Framework and Status of ECVs for the Terrestrial Domain

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SBSTA , Bonn, Germany 1-12 June 2009

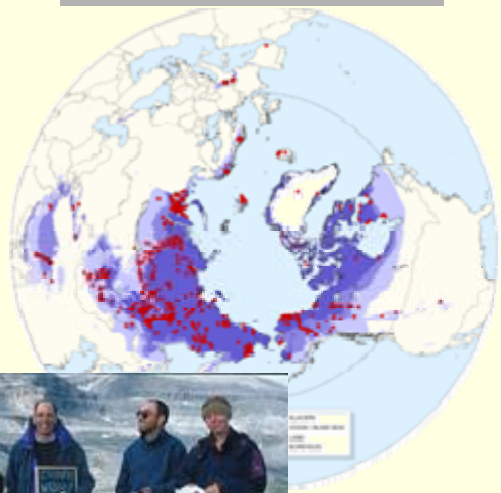
Outline

- **Framework for terrestrial observations**
  - Background
  - Progress to date
  - Proposal
  - Recommendations

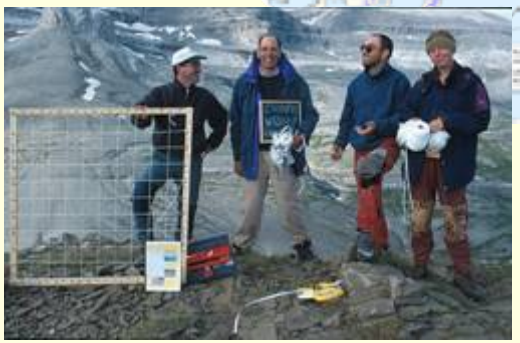
- **ECV standardization**
  - Task
  - Results and status
  - Recommendations

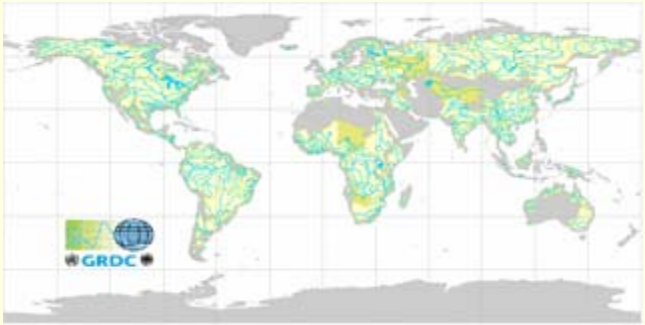
Framework (1): Task

- **Work followed invitation to GTOS by the COP/ SBSTA, motivated by GCOS Implementation Plan**



- **Task**
  - COP-9 "… , *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, taking into consideration possible models, such as those of the WMO/ IOC JCOMM..*"





Framework (2) - Response

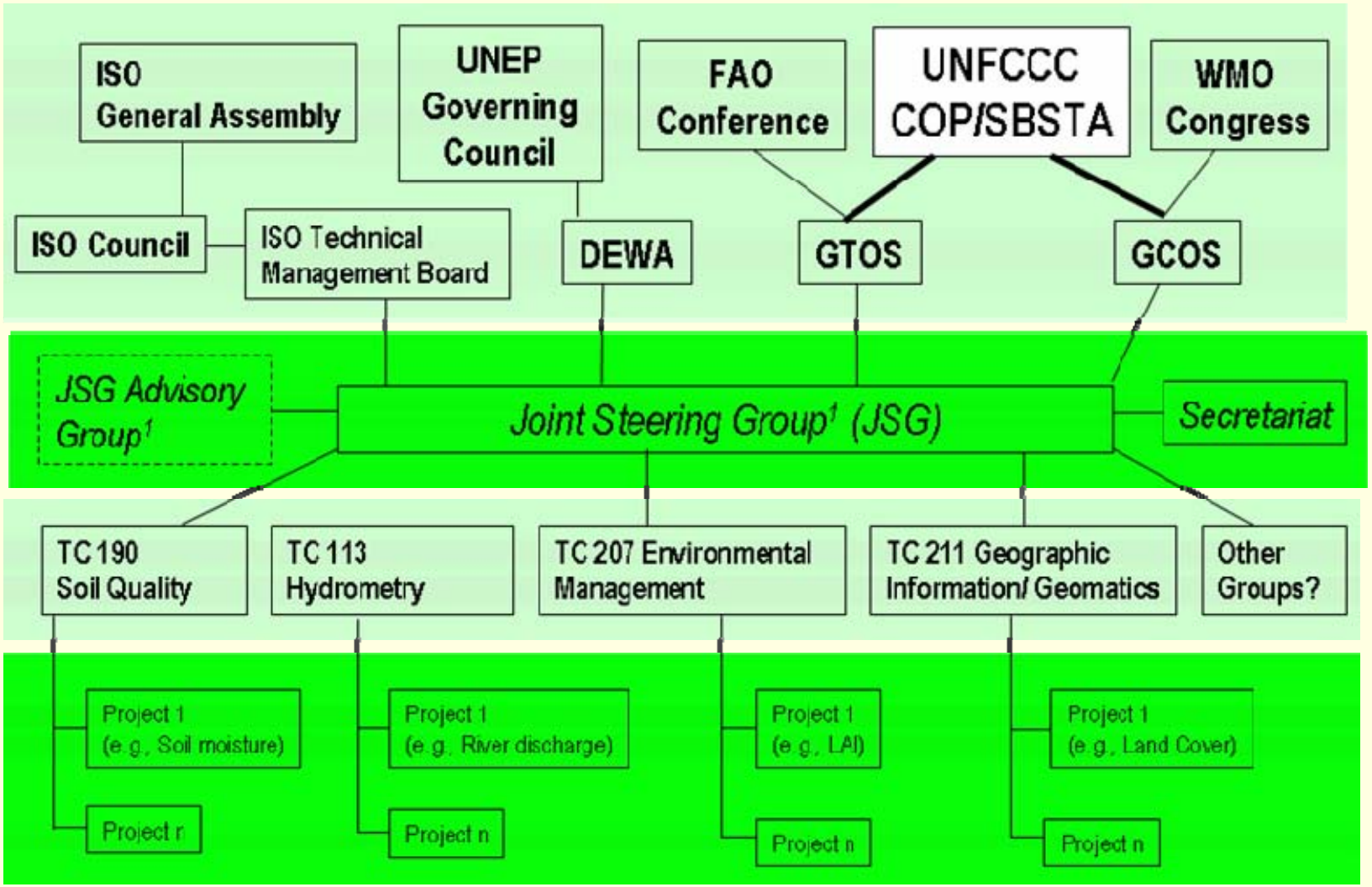
- Existing mechanisms investigated
- 3 options proposed to SBSTA -23
  - (JCOMM- like, ISO- like, IPCC- 'like')
- Progress reports submitted to SBSTA sessions: -26 (Bonn), -27 (Bali), -29 (Poznan)

- Helpful SBSTA feedback obtained, leading to a proposal
- Proposal developed, submitted to SBSTA -30

Framework (3) - Proposed framework: Principles

- **Meet requirements and guidelines of the SBSTA**
- **Build on existing organizations/ programs and capabilities as much as possible**
- **Minimize additional/ incremental activities and costs**

Framework (4) - Proposed framework



1) Meeting ad hoc, mostly via tele- conferences

EXISTING

NEW

Framework (5) – New entities

- **Joint Steering Group (JSG):** representatives of UN agencies and the ISO sponsoring the Framework: makes decisions about proposals for standards development, priorities, etc.

- **JSG Advisory Group:** technical support for the JSG

- **JSG Secretariat**

Note: all above expected to have modest level of effort once the Framework is functioning

Framework (6) - Joint Steering Group (JSG)

- **Due to the nature of the ECVs:**
  - The requirements for standards will be defined by UN organizations
  - Development of standards will entail issues (technical, structural, organizational) concerning various ISO TCs
  - Development of standards will also draw on expertise/ experience of research community, international programs,..
- **Therefore, a coordinating body needed→ 'Joint Steering Group' proposed, tentatively as a subcommittee of the ISO TMB**

Framework (7) - Joint Steering Group (JSG)

- **Decides on the mechanism and technical details for developing a particular standard; if required, initiates and oversees the development process *(refer to Part C of report to SBSTA for specifics)***

- **Will have a representation of the UN communities, ISO groups, and experts from other organizations**

- **Secretariat provided by a UN organization (provisionally GTOS/FAO)**

Framework (8) - Compliance with SBSTA-27 criteria

1. ***"Standards should be developed on a scientifically sound basis":***
   - "Standards should be based on the consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits" (ISO, 2004)

2. ***"Framework ..should provide for the involvement of governments in the development of standards and guidance materials and in their implementation": by***
   - Providing inputs and representatives to ISO- led process, within a country and internationally
   - Voting on adoption of standard
   - Endorsing standard through UN Decision Bodies (e.g., COP)
   - Deciding to adopt standard for national programs

Framework (9) - Compliance with SBSTA-27 criteria

3. ***"Access to those standards and guidance materials should be free and unrestricted."***
   - The resulting documents will be 'joint UN-ISO standards'
   - Will be available both through the UN organizations (free of charge, e.g. on the Internet), and through the ISO channels (for a fee)
   - Content identical (precedent exists)

4. ***"The process for developing the standards and guidance materials and the operation of the Framework should be cost-effective and sustainable and take into account existing standards and guidance materials":***
   - Minimum incremental cost (coordinating mechanism, JSG)
   - Most costs borne by participating countries/ organizations
   - Additional funds needed for involvement of developing countries
   - Existing standards considered when formulating a request, and when developing the actual standard

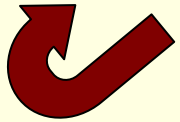
Framework (10) - Compliance with SBSTA-27 criteria

5. ***"The Framework should be flexible in view of future needs and developments in this area."***
   - As proposed, Framework is suited to the development of UN-ISO international standards for all terrestrial observations of interest to the UN agencies
   - Subject to changes in the participating agencies and related changes of the JSG, this Framework also suitable for other observations regarding the Earth's environment, using satellite and/or in situ techniques

Note: the proposed Framework also meets the criteria identified an earlier report to SBSTA-27

Framework (11) – Implications for

- **UN organizations (UNFCCC,…):** decide on requirements; contribute to standard development; endorse developed standards
- **ISO Technical Committees:** carry out the work, track and report on progress, deliver standards
- **National governments:** support their national committees' and experts' involvement in the development of the standards; support the TCxxx Secretariats' additional workload; endorse international standards' use through UN organizations; adopt standards in country monitoring programs
- **Research community:** contribute to the development of methods and standards, both in situ and satellite- based (the main challenge at present)



Framework (12): Status

- Proposal preparation completed
- Draft foundation documents prepared (refer to Part C of report)
- ISO Secretariat and GTOS Sponsors support the proposal
- If endorsed, initial meetings to be held in the fall of 2009

Framework (13): Recommendations

- **Issue:** Further progress in this area requires an endorsement of the proposed mechanism as meeting the need and intent of the COP/ SBSTA

- **Recommendation 1:** That COP/SBSTA endorse the Framework proposal developed in this report, in the present or modified form as appropriate.
- **Recommendation 2:** That COP/SBSTA request that the GTOS and its partners implement the UN-ISO Framework, by obtaining the approvals needed and setting up the appropriate mechanisms

Framework (14): Recommendations

- **Issue:** The development of an international consensus on standards can be a lengthy process that also requires adequate resources

- **Recommendation 3:** That the development of an initial set of ECV standards and guidance materials begin as soon as possible.
- **Recommendation 4:** That the COP request countries to identify human and financial resources for supporting the Framework.
- **Recommendation 5:** That the GTOS be requested to report on progress to the SBSTA at its 32nd session.

Essential Climate Variables (ECVs)

TERRESTRIAL ESSENTIAL CLIMATE VARIABLES

FOR CLIMATE CHANGE ASSESSMENT, MITIGATION AND ADAPTATION

WHAT ARE ECVS

Coordinated, harmonized and systematic observations of our environment are essential for addressing issues related to climate change and are required for the sustainable management of natural resources, environmental protection, food security and humanitarian programmes.

The Essential Climate Variables (ECVs) have been identified and endorsed by the international community as the core set of observations required to allow the United Nations Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change (IPCC) and other end users to achieve their objectives and mandates.

ECVs fall under the atmospheric, oceanic or terrestrial domains and have been selected on the basis that they are highly needed and are technically and economically feasible to undertake systematic observations of these variables.

ECV RELEVANCE TO CLIMATE CHANGE ISSUES

ECVs are fundamental for climate change related activities including:

- Monitoring climate change and understanding its causes;
- Data provision for modelling future climate change scenarios and characterizing extreme events such as floods, droughts and heat waves;
- Determining the feedbacks and amplifications which may occur in the climate system;
- Developing, implementing and monitoring mitigation mechanisms (such as REDD);
- Assessing the effects of climate change and extreme events on food security, agriculture and the environment;
- Predicting vulnerability to climate change and extreme events and allow the evaluation of suitable adaptation options.

FRAMEWORK

UNFCCC SBSTA (22nd session, Montreal 2005) invited GTOS to develop a framework for the preparation of guidance materials, standards and reporting guidelines for terrestrial observing systems for climate, and for assessing the status of the development of standards for each of the essential climate variables in the terrestrial domain.

RIVER DISCHARGE

Freshwater discharge from rivers into oceans plays a role in driving the climate system, as the freshwater inflows influence oceanic circulation patterns.

WATER USE

Fresh water is used in agricultural, industrial and household activities, and is essential for ecosystem maintenance. Globally, agriculture uses 70 percent of fresh water withdrawal and is therefore crucial for food security. Reliable observations are essential to predict future water needs and availability.

GROUNDWATER

Nearly 35 percent of global freshwater resources are taken from groundwater supplies. However these resources are threatened with depletion, salinization and contamination.

LAKE AND RESERVOIR LEVELS AND VOLUMES

Information on water volume changes and monitoring is crucial for water resources management and regional and global water-cycle studies. Such observations also provide critical indicators of climate change.

SNOW COVER

Over 50 percent of the Earth's land surface can be covered by snow during the winter of the Northern Hemisphere. Snow affects the surface's albedo and energy balance, modifying the overlying atmospheric thickness and surface temperature. Its characteristics will determine the state of permafrost, as well as the depth and timing of seasonal freezes and thaws and the ablation of glaciers, ice sheets and sea ice.

GLACIERS

Due to their proximity to melting conditions, glaciers react strongly to climatic changes and therefore provide valuable information on changes in climate. The shrinking and loss of glaciers will affect sea-level rise, fresh water resources and human activities.

PERMAFROST

Permafrost refers to earth materials that remain frozen for at least two consecutive years. In the northern hemisphere this can occupy 24 percent of the ice-free land surface. As the globe warms, permafrost landscapes begin to show with erosion and slope failures. Permafrost temperatures also provide an important indicator of climate change at the ground level.

ALBEDO

Land surface albedo is the ratio of the radiant flux reflected from the Earth's surface to the incident flux. This is a key physical parameter controlling the planetary radiative energy budget. Changes in snow cover, vegetation, etc. all have significant effects on albedo. Albedo is therefore fundamental in climate, biogeochemical, hydrological and weather forecast models.

LAND COVER

Land cover is defined as the observed physical cover of the earth, whether natural vegetation or man made. Such observations are important for sustainable management of natural resources, monitoring, understanding and mitigating climate change and addressing other important issues such as biodiversity and food security.

FAPAR

FAPAR is the photosynthetically active radiation absorbed by the vegetation canopy. It allows the monitoring of the seasonal cycle and inter-annual variability of vegetation activity related to photosynthesis. It is important for the energy balance of ecosystems and in the estimation of the carbon balance.

LEAF AREAS INDEX

Leaf Area Index is important in assessing growth and vigour of the vegetation. It is fundamental in land surface processes and parameterizations in climate models. It is a key link between the biosphere and the atmosphere through various processes such as photosynthesis, respiration, transpiration and rain interception.

BIOMASS

Vegetation biomass is a larger global store of carbon than the atmosphere, and estimates of its changes enable a direct measurement of carbon sequestration or loss. Such data can help quantify the human induced impacts on global climate change and validate carbon-cycle models.

FIRE DISTURBANCE

Fire is an important ecosystem disturbance with varying return frequencies, resulting in land cover alteration and change, and atmospheric emission on multiple scales.

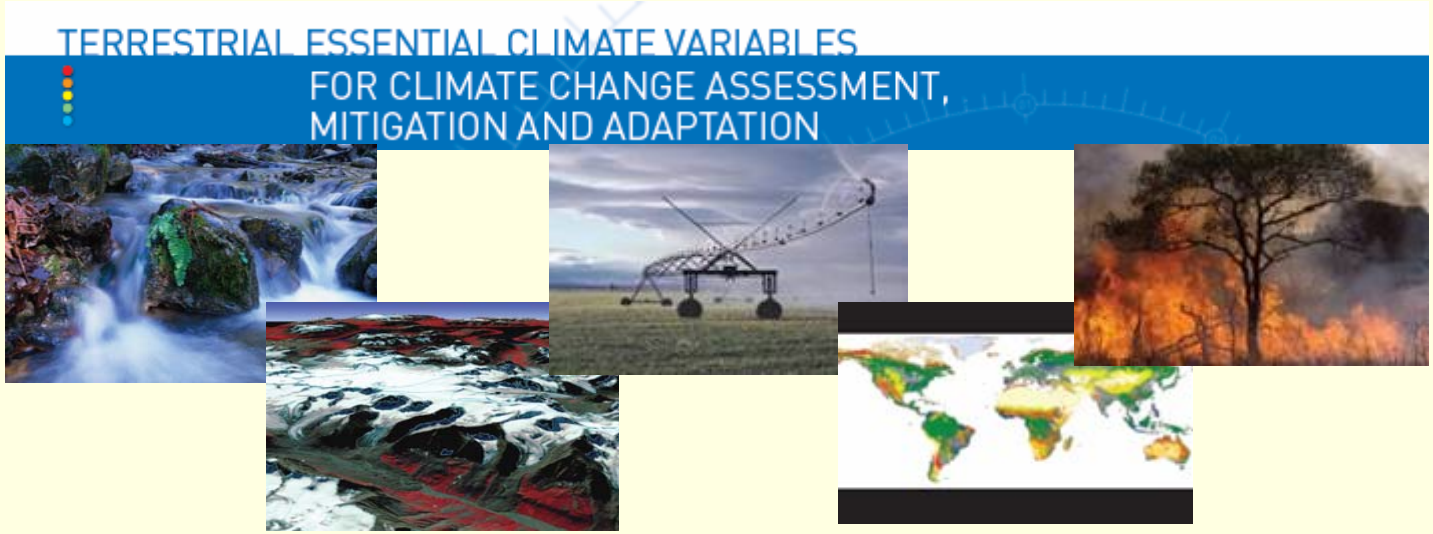
GTOS

UNEP ICSU

ECVs (1): Task

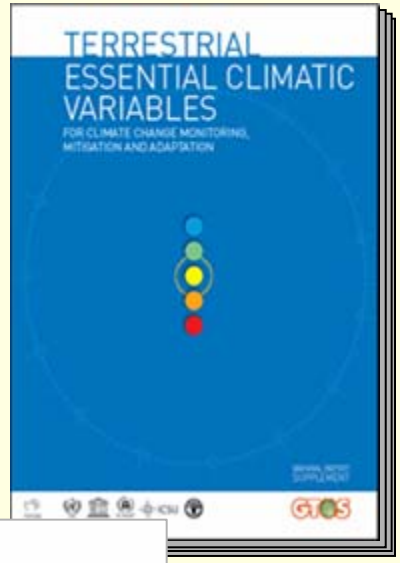
- **Response to invitation to GTOS by the SBSTA -23**

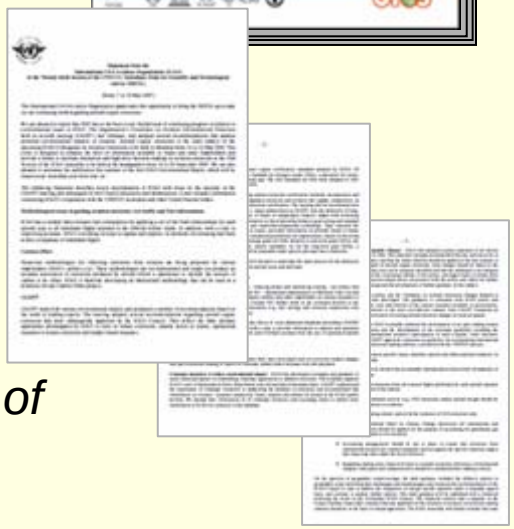
- **Task:**
  - "… *GTOS secretariat to assess the status of the development of standards for each of the essential climate variables in the terrestrial domain*"



ECVs (2): Response

- **Initial report** to SBSTA prepared for 13 terrestrial ECVs:
  - *Albedo; Biomass; Fire Disturbance; FAPAR; Glaciers and Ice Caps; Ground Water; Lake Levels and Reservoir Storage; Land Cover; Leaf Area Index; Permafrost; River Discharge; Snow Cover; Water Use; (+ Soil Moisture)*
- **Detailed reports** then completed by experts for individual ECVs and peer- reviewed (refer to http://www.fao.org/gtos/topcECV.html)
- **A report** on existing standards for 14 ECVs completed in 2009 and peer- reviewed, dealing with *in situ* measurements only (*refer to Part D of report to SBSTA*)
- **A tentative workplan** for terrestrial ECV standards development prepared
- **Results submitted** to SBSTA 30 *(refer to Part D of GTOS report)*

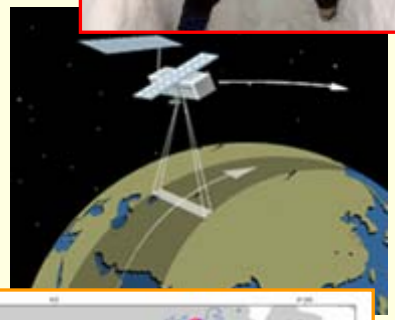


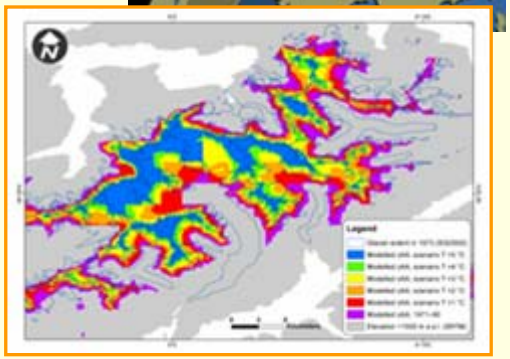


ECVs (3): Overall Findings

- Depending on the ECV, satellite or in situ observations serve as the primary source of information: 5 for satellites, 4 for in situ, 5 where both equally important
- Two main groups previously developing international standards for terrestrial ECVs: WMO Commissions, ISO Technical Committees (TCs); many relevant ISO International Standards identified
- The Scope of 4 ISO TCs covers terrestrial ECVs: TC 113 (Hydrometry); TC 190 (Soil Quality); TC 207 (Environmental Management); TC 211 (Geographic Information/ Geomatics)

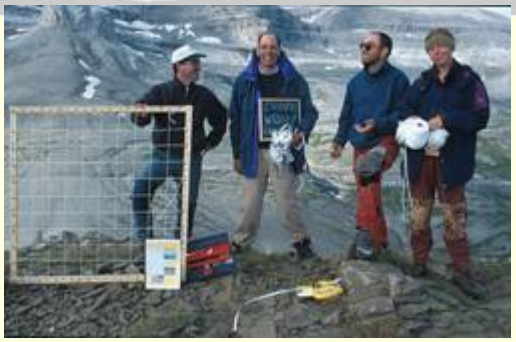
in situ measurements+ remote sensing+ modelling





ECVs (4): Focus on *in situ*

- **Initial standardization to focus on in situ observations:**
  - Existing standards, guides will be considered
  - Relevant ISO standards will be included
- **Satellite-based measurement and reporting standards need to be considered separately at this point for several reasons:**
  - Most of the methodologies still under development;
  - The monitoring, generation of products and reporting work is carried out by only a few agencies and standardization is therefore much easier;
  - Further development of methodologies and intercomparisons of derived products are the greatest current priorities;
  - The ECV developmental activities are handled under the umbrella of the CEOS and the GEO initiative.



ECVs (5): Summary table

ECV Name	INSitu,SATellite, EQUal_importance	Global data sets produced?	In situ data used and source?	Validation of methods & Products
Albedo	SAT	Y	Y (countries/ WMO)	Underway
Biomass	EQU	No		
Fire Disturbance	SAT	Y	Y (projects)	Underway
FAPAR	SAT	Y	Y (projects)	Underway
Glaciers&Ice Caps	EQU	Y	Y (GTN-G)	Underway (for satellite)
Ground Water	INS	No		
Lake Levels and Reservoir Storage	EQU	No		Network in development
Land Cover	SAT	Y	Y (projects)	Underway
Leaf Area Index	SAT	Y	Y (projects)	Underway
Permafrost	INS	Y	Y (GTN-P)	Operational*
River Discharge	INS	Y	Y (countries/ WMO)	Operational*
Soil Moisture	*EQU*	*No*		
Snow Cover	EQU	Y	Y (countries/ WMO)	Underway (for satellite)
Water Use	INS	No		

ECVs (6): Summary

- **Considering the need and 'readiness' for developing an international standard for *in situ* observations:**
  - 5 ECVs were ranked as High priority: Biomass, Glaciers, Land Cover, Permafrost, Soil Moisture
- **Regarding ECVs relying <u>primarily</u> or <u>equally</u> on satellite data, *in situ* measurement standards:**
  - Are 'in good shape' (existing documents satisfactory for the present, or work is in progress): Albedo, Land Cover, Lake Levels and Reservoir Storage, Snow Cover
  - ***Need to be developed***: Biomass, Glaciers and Ice Caps, LAI, FAPAR, Soil Moisture
  - Need more methodological R&D: Fire Disturbance

ECVs (7): Conclusions

- **UNFCCC measurement needs well understood**
- **Terrestrial ECV in greatest need for standardization**
- **Status of standardization reviewed and documented**
  - *In situ* observations ready for standardization
  - Satellite methodologies still under development in most cases
- **A tentative workplan with priorities developed**
- **Actual development of standards subject to approval of the proposed Framework, setting up the organizational structure, and finalizing the workplan**

ECVs (8): Recommendations

Issue: Further progress in this area requires:

- the setting up of an international framework for standardization; and
- further development of satellite-based measurement tools and methodologies so that an overall standardization becomes feasible for terrestrial ECVs

Recommendation 1: That the report (specifically Part D) be employed in preparing a workplan for the development of standards and guidance materials for terrestrial ECVs

Recommendation 2: That the COP/SBSTA encourage the CEOS and countries with satellite- based earth observation programs to continue, and if possible accelerate methodology development, validation and intercomparisons of satellite-based ECV products for the terrestrial domain

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