

# **Evaluation and Quality Control in the Provision of Climate Services**

**General remarks and some activities of  
international programmes related to climate datasets**

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## Evaluation and QC are needed throughout the production chain

### From the incoming observational data

- to determine when data should not be used because of gross error
- to determine which data the production system is capable of processing reliably
- to determine and correct the biases in many types of data

### Through the various steps of the production system

- not only data analysis and modelling tasks, but also archiving, data delivery, ...

### To the presentation of outgoing information

- two news releases issued on 21 January 2014 from .gov websites:

*“The globally averaged temperature for 2013 tied as the fourth warmest year since record keeping began in 1880, according to NOAA scientists”*

*“NASA scientists say 2013 tied with 2009 and 2006 for the seventh warmest year since 1880”*

## **Evaluation and QC are needed across the range of products and services**

- observational data and metadata
- data products from analysis of single variables
- data products from comprehensive reanalysis
- monitoring, interpretation and attribution
- predictions and projections

## **Products of one type are commonly used in the generation or evaluation of other types of product**

- including the evaluation of components such as the models used to make projections
- providing itself some evaluation of the product being used

## **Reanalysis is central in this**

- using observational data and metadata, and data products for variables that have to be specified in its production system
- providing outputs that support the range of product and service lines

## **Evaluation and QC are fundamental in the formation of data products**

### **Analysis of data generally uses some form of background information**

- the station climatology in CRUTEM4 or a short-range model forecast in ERA-Interim
- needs prior estimation of error statistics of the background and the observations
- may use dynamical estimates of uncertainty

### **Produces feedback on data rejections, fits to used data, and inferred biases**

- and information on the value of and continuing needs for data rescue and rehabilitation

### **Has been difficult to access and use from past reanalyses**

- hence development in ERA-CLIM of a facilitating Observation Feedback Archive
- a tool to support both internal and external product evaluation and intercomparison
- a tool to support the conscientious user
- good exploitation requires accessible documentation of working of assimilation system

## **Evaluation and QC of the resulting data products remains the key need**

- the proof of the pudding is in the eating

## **Need is for both self-evaluation and more-independent forms of evaluation**

- by individual providers of a product or service line
- by a separate activity of the service as a whole
- by outside bodies such as the World Climate Research Programme (WCRP)
- by users

## **Need is for comparison with products from other sources**

## **Need is for thoroughness**

- expressing low confidence because a set of alternative products differ is insufficient
- need is to establish which (if any) of the alternatives is fit for purpose
- answer may vary in space and time, and from variable to variable

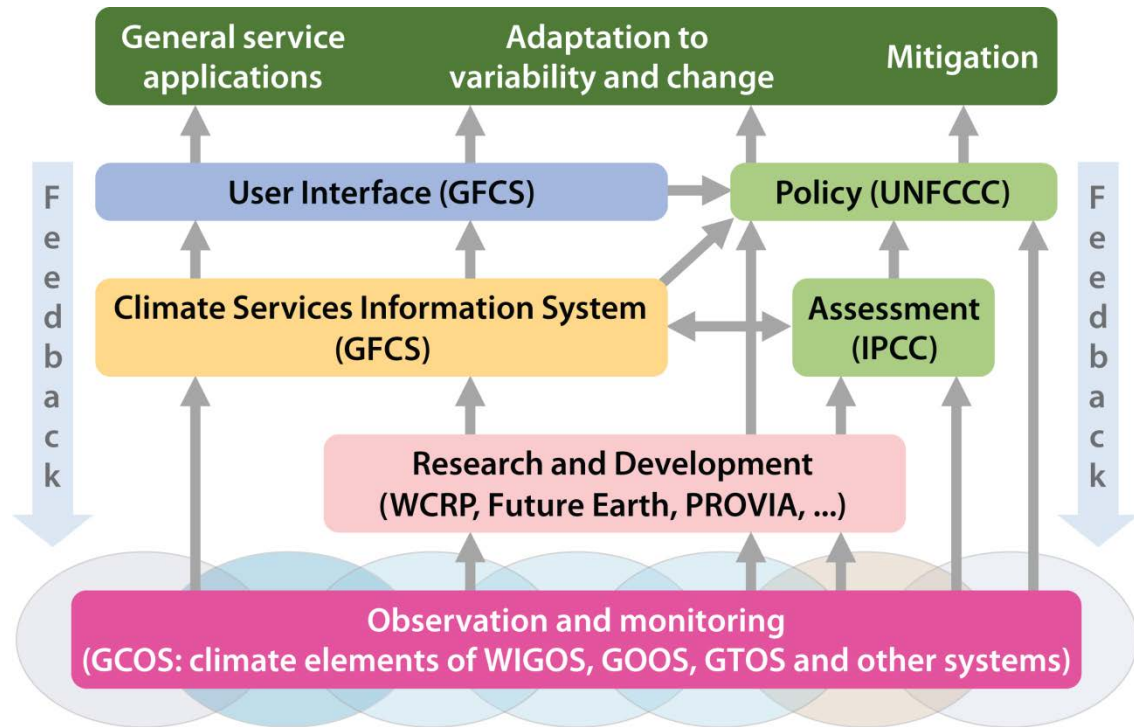
## The programme for the Global Climate Observing System (GCOS)

- assesses and communicates requirements for climate observation and data products
- identifies in particular the Essential Climate Variables (ECVs) on which data are needed
- advises on and promotes implementation, and reviews progress
- reports to its sponsors and the UNFCCC

## The programme supports

- assessment
- policy
- research
- services

**and has developed specific requirements for products from space-based data**



## The GCOS/WCRP Atmospheric Observation Panel for Climate in 2007:

- discussed generally the desirability of identifying datasets as meeting requirements
- considered a request from its surface pressure working group for formal recognition of the group's database as a GCOS repository

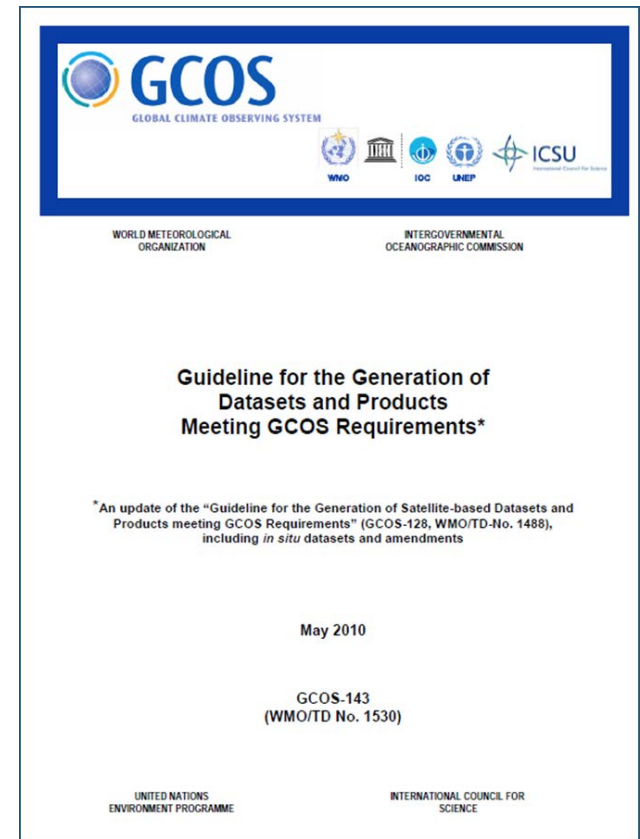
## The GCOS Steering Committee

- decided GCOS could not formally recognize datasets
- requested instead production of guidance

## First version of guideline was published in 2009

- “for satellite-based datasets and products”
- and subsequently reviewed and extended to cover *in situ* data

## Revised guideline was published in 2010



# The guideline: Items to which producers of data records and products should pay particular attention

## FCDR: Fundamental Climate Data Record

## ECV: Essential Climate Variable

1. Full description of all steps taken in the generation of FCDRs and ECV products, including algorithms used, specific FCDRs used, and characteristics and outcomes of validation activities
2. Application of appropriate calibration/validation activities
3. Statement of expected accuracy <sup>6</sup> , stability and resolution (time, space) of the product, including, where possible, a comparison with the GCOS requirements
4. Assessment of long-term stability and homogeneity of the product
5. Information on the scientific review process related to FCDR/product construction (including algorithm selection), FCDR/product quality and applications <sup>7</sup>
6. Global coverage of FCDRs and products where possible
7. Version management of FCDRs and products, particularly in connection with improved algorithms and reprocessing
8. Arrangements for access to the FCDRs, products and all documentation
9. Timeliness of data release to the user community to enable monitoring activities
10. Facility for user feedback
11. Application of a quantitative maturity index if possible
12. Publication of a summary (a <u>webpage</u> or a peer-reviewed article) documenting point-by-point the extent to which this guideline has been followed

**which can be achieved through appropriate entries in a web-hosted inventory**



## **The WCRP/GCOS Observation and Assimilation Panel (WOAP) in 2008:**

- expressed need for user guidance on quality of a “proliferation” of reanalysis products

## **WCRP and SCOPE-CM in 2009:**

- expressed concern over need for review and intercomparison of datasets, including the algorithms used in forming products

## **The GCOS Steering Committee:**

- called for further elaboration of the issues, and referred the matter to WOAP

## **WOAP discussed the issue in 2010, with outcomes including:**

- a letter sent from GCOS and WCRP to agencies calling for strengthening of international expert groups on climate data
- establishment of reanalysis.org website to facilitate sharing of information
- 2011 workshop on Evaluation of Satellite-Related Global Climate Datasets

## Objectives

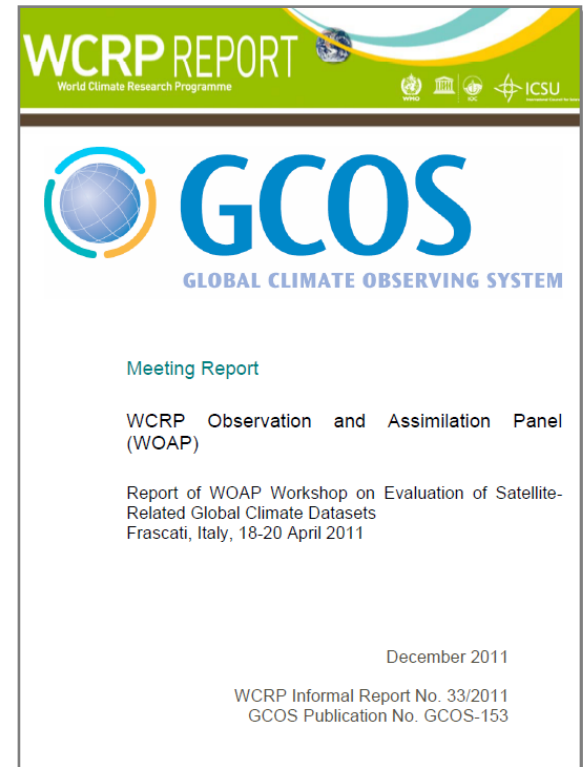
- evaluate some ECV datasets against the GCOS Guideline
- provide a framework for future evaluation of global climate datasets
- assess the value of establishing an inventory of the status of datasets

## Ideas were explored and developed for eight ECVs

- atmosphere: cloud properties, surface radiation
- ocean: sea ice, sea-surface temperature and surface winds
- land: FAPAR, soil moisture and snow cover

## Developed a proposal for an inventory of datasets

- building on the GCOS guideline
- subsequently being carried forward by GCOS/WCRP and joint space-agency actions





## International programmes have been important

- in expressing requirements, providing guidance, undertaking assessments and more
- and have a continuing role in this
- and in developing a more coordinated and integrated approach to design and implementation of the “system of systems” for global observation of climate

## Supporting their activities should be one task of the CCCS

- recognising the need for continued attention to be paid to coordination and integration among the programmes themselves

## Some questions:

- How far can rigorous Quality Assurance approaches (CEOS/GEO QA4EO; FP7 project QA4ECV) be applied across the set of products of the service?
- What is need for evaluation of uncertainty estimates or quality indices?
- Are uncertainties or quality indices what a user requires? Are samples or scenarios preferred?