Observations to explain climate-induced changes in the global biosphere

The Essential Climate Variables (ECVs) have been defined in the context of the climate system by the Global Climate Observing System (GCOS) since 2004. One ECV is a physical, chemical or biological variable or a group of linked variables that critically contributes to the characterization of Earth’s climate. They were identified based on their relevance, feasibility and cost-effectiveness.

The GCOS regional alliances formed in 1994 under Intergovernmental Oceanographic Commission of UNESCO, meet every 2 years but are of highly variable capacity and interest and omit large parts of ocean basins.

Multi-year ground-based observations are collected over a series of selected sites organized through regional or international research networks, such as SurflRad, FluxNet, NEON, ARM, BSRN, LTER, OZFlux, USRCNTERN …

Space Earth Observation

New (pre-)operation products (such as NOAA Climate Data Record or Copernicus Climate Change Service) using past or new sensors are now systematically delivered providing longer-term series and higher spatial resolution, respectively.

Zooplankton observations. Black points show continuous plankton recorder (CPR) samples, our longest time series (~80 years); red points indicate some of the long term zooplankton sampling stations (incomplete)

Are the measured ECVs accurate enough to explain changes of the biosphere (for example, species composition and biodiversity)?

Are the biosphere ECVs sufficient to measure biological contributions to the carbon and climate cycles?

Ocean Biological/ecosystems

- Marine habitat properties
- Plankton

Terrestrial Biosphere

- Above-ground biomass
- Albedo
- Evaporation from land
- Fire
- Fraction of absorbed photosynthetically active radiation (FAPAR)
- Land cover
- Land surface temperature
- Leaf area index
- Soil carbon
- Soil moisture

https://gcos.wmo.int/en/essential-climate-variables/ecv-factsheets

Ground-based network

Monitoring networks are regional and variable

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Are the measured ECVs accurate enough to explain changes of the biosphere (for example, species composition and biodiversity)?

How are the biosphere ECVs linked to species composition, biodiversity, etc.?

Are the biosphere ECVs sufficient to measure biological contributions to the carbon and climate cycles?

Biodiversity

Impact of marine foodweb changes on marine habitat ECVs


Impact of marine foodweb changes on marine habitat ECVs


Increasingly rapid progress in both land and marine global observations of the biosphere; Several ECVs are sufficient to explain some biosphere changes; Connections between ECVs, EOVs and EBVs and collaborations between observing communities are growing, including linking the terrestrial Essential Variable systems

Authors

Nadine Gobron1 & Nic Bax2
1 European Commission Joint Research Center, Ispra, Italy
2 CSIRO Oceans&Atmosphere, Hobart, Australia