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Internationally coordinated glacier monitoring: strategy and datasets

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Internationally coordinated monitoring of long-term glacier changes provide key indicator data about global climate change and began in the year 1894 as an internationally coordinated effort to establish standardized observations. Today, world-wide monitoring of glaciers and ice caps is embedded within the Global Climate Observing System (GCOS) in support of the United Nations Framework Convention on Climate Change (UNFCCC) as an important Essential Climate Variable (ECV). The Global Terrestrial Network for Glaciers (GTN-G) was established in 1999 with the task of coordinating measurements and to ensure the continuous development and adaptation of the international strategies to the long-term needs of users in science and policy. The basic monitoring principles must be relevant, feasible, comprehensive and understandable to a wider scientific community as well as to policy makers and the general public. Data access has to be free and unrestricted, the quality of the standardized and calibrated data must be high and a combination of detailed process studies at selected field sites with global coverage by satellite remote sensing is envisaged.

Recently a GTN-G Steering Committee was established to guide and advise 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 having different levels of detail and global coverage provide fast access to continuously updated information on glacier fluctuation and inventory data. For world-wide inventories, data are now available through (a) the World Glacier Inventory containing tabular information of about 130,000 glaciers covering an area of around 240,000 km2, (b) the GLIMS-database containing digital outlines of around 118,000 glaciers with different time stamps and (c) the Randolph Glacier Inventory (RGI), a new and globally complete digital dataset of outlines from about 180,000 glaciers with some meta-information, which has been used for many applications relating to the IPCC AR5 report. Concerning glacier changes, a database (Fluctuations of Glaciers) exists containing information about mass balance, front variations including past reconstructed time series, geodetic changes and special events. Annual mass balance reporting contains information for about 125 glaciers with a subset of 37 glaciers with continuous observational series since 1980 or earlier. Front variation observations of around 1800 glaciers are available from most of the mountain ranges world-wide. This database was recently updated with 26 glaciers having an unprecedented dataset of length changes from from reconstructions of well-dated historical evidence going back as far as the 16th century. Geodetic observations of about 430 glaciers are available. The database is completed by 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 contains 13,000 pictures from around 500 glaciers, some of them dating back to the 19th century. A key challenge is to combine and extend the traditional observations with fast evolving datasets from new technologies.