

## **Briefing Note on Guidance Mechanism for Datasets and Products Meeting GCOS Requirements – Background and Results of July discussion**

**For SCOPE-CM Executive Panel – 3<sup>rd</sup> session  
(15-16 October 2009, Rostock, Germany)**

### **INTRODUCTION**

1. In the framework of SCOPE CM, as well as in other space-related climate activities, the need has emerged for a process through which GCOS and WCRP would ensure that ECV datasets and products (aka FCDRs and TCDRs) generated by space agencies and affiliated institutions are truly meeting the requirements of the climate community.

### **BACKGROUND**

2. The SCOPE-CM Implementation Plan (v1.3, 20 March 2009) foresees to:
  - Establish a mechanism where scientists, and stakeholders (climate community, GCOS) provide feedback [to datasets and products generated within SCOPE CM] (Who: SCOPE CM Executive Committee and GCOS; by 2010; task 2.7)
  - Provide guidance for the generation of SCOPE-CM ECV satellite products meeting GCOS requirements (Who: GCOS; by 2012 and beyond; task 2.13)
3. In October 2007, the GCOS Steering Committee, at its 15<sup>th</sup> session, “requested the GCOS Secretariat, in collaboration with the three GCOS panels, to develop guidelines for datasets and products meeting GCOS requirements, in response to the needs of the IPCC, space agencies and data providers or users (Action 23)”.
4. In April 2008, the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC) at its 14<sup>th</sup> session recommended that, “data and product suppliers provide users with sufficient information to allow them to assess to what extent the datasets meet GCOS requirements, i.e. the climate-worthiness of the datasets. For this purpose, the suppliers should follow guidelines to be presented by GCOS prominently on its Secretariat website and on other websites as appropriate. [...]. They should be based on the GCOS Climate Monitoring Principles, and, where satellite data are concerned, the Satellite Supplement to the GCOS Implementation Plan (GCOS-107) [Rec. 42]”.
5. In October 2008, the GCOS Steering Committee, at its 16<sup>th</sup> session, “endorsed the approach taken in developing the guidelines [GCOS-128] [and] encouraged their use [...]. It also requested the GCOS Secretariat to expand the scope of the guidelines to in- situ observations and arrange for their review by the Panels and Sponsor representatives. [The Committee] also considered it would be useful if the GCOS Sponsors could advise on the precise role they would like the GCOS Secretariat to play in helping data providers follow those guidelines.

6. Based on above requests, in March 2009, GCOS Secretariat published the *Guideline for the Generation of Satellite-Based Datasets and Products Meeting GCOS Requirements (GCOS-128)*<sup>1</sup>, which recalls the GCOS Climate Monitoring Principles and the requirements of the *GCOS Satellite Supplement*, and states a 12-point checklist which gives guidance to data providers on how to supply sufficient information to users for their assessment of dataset quality (cf Appendix). Point 11 recommends the “Application of a quantitative maturity index if possible”, and point 12 the “Publication of a summary (preferably online) documenting point-by-point the extent to which the Guideline has been followed”.
6. The SCOPE-CM Executive Panel (SEP) and pilot project leads have been duly informed of GCOS-128. The first session of SEP in February 2009 decided that: “The maturity matrix and the GCOS Guidelines should be used as a basis for the assessment of existing and intended SCOPE-CM products. This assessment should be used to monitor the status and document the progress of the activities/projects. (DEC-SEP-01-01)”.
7. In order to meet the request by GCOS Steering Committee under item (5), GCOS Secretariat is currently developing a revised GCOS-128 to extend it to in-situ datasets, in consultation with GCOS Panels and sponsors.
8. In the course of this revision, due to be finalized by the end of 2009, additional feedback to GCOS-128 by space agencies has been solicited at CEOS SIT-24 (September 2009) and in a paper to CGMS-37 in October 2009.

#### **SCOPE-CM EXECUTIVE PANEL, 2<sup>ND</sup> SESSION, 2 JULY 2009**

9. The SEP, at its 2<sup>nd</sup> session (conducted by telephone) agreed, inter alia, on the following actions:

“WMO Space Programme and GCOS Secretariat to use the opportunity of the next GCOS meeting on the updated Implementation Plan [see below] to address with WCRP QA issues and review mechanisms/processes for ECV data sets, to meet the requirements, to identify gaps/weaknesses and means to bridge those, as well as the potential role of SCOPE-CM initiatives. The discussion should also address the opportunities to extend from atmosphere to the other domains (ocean, terrestrial).” (Action SEP-02-01)

The SEP expressed the opinion, that the data sets and ECV products in principle should be reviewed independently and by external communities. The self assessment (e.g. against the Maturity Index and the GCOS guidelines) should be seen as a first step.

“The SEP will be informed on the outcome and results of this meeting. WMO SP to inform the SEP on the outcome of the discussions with GCOS Secretariat, WMO SP and WCRP on review mechanisms for ECV products.” (Action SEP-02-02)

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<sup>1</sup> GCOS (2009): *Guideline for the Generation of Satellite-Based Datasets and Products Meeting GCOS Requirements*, GCOS-128 (WMO/TD-No. 1488), <http://www.wmo.int/pages/prog/gcos/Publications/gcos-128.pdf>

## INFORMAL MEETING ON 21 JULY 2009 AT WMO, GENEVA

10. An informal 1.5h-discussion on a possible review mechanism to ensure acceptance of ECV satellite-based datasets and products was held on 21 July 2009 at the fringes of a meeting on updating the GCOS Implementation Plan at WMO, Geneva. Participants included: Ghassem Asrar (WCRP), Stephan Bojinski (GCOS), Albert Fischer (IOC), Ed Harrison (OOPC), Rob Koopman (GEO), Anna Kuhn (GCOS), Eric Lindstrom (OOPC), Paul Mason (GCOS), Carolin Richter (GCOS), Barbara Ryan (WMO SP), Adrian Simmons (AOPC) and Michael Tanner (GEO).
11. The group discussed possibilities for a more formal recognition mechanism (“peer-review”) to ensure proper quality control and acceptance of ECV datasets and products by the climate user community (both scientific and operational users). Such a mechanism would go beyond the self-assessment of datasets and products by providers as promulgated by GCOS-128. The latter would ensure full documentation and thus transparency to users, but does not constitute a quality assessment per se.
12. Discussants raised the following points:
  - a. GCOS-128 (the Guideline) stipulates a useful metadata standard that helps ensure that users have all information available they need to assess the quality of an ECV dataset or product. It thus contributes to an effective peer-review mechanism, but does not propose a new one.
  - b. The scientific community is largely self-organized, through existing peer-review mechanisms in the scientific literature and existing international working groups.
  - c. By virtue of this self-organization, high-quality datasets and products will, in most cases, naturally be accepted by the community, and thus find entry into scientific studies or into operational environments, e.g., when improving the skill of operational forecasts. (“The best evaluation for a data record or derived product is to try to use them.”)
  - d. For many, but not all ECVs, there are international scientific working groups in place which have implicit or explicit mandates to perform quality assessments and intercomparisons of new datasets and products within their field of expertise. These groups need to be strengthened where needed, their involvement for providing feedback should be encouraged, and they need to be instigated where so far lacking. (In GCOS-107, a first step was made to identify such groups for each ECV.)
  - e. GCOS and WCRP facilitate international consensus on dataset/product requirements and needs related to climate monitoring and climate research. The GCOS requirements in GCOS-107, for example, have been serving as recommended targets for the quality of ECV datasets and products; however, many factors can affect the effective quality of a dataset, and neither GCOS secretariat nor panels can replace the critical review by scientists through existing peer-review mechanisms.
  - f. One of the biggest drawbacks in the current situation is, in many cases, the lack of uncertainty statements associated with the release of climate-relevant products, and poor documentation and transparency.
  - g. For this reason, the use of GCOS-128, ensuring full documentation and transparency on the part of data/product providers, should be encouraged. Such guidance should ideally be formally endorsed, and instilled into the funding schemes of agencies and operators of observing systems.

- h. The group suggested that, in the current revision of GCOS-128, to add a point requesting information by providers on what scientific review process has been used in the generation of an ECV dataset or product.

## **CONCLUSIONS**

- 13. In summary, the secretariats of GCOS and WCRP agreed to write a letter to space agencies and other funding bodies, calling for:
  - a. Strengthened existing scientific working groups that are currently undertaking peer-reviews of ECV datasets and products
  - b. Instigation of new working groups for ECVs where these do not currently exist
  - c. Full engagement of these groups by agencies, e.g. through workshops, in the generation of ECV datasets and products, e.g. related to the selection of reprocessing algorithms, the early quality assessment of datasets and the establishment of user feedback cycles based on groups referred to in (a.) and (b.)
  - d. Agencies to ensure full documentation and transparency in the generation of ECV datasets and products by following the GCOS Guideline (GCOS-128), to enable users to assess quality and assign uncertainties
  - e. Making full documentation a requirement in funding schemes of agencies
  
- 14. GCOS and WCRP agreed to publish (on their respective website, for example) a (non-exhaustive) list of international working groups engaged in peer-reviewing, quality assessment and intercomparisons of ECV datasets and products, by ECV where possible. All current or new producers of such datasets should be encouraged to engage these groups in their work.

## APPENDIX

# Guideline for the Generation of Satellite-based Datasets and Products meeting GCOS Requirements

March 2009

GCOS Secretariat

(Annexes not reproduced here; see for full document GCOS-128  
<http://www.wmo.int/pages/prog/gcos/Publications/gcos-128.pdf> )

## 1. Introduction

This document provides a short summary of GCOS requirements for satellite-based climate monitoring that can serve as a guideline for the generation of satellite-based datasets and derived products in order to meet the requirements for climate monitoring and the long-term aspects of climate research.

These guidelines are intended to help space agencies and other relevant institutions in the way they process and analyze datasets obtained from satellite instruments, to subsequently generate Essential Climate Variable (ECV) products (cf. Annex I and III).

As noted in GCOS-107, satellite observing systems should, for the purpose of climate monitoring, adhere to the GCOS Climate Monitoring Principles (see Annex II) to the greatest extent possible. Datasets obtained from such satellite systems (“Fundamental Climate Data Records, FCDRs”) will be of maximum value for monitoring the state of the Earth’s climate, through, e.g., trend analyses, assimilation in climate models, use in reanalyses, and validation of model outputs. Satellite systems include both instruments with plans for sustained operation and continuity, as well as instruments mainly intended to support research interests of limited duration.

It is recognized that, given the complexity of some ECV-related products, additional expertise and guidance may be needed for the generation of FCDRs and ECV satellite products, depending on the specifics of each case and application.

## 2. Background

In 2006, GCOS provided supplemental detail to the space-based requirements of the *Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC*<sup>2</sup> (GCOS-92, October 2004, the ‘GCOS Implementation Plan’) by issuing the document *Systematic Observation Requirements for Satellite-based Products for Climate*<sup>3</sup> (GCOS-107, September 2006, hereafter called the ‘Satellite Supplement’).

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<sup>2</sup> GCOS (2004): *Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC*, GCOS-92, October 2004, [http://www.wmo.int/pages/prog/gcos/Publications/gcos-92\\_GIP.pdf](http://www.wmo.int/pages/prog/gcos/Publications/gcos-92_GIP.pdf)

<sup>3</sup> GCOS (2006): *Systematic Observation Requirements for Satellite-based Products for Climate* – Supplemental details to the satellite-based component of the GCOS Implementation Plan, GCOS-107, September 2006, <http://www.wmo.int/pages/prog/gcos/Publications/gcos-107.pdf>

The GCOS Steering Committee, at its 15<sup>th</sup> session in October 2007, requested “the GCOS Secretariat, in collaboration with the GCOS science panels, to develop guidelines for datasets and products meeting GCOS requirements, in response to the needs of [...] space agencies.”

Before that, the GCOS Atmospheric Observation Panel for Climate, at its 13<sup>th</sup> session in April 2007, had recognized that “it could be beneficial for GCOS to develop a process through which it might formally or informally recognize products that meet the requirements expressed in the Second Adequacy Report and the Implementation Plan. As an example, it was suggested that a data set might be formally recognized once it had been described in the peer-reviewed literature and made freely available to users.”

The need for guidelines to support such a recognition process has been identified by space agencies, for example, in the context of the SCOPE-CM initiative (Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring).

### **3. The Satellite Supplement (GCOS-107)**

The Satellite Supplement stated requirements for datasets and products addressing 26 ECVs (see Annex I) with a major satellite component, as well as nine cross-cutting needs, for the purpose of systematic observation of climate from space. The document made indications in terms of expected accuracy, stability and resolution of ECV satellite products. It also included indications for the Fundamental Climate Data Records (FCDRs) required for the generation of products, relevant satellite instruments, necessary involvement of expert groups, supplemental needs for non-FCDR-type data records, and other application areas of ECV satellite products.

As such, the Satellite Supplement already provides a substantial body of guidance for the generation of datasets and products with the intention to meet GCOS requirements. These requirements are being updated by GCOS science panels on a regular basis, with involvement of relevant expert groups as appropriate. These updates are also provided to WMO as input to the Rolling Review of Requirements of the WMO Global Observing System (GOS)<sup>4</sup>. In addition, given the complexity of climate variability and, in part, limited knowledge of the expected variability of ECVs over space and time, several caveats apply to the use of requirements as such. For example, it is possible that a combination of data records from two satellite instruments, neither of which meeting any of the requirements given in the Satellite Supplement, could usefully meet the needs for climate monitoring if applied together in careful analysis.

### **4. Guideline**

A guideline for the generation of FCDRs and derived ECV satellite products, and subsequent quality assessment by providers as well as users, is given by adherence to the following:

- Fundamentally, the GCOS Climate Monitoring Principles, in particular those specific to satellite systems (see Annex II)
- In expanded form, the Satellite Supplement (see Annex III); wherever target requirements for particular ECV satellite products are given in the Satellite Supplement, it is expected that the producer as well as the user of these products will be able to judge whether the product meets these requirements, provided adequate documentation (metadata etc.) is available

In line with the GCMPs and the Satellite Supplement, the GCOS Steering Committee recommends particular attention to the following needs related to the generation of ECV satellite datasets and products:

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<sup>4</sup> The WMO/CEOS database requirements, including those by GCOS, can be found at <http://www.wmo.int/pages/prog/sat/Databases.html#UserRequirements> (26 March 2009)

1. Full description of all steps in the generation of datasets and products, including algorithms used, specific FCDRs used, and characteristics and outcomes of validation activities
2. Information on publications in peer-reviewed journals, covering both the description and the application of datasets and products
3. Statement of expected accuracy, stability and resolution (time, space) of the product, including, where possible, a comparison with the requirements stated in the Satellite Supplement (or any subsequent revision)
4. Arrangements for access to the datasets, products and all documentation
5. Version management of datasets and products, particularly in connection with improved algorithms and reprocessing
6. Long-term stability and homogeneity of the product
7. Full application of all appropriate calibration/validation activities that would enhance product quality
8. Global coverage where appropriate
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 (preferably on-line) documenting point-by-point the extent to which this guideline has been followed

Experience with historical satellite data records has shown that continuous, cyclical improvement of the quality of datasets and product is generally needed, since historical records usually have challenges in terms of homogeneity. A one-time assessment of quality/maturity of datasets and products must not preclude this improvement over time.

