38-2

Integrated glacier monitoring from in situ and remotely sensed observations in different mountain regions: strategies and datasets

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Changes in glaciers and ice caps provide some of the clearest evidence of climate change, with impacts on sea-level variations, regional hydrological cycles and natural hazard situations (WGMS 2008). Internationally coordinated collection and distribution of standardized information about the state and change of glaciers and ice caps was initiated in 1894 and is today organized within the Global Terrestrial Network for Glaciers (GTN-G), as a contribution to the Global Climate Observing System (GCOS) and under the auspices of ICSU/WDS, IUGG/IACS, UNEP, UNESCO, and WMO. GTN-G ensures the continuous development and adaptation of the international strategies to the long-term needs of users in science and policy. A GTN-G Steering Committee coordinates, supports and advices the operational bodies responsible for the international glacier monitoring, which are the World Glacier Monitoring Service (WGMS), the US National Snow and Ice Data Center (NSIDC), and the Global Land Ice Measurements from Space (GLIMS) initiative.

Several online databases containing a wealth of diverse data types with different levels of detail and global coverage provide fast access to continuously updated information on glacier fluctuation and inventory data. Glacier inventory data (e.g., digital outlines) is available for about 180,000 glaciers (GLIMS database, Randolph Glacier Inventory; RGI, World Glacier Inventory; WGI). Glacier front variations with about 45,000 entries since the 17th century and about 6,200 glaciological and geodetic mass (volume) change observations dating back to the 19th century are available in the Fluctuations of Glaciers (FoG) database. These datasets reveal clear evidence that glacier retreat and mass loss is a global phenomenon (Zemp et al. 2015). Glaciological and geodetic observations show that the rates of the 21st-century mass loss are unprecedent on a global scale, for the time period observed, and probably also for recorded history, as indicated in glacier reconstructions from written and illustrated documents.

The databases are completed by specific index datasets (e.g., glacier thickness data) and a dataset containing information on special events including glacier surges, glacier lake outbursts, ice avalanches, eruptions of ice-clad volcanoes, etc. related to about 200 glaciers. A special database of glacier photographs (Glacier Photograph Collection; GPC) contains more than 15,000 pictures from around 500 glaciers, some of them dating back to the mid-19th century.

All glacier datasets are made freely available through the respective operational bodies within GTN-G, and can be accessed through the GTN-G Global Glacier Browser (http://www.gtn-g.org/data_browser.html).

Current efforts are to re-establish or complement former measurements in different regions of the world to establish a well-distributed baseline for sound estimates of climate-related glacier changes. Therefore, the WGMS is also involved in capacity building and twinning activities. Currently running projects are “Capacity Building and Twinning for Climate Observing Systems” (CATCOS) and “Sustainable Mountain Development for Global Change” (SMD4GC). In this framework, the WGMS regularly organizes international summer schools to train local participants in both field and office work in glacier monitoring, invites guest scientists for scientific exchange, and offers student internships.

The well-known glacier monitoring programmes and the WGMS network represent ideal platforms and gateways to reach local stakeholders, and are therefore seen as essential channels for capacity building efforts. Reciprocally, capacity building and twinning efforts are very important enhancers of the monitoring programmes in terms of strengthening, maintaining, and improving systematic glacier and natural hazard monitoring.

References:

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