



Required Observations of Terrestrial Essential Climate Variables (ECVs)

Submission to the “Data and Observations” call of the
Nairobi Work Programme on Impacts, Vulnerability and
Adaptation to Climate Change.

September 2007

Prepared and submitted by the Secretariat of the
Global Terrestrial Observing System (GTOS)

Version 05

Introduction

The mandate of Work item 2 “Data and observations”, of the Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change, is to improve the collection, management, exchange, access and use of observational data and other relevant information on current and historical climate variability and change.

Data and observation requirements for climate-related purposes were addressed in the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (GCOS 2004). This Plan was specifically developed to ensure the availability of global observations of the essential climate variables and associated data to meet the requirements of Parties of the UNFCCC as well as other stakeholders.

The Global Terrestrial Observing System (GTOS) has supported the preparation and realization of the GCOS implementation plan, particularly with respect to its terrestrial component and the 13 terrestrial Essential Climate Variables (ECVs): Albedo; Biomass; Fire disturbance; Fraction of absorbed photosynthetically active radiation; Glaciers and ice caps; Ground water; Lake levels; Land cover (including vegetation type); Leaf area index; Permafrost and seasonally-frozen ground; River discharge; Snow cover, and Water use. Current and historical data and information on these terrestrial as well as atmospheric and oceanic ECVs are of fundamental importance, not only for climate change impact assessment and adaptation but also for related issues such as characterizing the state of the climate system, predicting future climate change, and enabling the assessment of vulnerability and risk to climate change.

Through the Terrestrial Observation Panel for Climate (TOPC), a joint panel of the GTOS and the Global Climate Observing System (GCOS), support and coordination is being provided to the networks undertaking *in situ* observations (refer to www.fao.org/gtos/GT-NET.html). TOPC has also assisted in the preparation of the systematic observation requirements for satellite-based products for climate (GCOS 92).

To a considerable extent, the challenges involved in adaptation to climate change concern the terrestrial domain. Thus, data and observations of the terrestrial ECVs are of vital importance to the Nairobi Work Programme and related climate change response initiatives but also to various other sustainable development activities and stakeholders (please also refer to GCOS submission for additional details).

A framework for terrestrial climate - related observations

Realizing the need to develop appropriate policies to deal with climate change and based upon the GCOS Implementation Plan, the Conference of the Parties in its ninth session (Decision 11/CP.9; UNFCCC, 2003) requested the GTOS Secretariat, “*in consultation with other international or intergovernmental agencies, as appropriate, to develop a framework for the preparation of guidance materials, standards and reporting guidelines for terrestrial observing systems for climate, and associated data and products*”.

In response to this request, analysis has been undertaken to identify the desirable characteristics, necessary elements, and the stakeholder requirements for an effective framework. Based on existing practices, several organizational options were identified in two categories: an intergovernmental model and an international organization model. The identified options build on mechanisms and practices previously employed to achieve an international consensus on technical matters subsequently to be

adopted, and acted upon, by individual countries. Results of this work were submitted to UNFCCC SBSTA which include details on (see GTOS 2007a): the organizational options for establishing such a framework; costs of establishing and operating; mechanisms for the endorsement of standards and guidelines that would be needed for national acceptance and implementation; and an analysis of the advantages and disadvantages of the various options to allow the adequate appraisal by the stakeholders.

It is evident that such a framework is vital for generating the tools, methodologies, data, information and support required by the UNFCCC in meeting its long-term objective to stabilize greenhouse gas concentrations in the atmosphere, and for assisting member countries in meeting their requirements when confronting the effects of climate change. A further definition of the framework will be undertaken after guidance has been received from UNFCCC COP/SBSTA in December 2007.

Existing standards for terrestrial ECVs

At its 23rd Session in Montreal (November 2005), the UNFCCC SBSTA/COP requested the GTOS Secretariat to “*assess the status of the development of standards for each of the essential climate variables in the terrestrial domain*” to ensure data compatibility between the different data producers and allowing the development of harmonized regional and global data sets (GTOS 2007b).

The question of standards for the terrestrial ECVs encompasses a very broad spectrum in terms of: (i) the environmental variables involved; (ii) the geographic coverage and diversity of these variables leading to different measurement approaches; (iii) the types of documents or formats relevant to the development of standards (‘standards’, ‘guides’, ‘protocols’, ‘guidelines’); (iv) the areas in principle requiring standardization (initial measurements, data processing, analysis, final product); (v) the need for *in situ* as well as satellite measurements for most terrestrial ECVs, requiring conceptually different approaches; and (vi) the number and dispersion of sources where information relevant to ECV standardization may be generated or archived.

Taking the above into consideration, the GTOS Secretariat, in collaboration with its partners, has undertaken a review of the available standards, guidelines, measurements and processing protocols already being used by national institutions and international organizations. The review has revealed that few definitive standards exist for the 13 terrestrial ECVs. However, guides, descriptions of measurement methods, and protocols are available in several cases that describe in detail how a specific terrestrial variable should be sampled and measured. A status report has been submitted to UNFCCC SBSTA (GTOS 2007b).

Actions needed

Given the critical importance of terrestrial ECVs to developing appropriate response to global and regional climate changes, it is evident that the above tasks are necessary to lay the foundation for a coordinated approach. However, the key issue is the existence of programmes for the measurement, archiving, and data analysis that will yield objective information on the response of the terrestrial environment to climate variability and change. In most cases, these measurements must be made from satellite platforms and by *in situ* networks (refer to GTOS 2007b). The challenges in implementing and maintaining an overall coordinated system are considerable. Currently:

- Coordinated action has been taken by the Committee on Earth Observation Satellites (CEOS) in regards to the satellite components, as reported at SBSTA 25.
- Effective use of satellite data requires special *in situ* measurements to establish the necessary relationships between the radiation measurements and the biophysical surface properties.

Coordinated measurements of this type are only gradually being established, in virtually all cases as part of research programmes.

- Several global *in situ* networks are operational. However, these networks have not been established for all the ECVs and, where established, often have incomplete coverage and/or lack the necessary financial resources to meet their objectives. The operation of individual measurement sites depends on national support which is not always available or assured over time. The need for increased support to *in situ* observations has been stated by the COP/ SBSTA previously, but in reality problems persist.
- For most terrestrial ECVs, the generation of data products with information on the changing terrestrial response to climate presently involves calibration, integration, and analysis of data from various sources. Intercomparisons of different approaches and strategies, carried out through workshops, are an important vehicle in this process.

Thus, to ensure the availability of data and information on the terrestrial response to climate, actions are needed in the following areas:

- Coordinated acquisition of satellite measurements of the individual ECVs, building upon the CEOS progress to date.
- Implementation of an international framework for *in situ* observations (refer to GTOS 2007a).
- Increased support by the Parties for making and reporting *in situ* observations for the terrestrial ECVs, within the international framework.
- Supporting national and international projects, data centres, and other initiatives addressing the generation of integrated, quality controlled products for individual terrestrial ECVs.

Specific recommendations

To make progress on the above required actions, the GTOS Secretariat recommends that the following actions are undertaken:

- Provide the political and financial support to allow the strengthening of existing *in situ* observational networks and the creation of new networks where required. This long term financial support and political commitment pertains to the five current Global Terrestrial Networks on hydrology, glaciers, permafrost, rivers, and lakes.
- UNFCCC SBSTA to support the development of a terrestrial framework by providing guidance on its preference on possible options and assisting in the realizing an initial workshop to further elaborate the desired mechanism.
- UNFCCC SBSTA to comment on and endorse the current status of the process and to review the available standards and generate the support to allow groups of experts (through workshops and correspondence) to finalize the products and recommendations.
- UNFCCC SBSTA to work with GTOS and GCOS on a procedure and funding mechanisms that recommends identification and selection of current research *in situ* programmes that are ready to move into a more sustained routine monitoring network.
- Increased support of the Parties for coordinated cross – comparison of products which are approaching an operationally useful status, e.g. land cover, leaf area index, and albedo.

Reinforcing observational *in situ* networks, ensuring data records, maintaining data harmonization and facilitating data access are all fundamental to achieving such objectives. However, there is currently a lack of national engagement and or resources, restrictive data policies, and inadequate national and

international data system infrastructure. There is a need for a clear commitment from all stakeholders to commit both individually and collectively to the collection, processing and distribution of the required observations.

The Global Terrestrial Observing System strongly reaffirms its commitment to support the development of a terrestrial framework mechanism and to continue collaboration with other partners such as GCOS and stakeholders in climate change related activities, including the implementation of the Nairobi Work Programme. Nevertheless, for any system to be effective there must be the collective support by governments and international institutions as well as by other stakeholders.

References

GCOS. 2004. Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC, October 2004, **GCOS 92**, WMO/TD No. 1244.

Web link: www.wmo.int/pages/prog/gcos/Publications/gcos-92_GIP.pdf

GCOS. 2007. 107: 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, **GCOS-107**, September 2006

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GTOS 2007a. A Framework for Terrestrial Climate-Related Observations: Implementation Options, GTOS Progress Report to the 26th Meeting of the UNFCCC SBSTA, **GTOS 48**, March 2007.

Web link: www.fao.org/gtos/doc/pub48.pdf

GTOS 2007b: Assessing the Status of the Development of Standards for the ECVs in the Terrestrial Domain, GTOS Progress Report to the 26th Meeting of the UNFCCC SBSTA, **GTOS 49**, March 2007.

Web link: www.fao.org/gtos/doc/pub49.pdf

Web links

GCOS: www.wmo.ch/pages/prog/gcos/index.php

GTOS: www.fao.org/gtos/index.html

Observational networks: www.fao.org/gtos/GT-NET.html

Terrestrial ECVs: www.fao.org/gtos/topcECV.html

UNFCCC terrestrial framework: www.fao.org/gtos/topcFRAME.html