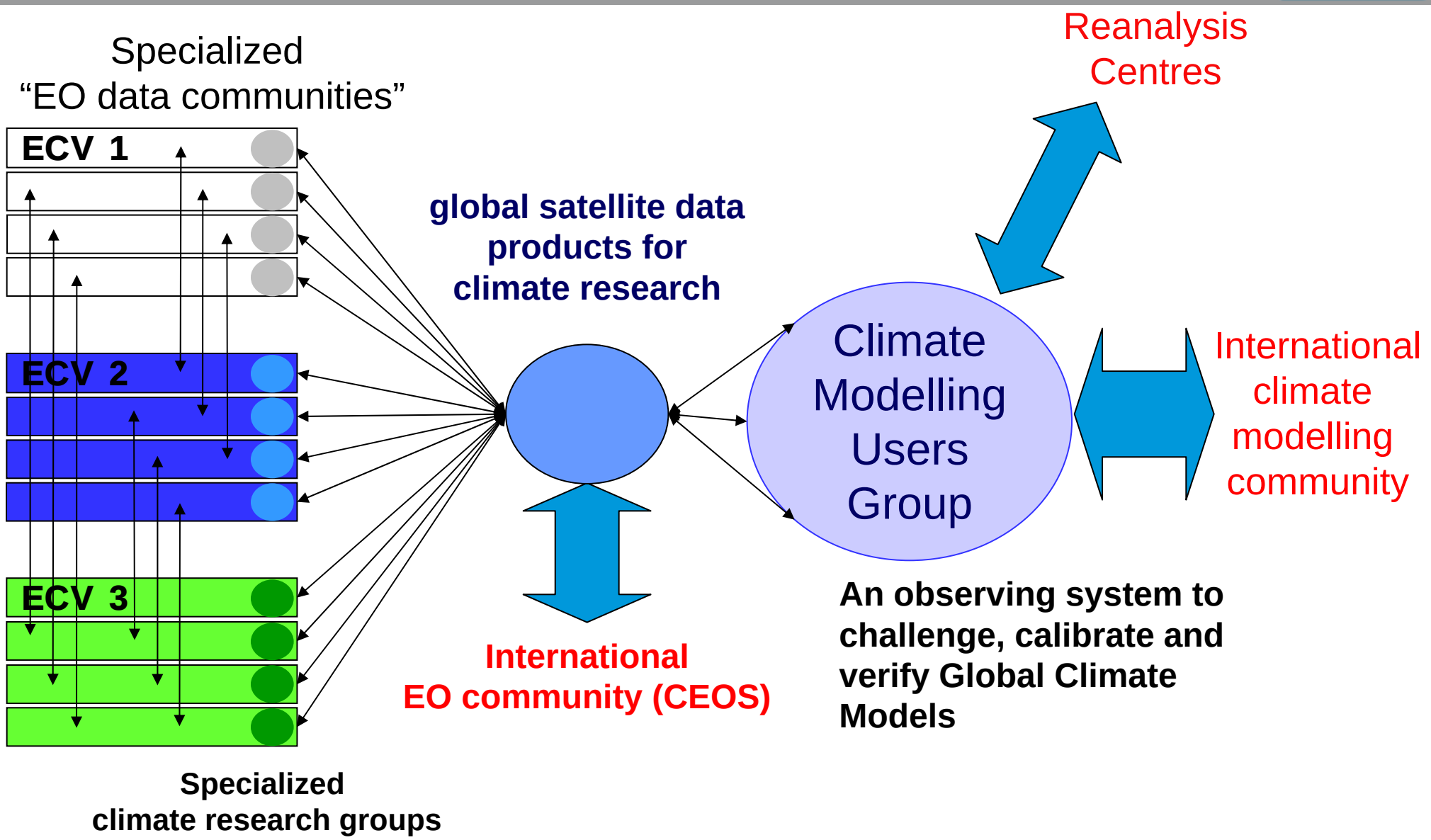
MétéoFrance
Arpege, MOCAGE, CNRM-CM, Mercator


Serge Planton


Thierry Phulpin


Iryna Khlystova

The role of CMUG

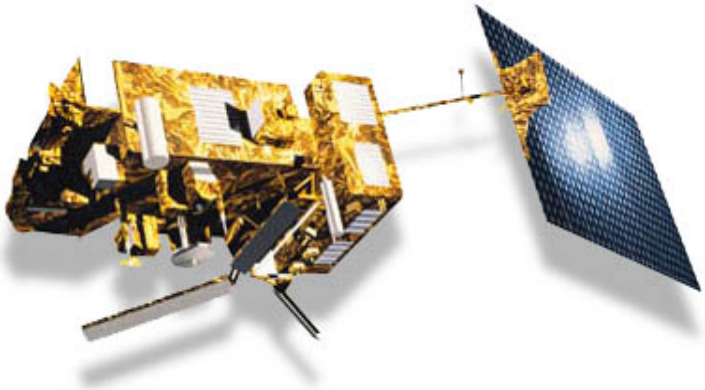


Lessons learnt from past

- **Recognise move of modellers to using fundamental measurements not products *This is especially true for reanalyses***
- **It took more than 15 years to get several satellite datasets used for climate model evaluation**
- **Observation simulators are important for some satellite products to compare apples with apples (e.g. clouds ..) We need to extend this concept more widely.**
- **Essential to include error characteristics**
- **Easy access to data and simple format to read**

Summary

- There is a wealth of satellite data to be exploited for climate research
- Considerable efforts are required to ensure satellite data are of climate quality which is the raison d'etre of the CCI
- The CMUG was setup to support the ESA CCI to bridge the gap between the EO and the climate research communities
- We are seeking input from the climate modelling and reanalysis communities.
- It is crucial the products produced are 'fit for purpose' otherwise this will be a lost opportunity (and wasted money).



We don’t want to leave our climate research scientists like this!

Any questions?

Please visit

www.cci-cmug.org

cmug@metoffice.gov.uk