

**WORLD METEOROLOGICAL ORGANIZATION**

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**COMMISSION FOR BASIC SYSTEMS**  
OPEN PROGRAMME AREA GROUP ON  
INTEGRATED OBSERVING SYSTEMS

ITEM: 7.3.2

**INTER PROGRAMME EXPERT TEAM ON  
OBSERVING SYSTEM DESIGN AND EVOLUTION  
(IPET-OSDE)  
*First Session***

Original: ENGLISH

GENEVA, SWITZERLAND, 31 MARCH – 3 APRIL 2014

## **ROLLING REVIEW OF REQUIREMENTS AND STATEMENTS OF GUIDANCE**

### **STATEMENTS OF GUIDANCE**

#### **GLOBAL CLIMATE OBSERVING SYSTEM (GCOS)**

*(Submitted by the GCOS Secretariat)*

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#### **SUMMARY AND PURPOSE OF DOCUMENT**

The document provides information on existing GCOS documentation that has been accepted by the CBS as Statement of Guidance for global observing systems for climate, and future plans for updating them.

It also reports on the next steps in assessing the adequacy for global observing systems for climate, which will take into account the EGOS planning and its related activities.

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#### **ACTION PROPOSED**

The Meeting is invited to note the information contained in this document when discussing how it organises its work and formulates its recommendations.

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**References:** Current versions of the Statements of Guidance  
<http://www.wmo.int/pages/prog/www/OSY/GOS-RRR.html#SOG>

**Appendix:** A. Report on the next GCOS Assessment Cycle

## DISCUSSION

The following GCOS reports are considered as Statement of Guidance for Global Observing Systems for Climate:

- Adequacy reports;
- Implementation Plan, and updates;
- Satellite Supplement and updates; and
- Progress Reports.

To date the following versions have been published:

- 1998: Report on the Adequacy of the Global Climate Observing Systems – United Nations Framework Convention on Climate Change, Publication No. [GCOS-48](#), COP-4, Buenos Aires, Argentina;
- 2003: Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC, Publication No. [GCOS-82](#), COP- 9, Milan, Italy;
- 2004: Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC, Publication No. [GCOS-92](#), COP-10, Buenos Aires, Argentina ;
- 2006: Systematic Observation Requirements for Satellite-based Products for Climate – Supplemental Details to the Satellite-based Component of the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC, Publication No. [GCOS-107](#);
- 2009: Progress Report on the Implementation of the Global Observing System for Climate in Support of the UNFCCC 2004–2008, Publication No. [GCOS 129](#), COP-15, Copenhagen, Denmark;
- 2010: Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (2010 Update), Publication No. [GCOS-138](#), COP-16, Cancun, Mexico; and
- 2011: Systematic Observation Requirements for Satellite-based Data Products for Climate – 2011 Update – Supplemental details to the satellite-based component of the “Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC ( 2010 Update)”, Publication No. [GCOS-154](#).

## APPENDIX A

### REPORT ON THE NEXT GCOS ASSESSMENT CYCLE

The following text is largely drawn from the GCOS Report of the Scoping Meeting for the Adequacy of the Global Observing System for Climate, 12-13 December 2013 (GCOS-178<sup>1</sup>).

#### **1.1 Starting the next assessment cycle for global observing systems for climate**

At the 21<sup>st</sup> Session of the GCOS Steering Committee, held from 22 to 24 October 2013, the GCOS Secretariat was requested to start the next round of assessment of the adequacy of the global observing system for climate.

The next GCOS progress report and implementation plan will be highly relevant to WMO programmes, especially in the light of the evolving Global Framework for Climate Services (GFCS).

#### **1.2 Information needed for Essential Climate Variables (ECVs)**

In assessing progress and drawing up the new implementation plan, experts for each of the physical domains will need to cover each domain ECV by ECV (Figure 1). The status report should confirm the relevance of each ECV or otherwise explain why the ECV was considered to be no longer required or better replaced by a related variable or group of variables. Progress should be categorised subjectively in the range “good” to “poor” as adopted in the 2009 published progress report<sup>2</sup>. Conclusions should be backed by statistics related to the availability and quality of observations and data products where possible; where such information is lacking, this should be identified as a deficiency.

Inter-relating ECVs in groups or clusters would be useful for activities led by the World Climate Research Programme (WCRP), because they need to characterise the fluxes needed to describe the energy, water and carbon cycles. The clustering of ECVs is seen as relevant to the observational characterisation of phenomena such as tropical cyclones, or to climate-change indices. In the course of assessing progress and developing the plan matrices should be created that relate the individual ECVs to specific climate cycles, phenomena and applications.

Observations that are not identified as essential for the global climate may be important locally, for example fog days or phenological data. Also, paleoclimatological data plays an important role in the science of climate change. Text could be included which would discuss “impact variables”, such as “coral reef cover” which is an Essential Biodiversity Variable, or other variables that can be considered as health indicators.

Climate change detection indices which are used in climate impact studies and can be related to climate services would help in assessing adequacy. Reference is made

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<sup>1</sup> [http://www.wmo.int/pages/prog/gcos/Publications/gcos\\_178.pdf](http://www.wmo.int/pages/prog/gcos/Publications/gcos_178.pdf)

<sup>2</sup> <http://www.wmo.int/pages/prog/gcos/Publications/gcos-129.pdf>

to the WMO CCI/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) and to the CLIMDEX project website which produces datasets for indices of climate extremes, [www.climdex.org](http://www.climdex.org).

ECVs have been recognized by space agencies, both generally through the CEOS responses to previous GCOS Implementation Plans, and specifically through particular activities of which the European Space Agency's Climate Change Initiative was particularly noteworthy for its use of the ECV concept as a basis. Specific agency-wide initiatives such as the development of the Architecture for Climate Monitoring from Space and the CEOS/CGMS/WMO ECV Inventory of climate datasets should also be cited.


The status of observation of each ECV should be assessed for global, regional and local scale. All scales should be taken into account wherever appropriate and practical, because the global picture is in general made up of observations that are in essence local. It would not be practical to cover all local deficiencies in observation, but important regional variations in data coverage and generic needs for local observation should be identified. There would inevitably be differences between ECVs, as some require true global coverage, whilst others are only relevant for particular regions or locations. It must be made clear that different ECVs require different network densities and measurement quality to be 'adequate'. For example, greenhouse gases can be measured adequately at a few places, whereas this would not be adequate for precipitation. Requirements vary on an ECV by ECV basis partly because of user needs but also partly because of the intrinsic nature of the ECVs and their time and space scales. There could also be differences from one application to another for a particular ECV. Considerations specific to an individual ECV should be included in the text discussing that ECV, but there should also be a wider cross-cutting discussion of what the GCOS programme understands by the word "global" as applied to the observation of climate.

The progress report should also include a discussion on the quality of networks, covering how they have improved or degraded, and identifying perceived threats. Discussion of cost issues would be appropriate in the progress report, as costs had been indicated in the earlier GCOS Implementation Plans.

It is considered important to take into account what the user of ECV data would like to see validated. In this regard, the assessment process should discuss how data on the ECVs can be used to discuss the attribution of extreme events to climate change, or how ECVs can address loss and damage associated with climate-change impacts. It was noted that the GCOS community is not as closely linked to the user community for specific sectorial benefit areas as GEO is, for example, and so there is an opportunity for the GCOS Secretariat to liaise with the GEO Secretariat, for instance in the upcoming GEO work plan symposium or existing task teams. Similar remarks could be made with regard to the GFCS.

**Figure 1:** List of Essential Climate Variables, domain by domain (GCOS-138<sup>3</sup>, Implementation Plan for the Global Observing System for Climate in support of the UNFCCC (2010 update)).

<sup>3</sup> <http://www.wmo.int/pages/prog/gcos/Publications/gcos-138.pdf>

OCEANIC	ATMOSPHERIC	TERRESTRIAL
<p style="text-align: center;">Surface (10)</p> <ul style="list-style-type: none"> <li>• Sea-surface temperature</li> <li>• Sea-surface salinity</li> <li>• Sea level</li> <li>• Sea state</li> <li>• Sea ice</li> <li>• Surface current</li> <li>• Ocean colour</li> <li>• Carbon dioxide partial pressure</li> <li>• Ocean acidity</li> <li>• Phytoplankton</li> </ul> <p style="text-align: center;">Sub-surface (8)</p> <ul style="list-style-type: none"> <li>• Temperature</li> <li>• Salinity</li> <li>• Current</li> <li>• Nutrients</li> <li>• Carbon dioxide partial pressure</li> <li>• Ocean acidity</li> <li>• Oxygen</li> <li>• Tracers</li> </ul>	<p style="text-align: center;">Surface (6)</p> <ul style="list-style-type: none"> <li>• Air temperature</li> <li>• Wind speed and direction</li> <li>• Water Vapour</li> <li>• Pressure</li> <li>• Precipitation</li> <li>• Surface radiation budget</li> </ul> <p style="text-align: center;">Upper-air (5)</p> <ul style="list-style-type: none"> <li>• Temperature</li> <li>• Wind speed and direction</li> <li>• Water Vapour</li> <li>• Cloud properties</li> <li>• Earth radiation budget (incl. solar irradiance)</li> </ul> <p style="text-align: center;">Composition (5)</p> <ul style="list-style-type: none"> <li>• Carbon dioxide</li> <li>• Methane</li> <li>• Other long-lived greenhouse gases</li> <li>• Ozone, supported by their precursors</li> <li>• Aerosol, supported by their precursors</li> </ul>	<p style="text-align: center;">Biological/Ecological/Other (7)</p> <ul style="list-style-type: none"> <li>• Land Cover</li> <li>• FAPAR</li> <li>• Leaf area index</li> <li>• Above ground biomass</li> <li>• Soil carbon</li> <li>• Fire disturbance</li> <li>• Albedo</li> </ul> <p style="text-align: center;">Hydrological (5)</p> <ul style="list-style-type: none"> <li>• River discharge</li> <li>• Water use</li> <li>• Ground water</li> <li>• Lakes</li> <li>• Soil moisture</li> </ul> <p style="text-align: center;">Cryospheric (4)</p> <ul style="list-style-type: none"> <li>• Snow cover</li> <li>• Glaciers and ice caps</li> <li>• Ice sheets</li> <li>• Permafrost</li> </ul>
		
<p>GCOS has defined a list of Essential Climate Variables (ECVs) that are both technically and economically feasible for systematic observation and global implementation, and whose observations meet important requirements of the UNFCCC and the IPCC. It is these variables for which international exchange is required for both current and historical observations.</p>		
<p>For more information, please go to: <a href="http://gcos.wmo.int">http://gcos.wmo.int</a></p>		

The GCOS Scoping Meeting report suggests in its “Annex 5” a draft list of information items which need to be assembled in a template for each ECV. This annex can be found at the end of this document, for ease of reference.

Among many other sources of information, the preparation of the new implementation plan needs to take into account of the development of the WMO Integrated Global Observation System (WIGOS), for which the Implementation Plan for the Evolution of the Global Observing Systems currently makes considerable reference to the 2010 GCOS Implementation Plan. The new plan will also take into account the implementation planning for the GFCS and the Global Ocean Observing System (GOOS).

Sources of information in close relation to WMO programmes are:

- GFCS Implementation Plan, especially Annex III on the Observation and Monitoring Component
- GEO implementation planning for period to 2025
- GOOS planning
- Implementation Plan for the Evolution of Global Observing Systems
- WMO network monitoring for GSN and GUAN
- WMO Rolling Review of Requirements, Observing Systems Capabilities Analysis and Review Tool (OSCAR)
- Relevant WMO manuals and guides
- WMO annual statement on the climate
- Architecture for Climate Monitoring from Space
- CEOS/CGMS/WMO ECV Inventory database
- ESA Climate Change Initiative report on user requirements

The next GCOS progress report should not assess the observational capabilities of the WMO Global Observing Systems or the ocean observing networks per se, but

focus on the observational capabilities for climate applications. GCOS panel experts had been requested to assist in up-dating WMO's OSCAR (Observing Systems Capabilities Analysis and Review) database, which already carries information similar to some of that included in the ECV template.

The new GCOS implementation plan will be aligned with a vision to 2025, as this would tie in with the next implementation plan of the GEO and with the WIGOS planning process, which includes the Implementation Plan for the Evolution of the Global Observing System (GOS) in 2025. The overall performance for satellite systems or network performance can be assessed in 10- year intervals, but budgets and plans for some observing systems are often based on shorter periods. Also, the IPCC assessment cycle is repeated every six years or so, and the WMO Commission for Climatology operates in four-yearly cycles.

The new GCOS implementation plan should present a 10-year vision, but set initial five-year targets where appropriate, to enable a review of progress and an update of the plan as needed at the five-year stage. These time scales would allow alignment to existing long-term observation and research strategies, but enable a more timely response to be given to requests from sponsors, the UNFCCC and other stakeholders.

### 1.3 Road Map for 2014 to 2016

The progress report will be prepared for submission to the sponsors and UNFCCC Parties **in the course of 2014 and early 2015, to be submitted to the UNFCCC Secretariat in late summer (August) 2015.** It will document how actions in the 2010 Implementation Plan have been or are being addressed, reviewing the overall status of each ECV and identifying gaps.

The new Implementation Plan should include a chapter on the assessment of the adequacy of global observations for climate, which will draw on the progress report. A draft of the plan should be available **for public review in October 2015,** with **finalization in summer 2016** for delivery to meet the timescale that had already been indicated to the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA).

The GCOS Secretariat should take advantage of experts and discussions on the status of ECVs at the following key meetings:

- Terrestrial Observation Panel for Climate (TOPC), 16<sup>th</sup> session, 10-11 March 2014
- Atmospheric Observation Panel for Climate (AOPC), network workshop and 19<sup>th</sup> session, 9 – 11 April 2014
- GEO Work Plan Symposium, possibly 28 April – 2 May 2014
- WCRP Data Advisory Council (WDAC), 6-7 May 2014
- Ocean Observations Panel for Climate (OOPC), 17<sup>th</sup> session, 21-24 July 2014
- EUMETSAT/WCRP Climate Symposium, 13-17 October 2014

All GCOS panels will need to be engaged in the process. They will need to be given explicit tasks and guidance how to address cycles, and how to cluster the variables.

In addition, the GCOS Secretariat is asked to organise:

- A workshop with IPCC WG II and the disaster risk community;
- A small workshop on observations for mitigation with GOF-C-GOLD, which is already under preparation and tentatively scheduled for 5-9 May or 12-16 May 2014;
- A workshop, early in 2015, to map out the implementation plan, because this will need a wide ranging discussion, for example on the revision of the ECV list and on the documentation of the procedures.

The writing of the progress report should start around November 2014.

## **Annex**

### **Annex 5 (Scoping Meeting GCOS-178): ECV items of information**

Below is a draft of the list of information items that it is proposed to assemble for each ECV, to the extent applicable. It incorporates some of the items from the draft template proposed for the nomination of GOOS Essential Ocean Variables (Annex 4). The information assembled will be used in drawing up both the Progress Report and the Implementation Plan.

In due course relevant items will be needed for identified new ECVs.

#### **Name of ECV: To be pre-filled**

**Subsidiary variables:** List these for those ECVs that are not a single biogeophysical variable, but rather comprise a family of subsidiary variables.

**Supplementary measured variables:** For ECVs for which products may be derived from measurements of dependent quantities, e.g. IR and MW radiances, and GPS bending angles, for atmospheric temperatures.

**ECV Group membership:** Identify groups to which ECV belongs, for example groups of variables related to the energy, hydrological or carbon cycles, or sea-level change.

**Applications:** List key applications such as scientific understanding, climate-change monitoring, attribution, model initialisation and/or validation, and provision of service to end users (mentioning sector covered).

**Phenomena and indices:** As discussion of climate change often involves changes in frequency or intensity of extreme events such as tropical cyclones, or indices such as number of frost days, it should be noted whether the ECV in question contributes to characterisation of a key phenomenon or index linked to climate variability and change.

**Uncertainties identified by IPCC:** List the main uncertainties linked to observation and/or data products for the ECV, as identified in AR5; this should include the “key uncertainties” listed in the WG I Technical Summary and others in the body of the reports that are considered important.

**Pre-existing summary text on the ECV: This may be pre-filled** where it can be found in existing GCOS documents and text is judged to be reasonably up-to-date, but could otherwise be added if there is text to hand from other sources. It should comprise a single or small number of paragraphs, and could apply to groups of ECVs rather than a single one. If it does apply to more than one ECV there is no need to repeat the text for each, but the original entry should be cross-referenced for other ECVs in the group.



**Non-climate applications of observation:** *e.g. for weather forecasting. These may be covered already in pre-existing summary text.*

**Contributing observing networks, systems or approaches:** *List the principal source(s) of data on the ECV.*

**Links and references to observational methods and standards:** This could, for example, be to WMO Manuals and Guides, or to the proposed EOVS specifications of observation deployment and maintenance for the ocean ECVs. This need not include generally applicable guidance such as the GCOS Climate Monitoring Principles and Dataset Guidelines. If material is judged to be in need of updating (as has been indicated for the GTOS Terrestrial ECV Reports) this should be noted.

**Requirements for spatial and temporal scale, accuracy/uncertainty and stability:** *This could be done by reference (to OSCAR database if entry is up-to-date, to proposed EOVS specifications, to entries in Satellite Supplement reproduced below), but should otherwise be discussed more explicitly. Any distinctions between requirements for observations and for data products should be noted.*

**Arrangements for observational monitoring:** *List what, if anything, is in place or needed for routinely checking functioning of observing system.*

**Changes in observation:** List recent and planned future changes to observing networks, systems and methods. Discuss perceived threats.

**Observational performance:** Should build on immediately preceding entries, and give quantitative information on performance: spatial and temporal coverage, accuracy and stability (i.e. quality as well as quantity), where possible. Provision of graphs or tables (or pointers to where the underlying data can be found) is needed here (or under item below on assessment of progress on action.)

**Data recovery:** List opportunities, progress, needs and obstacles as appropriate.

**Data centres:** List principal international data centres or national/regional centres with substantial holdings of global observations and/or data products.

**Data products:** List the types of processed product that are needed/available. Identify issues.

**Product oversight and coordination:** *Identify which if any international groups or other bodies have a role here.*

**Product assessments:** List any independent assessments of products that have been carried out or are in progress. Summarise conclusions reached.

**Action from IP-10: To be pre-filled.** If action is in a domain, but not attached to a single ECV, it will be assigned to first ECV to which it applies. Actions designated as cutting across domains will be reviewed in a second step.

**Assessment of progress on action:** Short text, quantitative where possible, with graph or table if readily available and message is clear. Provide subjective ranking on five-point scale denoting progress as good, good-moderate, moderate, moderate-low and low. See 2009 Progress Report. Flag if there has been absolutely no progress; we could have this as sixth category if needed.

**Product requirement from 2011 Satellite Supplement:** *To be pre-filled. Requirements designated as cutting across domains will be reviewed in a second step.*

**Progress towards meeting product requirement:** Short text. Not much time has passed since 2011 supplement. However it may be appropriate to refer back to corresponding requirement in the original 2006 supplement or to 2006 and 2012 CEOS responses.

**General links and references:** *Provide any key web links or references that are in addition to the more specific ones listed earlier.*

**Expert group or individual:** *Provide name here if panel does not have expertise to complete some sections, and has taken input from, or input needs to be taken from, another expert group or individual.*

Identify a lead for an ECV to be tasked with canvassing a broad range of peers in forming an initial text.

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