

# CEOS Working Group on Climate (WGClimate)

Mark Dowell  
EC/JRC



## Rationale

- Many Climate Initiatives undertaken by space agencies
  - SCOPE-CM
  - ESA Climate Change Initiative
  - NOAA Climate Services
  - .....
- Many relevant existing Scientific Groups
  - IOCCG
  - GHRST
  - Sea surface topography
  - ...etc...
- CEOS virtual Constellations contribute in specific ECV areas
  - Ocean Surface Topography
  - Precipitation
  - Ocean colour
  - Ocean Surface Vector Winds
  - Land Surface Imaging
  - .....
- Need to have overall coherent approach

**Draft decision -/CP.15**  
**Systematic climate observations**

*The Conference of the Parties,*

*Recalling Article 4, paragraph 1(g-h), and Article 5 of the Convention,*

*Further recalling decisions 8/CP.3, 14/CP.4, 5/CP.5, 11/CP.9, 5/CP.10 and 11/CP.13,*

*Having considered the conclusions of the Subsidiary Body for Scientific and Technological Advice at its thirtieth session,*

*Noting the important role of the Global Climate Observing System in meeting the need for climate observation under the Convention,*

1. *Expresses its appreciation:*
  - (a) To the secretariat and sponsoring agencies of the Global Climate Observing System for preparing the report on progress with the *Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC* (hereinafter referred to as the Global Climate Observing System implementation plan);
  - (b) To the secretariat and sponsoring agencies of the Global Terrestrial Observing System for developing a framework for the preparation of guidance materials, standards and reporting guidelines for terrestrial observing systems for climate;
  - (c) To the Committee on Earth Observation Satellites for its coordinated response, on behalf of Parties that support space agencies involved in global observations, to the needs expressed in the Global Climate Observing System implementation plan;
2. *Recognizes* the significant progress made during 2004–2008 in improving the observing systems for climate relevant to the Convention;
3. *Notes* that, despite the progress made, only limited advances have been made in achieving long-term continuity for several in situ observing systems and that there are still large areas, in Africa for example, for which in situ observations and measurements are not available;
4. *Also notes* that not all climate information needs under the Convention are being met;
5. *Urges* Parties to work towards addressing the priorities and gaps identified in the report on progress with the Global Climate Observing System implementation plan, in particular the implementation of the regional action plans that were developed during 2001–2006, and ensuring sustained long-term operation of essential in situ networks, especially for the oceanic and terrestrial domains, including through provision of the necessary resources;
6. *Invites* relevant United Nations agencies and international organizations to do the same;
7. *Encourages* Parties in a position to do so to support activities aimed at sustaining climate observations over the long term in developing countries, especially the least developed countries and small island developing States;
8. *Invites* the Global Climate Observing System secretariat, under the guidance of the Global Climate Observing System Steering Committee, to update, by the thirty-third session of the

**Encourages** the **Committee on Earth Observation Satellites** to **continue coordinating and supporting the implementation of the satellite component** of the Global Climate Observing System;

**Urges Parties that support space agencies** involved in global observations to enable these agencies to continue to implement, **in a coordinated manner through the Committee on Earth Observation Satellites, the actions identified in the updated report of the Committee on Earth Observation Satellites,**<sup>1</sup> in order to meet the relevant needs of the Convention, in particular by ensuring long-term continuity of observations and data availability.

## Committee on Earth Observing Satellites NEW - Working Group on Climate (WGClimate)



WGClimate was endorsed as a full CEOS WG (joining WGISS, WGCV and WGEdu) and will coordinate and encourage collaborative activities between the world's major space agencies in the area of climate monitoring



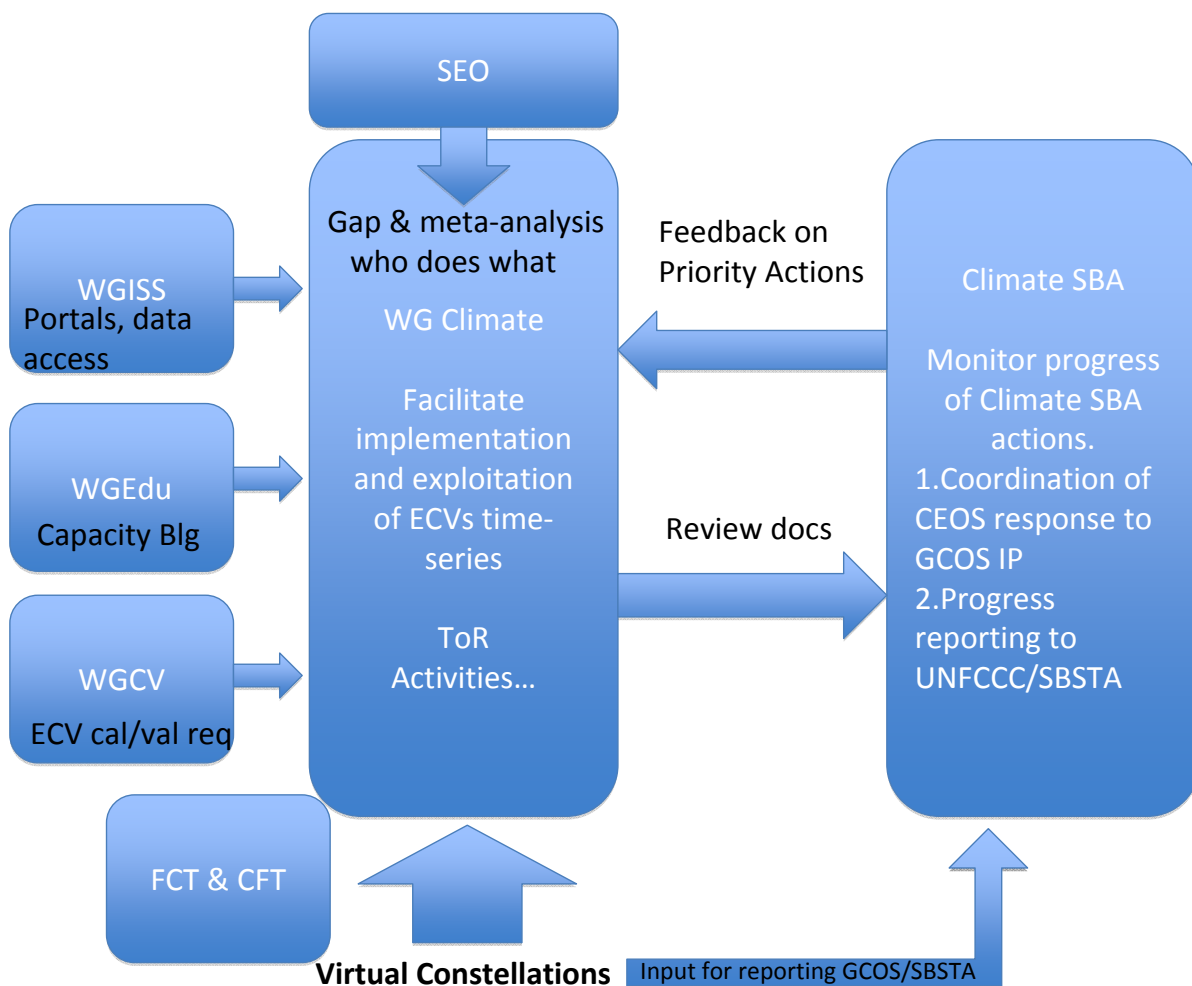
Mandate of this new Working Group is to **facilitate** the **implementation** and **exploitation** of Essential Climate Variable (ECV) time-series through coordination of the existing and substantial activities undertaking be CEOS member agencies.

Chair of CEOS WGClimate  
Mark Dowell (EC/JRC)  
Vice Chair John Bates (NOAA/NCDC)

# Membership

- Mark Dowell - EC/JRC (Chair)
- John Bates – NOAA (Vice Chair)
- Tamotsu Igarashi - JAXA
- Joerg Schulz - EUMETSAT
- Yang Jun - CMA
- Andy Shaw - UKSA/NCEO
- Pascal Lecomte - ESA
- John Dwyer - USGS
- Eric Lindstrom - NASA
- Didier Renaut - CNES
- Daniel Alejandro Vila - INPE
- Stella Melo - CSA
- Albrecht von Bargaen - DLR
- Robert Husband - EUMETSAT
- Mitch Goldberg – NOAA (Climate SBA)
- Brian Killough – NASA (SEO)
- Shelley Stover – NASA (SEO)
- Kerry Sawyer – NOAA (DCEO)
- Carolin Ritcher - GCOS
- Barbara Ryan - WMO
- Jerome Lafeuille - WMO
- Seonkyun Baek - GEO

## Membership of CEOS VCs and WGs (?)



# Proposed Terms of Reference

- The CEOS Climate Working Group will:
  - Review and assess, on behalf of CEOS, the generation of Fundamental Climate Data Records (FCDRs) and derived Essential Climate Variable (ECV) climate products supported by Member space agencies, complementary with existing entities and roles;
  - Contribute to the review of compliance of satellite missions and products with the GCOS Climate Monitoring Principles and with the “Guideline for the Generation of Datasets and Products meeting GCOS Requirements” (GCOS-143);
  - Identify multi-agency implementation teams for each product and review their actions, and ensure that a coherent implementation plan exists for each and every product taking full account of other pertinent international initiatives such as SCOPE-CM and science programmes;
  - Make recommendations to the above teams and receive recommendations from them, for transmission to CEOS Agency Principals;
  - Ensure coherence of climate product generation supported by space agencies, including with other relevant international initiatives, in particular SCOPE-CM, and);
  - Undertake any other relevant activities as instructed by CEOS Chair.

# Proposed Terms of Reference

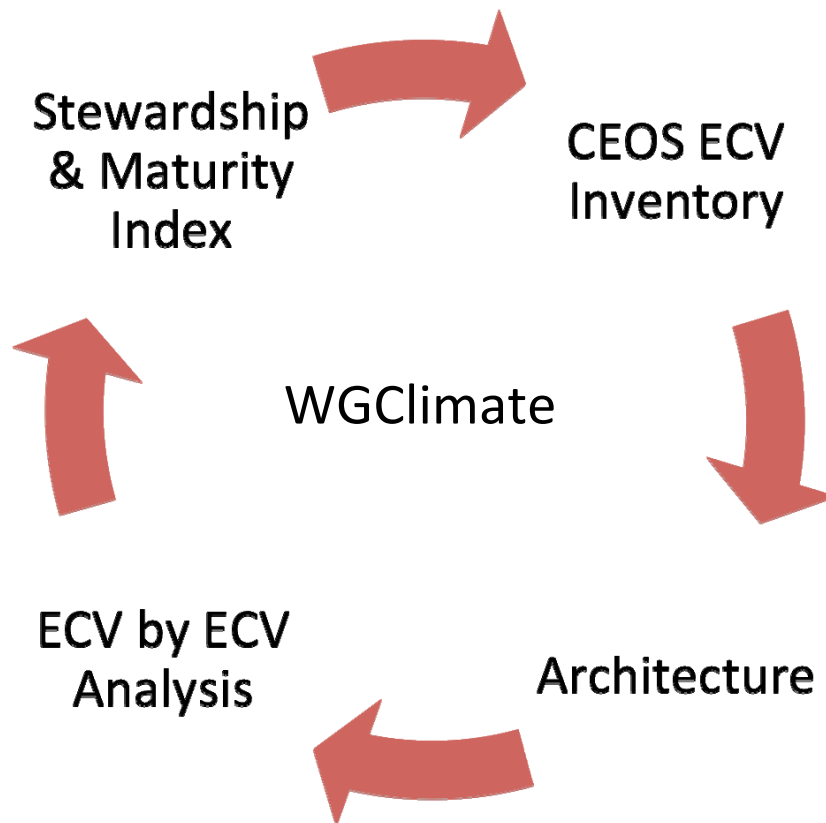
- In addition, it will:
  - Provide guidance to CEOS regarding climate-related Tasks in the GEO Work Plan, and review relevant reports on behalf of CEOS Plenary, including:
    - The update of documents such as the CEOS Response to GCOS requirements, and
    - The update of reports to SBSTA/UNFCCC on CEOS climate actions, as requested;
  - Support generally the work of GCOS in defining and delivering the Essential Climate Variables required by the UNFCCC;
  - Support and advise on the overall relation of CEOS to the UNFCCC and its subsidiary bodies, and to the IPCC.

# Proposed Terms of Reference

- In carrying out the tasks above, it will:
  - Undertake an analysis, **addressing each ECV in turn**, of the extent to which the current status of production of satellite climate records meets the GCOS requirements, including an analysis of the consistency of definitions of ECVs;
  - Work with the **CEOS Virtual Constellations** to ensure a coherent and consistent approach to the provision of climate records across their various topical areas;
  - Promote openness, traceability and access to climate data, codes and products;
  - Facilitate the **inter-comparison of model outputs** with data by identifying a subset of parameters key to the IPCC needs and encourage providers to deliver the necessary data in the required form;
  - **Interact with Science programs such as WCRP and IGBP** to assist them in enabling their analysis, assessment and feedback to space agencies on the production of climate records;
  - Build on the work of the **CEOS WGCV, GSICS, and the QA4EO** initiative to support the calibration and validation underpinning the production of climate data records;
  - Coordinate with **existing in situ networks** to integrate complementary measurements and observations.

## Priorities to be discussed at first meeting

- CEOS ECV Inventory:
  - Discussion on maturity index
  - Discussion on climate information stewardship issues
- Climate Monitoring Architecture
- ECV by ECV analysis/assessment
- Outreach/Networking: both internal with other CEOS WGs and VCs & external SCOPE-CM/GSICS and WCRP CMIP



## Representation at meetings

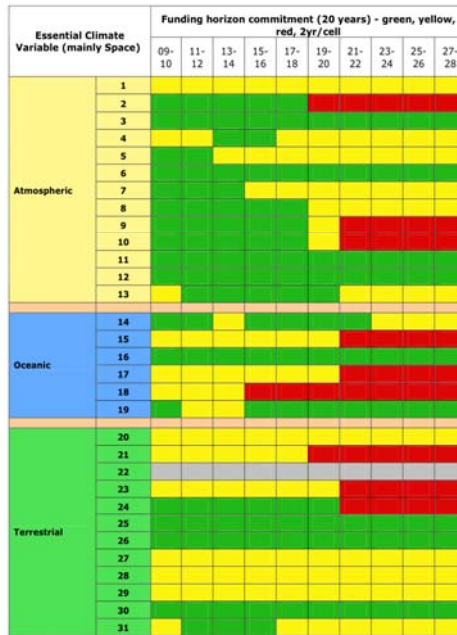
- Jan 2011: GCOS Satellite Supplement Update meeting
- Jan 2011: WMO-GCOS Continuity and Architecture Requirements for Climate Monitoring meeting
- Feb 2011: WGClimate technical meeting to discuss SEO support and Architecture (Dowell, Bates, Killough, Stover, Lecomte, Husband)
- Mar 2011: CEOS-CGMS Climate monitoring Architecture writing team meeting
- Apr 2011: WCRP-GCOS WOAP meeting
- Oct 2011: WCRP Open Science Conference



# Example ECV Gap Analysis

8 Gap analysis: Table 5

Essential Climate Variable (mainly Space)		Fundamental Climate Data Record	GCOS Horiz Res. Goal
Atmospheric	1 Precipitation	Passive microwave radiances, high frequency geostationary IR, Active radar (for calibration)	100 km (1 km for extreme events)
	2 Earth Radiation Budget	Broadband radiances, Spectrally resolved solar irradiances, Geostationary multi-spectral imagery	100 km
	3 Upper-air Temperature	Passive microwave radiances, GPS radio occultation, High spectral resolution IR radiances for re-analyses.	100 km
	4 Upper-air Wind	VIS/IR imagery, Doppler wind lidar	100 km
	5 Surface Wind Speed and Direction	Passive microwave radiances and scatterometry	10 km
	6 Water Vapour	Passive microwave radiances, UV/VIS Radiances, IR imagery/soundings in 6.7um band, Microwave soundings in 183 GHz band	10 - 50 km
	7 Cloud Properties	VIS/IR imagery, IR and microwave soundings	99 - 100 km
	8 Carbon Dioxide	NIR/IR radiances	10 - 250 km
	9 Methane	NIR/IR radiances	10 - 50 km
	10 Other GHGs	NIR/IR radiances	10 - 50 km
	11 Ozone (tropospheric)	UV/VIS radiances, IR/Microwave radiances	5 - 50 km
	12 Ozone (stratospheric)	UV/VIS radiances, IR/Microwave radiances	50 - 100 km
	13 Aerosol Properties	VIS/NIR/SWIR radiances	1 - 10 km
Oceanic	14 Sea-Surface Temperature	Single & multi-view IR and microwave imagery	1 km
	15 Sea Level	Altimetry	25 km
	16 Sea Ice	Passive Microwave imagery (DMSF, AMSR2), SAR, TIR & VIS imagery	12 - 100 km
	17 Sea State	Altimetry, scatterometer, SAR	25 km
	18 Ocean Salinity	Microwave radiances	15 - 100 km
19 Ocean Colour (TOP + CHL a)	Multispectral VIS imagery	1 km	
Terrestrial	20 Snow Cover (Extent, Snow Water Equivalent)	VIS/NIR/IR and passive microwave optical imagery	100 m - 100 km
	21 Glaciers and Ice Caps	VIS/NIR/SWIR optical imagery, Altimetry	30 m
	22 Permafrost and seasonally-frozen ground	-	250 m
	23 River Discharge	Altimetry	10 km
	24 Lake level/properties	VIS/NIR imagery radar imagery, Altimetry, IR imagery	1 - 4 km
	25 Albedo	Multispectral and broadband imagery	1 km
	26 Land Cover	Multispectral VIS/NIR imagery	250 m
	27 LAI/AR	VIS/NIR imagery	250 m
	28 Leaf Area Index	VIS/NIR imagery	250 m
	29 Biomass	L Band / P Band SAR, Laser altimetry	10 m
	30 Fire Disturbance	VIS/NIR/SWIR/TIR multispectral imagery	250 m
	31 Soil Moisture (surface and root zone)	Active and Passive microwave (Scatterometer and SMO2)	50km



# Prototype SEO CEOS ECV Inventory



Home Missions Instruments Measurements Requirements Mission Timelines Statistics CDR CDR Timeline

Primary Investigator	Agency	Project	Description	ECV	Start	Stop	Missions	Instruments
Unknown	ESA	Clouds	Inter-calibrated radiance data sets are used to produce cloud cover, cloud top height and temperature, liquid and ice water path. Includes uncertainty estimates.	Cloud Properties	2007	2009	Aqua Earthsat Metop-A Metop-B Metop-C NOAA-15 NOAA-16 NOAA-17 NOAA-18 NOAA-19 Terra	MERIS ATOVS (HIRS) + AMSU + AVHRR/2) AIRS/IRS MODIS
Unknown	ESA	Ozone	Long term ozone series matching GCOS requirements to reduce uncertainty in estimates of ozone trends and ozone induced relative forcing.	Ozone	1995	2011	Aura Earthsat Metop-A Metop-B Metop-C OziR SCISAT-1	OMI MERIS GOMOS SCIAMACHY GOME GOME-2 SMR ACE-FTB
Unknown	ESA	Aerosols	Produces a global set of aerosol products to improve aerosol retrieval algorithms and characterize and quantify their errors.	Aerosol Properties	1997	1999	ADEOS Earthsat Metop-A Metop-B Metop-C	POLDER MERIS GOMOS SCIAMACHY JASTR JASR-2 GOME-2
Unknown	ESA	CO2, CH4, and Greenhouse Gases	Multi-year Carbon Dioxide (CO2) and Methane (CH4) products will be generated and the data source are SC Earthsat and TANSO	Carbon Dioxide, Methane, and	N/A	N/A	Aqua Earthsat	ARRS AIRS

ECV: Precipitation - 4 Records Located

Gold-colored squares indicate CDR project coverage.

Project	Agency	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Long Term Precipitation with Uncertainty	NASA	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Global MW Rain Rate	NASA	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
SCOPE-CM Water Vapor, Liquid Water, and Precip	EUMETSAT	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Global Merged Precipitation	NASA	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold

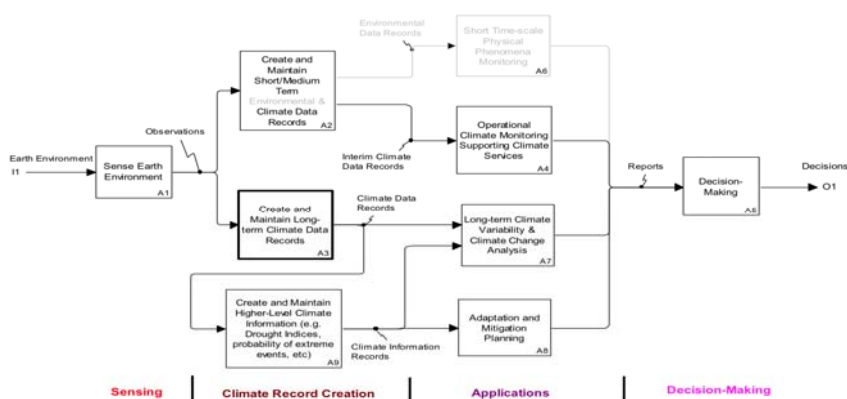
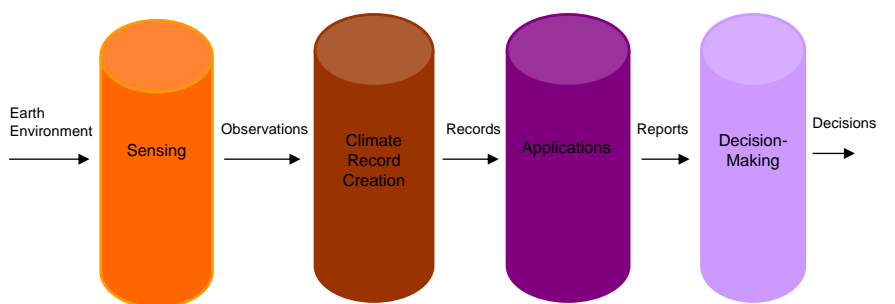
# Why do we need a Climate Monitoring Architecture?

Based on discussions three main "needs/usage scenarios" have emerged for a climate monitoring architecture:

- A Assist in **promotion of a common** understanding of the implementation implications of meeting the various space-related climate monitoring requirements (e.g. from GCOS)
- B To support **an assessment of the degree to which the currently implemented systems meet the requirements** (and the generation of an action plan to address identified shortfalls/gaps/duplication)
- C To improve our **understanding of the end-to-end information flows** and dependencies (i.e. from sensing through to decision-making)

EUM/SIR/VWG/11/012  
WP 2000: Climate SBA

## Architecture / conceptual framework





## ECV by ECV analysis

- Identifying roles and responsibilities
- Establish role of VCs
- Define common “ECV strategy” template
- Interagency assessments
  - Do we need an "independent assessment" bodies?
  - Establish role of WGCV
- Identify pilot ECVs for assessment

## Planned documents

- WGClimate guidance document defining governance of WG
- 2-3 year Workplan
- Web presence, PR

# Representation

- WGClimate chair and vice chair would like to prioritize representation at various relevant meetings
- 2011 focus on WCRP/WOAP, GCOS, SCOPE-CM, WMO
- Do not plan to attend COP-17 (could provide a poster)