

Review of ECV Requirements 6.1



**GLOBAL CLIMATE
OBSERVING SYSTEM**

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GCOS maintains and reviews the Essential Climate Variables (ECV) and their requirements

GCOS IP 2016

Action G10:	Maintain ECV requirements
Action	Routinely maintain, review and revise list of ECV requirements. The GCOS secretariat will ensure that there is a consistent approach between panels.
Benefit	Clear, consistent and complete list of ECV requirements as a basis for national and international climate observations ensures consistency between observations.
Who	GCOS Panels, GCOS secretariat
Time frame	Develop a systematic approach in 2017 and review every five years
Performance indicator	Annually updated list of ECV requirements.
Annual cost	US\$ 1 000–10 000 for experts

Process to update ECV requirements

- **2018-2019:** GCOS expert panels, in consultation with their communities, revised definitions, ECV products and requirements
- **January-February 2020:** First public consultation on the requirements
- **March 2020-March 2021:** ECV stewards address comments from consultation and update requirements for the ECV products
- **January-February 2022:** Final review of requirements as part of the public review of the revised GCOS IP
- **October 2022:** Updated requirements published as part of the updated GCOS IP
- **Update of the OSCAR/Requirements for the Climate Monitoring Application Area with the requirements.**

Requirements

Uses of GCOS Climate Monitoring (from GCOS mandate in MoU)

- Climate System Monitoring, climate change detection and monitoring the impacts of and the response to climate change, especially in the terrestrial ecosystems and mean sea-level;
- Data for application to national economic development;
- Research towards improved understanding, modelling and prediction of the climate system.

- The current review of ECV requirements needs to address all of these users
 - Different users may have different requirements
- WMO has asked GCOS to be responsible for the application area Climate Monitoring
 - Information on requirements is stored in OSCAR/Requirements
- Therefore
 - GCOS will follow the same approach to WMO with requirements with Goal, and Threshold (and optionally breakthrough) values
 - Goal should cover all users if feasible
 - Threshold is the minimum
 - OSCAR/Requirements can store the requirements for all domains

"threshold" is the minimum requirement to be met to ensure that data are useful

"goal" is an ideal requirement above which further improvements are not necessary

"breakthrough" is an intermediate level which, if achieved, would result in a significant improvement

Evolving definitions of requirements

Item	Notes
ECV	Name of ECV
Products	Sub-variables needed (e.g. lake area, temperature and colour)
Frequency	e.g. hourly, annual, etc.
Resolution	Horizontal and vertical
Required measurement uncertainty	Follow international definitions
Stability	Vital for climate change
Standards/References	Where they exist

2016



Name					
Definition					
Unit					
Note					
Requirements					
Item needed	SI Unit	Metric		Value	Derivation and References and Standards
Horizontal Resolution			G		
			B		
			T		
Vertical Resolution			G		
			B		
			T		
Temporal Resolution			G		
			B		
			T		
Timeliness			G		
			B		
			T		
Required Measurement Uncertainty			G		
			B		
			T		
Stability			G		
			B		
			T		
Standards and References					

2022

2016 Essential Climate Variables (ECVs)

Atmospheric

Surface

Precipitation, Surface pressure, Surface radiation budget, Surface wind speed and direction, Surface temperature, Surface water vapour

Upper-air

Earth radiation budget, Lightning, Upper-air temperature, Upper air water vapor, Upper-air wind speed and direction

Composition

Aerosols properties, Carbon dioxide, Methane and other greenhouse gases, Cloud properties, Ozone, Aerosol and ozone precursors

Oceanic

Physical

Ocean surface heat flux, Sea ice, Sea level, Sea state, Sea surface Salinity, Sea surface temperature Subsurface currents, Subsurface salinity, Subsurface temperature

Biogeochemical

Inorganic carbon, Nitrous oxide, Nutrients, Ocean colour, Oxygen, Transient tracers

Biological/ecosystems

Marine habitat properties, Plankton

Terrestrial

Hydrology

Groundwater, Lakes, River discharge, Soil moisture

Cryosphere

Glaciers, Ice sheets and ice shelves, Permafrost, Snow

Biosphere:

Above-ground biomass, Albedo, Fire, Fraction of absorbed photosynthetically active radiation, Land cover, Land surface temperature, Latent and sensible heat fluxes, Leaf area index, Soil carbon

Human use of natural resources:

Anthropogenic greenhouse gas fluxes, Anthropogenic water use

For each ECV, there may be several separate ECV products, identified as essential to fully define the ECV.

Example:

Water vapour (upper-air): Total column water vapour; tropospheric and lower-stratospheric profiles of water vapour, upper tropospheric humidity

Lakes: lake water level, water extent, lake surface-water temperature, lake-ice thickness, lake-ice cover, lake colour.

Sea ice: Sea-ice concentration, sea-ice extent/edge, sea-ice thickness, sea-ice drift

However:

In the process of reviewing the ECV products and their requirements, for many ECVs **the number of these ECV products has increased** (..Water vapour has now 10 ECV products)

Agreeing on what is really essential

- All ECV and their products:
 - Feasible to measure and sustainable
 - Have a clearly specified user need going beyond scientific curiosity;
 - Number of ECV and products should be the minimum needed to meet user needs.
 - Measure a significant part of the climate system;
- Requirements:
 - aligned with existing observing systems (e.g. for NWP) (addition of uncertainty and stability) – where possible
 - differing requirements for different uses may be needed for a specific ECV.

DECISION

1. the GCOS expert panels review the ECV products to ensure that they are relevant for GCOS mandate and produce a clear justification for the need of each product based on its relevance for Climate Monitoring and clear user-defined needs.
2. the GCOS Secretariat involves the user community in reviewing the relevance of the ECV products for the needs of their communities.
3. the GCOS Secretariat produce a list of essential ECV products, identified through 1) and 2) to be approved by the Steering Committee.
4. Requirements for the agreed ECV products will be included in the update of the GCOS IP and in the OSCAR/Requirements.

- a) when the GCOS expert panels review the ECV products they should ensure that they are relevant for GCOS mandate and produce a clear justification for the need of each product based on its relevance for climate monitoring and clear user-defined needs.
- b) the GCOS Secretariat involve the user community in reviewing the relevance of the ECV products for the needs of their communities.
- c) the GCOS Secretariat produce a list of essential ECV products, identified through a) and b) to be approved by the Steering Committee.
- d) requirements for the agreed ECV products will be included in the update of the GCOS IP and in the WMO OSCAR/Requirements.

Furthermore the Steering Committee reaffirms that an ECV and its products should:

- Be feasible and sustainable to measure;
- Have a clearly specified user need going beyond scientific curiosity;
- Number of ECV and products should be the minimum needed to meet user needs.
- Measure a significant part of the climate system;

The Steering Committee also decided that, where possible, requirements should be aligned with existing observing systems (e.g. for NWP) while noting the specific climate needs (e.g. accuracy, stability and historic time series). The Steering Committee also notes that differing requirements for different uses may be needed for a specific ECV.

Thank you



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