Monitoring Module 1 (August, 28, 2014) International Monitoring Strategies – Monitoring of the Cryosphere

Learning Objectives

1. You know about the principles and strategies of long-term monitoring programmes and you are able to distinguish between monitoring and research projects.

2. You are aware about the role and the organisation of international glacier- and permafrost observation programmes and you know about the World Glacier Monitoring Service (WGMS) as an example for monitoring networks (including goals globally embedding and used metrics).

Terms and Concepts

Importance and differences of glaciers and permafrost as climate indicators, Essential Climate Variables (ECVs) GCOS/GTOS and GTN-G/GTN-P, GCOS monitoring principles, TIER structure of GHOST, WGMS

References and Further Reading

Literature

GCOS (2010): Overview on monitoring principles and the ECVs of GCOS

Haeberli et al. (2000): Glacier monitoring: strategy and international embedding

UNEP (2007): Results from the international cryosphere observations (incl. outlook)

WGMS (2008): Results from the world wide glacier observation

Weblinks

General Climate Monitoring:

GCOS: www.wmo.int/pages/prog/gcos/index.php

GTOS: www.fao.org/gtos/

GCOS Climate Monitoring Principles: http://gosic.org/gcos/GCOS-climate-monitoring-principles.htm

Glacier Monitoring:

World Glacier Monitoring Service (WGMS): www.wgms.ch

GTN-G: www.gtn-g.org

Permafrost Monitoring:

GTN-P: www.gtnp.org

Circumpolar Active Layer Monitoring (CALM): www.udel.edu/Geography/calm/

Additional Information

Monitoring

Scientifically sound statements/claims about long-term changes concerning climate, glaciers, permafrost or snow cover are only possible based on regularly, long-term and normalized measurements of key variables. The length and comparability of the measurements series are of high importance to separate long-term trends from short-term variability or measurement mistakes. In research projects typically the detailed process understanding is improved, hypotheses are tested or new measurements devices and strategies are developed; such projects normally last for 3-4 years. Quality and length of measurements series as derived in the framework of monitoring projects are fundamental for the improvement of the scientific understanding, to integrate results from single research projects or locations to the overall context, or as a data base for validation and improvements of models, which are used for the extrapolation in space and time. Therefore the data obtained by long-term monitoring programmes should be provided to research projects.

The service of global, regional and national climate-related monitoring networks has to consider the GCOS-principles of climate observations. Special attention has to be put on the quality management of the measurement series, on the homogenization of the data series from different measurement devises, on a save data storage and has to be focussed on key variables and regions.

Global climate observation and ECV’s

In the early 80ies the importance of long-term climate observations was recognised and set on the political agenda. In the scope of the Kyoto-Protocol the Global Climate Observing System (GCOS) was established in 1992 to ensure that the observations and information needed to address climate-related issues are obtained and made available to all potential users. The analyses of the data compiled in the framework of GCOS are an essential fundament for the work of international expert panels like the IPCC (Intergovernmental Panel on Climate Change).

To fulfil the tasks of GCOS a range of Essential Climate Variables (ECVs) were determined, which are relevant for long-term monitoring but also economically feasible. Glaciers and ice caps (Global Terrestrial Network for Glaciers, GTN-G) as well as Permafrost (Global Terrestrial Network for Permafrost, GTN-P) are part of the 13 ECVs of the Global Terrestrial Observing System (GTOS/GT-NET). The GT-NET is a master network with the main task to coordinate methods and standards to ensure the comparability of different data collections. The observations are organized using the Global Hierarchical Observing Strategies (GHOST) in regard to the different temporal and spatial scales of the observed processes and parameters to ensure a best possible cover and integration of the data. GHOST is organized in 5 different steps (Tier 1-5).

Example: global glacier monitoring

The most important measurement parameters about the fluctuation of glaciers are the mass balance and length change data, where mass balance is a direct and undelayed signal and length changes of glaciers are an indirect, delayed, filtered and enhanced signal. The WGMS collects standardised observations of temporal glacier fluctuation as well as the spatial distribution of surface ice (glacier inventories). GTN-G aims at combining (a) in-situ observations with remotely sensed data, (b) process understanding with global coverage and (c) traditional measurements with new technologies by using an integrated and multi-level strategy.

References

GCOS (2010): GCOS Monitoring Principles and ECVs brochure, Global Climate Observing System GCOS, Genf, 4s.

Haeberli, W., Cihlar, J. und Barry, RG. (2000): Glacier monitoring within the global climate observing system, Annals of Glaciology, 31(1): 241–246.

UNEP (2007): Global Outlook for Ice and Snow, United Nations Environment Programme, Nairobi, Kenya (www.unep.org/geo/geo_ice/)

WGMS (2008): Global glacier changes: facts and figures, Zemp, M., Roer, I., Kääb, A., Hoelzle, M., Paul, F. und Haeberli, W. (eds.), UNEP, WGMS, Zürich, 88s. (http://www.grid.unep.ch/glaciers/)