

# Summary Report of the Twelfth Session of the Terrestrial Observation Panel for Climate (TOPC) of the Global Climate Observing System and the Global Terrestrial Observing System

FAO HQ, Rome, Italy, 10-11 March 2010

GTOS – 75  
GCOS – 141

(WMO/TD No. 1528)



**Global Terrestrial Observing System Secretariat**, Rome,  
**Global Climate Observing System Secretariat**, Geneva,  
2010

© World Meteorological Organization, 2010

The right of publication in print, electronic and any other form and in any language is reserved by WMO. Short extracts from WMO publications may be reproduced without authorization provided that the complete source is clearly indicated. Editorial correspondence and requests to publish, reproduce or translate this publication (articles) in part or in whole should be addressed to:

Chairperson, Publications Board  
World Meteorological Organization (WMO)  
7 bis, avenue de la Paix  
P.O. Box No. 2300  
CH1211 Geneva 2, Switzerland

Tel.: +41 (0)22 730 84 03  
Fax: +41 (0)22 730 80 40  
Email: [Publications@wmo.int](mailto:Publications@wmo.int)

**NOTE**

The designations employed in WMO publications and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of WMO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Opinions expressed in WMO publications are those of the authors and do not necessarily reflect those of WMO. The mention of specific companies or products does not imply that they are endorsed or recommended by WMO in preference to others of a similar nature which are not mentioned or advertised.

This document (or report) is not an official publication of WMO and has not been subjected to its standard editorial procedures. The views expressed herein do not necessarily have the endorsement of the Organization.

# Contents

1. Welcome and Introduction .....	1
2. Approval of Agenda .....	1
3. GTOS Strategy Update .....	1
4. Update on GCOS .....	3
5. GCOS Role in the GFCS .....	4
6. Review of Actions in the 11 <sup>th</sup> Session TOPC Report .....	4
7. GEO Global Forest Monitoring Facility (GFMF) .....	4
8. GTNs and ECVs overview .....	5
9. Reference Network for Ecosystem Sites .....	9
10. GCOS, GTOS and the GEO Communities of Practice (CoP) for an Integrated Global Carbon Observation System (IGCO) .....	9
11. 2004-2008 GCOS Progress Report .....	10
12. 2010 Update of the GCOS IP .....	10
13. ESA in Support of Terrestrial ECVs .....	11
14. Status of Standards and Guidelines for Terrestrial ECVs .....	12
15. Establishment of a Terrestrial Framework .....	12
16. Evaluation of GEWEX/WOAP Activities .....	14
17. Data in Support of Impact Studies .....	14
18. Calendar and Future Meetings .....	15
Annex I: Meeting Agenda .....	16
Annex II: Meeting Participants .....	18
Annex III: List of Actions .....	20
Annex IV: Status of Actions in the 11th Session TOPC Report .....	22
Annex V: TOPC Work Plan (2007 – 2011) .....	29
Annex VI: TOPC Terms of Reference (status May 2008) .....	30
Annex VII: TOPC Panel Members (status May 2008) .....	31
Acronyms .....	32

## 1. Welcome and Introduction

The Terrestrial Observation Panel for Climate (TOPC) was set up to develop a balanced and integrated system of in situ and satellite observations of the terrestrial ecosystem. The Panel focuses on the identification of terrestrial observation requirements, assisting the establishment of observing networks for climate, providing guidance on observation standards and norms, facilitating access to climate data and information and its assimilation, and promoting climate studies and assessments. TOPC is jointly sponsored by the Global Climate Observing System (GCOS), the Global Terrestrial Observing System (GTOS) of the United Nations Food and Agricultural Organization (FAO) and the World Climate Research Programme (WCRP).

The twelfth Session of the TOPC was held 10-11 March 2010 at the FAO Headquarter in Rome, Italy. This report summarizes key discussions and outcomes rather than being a full record of the meeting.

Han Dolman, Chairman of TOPC, welcomed meeting participants and provided a brief background of TOPC and its efforts to date. He apologized for the fact that the meeting had to be postponed from its original November 2009 date because only a sub-critical number of members would have been able to participate.

## 2. Approval of Agenda

The additional agenda item 'Data in support of Impact Studies' was added to the draft agenda, and the final meeting agenda is given in Annex I. For the list of participants see Annex II.

## 3. GTOS Strategy Update

Riccardo Valentini, Chairman of the GTOS Steering Committee (SC), reported mainly on the development of a new five-year GTOS strategic plan, based on discussions at last year's GTOS SC meeting, which was held 1-2 December 2009 in Paris, France.

The 2010-2015 GTOS strategy is planned to be in place by the end of 2010, following the finalization of an updated GTOS Implementation Plan (IP) by the end of July 2010. The new strategy shall frame a suitable structure for GTOS in the future, including revision of GTOS priority areas. GTOS needs to provide a sound scientific basis for supporting policy decisions and serves as a forum for the scientific community to develop discussions and methodological approaches for observations in the following main fields, with the GTOS co-sponsored panels contributing to these themes given in parentheses:

- Climate (TOPC)

- Carbon Cycle and Land Degradation (TCO; probably with a new name to be confirmed)
- Biodiversity (all the panels from their respective point of view)

GOFC-GOLD should provide a general transversal support, especially from a remote sensing perspective. The Chairman noted that there is overlap between the respective panels which will need an integrated approach. Thus it has been proposed that the different panels will work in a coordinated integrated way with possible working groups, formed by members of relevant panels with one leader, on specific activities and/or themes. Also new panels products should be conceived after a coordinated process that will be defined by the new IP.

The role of the GTOS strategy is to:

- I. Formulate, lead, monitor and revise as appropriate the overall approach to global terrestrial observations, by taking into account scientific, technical and institutional conditions, opportunities and constraints;
- II. Identify systematic observations/variables that are required and define their characteristics (e.g., standardization in observations and reporting);
- III. Advocate in the relevant international policy arena the adoption of the proposed variables, approaches and methods and take the steps necessary to ensure their ongoing provision, availability and use.

Expected outcomes are the development of guidelines and standards for improved terrestrial observation systems, and the provision of synthesis products, position papers, databases, geo-referenced analysis of global/regional/national terrestrial ecosystems services and their changes.

GTOS could have a focus on the African region, it will continue its support for the UN Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD) and the Integrated Global Carbon Observation (IGCO) in the frame of GEO, and wants to get more involved in water and desertification area.

Han Dolman suggested that TOPC should base its work plan and programme on the GCOS IP, which has been widely accepted, e.g. by space agencies. In contrast to this, the UN Convention to Combat Desertification (UNCCD) and the Convention on Biological Diversity (CBD) do not have IPs related to observations or concepts equivalent to the Essential Climate Variables (ECVs).

The TOPC members should also discuss new potential ECVs, i.g soil moisture which had been proposed as a terrestrial ECV.

Valentini illustrated one result in preparation for the Nagoya Biodiversity Convention (18 to 29 October 2010) showing that, despite a useful Millennium Assessment and some case studies, there is no systematic global observation in the area of biodiversity, and no universally accepted indicators to monitor biodiversity exist. Main reasons are the large, but uncoordinated number of studies in the field; the enormous variation of scales and interest (ranging e.g., from genomics to

landscape fragmentation), the missing science-policy link and the lack of an international institution responsible for coordination. The GEO Biodiversity Observation Network (GEOBON) may be a useful starting point in this area.

## 4. Update on GCOS

Carolin Richter, Director of the GCOS Secretariat, updated meeting participants on a range of recent GCOS-related activities:

### 4.1 GCOS supporting the UNFCCC

The GCOS Secretariat has led the preparation of the 2004-2008 GCOS Progress Report on the status of implementing the Global Observing System for Climate, which was presented at the 30<sup>th</sup> session of the United Nations Framework Convention on Climate Change (UNFCCC) Subsidiary Body for Scientific and Technological Advice (SBSTA 30) in Bonn, June 2009. It was responding to a request from SBSTA's 23<sup>rd</sup> session in December 2005. Parties to the UNFCCC endorsed the main findings of the report, and also forwarded to the Conference of the Parties (COP) a draft decision for consideration at its 15<sup>th</sup> session (COP 15) in Copenhagen in December 2009, where this decision was adopted with no discussion by the Parties.

The Progress Report is based on performance reports of all GCOS component systems, national reports on systematic observation for climate, expert advice and an open review by the community. It concludes that implementation of the various observing systems in support of the UNFCCC has progressed significantly over the last five years but that sustaining the funding of many important systems is fragile. There has been only limited progress in filling observing system gaps in developing countries.

Furthermore, the UNFCCC SBSTA has issued an invitation to prepare a 2010 Update of the GCOS IP, including a breakdown of costs for implementation. The cost estimate will comprise estimated global costs needed in addition to expenditure for already existing observation systems. A first draft was submitted for consideration by Parties at COP 15 in Copenhagen in December 2009.

### 4.2 GEOSS

GCOS is a participating organization of the Group on Earth Observation (GEO) and has been recognized as the climate observing component of the Global Earth Observation System of Systems (GEOSS). The GEO-VI Plenary (Washington, November 2009) approved an updated Strategic Target for the Climate SBA, explicitly recognizing the importance of systematic global climate observations.

### 4.3 WIGOS

GCOS supports the WMO Integrated Observing System (WIGOS) initiative and in 2009 elements of the implementation of the GCOS Reference Upper-Air Network (GRUAN) have been designated a WIGOS Pilot Project. It was noted that GCOS goes beyond WIGOS requirements with respect to terrestrial, oceanic, environmental and socio-economic variables.

## 5. GCOS Role in the GFCS

The World Climate Conference-3 (WCC-3), held from 31 August to 4 September 2009 in Geneva, Switzerland, agreed to initiate a Global Framework for Climate Services (GFCS) in order to generate information and services required for factoring climate variability and change into socio-economic decision-making. GCOS has been highlighted in the conference statement as an essential component of the GFCS, with its IP forming a science-based background, and GCOS panel experts were nominated to contribute to the outline of a future GFCS.

## 6. Review of Actions in the 11<sup>th</sup> Session TOPC Report

Han Dolman reviewed the status of actions from the 2008 TOPC session as given in Annex IV. It was noted that several Actions, were still open (cf. Annex III and Annex IV) and those identified as responsible were urged to do everything necessary to close those Actions.

## 7. GEO Global Forest Monitoring Facility (GFMF) – Architecture and Implementation

Mette Loyche Wilkie, Senior Forestry Officer (Forest Management) in the FAO Forest Resources Division delivered a presentation on the GEO Global Forest Monitoring Facility as part of the GEO Forest Carbon Tracking Task<sup>1</sup>. The original idea was to implement a global forest observing system by combining satellites and in situ measurements, a global data and information system which is composed of an archive, models and info delivery, as well as a reporting and verification system which consists of carbon results and verification.

Due to some concerns by countries related to data access and national sovereignty, the system will focus on transparency and accessibility to the data. It is supposed to build a facility to help countries doing the assessment themselves based on the best available information and data, rather than establishing an independent global reporting and verification system. Before the UN Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD) mechanism can be implemented, standards, protocols and pre-

---

<sup>1</sup> [www.geo-fct.org](http://www.geo-fct.org)

processing schemes have to be defined. It is planned to focus initially on about six to nine selected countries to implement the first carbon tracking, with a focus on tropical regions.

The nationally-led REDD+ process is supposed to give incentives to developing nations, which have been conserving their forests to help them continue, like countries in central Africa.

Furthermore, Google has offered to provide a portal for the global carbon forest task and there is a push for transparent access to data, open source software, and a research component in addition to monitoring.

Since there is only very limited funding available from GEO Secretariat, individual countries are expected to contribute the estimated 50 Mio US\$ for implementing REDD.

The upcoming schedule is as following: A draft will be presented at the GEO Ministerial Meeting in November 2010; the full plan including costing shall be ready by the end of 2011.

In the following discussion, it was noted that no agreed standards exist for the pre-processing of remote sensing data in support of forest monitoring, e.g., from space agencies. Concerns were raised that there was only limited involvement by users so far and input from observing systems would be crucial to make sure that the initiative is part of the community of best practice. Riccardo Valentini suggested that GTOS can contribute by providing elementary definitions and protocols. John Latham stressed that FAO has a mandate to monitor forests and would like to have better access to satellite data. Verification of country reports was regarded as a major problem - the UNFCCC for example only provides an agreed set of standardized methodologies which countries have to choose from, rather than doing verification.

## 8. GTNs and ECVs overview

### 8.1 Global Terrestrial Network for Glaciers (GTN-G) / Global Terrestrial Network for Permafrost (GTN-P)

Since Valery Vuglinskiy and Wilfried Haeberli were unable to attend, Konrad Steffen reported on cryosphere issues, covering not only permafrost, but also ice sheets. Melting of ice sheets contributes to the global sea level rise. The acceleration of sea level rise over the past decade was identified by satellite measurements; both in-situ tide gauge and satellite observations of sea level rise show a 3.0 to 3.3 mm per year increase for the past few years which is significantly larger than 1.8 mm per year for the previous decades. The area of Greenland ice melt has been increasing over the past three decades by approximately 8 % per decade. The total mass balance the ice sheet has been negative for the past ten years with values close to 250 Giga Tones (Gt) per year since 2007. If the current ice loss in Greenland and

Antarctica persists, the mountain glaciers continue to melt at the current rate, and the ocean thermal expansion under a warming climate is considered, a sea level rise of 0.86 m can be expected until 2100. Processes of the accelerated ice loss of the Greenland ice sheet are still not fully understood but are likely to be triggered by oceanic warming and by meltwater lubrication along the ice margins. In order to address the uncertainties related to the behaviour of ice sheets under a warming climate, detailed observational studies and high-resolution process models are needed. The World Climate Research Programme (WCRP) Climate and Cryosphere (CliC) plans workshops to bring observing and modeling communities together to follow-up on this issue, and TOPC recommended that GCOS support such workshops at an appropriate level.

The Gravity Recovery and Climate Experiment (GRACE) instrument measuring the gravity field can contribute to estimating the volume loss of ice sheets. GRACE II will hopefully be launched in 2016 together with the second 'Ice, Cloud, and land Elevation Satellite' (ICESat-2). NASA's ICESat-1 discontinued measurements two months ago, but ESA CryoSat was launched by mid-March, 2010. Satellite measurements remain crucial tools in assessing mass changes of large ice bodies; long-term monitoring at high accuracy will enable and improve prediction of sea level rise under a warming climate.

In the following discussion the panel member suggested to discuss a new GTN on Ice-Sheets, which led to the need of a general agreement upon GTNs specification.

## 8.2 Global Terrestrial Network for River Discharge (GTN-R)

Ulrich Looser from the Global Runoff Data Centre (GRDC) briefed meeting participants on the status of the Global Terrestrial Network for River Discharge (GTN-R): The original network proposal comprised of over 300 stations; currently 185 were confirmed by national hydrological services (NHSs). Near-real time data shall be in the data base within a year. Planned actions (see open Actions 3-10 in Appendix IV) depend on the availability of resources at the GRDC, which is supported by Germany as a contribution to the World Climate Programme (WCP) - Water.

The European Terrestrial Network for River Discharge (ETN-R) has been realized and is transmitting river discharge and/or water level data for participating European countries from over 700 stations by 26 providers to the European Joint Research Centre in Ispra. ETN-R is supporting the European Flood Alert System (EFAS)

The Hydrological Applications and Run-Off Network (HARON) project proposal was rejected in 2009 as an EU FP-7 project, on the grounds of insufficient scientific benefits of the observational data. TOPC could support GTN-R by strengthening the scientific use and demand of GTN-R/GRDC data.

**Action 1: Send support letter to WMO Members to contribute to the GTN-R. (GCOS Secretariat / GRDC)**

**Action 2: Investigate the inclusion of fresh water fluxes coming out of Greenland ice. (GRDC / TOPC Chairman).**

### 8.3 Global Terrestrial Network for Lakes (GTN-H/lakes)

Jean-François Crétaux presented the status of the International Data Centre on the Hydrology of Lakes and Reservoirs 'HYDROLARE' project on behalf of Valery Vuglinskiy. The data base is growing as it holds metadata, but it does not fully achieve its goal of operational state. A prototype data base is foreseen to start this year, but will not yet be accessible for users. Participants discussed how to accelerate the implementation of HYDROLARE. The collaboration with LEGOS<sup>2</sup> has been proved very helpful, and a formal agreement between the Russian State Hydrological Institute, the host institution of HYDROLARE, and LEGOS is in the making. GCOS has set out clear guidance, what is expected from HYDROLARE with respect to data access, quality control, and documentation, e.g. metadata has to be aligned with WMO Information System (WIS) standards.

HYDROLARE and LEGOS have also been working on a revised GTN-L list which will be finalized in 2010 for approval by TOPC as a whole.

### 8.4 Global Terrestrial Network for Groundwater (GTN-GW)

Han Dolman reported on the status of the GTN-GW. Groundwater as a key resource for drinking water and irrigation is getting low in many places, e.g. in India where surface water content is increasing at the same time (recent Nature article by Matthew Rodell<sup>3</sup>). Currently, there is no systematic monitoring and assessment of groundwater changes on a global scale. Shared observations are even declining because of the direct economic value of the data. The International Groundwater Resources Assessment Centre (IGRAC), hosted by the Dutch independent research institute for water, soil and subsurface issues (DELTARES), promotes sharing information on groundwater and is setting up a sustainable Global Groundwater Monitoring Network (GGMN) for a periodic assessment of the global change of groundwater resources.

The GRACE mission has started to document changes in water mass distribution. For Africa, it documents a decline in most places, especially along the West African coast and Northern Congo, and an accumulation in Southern Congo/Zambia. Common knowledge expects additional water in a warmer atmosphere, but it is not clear whether some of that water might relocate in the oceans. GCOS has endorsed IGRAC, and it would be desirable to have a presentation on IGAC at a future TOPC meeting.

<sup>2</sup> LEGOS is a joined laboratory sponsored by Centre National d'Etudes Spatiales (CNES), the national research organisations (CNRS), the Institut de Recherche pour la Développement (IRD) and the University Paul Sabatier (UPS), based in the 'Observatoire Midi Pyrenees', Toulouse, France.

<sup>3</sup> Matthew Rodell, Isabella Velicogna and James S. Famiglietti (2009) 'Satellite-based estimates of groundwater depletion in India', Vol 460, 20 August 2009, doi:10.1038/nature08238

**Action 3: Get Updated information on IGRAC; invite representatives to next TOPC meetings. (TOPC Chairman)**

### 8.5 ECV on Soil moisture

Han Dolman further reported on the soil moisture ECV, which is a key parameter in land surface processes: The measurement technique is mature and remote sensing instruments can provide spatially averaged values. ESA is currently operating the Soil Moisture Ocean Salinity Mission (SMOS), which also provides estimated of ocean salinity. NASA, for its part, is currently planning to launch the Soil Moisture Active & Passive Mission (SMAP) to contribute measurement of soil moisture, but not before 2015. Satellite observations cover the upper layer skin, but validation of the soil moisture is very difficult because of its large spatial variability, which makes it difficult to obtain representative measurements. Although absolute validation is difficult, trends should be consistent. In situ networks are being established for monitoring in situ trends and variability, partly motivated by the need for validation of satellite-derived products. Two centres collect soil moisture data: Rutgers University (USA) and Vienna University (Austria).

Currently, there are no widely accepted measurement practices for the soil moisture ECV. A reason is the lack of a strong user community with clear requirements and validation expectations. A workshop to clarify these issues may be the best approach, and ESA (Arino) might be interested in helping. The outcome could be the set-up of a small working group, involving both remote sensing and in situ measurements, as well as modelers, to establish documentation, guidelines and standards for in situ networks and think about the cal/val activities (similar to the GEWEX working group).

**Action 4: Establish a soil moisture working group including TOPC, WCRP, ESA and CNES. Organise a work shop supported by ESA. (GTOS Secretariat / GCOS Secretariat)**

**Action 5: Define the role of in situ data bases in soil moisture ECV development; liaise with the planned soil moisture workshop. (TOPC Chairman / GCOS Secretariat)**

### 8.6 ECV on Fire Disturbance

Kevin Tansey reviewed progress concerning the fire ECV and distributed an accompanying document on major activities with respect to fire disturbance:

- ESA has identified burned area as one of the ECVs for implementation in the Climate Initiative and plans for a public round robin competition and validation exercise.
- Active fire products are becoming more mature; an example for this is the FireMafs project by Martin Wooster.
- The Moderate Resolution Imaging Spectrometer (MODIS) collection 6 is making progress; NASA's call for proposals is open until the end of March.

- The first Committee on Earth Observation Satellites (CEOS) Land Product Validation (LPV) documentation has been published and more will follow within 2010.

During the following discussion, it was suggested to update the GTOS Report No. 68, 'Fire Disturbance: assessment report on available methodological standards and guides' to reflect the work that has been achieved recently. Han Dolman suggested issuing similar updates for other ECVs. Further, the GTOS Secretariat remarked that there should be a closer cooperation with the GOFCC.

**Action 6: Prepare written ECV status updates for all terrestrial ECVs for TOPC sessions similar to the one provided for the fire ECV. (TOPC Members)**

## 9. Reference Network for Ecosystem Sites

About 400 flux sites deliver data on water vapour and CO<sub>2</sub> fluxes and other associated parameters globally. Those measurements are mostly based on individual research projects and generally do not follow standardized procedures and often lack provisions for continuity, documentation, and validation. Han Dolman suggested selecting about 35 best sites to connect to the Flux and Energy Exchange Network (FLUXNET) and the CEOS Cal/Val group (see Action T3 in the draft 2010 GCOS IP). There is a lack of incentive or user push to get such an action going and sustained funding is always a problem. Also most of the FLUXNET sites cannot close the water or energy budget, which would limit the possible network to 30-40 sites. ESA is doing projects of limited scope, but no institution has a mandate to systematically generate ECVs globally and continuously for the foreseeable future. Therefore, Action T3 in the GCOS IP needs further elaboration through a proposal to be developed by small Task Team drawn from TOPC members and GCOS and GTOS Secretariats.

**Action 7: T3: Draft proposal for reference network in support of the 2010 GCOS IP Action T3. (TOPC Chairman / GCOS Secretariat / GTOS Secretariat)**

## 10. GCOS, GTOS and the GEO Communities of Practice (CoP) for an Integrated Global Carbon Observation System (IGCO)

Han Dolman briefed TOPC participants on the GEO Carbon Strategy, which is a key driver of current Carbon CoP activities. There are three major initiatives, which partly overlap:

- the GEO Carbon Strategy,
- the Coordination Action Carbon Observation System (COCOS), and
- the Integrated Global Carbon Observations (IGCO).

The GEO Task (GEO CL-09-03a) expresses the need to develop a coherent cross domain strategy. As the GEO Secretariat plans to feature the carbon topic prominently at the GEO Ministerial Meeting in Beijing, China, Han Dolman suggested that GTOS/GCOS should be seen as leaders in this area by actively contributing to this action.

GCOS and GTOS are interested in both stocks and fluxes of carbon, but current ECVs only deal with static stocks or state variables (e.g., temperature is included, but not latent heat flux).

Action T33 of the GCOS IP calls for the development of globally gridded estimates of terrestrial carbon fluxes from in situ observations and satellite products, and promotion of assimilation / inversion models. The NOAA Carbon Tracker is de facto doing this, but without connection to satellites.

Antonio Bombelli became new coordinator of Carbon CoP. He will take over from Roger Dargaville (Australia).

## 11. 2004-2008 GCOS Progress Report

Stephan Bojinski presented major results of the 2004-2008 GCOS Progress Report, with particular focus on the terrestrial component. For the terrestrial ECVs the score is slightly lower than in other domains because many terrestrial ECVs do not have a responsible agency, however, significant progress has been made over the past four years in almost all Actions.

## 12. 2010 Update of the GCOS IP

Stephan Bojinski discussed the 2010 update to the GCOS IP, including a review of major comments received during the open review period of the draft Plan between November 2009 and January 2010 on all 39 Actions in the terrestrial domain. The Panel made recommendations as to how to address these comments in the final version of the 2010 IP, which will be published in August 2010.

A major point of discussion related to the recognition of 'Terrestrial biodiversity and habitat properties' as a new ECV. Shaun Quegan asked why biodiversity was considered a climate variable and not an impact variable since it could not be measured globally. There is a community view that it would be necessary to keep track of biodiversity at reference sites together with related measurements of biogeochemical and meteorological variables. Participants had different views about whether reference sites should be expected and designed to measure biodiversity or whether this seemed overambitious and not feasible with regard to cost implications and capabilities. In addition, the GCOS IP has no associated action. Concerns were raised that ECVs are not a wish list, but based on both relevance and feasibility. Riccardo Valentini however supported the inclusion of biodiversity in

the list of ECVs, which may catalyze the desire of the three Rio conventions (UNFCCC, UNCCD, UNCBD) to work together.

In the following discussion Michel Verstraete reminded the Panel members with regard to the various UN conventions also to consider cross-cutting issues in their deliberations, i.e. the human dimension.

**Action 8: T31, biomass: GTOS to write 1 or 2 pages outline on requirements needed for that action. (GTOS Secretariat)**

**Action 9: Work out a concept for regular assessment of global observing systems for climate, including current and new ECVs. (GCOS SC)**

**Action 10: Elaborate the details of observing biodiversity and habitat properties as a potential ECV. (GTOS SC Chairman / TOPC Chairman / GCOS Secretariat)**

### 13. ESA in Support of Terrestrial ECVs

Olivier Arino presented the ESA Climate Change Initiative (CCI), which aims at securing comprehensive long-term climate observations from space. International partners are UNFCCC, GCOS, International Research Programmes (WCRP, IGBP, Diversitas and others), Space Agencies, as well as European Commission and national research programmes. Paul Mason is a member of the science advisory body, as is the director of WCRP, Ghassem Asrar.

The CCI foresees feedback mechanisms between:

- Reprocessing, e.g. calibration;
- ECV generation; and
- ECV assimilation & assessment.

The decision on tender proposals will be made by May 2010

The following three out of eleven ECVs addressed in the CCI are terrestrial variables:

- Glaciers
- Land Cover
- Fire Disturbance

First land cover products (GlobCover 2009) have been released in April 2010.

The GlobCarbon product has not much take-up by users so far (~ 400, while WCP has over 4000 users). Carbon is still in a research state and not easy to assimilate in climate models. ESA had a similar experience with ocean colour.

The Global Monitoring for Environment and Security Initiative (GMES) agreed to change to a free and open data policy for Sentinel products; this is necessary for the retrofit of Sentinel products to ENVISAT data.

## 14. Status of Standards and Guidelines for Terrestrial ECVs

Antonio Bombelli from the GTOS Secretariat reported on the development of standards and guidelines for terrestrial ECVs. An update on performance indicators shall be published before COP 16. Not all ECVs are ready for standardization at the current state, some need more development, and others need more methodological research. Considering the need and 'readiness' for developing an international standard for in situ observations, the first ECVs that can be considered for standardization within the new Terrestrial Framework are: are biomass, glaciers, land cover, permafrost, and soil moisture. GTOS proposes to specify the potential new terrestrial ECVs biodiversity and habitat properties and carbon fluxes before November 2010.

The 30<sup>th</sup> session of the SBSTA recommended that CEOS and countries with satellite-based earth observation programmes are encouraged to continue, and, if possible, accelerate methodology development, validation and intercomparisons of satellite-based ECV products for the terrestrial domain.

WMO has signed an MOU with Open Geospatial Consortium (OGC), who write specifications for the private sector, to align WMO's standard setting process with the International Organization for Standardization (ISO).

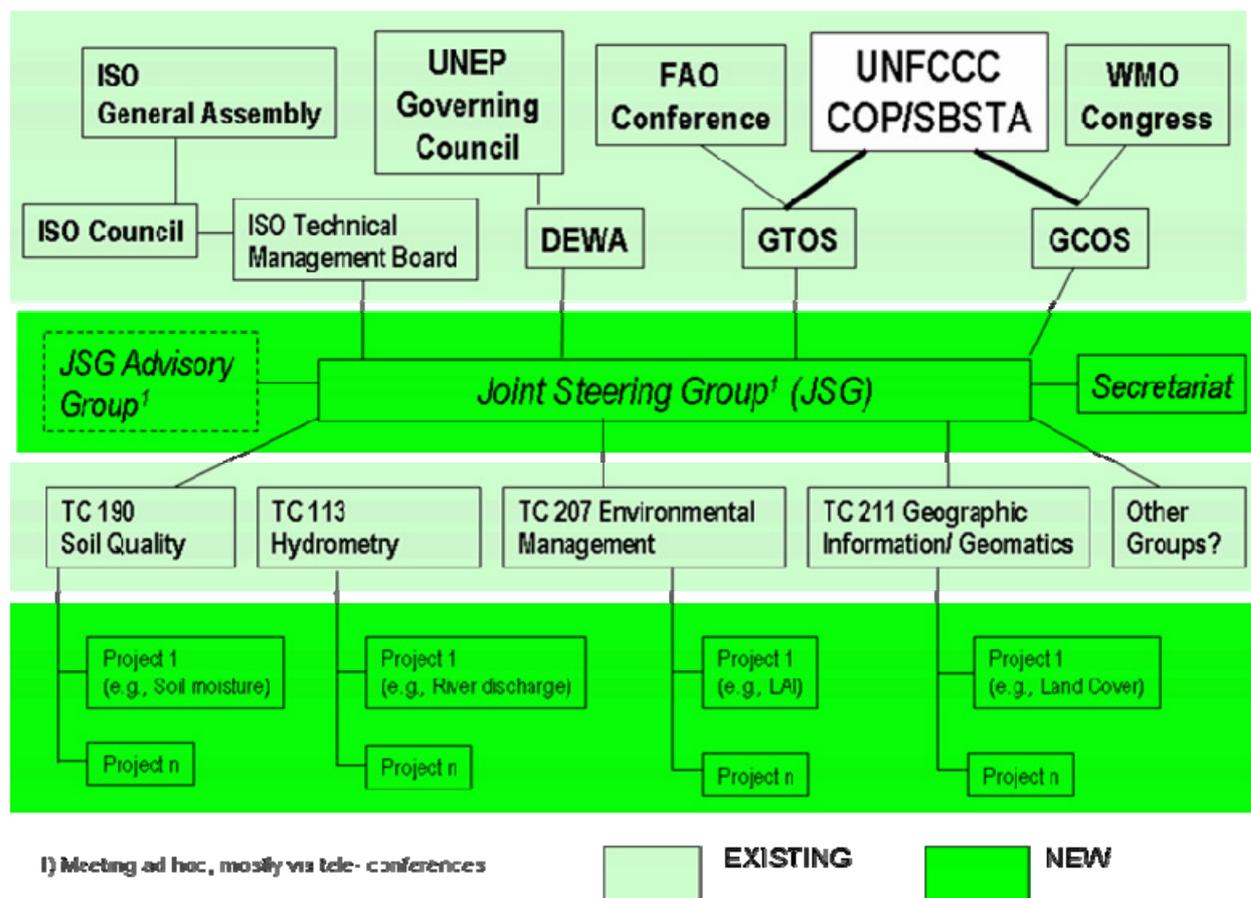
In the following discussion, concerns were raised that the standard-setting Framework may create parallel structures whereas it would be preferable to have one set of guidelines only (e.g., in the case of soil moisture). John Latham clarified that the onset of those guiding documents is to give an overview of the state of the art methodology.

## 15. Establishment of a Terrestrial Framework

John Latham, Director of the GTOS Secretariat, reported on the status, plans and role of TOPC and GTOS in establishing a terrestrial framework. The joint UN-ISO mechanism for the standardization of key terrestrial ECVs proposed by the GTOS (as shown in Fig. 1) foresees the set-up of a Joint Steering Group (JSG), which is to be supported by a JSG Advisory Group and would report back directly to the ISO Secretariat and Technical Management Board.

The proposed Framework employs collaborative arrangement between UN agencies and the ISO, formalized through a Memorandum of Understanding; Joint Steering Group, a new coordination entity within the ISO process with representation from the sponsoring agencies; and the conduct of the standards development work through ISO technical committees and the procedures they use. As well as

complying with the criteria identified by the SBSTA, the Framework also meets other criteria regarding efficiency, effectiveness and flexibility.



**Figure 1: Proposed structure of a terrestrial framework**

Figure 1 shows the proposed entities to constitute the Framework, and their relationships: intergovernmental and international organizations, including their components and programs; and new components that need to be established specifically for the development of standards for terrestrial observations.

The new components in figure 1 are considered as the minimum addition necessary to carry out the ECV standards development, and it consists of:

- UN-ISO JSG, a body which receives requests for standards development and decides on the modalities and strategy for developing the standard. Thus, the JSG must include representation of the agencies making the requests as well as the groups potentially carrying out the work.
- JSG Advisory Group, which prepares implementation options for developing each standard, ensures their feasibility and adequacy, and forwards these to the JSG for decision.
- A Secretariat supporting the JSG in its activities.

- Individual new standard development projects, as per JSG decisions.

The JSG could comprise representatives from GTOS/GCOS-TOPC and a JSG Secretariat could provisionally be hosted at FAO/GTOS Secretariat.

The implementation of the proposed Framework should proceed through several stages:

1. Endorsement of the UN-ISO Framework as a solution that would meet UNFCCC needs. This endorsement should be given by the COP/SBSTA.
2. Approval of the UN-ISO Memorandum of Understanding. This approval should be given by the ISO Council and the corresponding decision-making bodies in the participating UN organizations.
3. Completion of the Terms of Reference and procedures for the JSG.
4. Development of an initial work plan and of detailed plans for the initial set of projects.
5. Approval of the plan of work, beginning project execution.

By SBSTA 30 (Bonn, 2009) the SBSTA welcomed the proposal contained in the updated progress report for a joint terrestrial framework mechanism between relevant agencies of the UN and the ISO, and encouraged the GTOS Secretariat and the GTOS sponsoring agencies to implement the framework. GTOS has been requested to report on the results of the implementation of the framework and its elaboration of the work plan at SBSTA 33 (November/December 2010). An interagency meeting to discuss financial implications of proposals is planned for 2010.

**Action 11: Prepare 1-2-page explanatory paper on how the process of standardization shall progress. (GTOS Secretariat)**

## 16. Evaluation of GEWEX/WOAP Activities

The next WOAP meeting will be held from 29 to 31 March in Hamburg, German, and will be attended by Han Dolman. The TOPC Members requested the Chairman to discuss the potential ECV soil moisture also with this panel.

## 17. Data in Support of Impact Studies

Han Dolman and Stephan Bojinski informed participants that the IPCC/GEO/GCOS Workshop on data in support of climate impact studies, planned for May 2010, was postponed to November 2010.

Driver for holding such a workshop was the huge spatial discrepancy of IPCC studies, which nearly exclusively come from Europe and the US. Studies are often not transparent and data is not freely available. IPCC WG 2 is supposed to define a set of impact, adaptation and vulnerability variables, but many impact studies

would need higher resolution observations. Meeting participants were therefore asked to provide input with regard to socio-economic impact studies, e.g. for a stakeholder workshop showcasing the relevance of geophysical climate data (such as urban heat islands among other factors).

**Action 12: Provide a one page rationale in preparation for the next TOPC meeting about changing requirements of data for impact, mitigation and adaptation, modus operandi for GCOS and GTOS. (TOPC Chairman / GTOS Secretariat / GCOS Secretariat)**

## 18. Calendar and Future Meetings

It was agreed to hold the upcoming TOPC-XIII meeting 10-11 March 2011 at WMO Headquarters in GVA. The next SBSTA session will take place, May 31 - June 9 in Bonn, Germany.

## Annex I: Meeting Agenda

### **10 March 2010**

<p><u>9:30-11:00</u></p> <p>(1) Welcome and Introduction (H. Dolman)  (2) Approval of Agenda  (3) GTOS Strategy Update (R. Valentini)  (4) Update on GCOS (C. Richter)  (5) GCOS Role in the GFCS (C. Richter)  (6) Review of Actions in 11th Session TOPC Report (Chair)</p>
<p><u>11:00-12:00 (ECVs)</u></p> <p>(7) The GEO Global Forest Monitoring Facility – Architecture and Implementation (Mette Loyche Wilkie, FAO)</p>
<p><u>12:00-13:30</u> – Lunch</p>
<p><u>13:30-15:30</u></p> <p>(8) GTNs and ECVs-overview  (K. Steffen – GTN-G/Permafrost)  (U. Looser – GTN-R)  (V. Vuglinskiy – GTN-H/Lakes)  (H. Dolman – GTN-GW)  (H. Dolman/Y.Polcher – ECV on Soil Moisture)  (K. Tansey – ECV on fire disturbance)  (9) Reference Network for Ecosystem Sites (H. Dolman, R. Valentini)</p>
<p><u>15:30-17:30</u></p> <p>(10) GCOS, GTOS and the GEO CoP for an Integrated Global Carbon Observation system (IGCO) (H. Dolman, R. Valentini, A. Bombelli)</p>

### **11 March 2010**

<p><u>9:00-10:30</u></p> <p>(11) <u>2004-2009 GCOS Progress Report: Assessment of progress in the Terrestrial Component of the GCOS Implementation Plan plus Critical Review (S. Bojinski)</u>  (12) <u>2010 Update of the GCOS Implementation Plan plus Critical Review and Discussion on Actions Relevant to TOPC (S. Bojinski)</u></p>
<p><u>10:30-11:00</u></p> <p>(13) <u>Developments at ESA in Support of Terrestrial ECVs (TBD)</u></p>
<p><u>11:00-12:30</u></p> <p>(14) <u>Status of Standards and Guidelines for Terrestrial ECVs (A. Bombelli)</u>  (15) <u>Establishment of a Terrestrial Framework: Status, plans and roles of TOPC/GTOS (John Latham)</u></p>
<p><u>12:30-13:30</u> – Lunch</p>
<p><u>13:30-14.30</u></p>

(16) Evaluation of GEWEX/WOAP Activities. Strategy for joint workshops (H. Dolman)

14.30-16.30

(17) Data in support of Impact Studies

(18) Calendar and Future Meetings (H. Dolman; All)

- Next TOPC Meeting
  - SBSTA 33
  - UNFCCC COP16 (Mexico)—GCOS/GTOS activities
  - Other
- Closure of the meeting

## Annex II: Meeting Participants

List of Participants		
<b>Han Dolman</b> Chairman	Faculty of Earth and Life Sciences Vrije Universiteit Amsterdam 1081 HV Amsterdam, The Netherlands	Phone: +31 20 5987358/7303 Fax: +31 20 5989940 E-mail: han.dolman@geo.falw.vu.nl
<b>Olivier Arino</b>	European Space Agency - ESRIND/EOP-SEP Via Galileo Galilei C.P.94, I-00044 Frascati (RM), Italy	Tel: +39 06 941 80564 Fax: +39 06 941 80552 E-mail: Olivier.Arino@esa.int
<b>Stephan Bojinski</b>	GCOS Secretariat c/o WMO, P.O. Box 2300, 1211 Geneva 2, Switzerland	Tel: +41 22 730 8150 Fax: +41 22 730 8052 E-mail: SBojinski@wmo.int
<b>Antonio Bombelli</b>	GTOS Secretariat Food and Agriculture Organisation of the United Nations (FAO), Viale delle Terme di Caracalla, I-00100 Roma, Italy	Tel.: +39 06 570 53808 E-mail: antonio.bombelli@fao.org
<b>Jean-Francois Crétaux</b>	CNES/Legos 14 Av Edouard Belin, 31400 Toulouse, France	Tel: +33 5 61332989 Fax: +33 5 61253205 E-mail: jean-francois.cretaux@cnes.fr
<b>Anna Kuhn</b>	GCOS Secretariat c/o WMO, P.O. Box 2300, 1211 Geneva 2, Switzerland	Tel.: +41 22 730 8272 Fax: +41 22 730 8052 E-mail: AKuhn@wmo.int
<b>John Latham</b>	Director GTOS Secretariat Food and Agriculture Organisation of the United Nations (FAO), Viale delle Terme di Caracalla, I-00100 Roma, Italy	Tel.: +39 06 570 54026 Fax: +39 06 570 53369 E-mail: john.latham@fao.org
<b>Ulrich Looser</b>	Global Runoff Data Centre (GRDC), Federal Institute of Hydrology (BfG) Am Mainzer Tor 1, 56068 Koblenz, Germany	Tel: +49 261 1306 5224 Fax: +49 261 1306 5722 E-mail: looser@bafg.de
<b>Jan Polcher</b>	Laboratoire de Météorologie Dynamique du CNRS Tour 25, 5eme étage, Case 99 4 pl. Jussieu, 75252 Paris cedex 05	Tel: 33 1 44274763 Fax: 33 1 44276272 E-mail: Jan.Polcher@lmd.jussieu.fr
<b>Shaun Quegan</b>	Centre for Terrestrial Carbon Dynamics (CTDC), University of Sheffield Hicks Building, Hounsfield Rd, S3 7RH Sheffield, UK	Tel: +44 114 222 3803 Fax: +44 114 222 3809 E-mail: S.Quegan@sheffield.ac.uk
<b>Carolyn Richter</b>	Director GCOS Secretariat c/o WMO, P.O. Box 2300, 1211 Geneva 2, Switzerland	Tel.: +41 22 730 82 75 Fax: +41 22 730 80 52 E-mail: crichter@wmo.int

<b>List of Participants</b>		
<b>Kevin Tansey</b>	Department of Geography, University of Leicester Leicester, LE1 7RH, UK	Tel: +44 116 2523859 Fax: +44 116 2523854 E-mail: <a href="mailto:kjt7@le.ac.uk">kjt7@le.ac.uk</a>
<b>Riccardo Valentini</b>	Department of Forest Science and Environment (DISAFRI), University of Tuscia Via S. Camillo de Lellis, 01100 Viterbo, Italy	Tel: +39 0761 357394 Fax: +39 0761 357389 E-mail: <a href="mailto:rik@unitus.it">rik@unitus.it</a>
<b>Michel Verstraete</b>	Institute for Environment and Sustainability, European Commission – JRC Via Enrico Fermi, 2749, I-21020, Ispra (VA), Italy	Tel: +39 0332 785 507 Fax: +39 0332 789 073 E-mail: <a href="mailto:Michel.Verstraete@jrc.ec.europa.eu">Michel.Verstraete@jrc.ec.europa.eu</a>
<b>Konrad Steffen</b>	University of Colorado, CIRES, Campus Box 216, Boulder, CO 80309-0216, USA	Tel: +001 303 492 8773 Fax: +001 303 492 1149 Email: <a href="mailto:Konrad.Steffen@colorado.edu">Konrad.Steffen@colorado.edu</a>



## Annex III: List of Actions

List of Actions		
No.	Subject	Responsible
1	Send support letter to WMO Members to contribute to the GTN-R.	GCOS Secretariat / GRDC
2	Investigate the inclusion of fresh water fluxes coming out of Greenland ice.	GRDC / TOPC Chairman
3	Get Updated information on IGRAC; invite representatives to next TOPC meetings.	TOPC Chairman
4	Establish a soil moisture working group including TOPC, WCRP, ESA and CNES. Organise a work shop supported by ESA.	GTOS Secretariat / GCOS Secretariat
5	Define the role of in situ data bases in soil moisture ECV development; liaise with the planned soil moisture Workshop (Dolman / GCOS Sec).	TOPC Chairman / GCOS Secretariat
6	Prepare written ECV status updates for all terrestrial ECVs for TOPC sessions similar to the one provided for the fire ECV.	TOPC Members
7	T3: Draft proposal for reference network in support of the 2010 GCOS IP Action T3	TOPC Chairman / GCOS Secretariat / GTOS Secretariat
8	T31, biomass: GTOS to write 1 or 2 pages outline on requirements needed for that action.	GTOS Secretariat
9	Work out a concept for regular assessment of Global Observing Systems for climate, including current and new ECVs.	GCOS SC
10	Elaborate the details of observing biodiversity and habitat properties as a potential ECV.	GTOS SC Chairman / TOPC Chairman / GCOS Secretariat

<b>List of Actions</b>		
<b>No.</b>	<b>Subject</b>	<b>Responsible</b>
<b>11</b>	Prepare 1-2-page explanatory paper on how the process of standardization shall progress.	GTOS Secretariat
<b>12</b>	Provide a one page rational in preparation for the next TOPC meeting about changing requirements of data for impact, mitigation and adaptation, modus of operandi for GCOS and GTOS.	TOPC Chairman / GTOS Secretariat / GCOS Secretariat



## Annex IV: Status of Actions in the 11th Session TOPC Report

<b>List of Actions</b>			
<b>No.</b>	<b>Subject</b>	<b>Status/remarks/next steps</b>	<b>Responsible</b>
<b>1</b>	The current ("old") ToRs to be put into the meeting report as an Annex (see TOR at <a href="http://www.wmo.int/pages/prog/gcos/index.php?name=topc">www.wmo.int/pages/prog/gcos/index.php?name=topc</a> ) and include Annex-III of the 2007 TOPC report and re-label it as "Work Plan 2007-2011".	DONE	Qamar
<b>2</b>	Update TORs in the GTOS website accordingly as well as on the GOSIC website ( <a href="http://gosic.org/gtos/TOPC-prog-overview.htm">http://gosic.org/gtos/TOPC-prog-overview.htm</a> ). Send an e-mail to Christina Lief ( <a href="mailto:christina.lief@noaa.gov">christina.lief@noaa.gov</a> ) for this purpose.	OPEN; Antonio Bombelli to put the correct TOPC Terms of Reference on the GTOS website; these can be found in Annex-I of the TOPC-XII report or at <a href="http://www.wmo.int/pages/prog/gcos/index.php?name=TOPC">http://www.wmo.int/pages/prog/gcos/index.php?name=TOPC</a>	Qamar
<b>3</b>	After approval by the Commission for Hydrology in November 2008, approach all 82 GTN-R countries, with the assistance of the WMO, to inform them on the status of the GTN-R and the country specific situation.	CLOSED FOR NOW?; At CHy (Nov 2008) decision to link the reactivation of the GTN-R project to the outcomes of the HARON project proposal to address resource constraints. With rejection of HARON proposal decision at the GRDC Steering Committee Meeting (Jun 2009) to decouple HARON and GTN-R project. Resource constraints at	GRDC
<b>4</b>	Request non-participating countries to contribute to the GTN-R.		GRDC
<b>5</b>	Finalise station selection		GRDC

<b>List of Actions</b>			
<b>No.</b>	<b>Subject</b>	<b>Status/remarks/next steps</b>	<b>Responsible</b>
<b>6</b>	Extend metadata and historical data collection for confirmed GTN-R station.	the GRDC still hampering full GTN-R reactivation. Australia busy with station selection. Adaptation of real-time data collection system for GTN-R expected during 2010.	GRDC
<b>7</b>	Extend near real-time data transfer.		GRDC
<b>8</b>	Adopt near real-time data collection software to GTN-R requirements.		GRDC
<b>9</b>	Explore funding mechanisms for the management, extension and operation of the GTN-R as part of the HARON proposal for funding to the European Commission.	CLOSED FOR NOW? HARON proposal rejected in 2009; follow-up planned in 2011	WMO; GCOS; GEO
<b>10</b>	Explore funding mechanisms for infrastructure investments to equip and maintain neglected GTN-R network stations.	CLOSED FOR NOW? No progress	WMO; GCOS; GEO
<b>11</b>	Contact the WMO Hydrological Commission on the pristine areas and basins initiative and other related activities to assess the need to create an advisory group (as proposed by the GCOS SC).	Open Not yet done; to be discussed by CHy advisory WG in April 2010	WMO, GCOS
<b>12</b>	After approval by the Commission for Hydrology in November 2008, approach all WMO member countries with the assistance of the WMO to	initial set of metadata from GRDC available; ongoing exercise	WMO, GCOS

<b>List of Actions</b>			
<b>No.</b>	<b>Subject</b>	<b>Status/remarks/next steps</b>	<b>Responsible</b>
	request identification of pristine basins and the provision of metadata and historical discharge data for inclusion into the GRDC database.		
<b>13</b>	SHI /HYDROLARE and CNES/LEGOS to agree on a collaborative agreement that would facilitate the contribution of the Hydroweb database (a database for lake level and surface variations from satellite remote sensing: radar altimetry and multi-spectral imagery) to HYDROLARE, noting the complementary nature of both efforts. Both institutions will work in cooperation on the implementation of an interface between Hydroweb data base and Hydrolare data centre. Exchange of bilateral visits between CNES/LEGOS and HYDROLARE in 2009 should be encouraged for this purpose, including the HYDROLARE Steering Committee meeting in July 2009.	Informal exchange at HYDROLARE Steering Committee in July 2009 and during meeting in the State Hydrological institute on 08.10.2009. The draft of Formal agreement between the Legos and the State Hydrological Insitute (SHI) was issued by Legos in February 2010. Now this draft is discussing at the SHI. The agreement will be signed during March 2001	Vuglinskiy , Cretaux
<b>14</b>	Make corrections on the current version of ECV T4: Water level in lakes and reservoirs, water storage: <ul style="list-style-type: none"> <li>• Shorten the Executive summary up to 2 pages (Vuglinskiy )</li> <li>• Verify the text of the sub-</li> </ul>	The mentioned corrections were done and the final version of ECV T4: Water level in lakes and reservoirs, water storage was issued and sent to print by Sessa Reuben from FAO on September 2009.	Vuglinskiy , Cretaux

<b>List of Actions</b>			
<b>No.</b>	<b>Subject</b>	<b>Status/remarks/next steps</b>	<b>Responsible</b>
	chapter 3.2 Satellite measurements (Cretaux)		
<b>15</b>	<p>Make a sorting of lakes based on their purpose:</p> <ul style="list-style-type: none"> <li>• Choose lakes that are indicators of climate change (Vuglinskiy )</li> <li>• Choose lakes that are actively used in industry (Vuglinskiy )</li> <li>• Choose lakes that play an important role for other ECVs (Vuglinskiy )</li> <li>• Review list of lakes in GTN-L for relevance and currency, in collaboration with the community (TOPC and partner institutions, e.g., CNES/LEGOS)</li> </ul>	<p>The list of GTN-L lakes was revised. Excluded were:</p> <ol style="list-style-type: none"> <li>1.lakes with water regime disrupted by anthropogenic activity;</li> <li>2.small lakes with surface area less than 100 km<sup>2</sup>;</li> <li>3.duplicate lakes;</li> </ol> <p>After this procedure 102 lakes were left into the GTN-L list (status on February 2010). The next step – to choose lakes with observations and make final selection. It is supposed that the final list will content 50-60 lakes.</p>	Vuglinskiy
<b>16</b>	Obtain ISO Standards for channels.	<p>Some standards were found, deal with a Liquid Flow Measurement in Open Channels: ISO 748, 1979, ISO 2537, 1988, ISO 3455,1976, ISO1088, 1985, ISO 1100, 1981, ISO 555, 1973.1987,ISO 1070, 1973</p>	Vuglinskiy

<b>List of Actions</b>			
<b>No.</b>	<b>Subject</b>	<b>Status/remarks/next steps</b>	<b>Responsible</b>
<b>17</b>	Definitive installation of the new lead structure (steering committee) for GTN-G as cooperation between WGMS, NSIDC and GLIMS under the auspices of the International Association of Cryospheric Sciences.		IACS/IUGG
<b>18</b>	Review the definition of the permafrost ECV during the update of the GCOS IP planned for 2009.	In progress; GCOS IP-10 currently under development; distinction made between permafrost and seasonally-frozen ground	Bojinski, Haeberli
<b>19</b>	Due to a substantial gap associated with snow in the observing system, seek a snow specialist replacement for Haeberli as a TOPC member in 2009, who can take a strong initiative in this important area.		Dolman
<b>20</b>	Consider carbon fluxes as a possible addition to the list of ECVs during the planned update of the GCOS IP.	Part of the review process for GCOS IP-10	Dolman, Bombelli; Bojinski
<b>21</b>	TOPC should remain in liaison with WMO and FAO in defining its role within the ISO-based terrestrial framework.		Latham
<b>22</b>	Update the ECV T13: Fire Disturbance. Assess the status of the development of standards for the Terrestrial Essential Climate Variables document. Discussion points including updating the status	Last updated on 1st November 2009. To be reviewed and updated in 2010	Tansey, GOFC-GOLD

<b>List of Actions</b>			
<b>No.</b>	<b>Subject</b>	<b>Status/remarks/next steps</b>	<b>Responsible</b>
	of FRP developments, report on how future ESA Sentinel and geostationary missions will contribute to this effort and to report on the understanding of the status of ground fire detection and monitoring.		
<b>23</b>	Establish validation protocols working through CEOS LPV and other partners. A concerted effort is required to implement them. The EC FP7 GMES fast track land service GEOLAND2 project has a burnt area validation component.	On-going. Developments are reported on the web site: <a href="http://lpvs.gsfc.nasa.gov/">http://lpvs.gsfc.nasa.gov/</a>	Tansey
<b>24</b>	Going back to 1982 with the AVHRR products, there needs to be similar accuracy assessment effort preferably to CEOS Stage 3. A 1km AVHRR initiative is needed - which could go back to 92 with gap filling in 1999.	There is an activity associated with a CEOS climate action development process (contact Ivan Csiszar) that will address this action.	Tansey, TOPC, GOF-C-GOLD
<b>25</b>	Work towards a centralized facility. The community has developed a Land Measurement Portal which includes fire ( <a href="http://landportal.gsfc.nasa.gov/">http://landportal.gsfc.nasa.gov/</a> ) that could be managed at any location - at this time NASA has stepped up. The idea of a centralized facility for all fire data seems to be a long way off at this time - given the various interoperability efforts which are underway in the various agencies. A	This could come under the responsibility of the ESA CCI project. See: <a href="http://earth.eo.esa.int/workshops/esa_cci/intro.html">http://earth.eo.esa.int/workshops/esa_cci/intro.html</a> for more details.	Tansey, TOPC, GTOS Sec

<b>List of Actions</b>			
<b>No.</b>	<b>Subject</b>	<b>Status/remarks/next steps</b>	<b>Responsible</b>
	<p>different approach might be to work/push for one location (portal) where all fire products are listed with active links to data, including validation data with the published accuracy assessment and an informed description/guide for the user community as to which data are appropriate for which broad kind of analysis. Once we have operational agencies with operational fire products and move out of the research domain then perhaps we can revisit centralization issue.</p>		

## Annex V: TOPC Work Plan (2007 – 2011)

- To identify key ECV's that play a role in feedbacks (amplification and impacts) within the climate system (snow, glaciers, lake level) and reassess whether current approaches to their measurement is adequate.
- Increased attention on coordination and long term maintenance of in situ networks to establish both independent bottom up data sets of ECV's and data sets required for calibration and validation of Earth Observation data.
- Investigate how a number of current research networks (e.g. Fluxnet, LTER's) can be effectively adopted (or endorsed) by GCOS/GTOS terrestrial networks.
- Promote the development of data integration and assimilation techniques for the terrestrial domain.
- Ensure that the five current Global Terrestrial Networks (hydrology, glaciers, permafrost, rivers, lakes) are fully implemented.
- Through GCOS and GTOS maintain strong links with SBSTA and UNFCCC and relevant international research programmes (e.g. WCRP, IGBP) in defining key requirements for observations of the terrestrial ECV's.
- Contribute to the 2009 GCOS progress report to the UNFCCC.
- Link with international opportunities to promote the need for continued observations such as the International Polar Year 2007-2008 ([www.ipy.org](http://www.ipy.org)), the International Year of Planet Earth 2007 - 2009 ([www.esfs.org](http://www.esfs.org)) and subsequent initiatives.
- Maintain engagement of CEOS to ensure delivery of required satellite observations as stated in the GCOS 107 report.
- Maintain engagement with efforts to establish international (continental) terrestrial observation networks.
- Liaise with GTOS wherever appropriate, e.g. in the establishment of guidelines and standards for the observation of terrestrial ECVs.
- Liaise with GCOS and GTOS science Panels on issues of common interest.

## Annex VI: TOPC Terms of Reference (status May 2008)

- Recognizing the need for specific and technical input concerning terrestrial observations for climate purposes, the sponsoring organizations of GTOS and the GCOS have jointly established TOPC with the following terms of reference:
- To define the requirements for long-term monitoring of terrestrial properties for climate and climate change;
- To liaise with relevant research and operational communities to identify measurable terrestrial (biosphere, cryosphere, and hydrosphere) properties and attributes which
  - control the physical, biological and chemical processes affecting climate,
  - are themselves affected by climate change, are indicators of climate change and provide information on impacts of climate change;
- To assess and monitor the adequacy of terrestrial observing networks (in situ, satellite-based) and promote the development of their capacity to measure terrestrial properties and exchange climate data and information;
- To identify gaps in present systems and design, promote and periodically revise plans for a long-term systematic observing system that fills these gaps, makes the data available and so better serves the needs of the research and operational communities;
- To coordinate activities with other global observing system panels and task groups to ensure consistency of requirements with the overall programmes;
- Publish and update GCOS/GTOS studies and planning documents;
- Carry out agreed assignments from the GCOS and GTOS Steering Committees;
- Report regularly to the GCOS and GTOS Steering Committees.

## Annex VII: TOPC Panel Members (status May 2008)

### **Han Dolman** (TOPC Chair)

Faculty of Earth and Life Sciences  
Vrije Universiteit Amsterdam  
1081 HV Amsterdam, Netherlands  
Phone: +31-20-5987358/7303  
Fax: +31-20-5989940  
E-mail: han.dolman@geo.falw.vu.nl

### **Jay Famiglietti**

Earth System Science  
3317 Croul Hall  
University of California, Irvine  
Irvine, CA 92697-3100, USA  
Phone: (949) 824-9434  
Fax: (949) 824-3874  
E-mail: jfamigli@uci.edu

### **Wilfried Haerberli**

Director  
Physical Geography Division  
Geographisches Institut - Physical Geography  
University of Zürich  
Winterthurerstr. 190 – Irchel  
CH-8057 Zürich, Switzerland  
Phone: +41 (0)44 635 51 20  
Fax: +41 (0) 44 635 40 04  
E-mail: Wilfried.haerberli@geo.uzh.ch

### **Ulrich Looser**

Global Runoff Data Centre (GRDC)  
Federal Institute of Hydrology (BfG)  
Am Mainzer Tor 1  
56068 Koblenz Germany  
E-mail: looser@bafg.de

### **Jan Polcher**

Laboratoire de Météorologie Dynamique du CNRS  
Tour 25, 5eme étage, Case 99  
4 pl. Jussieu,  
75252 PARIS cedex 05  
Tel: +33-1-44274763  
Fax: +33-1-44276272  
E-mail: Jan.Polcher@lmd.jussieu.fr

### **Shaun Quegan**

Director, Centre for Terrestrial Carbon  
Dynamics (CTDC)  
University of Sheffield  
Hicks Building  
Hounsfield Rd  
Sheffield S3 7RH, UK  
Tel: +44 114 222 3778  
Office: +44 114 222 3803  
Fax: +44 114 222 3809  
E-mail: S.Quegan@sheffield.ac.uk

### **Konrad Steffen**

Director of CIRES  
University of Colorado, CIRES,  
Campus Box 216  
Boulder, CO 80309-0216  
Tel: (303) 492 8773  
Fax: (303) 492 1149  
Email: Konrad.Steffen@colorado.edu  
Website: <http://cires.colorado.edu/steffen/>

### **Michel Verstraete**

Institute for Environment and Sustainability  
European Commission – JRC  
Via Enrico Fermi, 2749  
I-21020, Ispra (VA), Italy  
Tel.: +39 0332 785 507  
Fax: +39 0332 789 073  
E-mail: Michel.Verstraete@jrc.ec.europa.eu

### **Valery Vuglinskiy**

State Hydrological Institute of Roshydromet  
23, Second Line  
SU-199053 St. Petersburg / Russia  
Phone: +7 812 323 3458  
Fax: +7 812 323 1028  
E-mail: VVuglins@VV4218.spb.edu

### **Kevin Tansey**

Department of Geography, University of  
Leicester  
Leicester, LE1 7RH, UK  
Tel: +44 116 2523859  
Fax: +44 116 2523854  
E-mail: kjt7@le.ac.uk

## Acronyms

CBD	Convention on Biological Diversity
CEOS	Committee on Earth Observation Satellites
CCI	Climate Change Initiative (ESA)
CliC	Climate and Cryosphere Programme (WCRP)
CNRS	Centre national de la recherche scientifique
COCOS	Coordination Action Carbon Observation System
COP	Conference of the Parties
DELTARES	Dutch independent research institute for water, soil and subsurface issues
ECVs	Essential Climate Variables
EFAS	European Flood Alert System
ETN-R	European Terrestrial Network for River Discharge
FAO	Food and Agriculture Organization of the United Nations
FLUXNET	Flux and Energy Exchange Network
GCOS	Global Climate Observing System
GEO	Group on Earth Observations
GEO CoP	GEO Communities of Practice
GEOBON	GEO Biodiversity Observation Network
GEOSS	Global Earth Observation System of Systems
GFCS	Global Framework for Climate Services
GGMN	Global Groundwater Monitoring Network
GGMS	Global Groundwater Monitoring System
GMES	Global Monitoring for Environment and Security Initiative
GOFC/GOLD	GTOS Panels on Global Observation of Forest and Land Cover
GRACE	Gravity Recovery and Climate Experiment
GRDC	Global Runoff Data Centre
GTNs	Global Terrestrial Networks
GTN-G	Global Terrestrial Network for Glaciers
GTN-GW	Global Monitoring of Groundwater Resources
GTN-H	Global Terrestrial Network for Hydrology
GTN-P	Global Terrestrial Network for Permafrost
GTN-R	Global Terrestrial Network for River Discharge
GTOS	Global Terrestrial Observing System
HARON	Hydrological Applications and Run-Off Network
HYDROLARE	International Data Centre on the Hydrology of Lakes and Reservoirs
ICESat	Ice, Cloud, and land Elevation Satellite
IGBP	International Geosphere-Biosphere Programme
IGOS	Integrated Global Observing Strategy
IGCO	Integrated Global Carbon Observation
IGRAC	International Groundwater Resources Assessment Centre
IP	Implementation Plan

IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
JRC	Joint Research Centre
JSG	Joint Steering Group
LPV	Land Product Validation
MODIS	Moderate Resolution Imaging Spectrometer
NHSS	National Hydrological Services
OGC	Open Geospatial Consortium
REDD	UN Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
SBSTA	Subsidiary Body for Scientific and Technological Advice
SMAP	Soil Moisture Active & Passive Mission (NASA),
SMOS	Soil Moisture and Ocean Salinity Mission (ESA)
SC	Steering Committee
TCO	Terrestrial Carbon Observations
TOPC	Terrestrial Observation Panel for Climate
UNCCD	UN Convention to Combat Desertification
UNEP	UN Environment Programme
UNESCO	UN Educational Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WCC-3	World Climate Conference-3
WCP	World Climate Programme
WCRP	World Climate Research Programme