



GCOS

GLOBAL CLIMATE OBSERVING SYSTEM

GCOS Report to the CEOS WG Climate

– 2011 update to the satellite
supplement

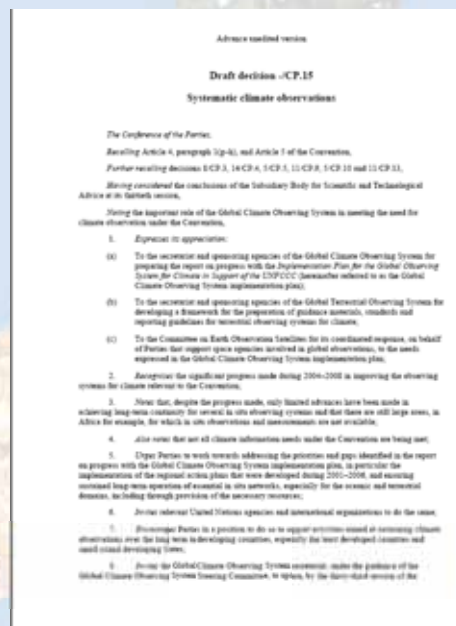
26–27 May 2011, Frascati, ESRIN/ESA, Italy



ICSU
International Council for Science

2010 Update to the GCOS Implementation Plan in support of the United Nations Framework Convention on Climate Change (UNFCCC)

- A decision on systematic climate observations (Decision 9/CP.15) adopted by the 15th session of the Conference of the Parties held in Copenhagen in December 2009, contains provisions to further enhance climate observations, including through observations from space, coordinated through the Committee on Earth Observation Satellites (CEOS), and activities to be undertaken by the Global Climate Observing System (GCOS) and the Global Terrestrial Observing System (GTOS).
- Submission of the of the updated GCOS Implementation Plan COP16, Cancun, Dec 2010



2010 Update to the GCOS Implementation Plan

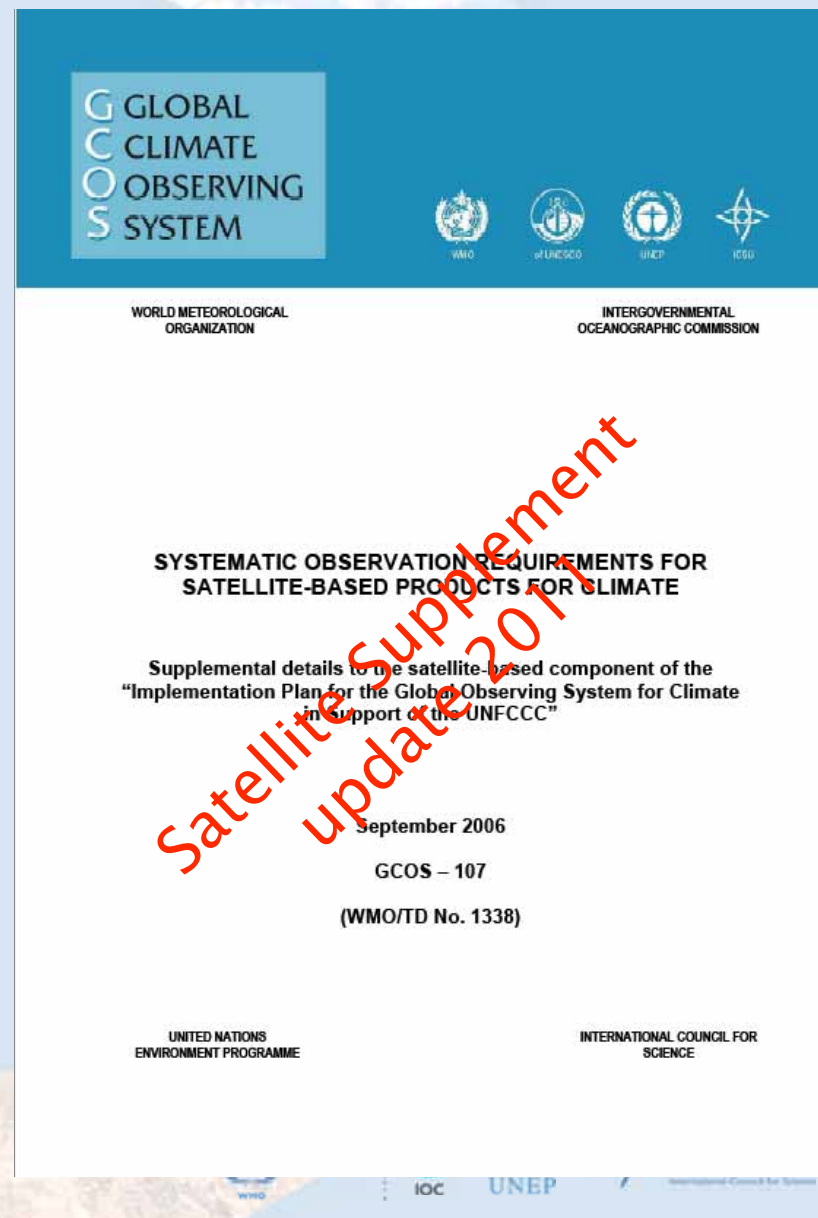
- **Basis:**
 - 2004 GCOS IP (GCOS-92); 2006 Satellite Supplement (GCOS-107)
 - Update, not rewrite
- **Recognizing changes since 2004 in:**
 - Science
 - Measurement Technology
 - Needs
 - International coordination
(e.g., GEO/GEOSS, UN “Delivering as One”, Space agency response to climate)
- **Responding to Plan in 2010-2015 would contribute to:**
 - Global observations addressing Essential Climate Variables
 - Associated analysis, research, infrastructure and capacity building

GCOS – 2011 Update to the Satellite Supplement

Update to the 2006 Satellite Supplement to the GCOS IP (GCOS-107)

- Update detailed GCOS requirements for FCDRs and ECV products in terms of
 - accuracy,
 - stability,
 - temporal/spatial resolution,
 - calibration and validation needs and opportunities,
 - relevant international working groups.

for Atmosphere, Ocean, Land and Cross-Cutting actions.



GCOS – 2011 Update to the Satellite Supplement

- Expert Meeting, January 10–12, 2011, Geneva

Outcome:

- improvements on most of the ECVs
- extra sections, e.g., on GHGs, precursors,
for example « pressure » emerges now also as space-based observed ECV.

Open for public review,
9 May – 1 July 2011 on
<http://gcos.wmo.int>

- Finalising draft, September 2011.
- Submission to 35th SBSTA session at COP17, Durban 2011, as INFORMATION Document.

SYSTEMATIC OBSERVATION REQUIREMENTS FOR SATELLITE-BASED PRODUCTS FOR CLIMATE

2011 Update

Supplemental details to the satellite-based component of the
"Implementation Plan for the Global Observing System for Climate in
Support of the UNFCCC (2010 Update)"

DRAFT version 1.1

(28 APRIL 2011)



Space based ECVs

Table 1: ECVs significantly dependent upon satellite observations³

Domain	Essential Climate Variables
Atmospheric (over land, sea and ice)	Surface wind speed and direction, Precipitation, Upper-air temperature, Upper-air wind speed and direction, Water vapour, Cloud properties, Earth radiation budget (including solar irradiance), Carbon dioxide, Methane, and other long-lived greenhouse gases, Ozone and Aerosol properties, supported by their precursors.
Oceanic	Sea-surface temperature, Sea-surface salinity, Sea level, Sea state, Sea ice, Ocean colour.
Terrestrial	Lakes, Snow cover, Glaciers and ice caps, Ice sheets, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (FAPAR), Leaf area index (LAI), Above-ground biomass, Fire disturbance, Soil moisture.

■ Requirements for products - Atmosphere

Table 2: Overview of Products – Atmosphere

ECV	Global Products requiring Satellite Observations	Fundamental Climate Data Records required for Product Generation (from past, current and future missions)	Product Numbers (IP-10 Reference Actions)
Surface Wind Speed and Direction	Surface wind retrievals	Passive microwave radiances and scatterometry	A.1 (A11)
Precipitation	Estimates of liquid and solid precipitation, derived from specific instruments and provided by composite products	Passive microwave radiances; Geostationary VIS/NIR/IR radiances	A.2 (A6, A8, A9, A10)
Upper-air Temperature	Upper-air temperature retrievals; Temperature of deep atmospheric layers	Passive microwave and IR radiances; GNSS radio occultation bending angles	A.3.1 A.3.2 (A20, A21)
Upper-air Wind Speed and Direction	Upper-air wind retrievals	VIS/IR imager radiances; Doppler wind lidar	A.4 (A11)
Water Vapour	Total column water vapour; Tropospheric and lower-stratospheric profiles of water vapour; Upper tropospheric humidity	Passive microwave radiances; UVVIS imager radiances; IR and microwave soundings; Limb soundings	A.5.1 A.5.2 A.5.3 (A7, A21, A22, A26)
Cloud Properties	Cloud amount, top pressure and temperature, optical depth, water path and effective particle radius	VIS/IR imager radiances; IR and microwave soundings	A.6.1 A.6.2 A.6.3 A.6.4 A.6.5 A.6.6 (A23, A24)
Earth Radiation Budget	Earth radiation budget (top-of-atmosphere and surface); Total and spectrally-resolved solar irradiance	Broadband radiances; Spectrally-resolved solar irradiances; Geostationary multispectral imager radiances	A.7.1 A.7.2 (A14, A25)
Carbon Dioxide, Methane and other GHGs	Retrievals of greenhouse gases, such as CO ₂ and CH ₄ , of sufficient quality to estimate regional sources and sinks	NIR/IR radiances	A.8.1 (A26, A28, A29)
Ozone	Total column ozone; Tropospheric ozone; Ozone profiles	UVVIS and IR/microwave radiances, from nadir and limb sounding	A.9.1 A.9.2 A.9.3 (A26, A32)
Aerosol Properties	Aerosol optical depth; Aerosol single scattering albedo; Aerosol layer height	UVVIS/NIR/SWIR and TIR radiances	A.10.1 A.10.2 A.10.3 (A33)
Precursors supporting the Ozone and Aerosol ECVs	Retrievals of precursors for aerosols and ozone such as NO ₂ , SO ₂ , HCHO and CO	UVVIS/NIR/SWIR and TIR radiances	A.11.1 (A26, A27, A34)

Requirements for products - Ocean

Table 3: Overview of Products – Oceans

ECV	Global Products requiring Satellite Observations	Fundamental Climate Data Records required for Product Generation (from past, current and future missions)	Product Numbers (IP-10 Reference Actions)
Sea Surface Temperature	Integrated sea-surface temperature analyses based on satellite and <i>in situ</i> data records	Single and multi-view IR and microwave imager radiances	O.1 (O4, O7, O8)
Sea Surface Salinity	Datasets for research on identification of changes in sea-surface salinity	Microwave radiances	O.2 (O12)
Sea Level	Sea level global mean and regional variability	Altimetry	O.3 (O10)
Sea State	Wave height, supported by other measures of sea state (wave direction, wavelength, time period)	Altimetry	O.4 (O16)
Sea Ice	Sea-ice concentration/extent/edge, supported by sea-ice thickness and sea-ice drift	Microwave and visible imager radiances Supported by SAR altimetry	O.5 (O18, O19, O20)
Ocean Colour	Ocean colour radiometry – water leaving radiance;	Multispectral VIS imager radiances	O.6.1, O.6.2 (O15, O23)
	Oceanic chlorophyll-a concentration, derived from ocean colour radiometry		

-

■ Requirements for products - Land

Table 4: Overview of Products – Terrestrial

ECV or supporting variable	Global Products requiring Satellite Observations	Fundamental Climate Data Records required for Product Generation (from past, current and future missions)	Product Numbers (IP-10 Reference Actions)
Lakes	For lakes in the Global Terrestrial Network for Lakes: Areas of lakes; Lake levels	VIS/NIR imager radiances, and radar imager radiances; Altimetry	T.1.1, T.1.2 (T8)
Snow Cover	Snow areal extent; Supplemented by: Snow water equivalent	Moderate-resolution VIS/NIR/IR and passive microwave imager radiances	T.2 (T16)
Glaciers and Ice Caps	Glacier 2D outlines (delineating glacier area); Supplemented by digital elevation maps of glaciers and ice caps	High-resolution VIS/NIR/SWIR optical imager radiances; Supplemented by: Radar, SAR, along-track stereo imaging	T.3 (T17)
Ice Sheets	Ice-sheet elevation changes; Supplemented by: Fields of ice velocity and ice mass change	Radar and laser altimetry; Supplemented by: SAR, Gravity	T.4 (T20)
Albedo	Broadband black sky and spectral white sky albedo	Multispectral and multiangular imager radiances	T.5 (T24, T25, T3)
Land Cover	Moderate-resolution maps of land-cover type; High-resolution maps of land-cover type, for the detection of land-cover change	Moderate-resolution multispectral VIS/NIR imager radiances; High-resolution multispectral VIS/NIR imager radiances Supplemented by: Radar	T.6.1, T.6.2 (T26, T27, T28)
FAPAR	Maps of the Fraction of Absorbed Photosynthetically Active Radiation	VIS/NIR multispectral imager radiances	T.7 (T31, T29, T3)
LAI	Maps of Leaf Area Index	VIS/NIR multispectral imager radiances	T.8 (T31, T30, T29, T3)
Biomass	Regional and global above-ground forest biomass	Long-wavelength radar and lidar	T.9 (T32)
Fire Disturbance	Maps of burnt area, supplemented by active-fire maps and fire-radiated power	VIS/NIR/SWIR/TIR moderate-resolution multispectral imager radiances	T.10 (T35, T36, T37, T38, T39)
Soil Moisture	Research towards global near-surface soil-moisture map (up to 10cm soil depth)	Active and passive microwave	T.11 (T13, T14)
Land-surface temperature	Land-surface temperature records to support generation of land ECVs	High-resolution IR radiances from geostationary and polar orbiting	T.12 (T5, T13, T23,
		satellites; microwave radiances from polar orbiting satellites	T27, T28)

Recommendations

- 1. Ensure attention to the needs identified in this report related to the planning, initiation and continuity of satellite missions that are needed to provide satellite climate data records;
 - 2. Ensure a systematic approach in applying, to the greatest extent possible, the GCOS Climate Monitoring Principles for the generation of satellite climate data records, recognizing in particular the need for overlaps in missions and for *in situ* measurements for calibration and validation purposes;
 - 3. Ensure long-term custody of satellite climate data records and their associated metadata, and provide open access to these records;
 - 4. Ensure and encourage the generation of, and access to, products based on the satellite climate data records;
 - 5. Ensure wide and continuing interaction among the international scientific, operational and end-user communities, to ensure effective feedback mechanisms and continuing advice on observation and product needs;
 - 6. Sustain active research satellite programmes that address challenging measurement needs and that allow capabilities to advance and be more cost effective.
-
- Parties supporting space agencies ensure that the remits of those agencies enable them to incorporate the needs for systematic observation of climate as identified in this report (e.g., appropriate structural arrangements and responsibilities within agencies; planning for the maintenance of satellite climate data records and product generation).

