

Essential Climate Variables

The Global Terrestrial Observing System (GCOS) identified 47 Essential Climate Variables (ECVs) considered to be technically and economically feasible for systematic observation. While some of the variables consist of global measurements, most represent geographically distributed data. They are divided into three categories: atmospheric, ocean, and terrestrial. Below are the 13 terrestrial ECVs

(for more information see: <http://www.wmo.int/pages/prog/gcos/index.php?name=essentialvariables>).

River discharge



Freshwater discharge from rivers into oceans influences the climate system and can affect oceanic circulation patterns. Monitoring is important to detect changes resulting from climate change.

Lake levels



Information on water volume changes and monitoring is crucial for water resources management and regional and global water-cycle studies. It can provide critical indicators of climate change in the region.

Ground water



Nearly 30% of global freshwater resources are taken from groundwater supplies and in some developing countries this accounts for the greatest part of their supply. As a result of a changing climate and a growing population, these resources are threatened with depletion, salinization and contamination. Despite its importance, ground water is rarely monitored.

Water use



Fresh water is used in agricultural, industrial and household activities, as well as for maintaining ecosystems. In developing countries, irrigation accounts for more than 90% of the water taken. Water is therefore crucial for food production and security, and reliable observations are essential to predict the effects of climate change on food production.

Snow cover



Over 50% of the Earth's land surface can be covered by snow during the winter of the Northern Hemisphere. Snow affects the surface's albedo and energy balance, as well as modifying the overlying atmospheric thickness and surface temperature. Its characteristics will determine the state of permafrost (continuously frozen land), as well as the depth and timing of seasonal freezes and thaws, glaciers, ice sheets and sea ice.

Glaciers and ice caps



Glaciers react strongly to climatic changes and therefore constitute a good source for monitoring changes. Glacier shrinking could affect sea-level rise, fresh water resources and human activities.

Permafrost and seasonably frozen ground

Earth materials that remain frozen for at least two years in a row are referred to as permafrost. As the globe warms, permafrost landscapes begin to thaw and erode. Permafrost temperature provides a useful indicator of terrestrial climate changes.



Albedo and reflectance anisotropy

Land surface albedo is a key parameter that controls the planetary radiative energy budget. Changes in snow cover and flooding patterns for instance are linked to changes in land albedo.



Land cover

Land cover refers to the observed surface of the earth, whether vegetation or human settlements. Observations are important for ensuring a sustainable management of natural resources, understanding and mitigating climate change, addressing food security, and other important issues.



Fraction of Absorbed Photosynthetically Active Radiation (FAPAR)

Referring to the photosynthetically active radiation absorbed by vegetation canopy, FAPAR, provides a reliable variable for monitoring seasonal cycle and variability of vegetation activity related to photosynthesis. This is important for the energy balance of ecosystems and the estimation of the carbon balance.



Leaf Area Index (LAI)

Referring to the amount of leaf material in ecosystems, this variable is important for monitoring the growth and strength of vegetation on the planet.



Biomass

Biomass refers to the mass of all organic matter at a specific moment, and is affected by photosynthesis (produces biomass) and fires (destroys biomass). It acts as a carbon sink during through photosynthesis, and is increasingly used for generating bioenergy. Forests are an important source of biomass, playing a crucial role in reducing carbon dioxide and mitigating the effects of climate change. Deforestation on the other hand, is the largest source of greenhouse gas emissions in developing countries.



Fire disturbance

Fire can transform land cover as well as produce atmospheric emissions. It's also an important land management practice. This information is used for estimating atmospheric emission, developing assessments and for planning and operation of fire management and preparedness.

