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The Global Climate Observing System

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- What is GCOS
- What are the Essential Climate Variables (ECV)
- Sunspot Number and ECV
- New GCOS Implementation Plan
- Conclusion

Global Climate Observing System

- The Global Climate Observing System (GCOS) is an internationally coordinated network of observing systems and a programme of activities that support and improve the network.
- It is designed to meet evolving national and international requirements for climate observations.





Global Climate Observing System

- Establishment of GCOS in 1992: co-sponsored by WMO, UNEP, IOC-UNESCO and ICSU
- UN Framework Convention on Climate Change (UNFCCC), Article 5: 'Systematic Observation'
- 3 Scientific Panels: 'Atmosphere', 'Ocean', 'Terrestrial'

Objective: "... ensure that the observations and information needed to address climate-related issues are obtained and made available to all potential users..."

International coordination: GCOS Secretariat at WMO National coordination: several national GCOS Office National Focal points: in most WMO members





Institutional Framework

Data providers

- National Meteorological and Hydrological Services
- National institutions responsible for oceanographic or terrestrial observation
- National and European space agencies
- National hosts of data centres
- Regional centres such as ECMWF
- Contributors to GEO observing initiatives
- Other providers of observations, data management or products

Coordinating systems/ bodies

- WMO observing systems (WIGOS)
- IOC-led co-sponsored Global Ocean Observing System (GOOS)
- Co-sponsored Global Terrestrial Observing System (GTOS)
- Research programmes (WCRP, ...)
- Other international bodies dealing with observations, data management or products (CEOS, CGMS, ...)
- National coordination mechanisms

GCOS Implementation Plan - Update 2010



- "Designate national coordinators ...achieve national coordination ... national plans for contributions to the global observing system for climate ..."
 - \rightarrow Focal point: >150 countries
 - → National Coordinator: 24 countries
- 50 "Essential Climate Variables (ECV)"
 → requirements by United Nations Framework Convention on Climate Change (UNFCCC), for global implementation, scientifically relevant and technically feasible

Essential Climate Variables

Domain	Essential Climate Variables	
	Surface: ³⁰	Air temperature, Wind speed and direction, Water vapour, Pressure, Precipitation, Surface radiation budget.
Atmospheric (over land, sea and ice)	Upper-air: ³¹	Temperature, Wind speed and direction, Water vapour, Cloud properties, Earth radiation budget (including solar irradiance).
	Composition:	Carbon dioxide, Methane, and other long-lived greenhouse gases ³² , Ozone and Aerosol, supported by their precursors ³³
Oceanic	Surface: ³⁴	Sea-surface temperature, Sea-surface salinity, Sea level, Sea state, Sea ice, Surface current, Ocean colour, Carbon dioxide partial
	Sub-surface:	pressure, Ocean acidity, Phytoplankton. Temperature, Salinity, Current, Nutrients, Carbon dioxide partial pressure, Ocean acidity, Oxygen, Tracers.
Terrestrial	River discharge, Water use, Groundwater, Lakes, Snow cover, Glaciers and ice caps, Ice sheets, Permafrost, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (FAPAR), Leaf area index (LAI), Above-ground biomass, Soil carbon, Fire disturbance, Soil moisture	

Source: GCOS Implementation Plan (2010)

GCOS

GCOS Climate Monitoring Principles (GCMP)

- 10 GCOS principles for systematic climate observation
- 10 additionally principles for satellite-based observations

GCOS CLIMATE MONITORING PRINCIPLES

Effective monitoring systems for climate should adhere to the following principles*:

- The impact of new systems or changes to existing systems should be assessed prior to implementation.
- 2. A suitable period of overlap for new and old observing systems is required
- The details and history of local conditions, instruments, operating procedures, data processing algorithms and other factors pertinent to interpreting data (i.e., metadata) should be documented and treated with the same care as the data themselves.
- The quality and homogeneity of data should be regularly assessed as a part of routine operations.
- Consideration of the needs for environmental and climate-monitoring products and assessments, such as IPCC assessments, should be integrated into national, regional and global observing priorities.
- 6. Operation of historically-uninterrupted stations and observing systems should be maintained
- High priority for additional observations should be focused on data-poor regions, nonobserved parameters, regions sensitive to change, and key measurements with inadequate temporal resolution.
- Long-term requirements, including appropriate sampling frequencies, should be specified to network designers, operators and instrument engineers at the outset of system design and implementation.

...historically-uninterrupted stations and observing systems...

 Data management systems that facilitate access, use and interpretation of data and products should be included as essential elements of climate monitoring systems.

Source: GCOS Implementation Plan (2010)

Solar cycles and Climate variability

Solar cycles (and SSN) have several effects on earth atmosphere:

- Variation on the TSI reaching the top of atmosphere (TOA)
- Other interactions inside the atmosphere- > «space weather»

SSN data series can be used to «extrapolate in the past» actual knowledge on interactions between solar effects in the atmosphere

Sunspot Number and TSI



Sun activity and atmospheric interaction

 CERN CLOUD (Cosmics Leaving Outdoor Droplets): The CLOUD project aims to study the influence of galactic cosmic rays on the Earth's climate through the media of aerosols and clouds.

From time to time the sun's magnetic field experiences brief periods of intense activity, when large quantities of highly charged plasma are thrown out into the solar system. This plasma blocks cosmic rays from reaching the Earth's atmosphere, resulting in a temporary reduction in the ionisation rate.

• Evidence for solar wind modulation of lightning C J Scott *et al* 2014 *Environ. Res. Lett.* **9** 055004





GCOS - AOPC/OOPC Working Group on Surface Pressure

You are at: WGSP Home > Download Climate Timeseries > Sunspots



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WMO/IOC/UNEP/ICSU GLOBAL CLIMATE OBSERVING SYSTEM

TOPC-XV Doc. 9.3 (21.II.2013) Rev 1

GCOS/WCRP TERRESTRIAL OBSERVATION PANEL FOR CLIMATE FIFTEENTH SESSION GENEVA, SWITZERLAND, 6 – 7 MARCH 2013

Item 9.3

How to find operational data centres for each ECV?!

WDC for Sunspot Index and long-term solar observations (SILSO), Belgium

sidc.oma.be/sunspotdata/

Sunspot Index

presumably not relevant

New GCOS Implementation plan

The GCOS programme has started the process for:

- a 2015 report on the progress and status of climate observation
- •a new "Implementation Plan" in 2016, which should identify:
 - continuing and new requirements, including possible amendment of the ECV list
 - the adequacy of present arrangements for meeting the requirements
 - the additional actions needed, with indicative costs, performance indicators and potential agents for implementation
- statements of specific product requirements
 - from both *in situ* networks and the space-based component
 - and from integration of the data provided by both either embedded in the main Plan or as separate supplement(s)

Conclusion (personal view)

- How to make more "relevant" the SSN in the new GCOS Implementation Plan?
- Probably the SSN will never be declared as ECV, but could be included as supporting data series for the radiation budget on TOA, particularly for long climate series.
- SSN researchers should contact the national GCOS office in order to better consider the SSN data series in the new implementation plan.
- This could help in supporting and increasing visibility of the SSN observations in the future.



Thank You for Your attention