Architecture for Monitoring Climate from Space
- Status -

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WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

BACKGROUND

World Climate Conference-3 (Sept. 2009) established the Global Framework for Climate Services (GFCS) with the following aim:

Enable better management of the risks of climate variability and change and the adaptation to climate change, through the development and incorporation of science-based climate information and prediction into planning, policy and practice on the global, regional and national scale.

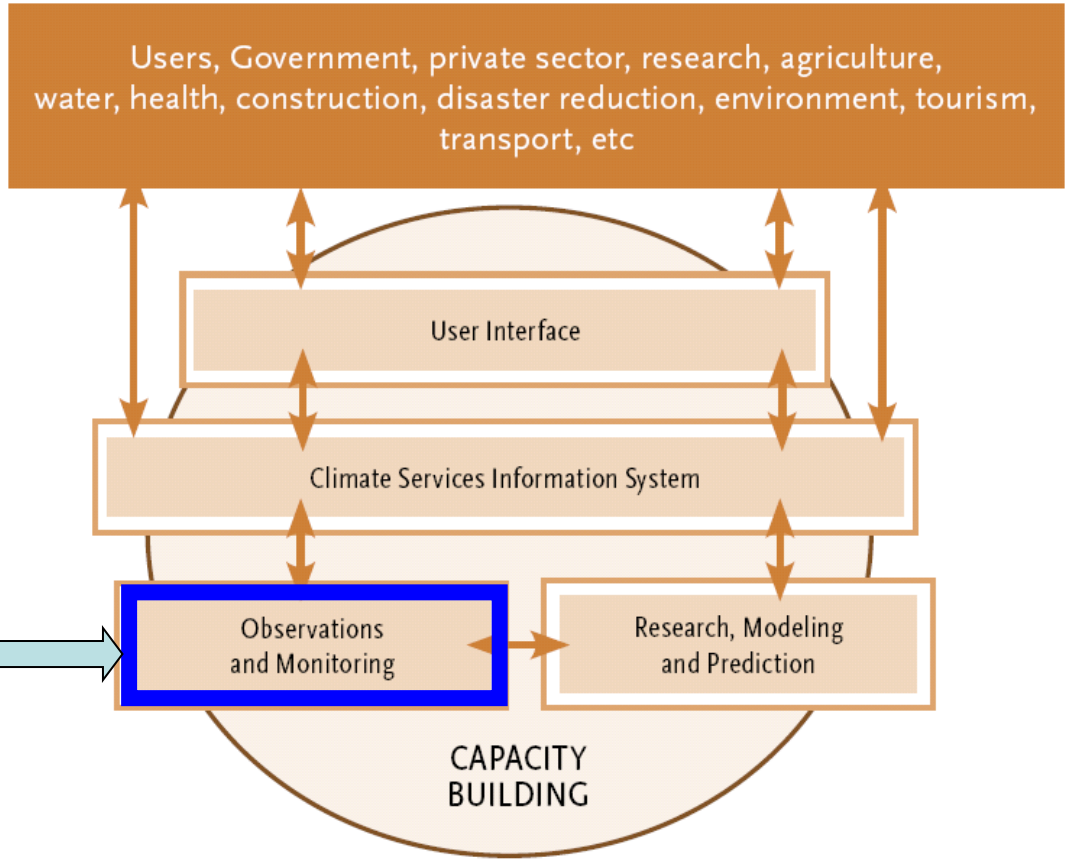
BACKGROUND

The Implementation Plan and Governance Scheme of the GFCS was approved by WMO Extraordinary Congress in October 2012

The Architecture for Climate Monitoring from Space (ACMS) will be a major building block for the Obs. & Monitoring Pillar of the GFCS.

BACKGROUND

Space and Surface Architect. for Climate Monitoring



BACKGROUND

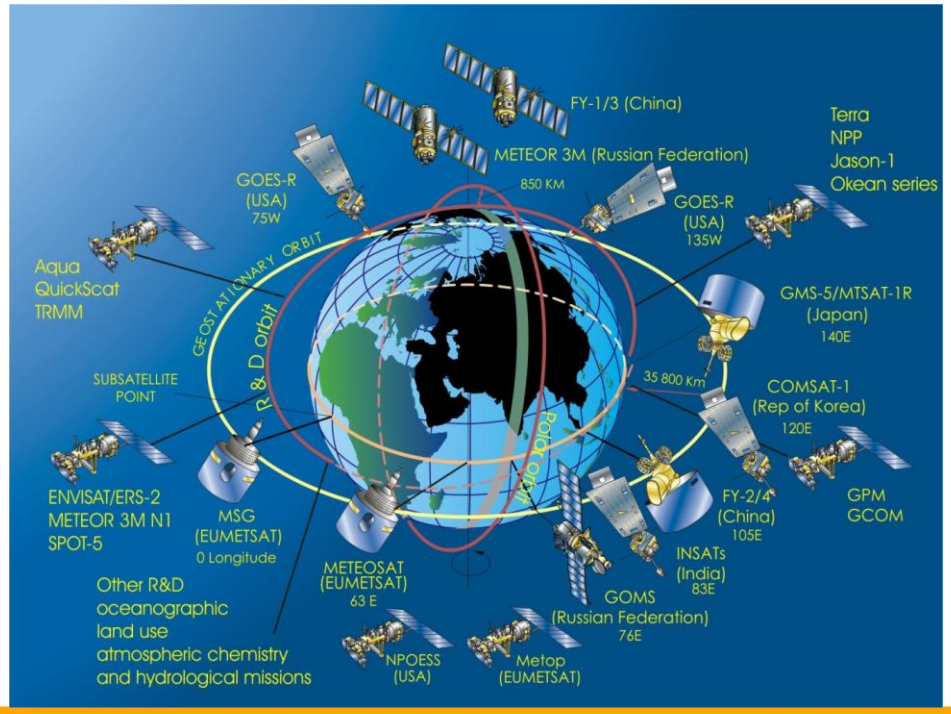
The Obs. & Mon pillar will specify the required data sets, ECVs, as input for the Climate Services Information System. It is expected that additional ECVs will be required beyond those laid down presently in GCOS.

At this time 36 out of the 55 GCOS ECVs can be extracted from satellite data. There is room for technological and scientific development to increase in future the number of satellite derived ECVs.

However, we face a structural problem: There is no satellite observing system in place which is designed to meet the long-term requirements for monitoring climate from space.

BACKGROUND

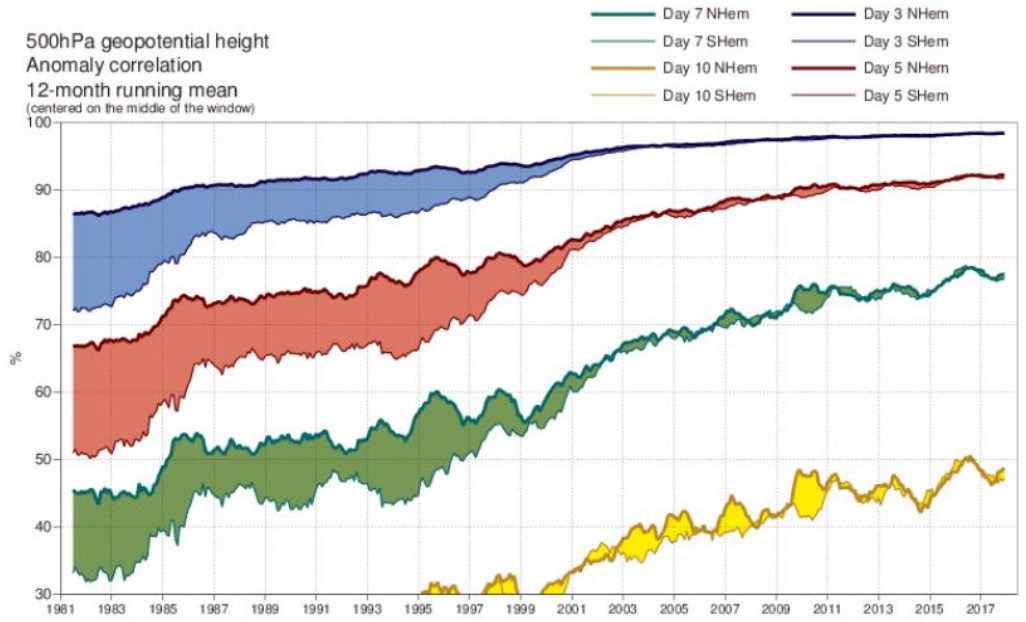
We have a situation similar to the 60s of the last century when the World Weather Watch was established. The space component of the GOS developed over the last 50 years to the present weather constellation.



2017

BACKGROUND

We have seen the tremendous achievements in NWP to a large portion caused by the advances in satellite observations



Anomaly correlation of ECMWF 500hPa height forecasts

ECMWF 2017

BACKGROUND

WMO Space Programme, the Committee of Earth Observation Satellites (CEOS) and the Coordination Group for Meteorological Satellites (CGMS) started in January 2011 a process to develop a strategy towards an Architecture for Climate Monitoring from Space.

As a first step of the architecture a logical view was elaborated and approved by CEOS and CGMS and endorsed by the Executive Council of WMO in 2012 (EC-64). A report was published in 2013.

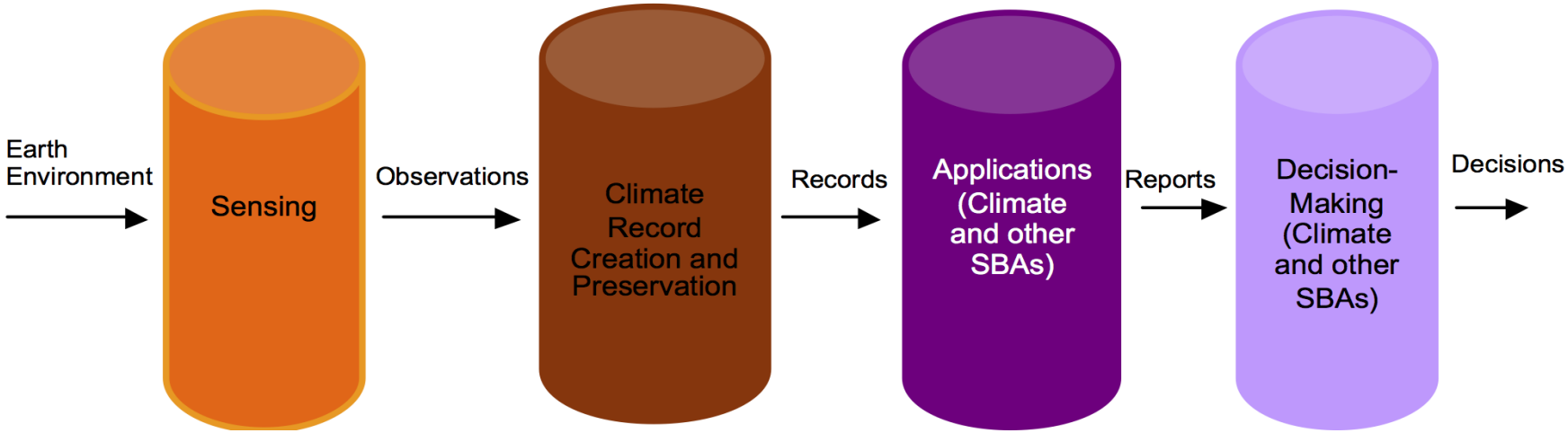
The physical view as the second step is under development.

BACKGROUND

- **Logical View:** represents the requirements baseline as a set of interlinked functions and associated dataflows (i.e. the target) .

- **Physical View:** describes how the logical view is physically implemented, i.e. how close we are to achieving the target.

BACKGROUND



Pillars of the logical view

PHYSICAL VIEW

Main Objective:
To systematically expose the ECV-relevant data holdings of space agencies to potential users.

Methodology:
Invite space agencies to populate questionnaires to provide input to an inventory of ECVs

USAGE OF THE INVENTORY

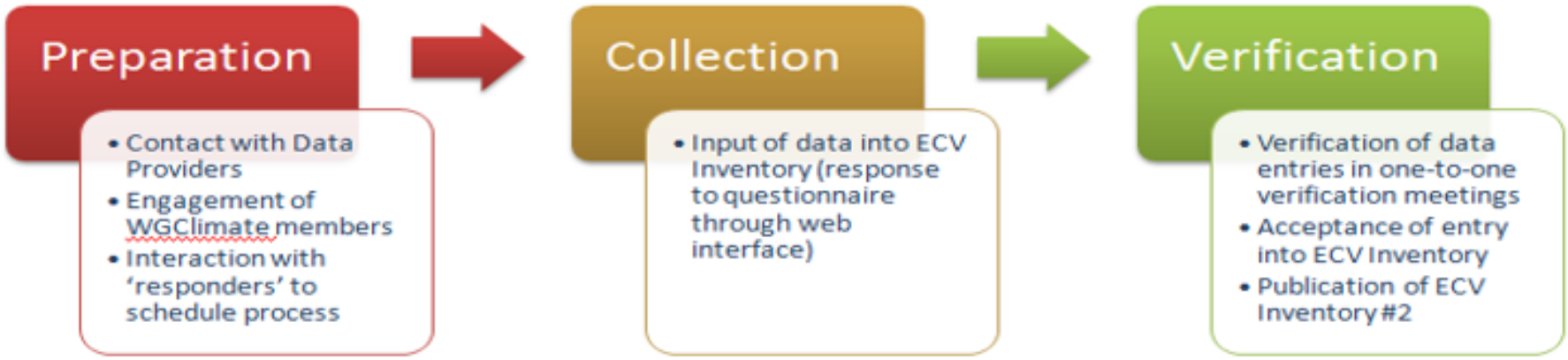
- It describes the current and planned monitoring capability on an ECV basis (allow easier response to e.g. GCOS IP, GFCS IP), and provides the basis for developing a gap analysis

- Combined perspective of the logical and physical views should enable the design of an optimum “macro scale” space system configuration (climate constellation) and its components (virtual constellations)

- Formulation and implementation of a coordinated action plan to address such gaps and shortfalls

ECV INVENTORY

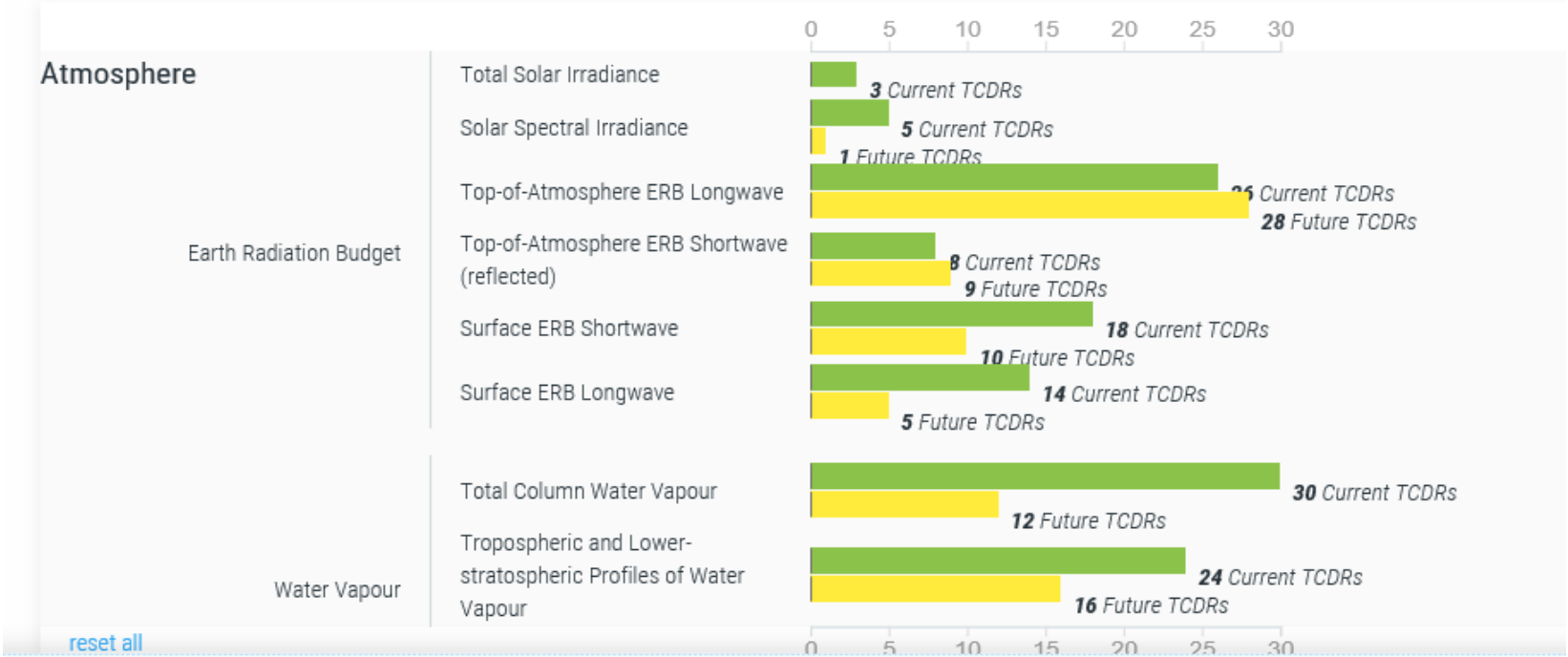
A Joint CEOS/CGMS Working Group on Climate (JWGCLIM), established in 2013, led the work on the inventory (2 cycles) based on the following steps:



April – May 2016 | June – Dec. 2016 | July 2016 – August 2017

ECV INVENTORY

TCDR Overview



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ECV INVENTORY

ECV Inventory Data & Download

Search: Show: 10

ID	Domain	ECV	Product	Physical Quantity	Status	Org	From	To
11536	Atmosphere	Earth Radiation Budget	Total Solar Irradiance	Total Solar Irradiance	Current	NOAA NCEI	2003-03-01	2016-12-31
11535	Atmosphere	Earth Radiation Budget	Total Solar Irradiance	Total Solar Irradiance	Current	NOAA NCEI	2003-03-01	2016-12-31
11534	Atmosphere	Earth Radiation Budget	Solar Spectral Irradiance	Solar Spectral Irradiance	Current	NOAA NCEI	2003-03-01	2016-12-31
11533	Atmosphere	Earth Radiation Budget	Solar Spectral Irradiance	Solar Spectral Irradiance	Current	NOAA NCEI	2003-03-01	2016-12-31

WGClimate | CEOS CGMS

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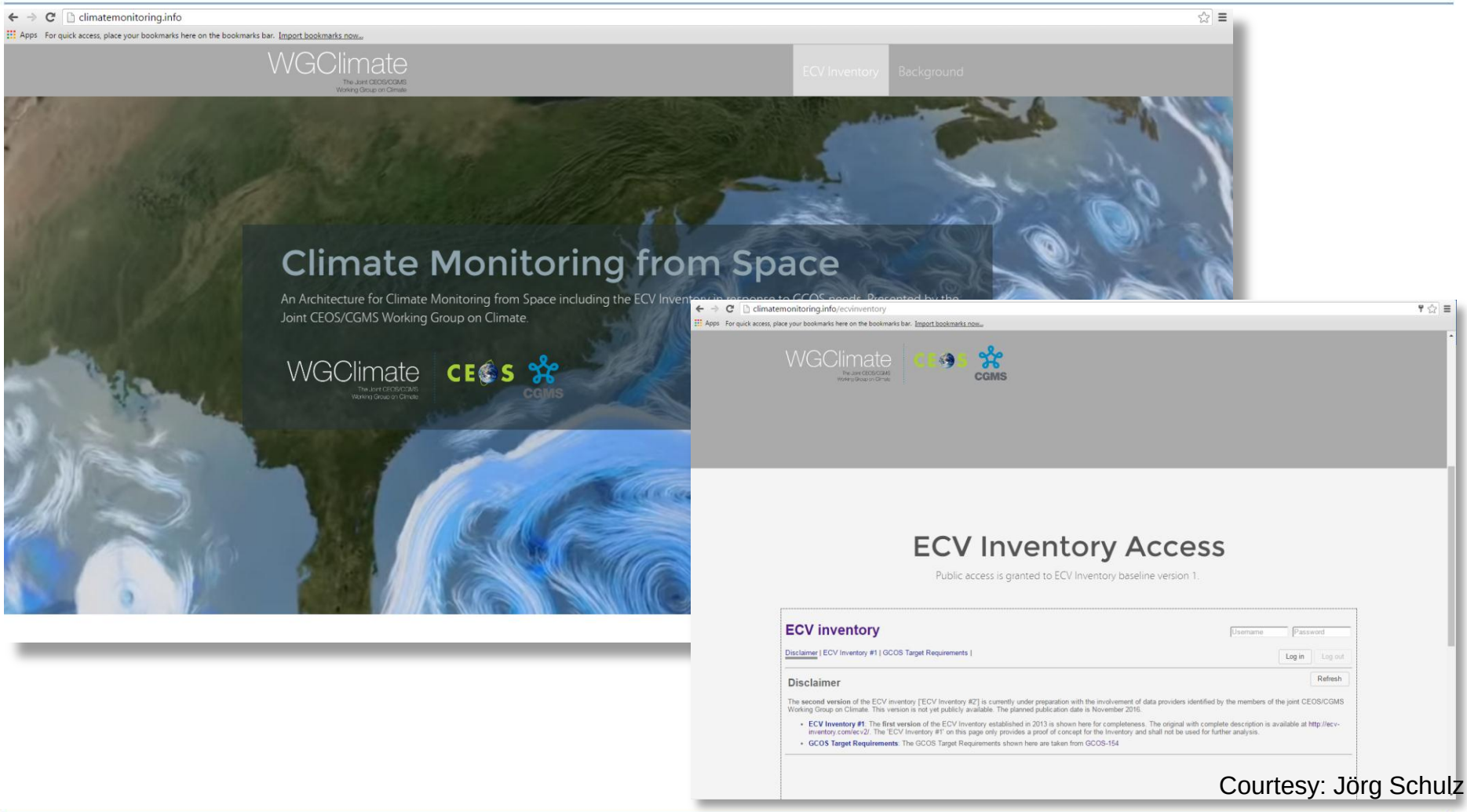
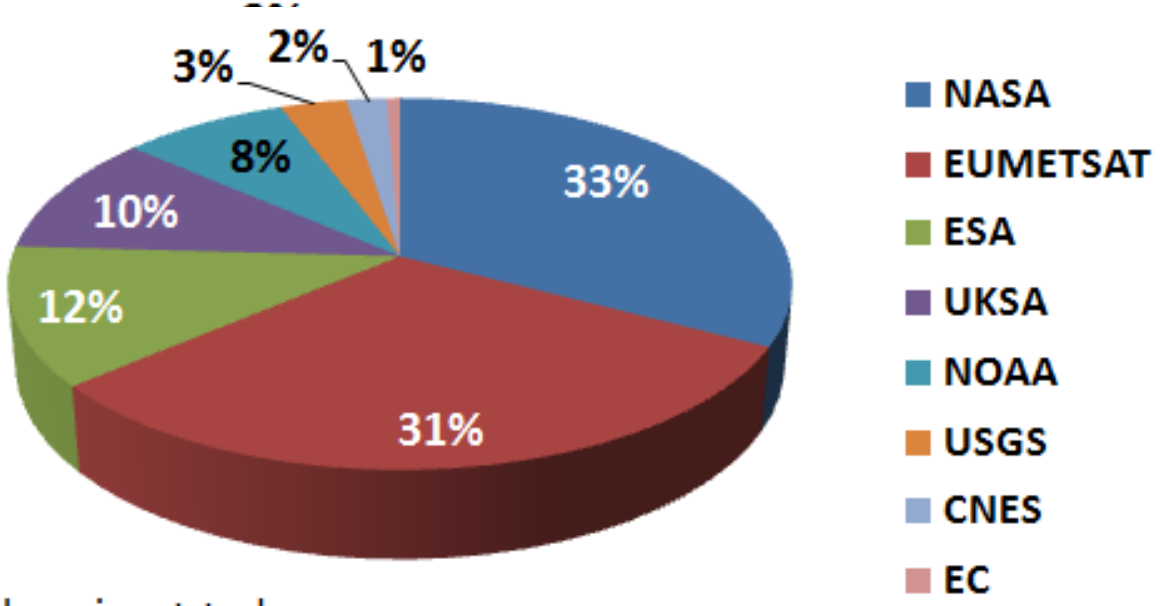
IMPLEMENTATION: JWG Climate web site



Courtesy: Jörg Schulz

INVENTORY CYCLE #2 STATUS

(End of 2016)



Other agencies with no input today:

- UK Met Office (input announced) ;
- ISRO. JAXA (help sent, awaiting activity);
- CSA, KMA (status unknown)
- CMA, DLR, INPE, NSC (stated there would be no input)
- ASI, JMA, Roshydromet (no feedback at all)

Courtesy: Jörg Schulz

INVENTORY Cycle #2 STATUS

(End of 2016)

- Total number of entries: 913 (496 current + 417 future)
- Per GCOS ECV domains:
  - -- Atmosphere 658 (376 current + 282 future)
  - -- Land 135 (56 current + 79 future)
  - -- Ocean 120 (64 current + 56 future)
- No records were submitted for the following ECVs:
  - -- Atmosphere: 5 (temperature of deep layers, tropospheric ozone profiles, NO2 tropospheric column, SO2 and HCHO tropospheric columns)
  - -- Land: 3 (fire radiative power, ice sheet elevation data and mass charge, areas of lakes and above ground biomass)
  - -- Ocean: 1 (sea surface salinity)

INVENTORY Cycle #2 STATUS

(End of 2016)

ECV	ECV Product	1971-1975	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015	2016
Atmosphere											
Surface Wind	Surface Wind Speed and Direction	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	7 7 7 7	7 8 8 8 8 8 8 8	8 8 8 8 10 10 11 11 11 11	10 12 12 10 10 10 10 9 8 8	7
Precipitation	Precipitation	0 0 0 0 0 0 1 1 1 1 1 1 1 1 1	6 6 6 6	6 7 7 7 7 7 7 7	7 8 8 8 8	7 7 7 7 7 7 7 6 7 7	6
Upper Air Temperature	Tropospheric Temperature Profile	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 2	2 2 2 2 10 10 10 10	10 11 11 11 11 11 11	8 8 8 8 8	4
	Stratospheric Temperature Profile	0 0 0 0 0 0 0 0 0 0 0 0 0 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	9 9 9 9 9 9 8 8	4
	Temperature of Deep Layers	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0
Upper Air Wind	Upper-air Wind Speed and Direction	0 0 0 0 0 0 0 1 1 1 1 1 1 1 1	1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 2	2
Water Vapour	Total Column Water Vapour	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 8	8 8 8 8 11 11 11 11	11 12 12 14 14 14 15 24	24 24 25 26 26 22 22 22	17
	Tropospheric and Lower-stratospheric Profiles of Water Vapour	0 0 0 0 0 0 0 0 0 1 1 1 1 1 1	1 3 3 3 3 4 4 4	4 4 4 4 4 4 6 6	6 6 22 22 22 22 23 23	21 20 20 18 17 17 17	8
	Upper Tropospheric Humidity	0 0 0 0 0 0 0 0 0 0 0 0 0 0 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 4 4	4 4 4 4 2 2 2 3	1
Cloud	Cloud Amount	0 0 0 0 0 0 0 0 1 1 2 4 4 4 4	4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4	19 19 19 20 21 21 18	4
	Cloud Top Pressure (CTP)	0 0 0 0 0 0 0 0 1 1 2 4 4 4 4	4 4 4 4 4 4 4 4	4 4 5 5 5 5 5 5	5 5 14 20 20 22 24 25	25 22 19 13 13 13 13	4
	Cloud Top Temperature (CTT)	0 0 0 0 0 0 0 0 1 1 1 3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	11 17 17 17 18 18 18 16	4
	Cloud Optical Depth (COD)	0 0 0 0 0 0 0 0 1 1 1 3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 6 6 8 9 9 9 7	0
	Cloud Water Path (liquid and ice)(CWP)	0 0 0 0 0 0 0 0 1 1 1 5 5 5 5	5 5 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 21 21 21 23 23 23 19	4
	Cloud Effective Particle Radius (liquid and ice)(CRE)	0 0 0 0 0 0 0 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 4 4 4 4 4 4	0
Earth Radiation Budget	Top-of-Atmosphere ERB Longwave	0 0 0 0 0 0 0 0 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 3 3	21 24 24 24 25 25 25 25	9
	Top-of-Atmosphere ERB Shortwave (reflected)	0 0 0 0 0 0 0 0 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 2 2	2 5 5 7 7 7 7 7	0
	Surface ERB Longwave	0 0 0 0 0 0 0 0 0 0 0 3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 5 5 5 14 14 14 14	14 14 14 11 2 2 2 2	0
	Surface ERB Shortwave	0 0 0 0 0 0 0 0 1 1 4 10 10 10 10	10 10 10 10 10 10 10 10	10 10 10 10 10 10 10 10	10 10 12 12 12 18 14 14	14 14 14 11 5 5 2 2	0
	Total Solar Irradiance	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	3 3 3 3 3 3 3 3	3
	Solar Spectral Irradiance	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	2 2 2 2 2 2 2 2	2 2 2 2 2 5 5 5	5 5 5 5 5 3 3 3	3
CO2, CH4 and other GHG	Tropospheric CO2 Column	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	11 11 11 11 11 11 13 13	4
	Tropospheric CO2 Profile	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0
	Tropospheric CH4 Column	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	2 2 2 2 3 4 4 8	0
	Tropospheric CH4 Profile	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	8 8 8 8 9 10 10 10	4
	Stratospheric CH4 Profile	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	10 9 9 9 8	0
Ozone	Total Ozone	2 2 2 2 2 2 2 2 2 2 2 3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	11 11 11 11 12 13 13 12	3
	Tropospheric Ozone Profile	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	11 10 8 8 8	0
	Ozone Profile in Upper Troposphere and Lower Stratosphere	1 1 1 1 1 1 1 2 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 3 2 2 2 2 2 0	0
	Ozone Profile in Upper Stratosphere and Mesosphere	1 1 1 1 1 1 1 1 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 0	0
Aerosol	Aerosol Optical Depth	0 0 0 0 0 0 0 0 0 0 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 7 7 12 12	12 13 13 14 14 17 22 24	28 28 26 18 14 9 9 9	2
	Aerosol Single-scattering Albedo	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	1 1 1 1 1 1 1 0	0
	Aerosol-layer Height	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	1 1 1 1 2 2 2 2	1 1 1 1 1 1
	Aerosol-extinction Coefficient Profile	0 0 0 0 0 0 0 0 0 0 0 0 0 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	2 2 2 1 1 1 1 1	0
Precursors ECVs	NO2 Tropospheric Column	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0
	SO2; HCHO Tropospheric Columns	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0
	CO Tropospheric Column	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 1 1 1 1 1 0 0	0
	CO Tropospheric Profile	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	8 8 8 8 9 9 9 9	3

Number of existing data records for the atmospheric domain per ECV product and year for the period 1971-2016

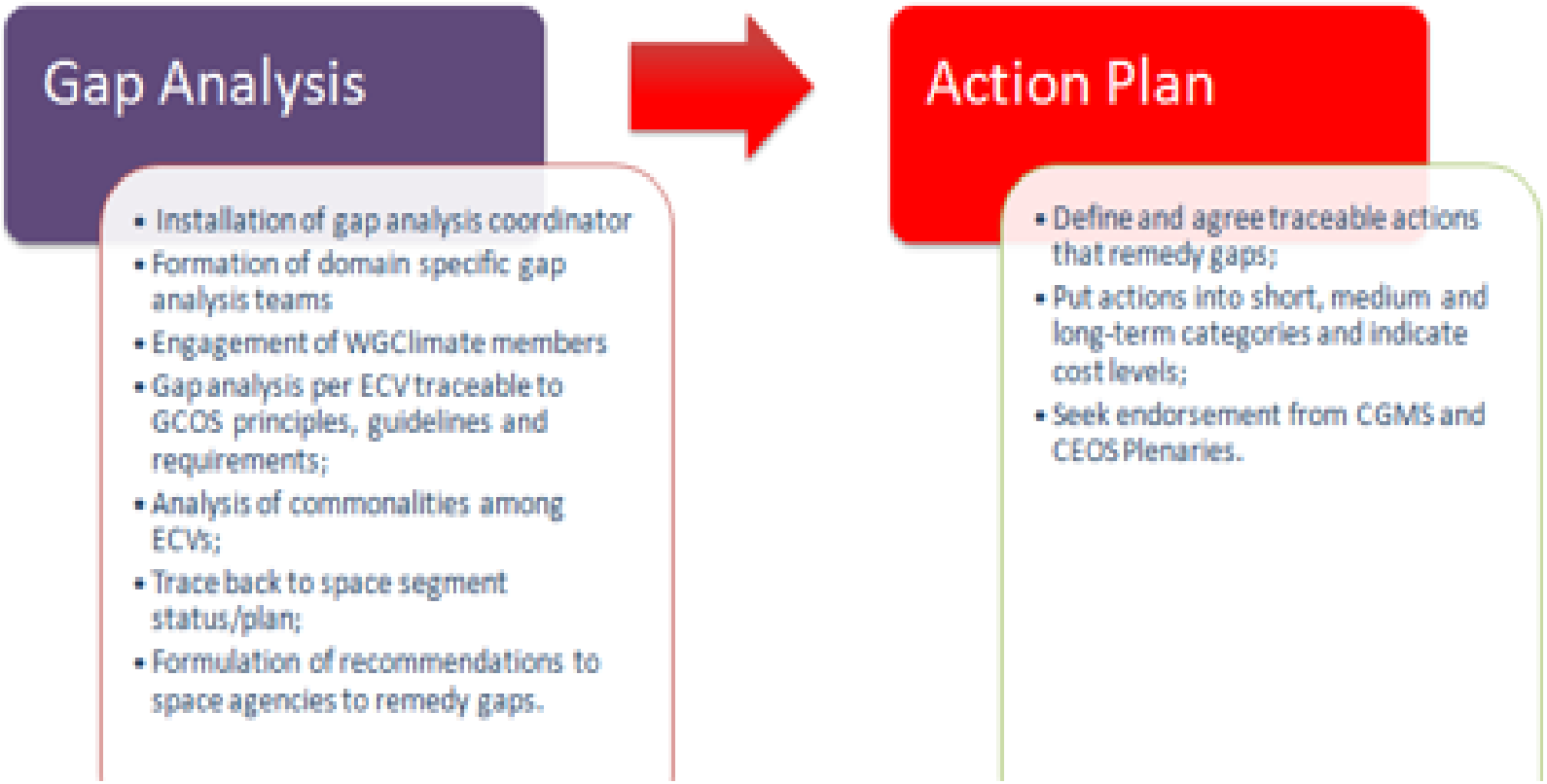
INVENTORY Cycle #2 STATUS

(End of 2016)

ECV	ECV Product	2001-2005					2006-2010					2011-2015					2016-2020					2021-2025					2026-2032				
Atmosphere																															
Surface Wind	Surface Wind Speed and Direction	3	3	3	3	3	3	3	3	3	5	5	5	5	2	2	2	2	1	3	2	0	0	0	0	0	0	0	0	0	0
Precipitation	Precipitation	3	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	2	1	0	0	0	0	0	0	0	0	0	0
Upper Air Temperature	Tropospheric Temperature Profile	0	4	12	12	12	12	12	12	12	12	12	12	12	12	12	6	6	6	4	4	0	0	0	0	0	0	0	0	0	0
	Stratospheric Temperature Profile	0	4	12	12	12	12	12	12	12	12	12	12	12	12	12	6	6	6	4	4	0	0	0	0	0	0	0	0	0	0
	Temperature of Deep Atmospheric Layers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Air Wind	Upper-air Wind Speed and Direction	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	1	0	0	0	0	0	0	0	0	0	0	0
Water Vapour	Total Column Water Vapour	2	2	10	10	10	12	12	12	12	12	12	12	12	11	11	6	5	5	5	4	0	0	0	0	0	0	0	0	0	0
	Tropospheric and Lower-stratospheric Profiles of Water Va	0	0	16	16	16	16	16	16	16	16	16	16	16	16	16	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0
	Upper Tropospheric Humidity	5	5	7	7	7	7	7	7	7	7	7	7	7	6	6	5	5	5	5	5	0	0	0	0	0	0	0	0	0	0
Cloud	Cloud Amount	13	13	21	23	23	23	23	23	23	23	23	23	23	23	21	12	12	12	10	10	1	1	1	1	0	0	0	0	0	0
	Cloud Top Pressure (CTP)	7	7	15	17	17	17	17	17	17	17	17	17	17	17	15	9	9	9	7	7	1	1	1	1	0	0	0	0	0	0
	Cloud Top Temperature (CTT)	7	7	15	17	17	17	17	17	17	17	17	17	17	17	15	9	9	9	7	7	1	1	1	1	0	0	0	0	0	0
	Cloud Optical Depth (COD)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	Cloud Water Path (liquid and ice)(CWP)	14	14	14	18	18	18	18	18	18	18	18	18	18	18	14	10	10	10	6	5	1	1	1	1	0	0	0	0	0	0
	Cloud Effective Particle Radius (liquid and ice)(CRE)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0
Earth Radiation Budget	Top-of-Atmosphere ERB Longwave	7	7	25	25	28	28	28	28	28	28	28	28	28	28	22	13	13	11	10	10	1	1	1	1	1	1	1	1	1	1
	Top-of-Atmosphere ERB Shortwave (reflected)	6	6	6	6	9	9	9	9	9	9	9	9	9	9	6	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1
	Surface ERB Longwave	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
	Surface ERB Shortwave	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6	6	6	4	4	2	2	2	2	2	2	2	2	2	2
	Total Solar Irradiance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Solar Spectral Irradiance	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2, CH4 and other GHG	Tropospheric CO2 Column	0	0	10	10	10	10	10	11	11	13	13	13	13	13	13	9	4	4	4	4	0	0	0	0	0	0	0	0	0	0
	Tropospheric CO2 Profile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tropospheric CH4 Column	0	0	2	2	2	2	2	3	3	7	7	7	7	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tropospheric CH4 Profile	0	0	8	8	8	8	8	8	8	8	8	8	8	8	8	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0
	Stratospheric CH4 Profile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ozone	Total Ozone	0	0	8	8	8	9	9	9	9	9	9	9	9	9	9	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0
	Tropospheric Ozone Profile	1	1	2	2	3	3	3	4	4	4	3	2	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ozone Profile in Upper Troposphere and Lower Stratosphe	1	1	2	2	3	3	3	5	5	5	4	3	2	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ozone profile in Upper Stratosphere and Mesosphere	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aerosol	Aerosol Optical Depth	4	4	6	8	9	9	9	10	10	8	8	7	7	6	6	4	4	2	2	2	2	2	2	2	1	0	0	0	0	0
	Aerosol Single-scattering Albedo	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aerosol-layer Height	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aerosol-extinction Coefficient Profile	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Precursors ECVs	NO2 Tropospheric Column	0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SO2; HCHO Tropospheric Columns	0	0	0	0	0	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CO Tropospheric Column	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CO Tropospheric Profile	0	0	8	8	8	8	8	8	8	8	8	8	8	8	8	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0

Number of planned data records for the atmospheric domain per ECV product and year for the period 2001 - 2032

FINALISATION OF CYCLE #2

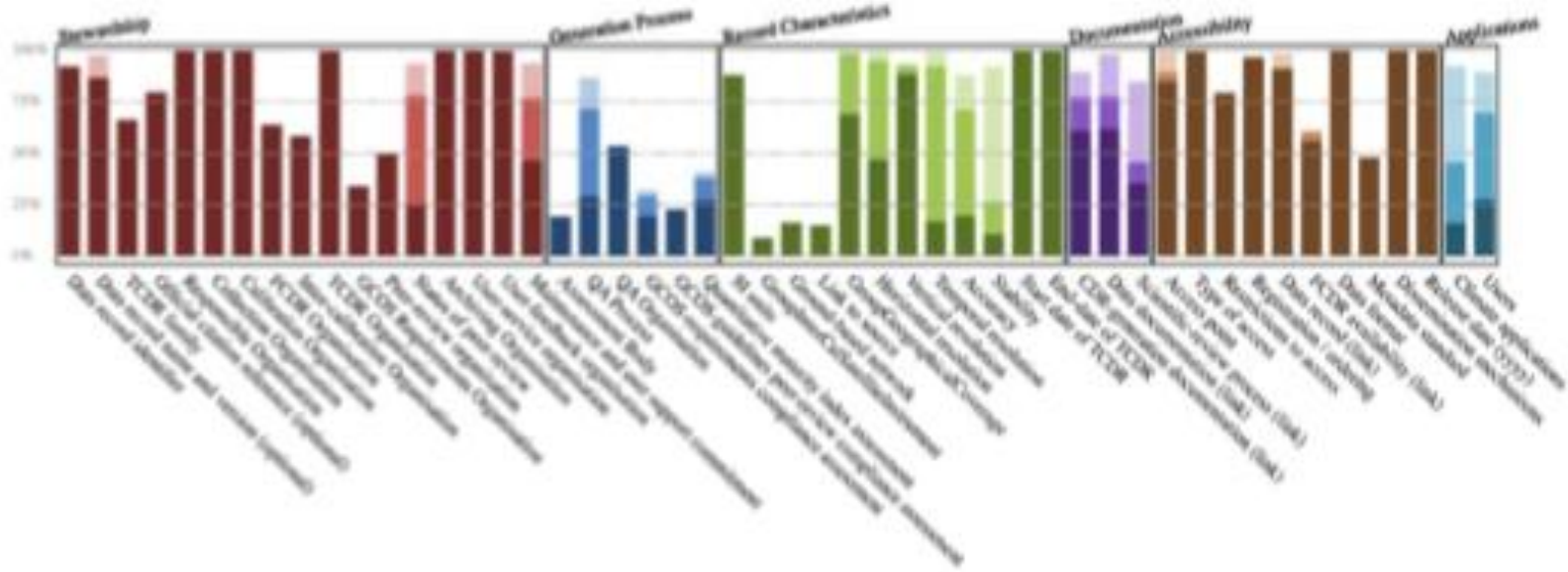


November – December 2017

December 2017 – March 2018

GAP ANALYSIS

The CDRs were analysed using socalled ECV Inventory Catagories: Stewardship, Generation Process, Record Characteristics, Documentation, Accessibility, Applications



Level of response to the questionnaire and grades of responses to the individual questions for all data records (496) in the current part of the ECV Inventory

GAP ANALYSIS

Eight focused gap analyses have been undertaken for the following ECVs:

- Atmosphere
  - Carbon Dioxide
  - Methane
  - Precipitation
- Ocean
  - Sea Surface Temperature
  - Sea Surface Salinity
- Land
  - Land Surface Temperature

ACTION PLAN

Out of the focused gap analysis an action plan was developed comprising 24 actions e.g. for carbon dioxide the following:

Recommendation #10: To ensure continuity of CO2 CDRs, agencies or partner entities are requested to commit to the generation of CDRs in all relevant spectral domains including SWIR from existing or approved missions measuring tropospheric and total column CO2.

Action #11: CEOS and CGMS Agencies with interests in and/or mandates for developing CO2 climate data records to strive for ensuring consistent, well calibrated, bias-free time-series that can be continued into the future. . . .

NEXT STEPS

Combined perspective of the logical and physical views should enable the design of an optimum “macro scale” space system configuration (climate constellation) and its components (virtual constellations).

A Virtual Constellation is defined by CEOS as a coordinated set of space and/or ground segment capabilities from different partners that focuses on observing a particular parameter (ECV) or set of parameters (ECVs) of the Earth system.

CLIMATE CONSTELLATION

Currently, CEOS Virtual Constellations include:

- Atmospheric Composition (AC-VC)
- Land Surface Imaging (LSI-VC)
- Ocean Color Radiometry (OCR-VC)
- Ocean Surface Topography (OST-VC)
- Ocean Surface Vector Wind (OSVW-VC)
- Precipitation (P-VC)
- Sea Surface Temperature (SST-VC).

CLIMATE CONSTELLATION

CGMS, which is coordinating the Weather Constellation, should establish Virtual Constellations for ECVs which can be derived from the sensing data of the Weather Constellation e.g. Atmospheric Wind Vectors (AMV-VC), Vertical Temperature Profiles (VTP-VC), Atmospheric Humidity Profiles (AHP-VC) etc.

The VCs of CEOS and CGMS should form the Climate Constellation. Not yet agreed by CEOS and CGMS as well as a governance scheme for running the Climate Constellation has still to be developed.

Latest Developments

At CGMS-46 (June 2018) the Gap Analysis and the Action Plan have been discussed and two items got the highest priority:

- GHG Monitoring
- Precipitation (passive microwave observations).

On GHG Monitoring the report „A Constellation Architecture for Monitoring Carbon Dioxide and Methane from Space“ was endorsed and a subgroup under JWGCLIM will be established to develop a joint CEOS-CGMS GHG virtual Constellation.

CEOS-32 (Oct. 2018) confirmed the results of CGMS-46.