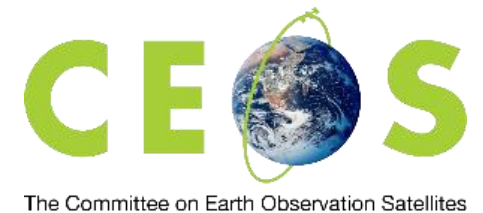


# Gap Analysis Past and Future

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and many contributors to various parts of gap analysis





- ECV Inventory fully describes current and planned implementation arrangements (ECV-by-ECV) within the Architecture;
- Updated continuously with versions of Inventory, gap analysis, action plan created annually with approval from CEOS and CGMS;
- Recommendations and Coordinated Actions inform space agency planning, improve availability and interoperability of climate data;
- Feeds material for all future responses to the GCOS IP.

Related to the objectives of the WG Climate the gap analysis addresses three topics:

- An assessment of ECVs and their ECV Products where no data records exist or are not planned;
- An assessment of the existing and planned climate data records with respect to the fulfilment of criteria, published by GCOS, that provides guidance to climate data record providers on the sustainable process to generate CDRs, and on the quality required to be able to serve known climate applications;
- An assessment of 8 ECVs (Carbon Dioxide, Methane, Precipitation, Sea Surface Temperature, Sea Surface Salinity, Land Surface Temperature, Leaf Area Index, and Above-ground Biomass) and their associated ECV Products with respect to a more optimised use of past and current satellite measurements and an analysis of missing measurements in the future, which would prevent the generation of CDRs for specific ECV Products.



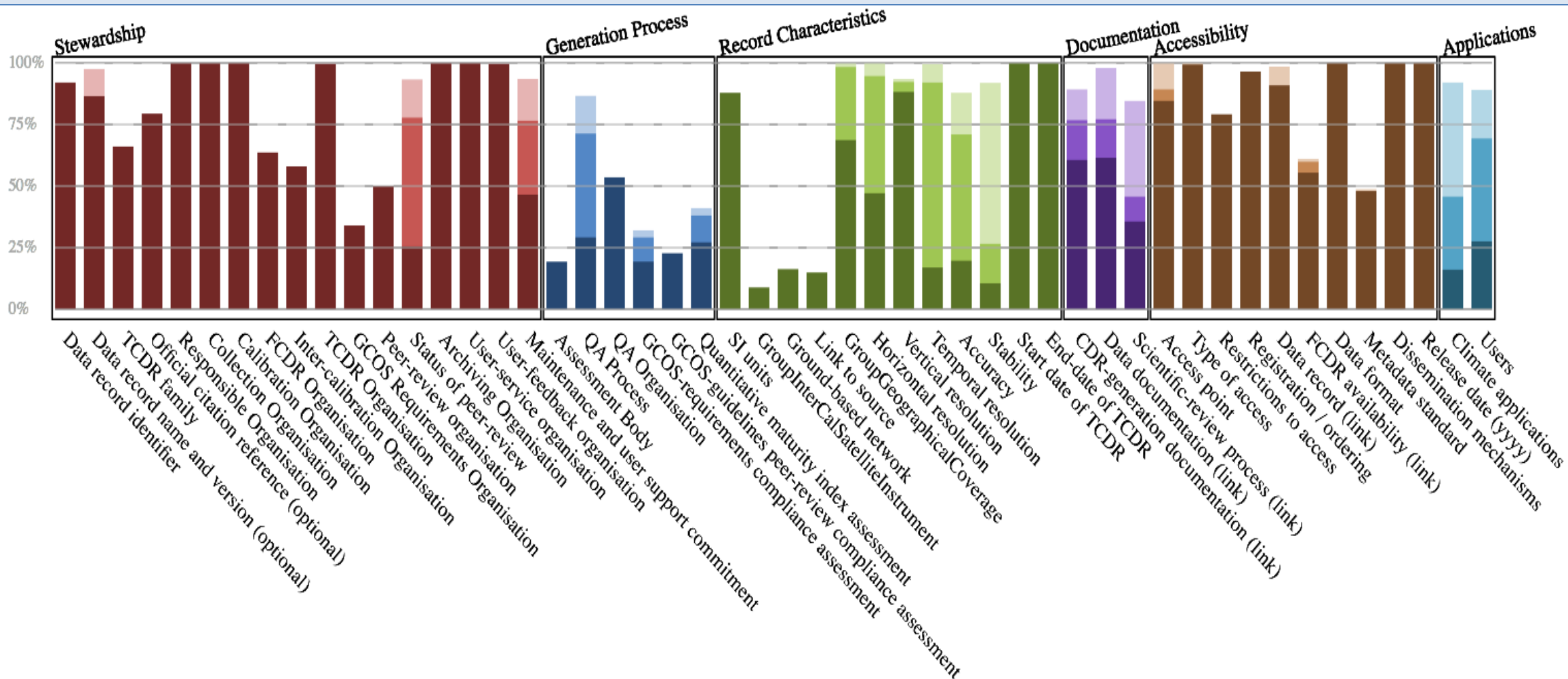
# Planned Atmospheric ECV Products

ECV	ECV Product	1966-1970	1971-1975	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015	2016-2020	2021-2025	2026-2032
Atmosphere														
Surface Wind	Surface Wind Speed and Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
Precipitation	Precipitation	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Air Temperature	Tropospheric Temperature Profile	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stratospheric Temperature Profile	0	0	0	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
Upper Air Wind	Upper-air Wind Speed and Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Vapour	Total Column Water Vapour	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tropospheric and Lower-stratospheric Profiles of Water Vapour	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upper Tropospheric Humidity	0	0	0	0	0	0	0	0	0	0	0	0	0
Cloud	Cloud Amount	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cloud Top Pressure (CTP)	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cloud Top Temperature (CTT)	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cloud Optical Depth (COD)	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cloud Water Path (liquid and ice)(CWP)	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cloud Effective Particle Radius (liquid and ice)(CRE)	0	0	0	0	0	0	0	0	0	0	0	0	0
Earth Radiation Budget	Top-of-Atmosphere ERB Longwave	0	0	0	0	0	0	0	0	0	0	0	0	0
	Top-of-Atmosphere ERB Shortwave (reflected)	0	0	0	0	0	0	0	0	0	0	0	0	0
	Surface ERB Longwave	0	0	0	0	0	0	0	0	0	0	0	0	0
	Surface ERB Shortwave	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Solar Irradiance	0	0	0	0	0	0	0	0	0	0	0	0	0
	Solar Spectral Irradiance	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2, CH4 and other GHG	Tropospheric CO2 Column	0	0	0	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
	Tropospheric CH4 Column	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tropospheric CH4 Profile	0	0	0	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
Ozone	Total Ozone	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tropospheric Ozone Profile	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ozone Profile in Upper Troposphere and Lower Stratosphere	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
Aerosol	Aerosol Optical Depth	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aerosol Single-scattering Albedo	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aerosol-layer Height	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aerosol-extinction Coefficient Profile	0	0	0	0	0	0	0	0	0	0	0	0	0
Precursors ECVs	NO2 Tropospheric Column	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
	CO Tropospheric Column	0	0	0	0	0	0	0	0	0	0	0	0	0
	CO Tropospheric Profile	0	0	0	0	0	0	0	0	0	0	0	0	0

# Atmospheric ECVs

- All ECVs are partially covered, although a dense population only exists for the period 2001-2010;
- For existing CDRs, five ECV Products (Temperature of Deep Layers, Tropospheric Ozone and CO<sub>2</sub> Profiles, and NO<sub>2</sub>, SO<sub>2</sub> and HCHO Tropospheric Columns) have no entries in the ECV Inventory. However, Temperature of Deep Layers does not constitute a real data gap because data records are known to exist for this ECV even though they are not currently registered in the inventory;
- For planned CDRs, very few plans exist for the extension of CDRs beyond 2020. For 4 ECV Products (Total Solar Irradiance, Tropospheric CO<sub>2</sub> Profile, Stratospheric CH<sub>4</sub> Profile, and CO Tropospheric Column) no entries exist in the ECV Inventory. However, some limitations in the Inventory for planned CDRs has now been identified, so in some cases these gaps may not be real. Improvements to the inventory will be made for the next update.

# Analysis against GCOS criteria



# Individual ECV analysis SST

Technology	Instrument	Mission	Launch	EOL	WMO relevance for SST	CEOS relevance for SST	No. current CDRs in ECV Inventory	No. future CDRs in ECV Inventory	Comments
Cross-nadir infrared sounder	IMG	ADOES	17/08/1996	30/06/1997	Primary	N	-	-	
	AIRS	Aqua	04/05/2002	2018	Primary	Y	9	8	No gaps in the use of AIRS.
	TES-nadir	Aura	15/07/2004	2018	Primary	N	-	-	
	IASI	Metop-A Metop-B	19/10/2006	2018	Primary	Y	-	-	EUMETSAT plans to release reprocessed SST in 2019
			17/09/2012	2018			-	-	
	CrIS	SNPP	28/10/2011	2018	Primary	N	-	-	
	GIIRS	FY-4A	10/12/2016	2021	Primary	N	-	-	
	HIRS/2	NOAA-6 NOAA-7 NOAA-8 NOAA-9 NOAA-10 NOAA-11 NOAA-12 NOAA-13 NOAA-14 TIROS-N	27/06/1979	31/03/1987	Very High	N	-	-	
			23/06/1981	07/06/2986			-	-	
			28/03/1983	29/12/1985			-	-	
			12/12/1984	13/02/1998			-	-	
			17/09/1986	30/08/2001			-	-	
			24/09/1988	16/06/2004			-	-	
			14/05/1991	10/08/2007			-	-	
09/08/1993			21/08/1993	-			-		
30/12/1994			23/05/2007	-			-		
13/10/1978			27/02/1981	-			-		
VAS	GOES-4 GOES-5	09/09/1980	22/11/1988	Very High	N	-	-		
		22/05/1981	18/07/1990			-	-		



- Recommendation #15: *The SST-VC should foster further work on SST ECV products in regards to the improvements that may be possible by better exploiting/integrating geostationary, historic IR sounders and C-band radiometers.*
- Recommendation #16: *C-band microwave radiometer measurements for all-weather SST:*
  - *(Short term) All efforts to maximise the life time of AMSR-2 on JAXA's GCOM-W1 should be supported.*
  - *(Mid-term) The possibility of an AMRS-2 on GCOM-W2 should be prioritised; full data sharing in regards to MWI instruments of the FY-3 series and HY-2B.*
  - *(Longer term) Agencies with operational mandates should develop and fund a sustainable plan, with redundancy, for observations from C-band microwave conical scanning radiometers.*

WGClimate Coordinated Actions						
Actionee	Action #	Description	Action feedback/closing document	Deadline	Status	Comments
VC-SST	16	The CEOS SST-VC to work with GHRSSST on future utilisation of the mentioned data sources and regularly inform WGClimate on the progress which shall become measurable in the ECV Inventory as well.	Telecon with VC-SST lead needed.	31 Jan 2019	OPEN	Science, C-SST SST lead needed
WGClimate	17	CEOS and CGMS Agencies with experience in microwave radiometry to help maximise the lifetime of the AMSR-2 instrument on GCOM-W1.	Assess status	SIT-34	OPEN	
WGClimate	18	CEOS and CGMS Agencies to strive to ensure that the needed C-band microwave data are made publicly available and can be used for the generation of climate data records.	Check availability, maybe with WGISS, then point out what is missing. May strive for CEOS and/or CGMS Plenary action.	47th CGMS and 33rd CEOS Plenary	OPEN	Data Access
WGClimate VC-SST	19	CEOS and CGMS Agencies with interests in and/or mandates for developing C-band microwave radiometers to coordinate their efforts to arrive at an operational capability, and coordinate their efforts with WGClimate and the SST-VC.	Telecon with VC-SST lead needed.	31 Dec 2019	OPEN	Science, VC-SST SST lead needed

## Main targets: Comparison #2/#3

- Assess content of the ECV Inventory: population (distribution per domain, existing / planned), absolute gaps, agencies' contributions
- Assessment against GCOS criteria
- Revisit set of ECVs / ECV Products targeted by previous gap analysis (CO<sub>2</sub>, CH<sub>4</sub>, Precipitation, Land Surface Temperature, Leaf Area Index, Above-Ground Biomass, Sea Surface Temperature, Sea Surface Salinity) and assess evolution, cross-referencing with the Recommendations and Actions

# Main targets: ECVs for detailed analysis

– Draft proposal, based on analysis of GCOS-IP actions:

- Atmosphere
  - Aerosols
  - Lightning
  - Surface Winds
  - Upper-air winds
  - Water Vapour UT/LS
- Land
  - Fire
  - Land Cover
  - Soil Moisture
  - FAPAR
  - Glaciers
- Ocean
  - Sea Level
  - Sea State
  - Ocean-surface heat flux

▶ Considerations

- ▶ Workload
- ▶ Expertise
- ▶ Other (relevance, cycles, ...) >  
Scatterometry? Limb sounding?

Help from WCRP for analysis would be appreciated:

- GEWEX for ocean surface heat flux and associated state variables;
- SPARC for Water Vapour UT/LS

Need matter experts in parameter and remote sensing (instrument knowledge)

Availability between May - September