Detect changes in glaciers

Application
Glaciers

Currently there is a general consensus that the Earth's average temperature is increasing. Glaciers are key indicators of climatic changes as they show an enhanced and well recognisable reaction to even small climatic fluctuations. One of the consequences of global warming is the rising of global mean average sea level which mainly results from melt water from glaciers, ice sheets, ice caps, icebergs, and sea ice. In Europe several glaciers have completely disappeared as a result from higher temperatures. Receding glaciers can cause massive flooding and affect stream flow and temperature of mountainous sheds which in turn affects habitats of various flora and fauna species. Glacier- and permafrost-related hazards such as glacier floods and avalanches represent a continuous threat to human lives and infrastructure. Disasters associated with the glacial and periglacial environment can cause thousands of casualties and massive economic loss in one event.

The effects of climate change are being investigated on a global scale. Satellite remote sensing proves to be a very valuable technology in the attempt to understand the impact of melting glaciers. Various remote sensors operating in different spectral regions (visible, infrared, microwave) have been widely used to study parameters such as ice thickness, surface ice velocities, and changes in surface elevation over time.

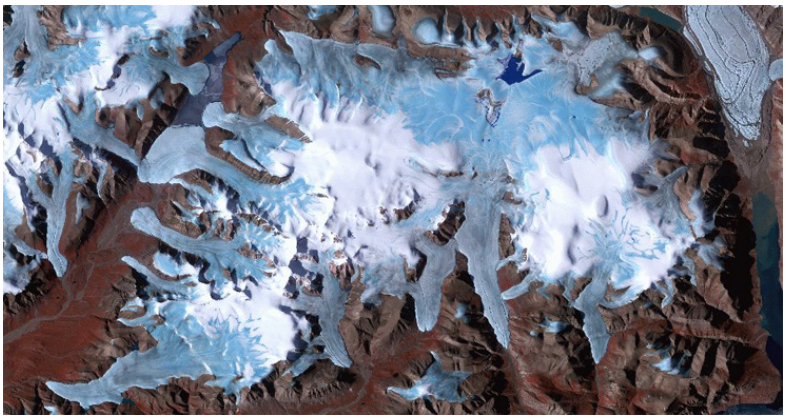
The Aletsch Glacier or Great Aletsch Glacier is the largest glacier in the Swiss Alps in the canton of Valais.

Monitoring of glaciers has been organised within the Global Terrestrial Network for Glaciers (GTN-G) which is operated by the world glacier monitoring service (WGMS). The WGMS, in turn, is part of the Global Climate/Terrestrial Observing Systems (GCOS/GTOS) and aims to collect and publish mass-balance data of glaciers obtained by direct glaciological and geodetic methods as a contribution to the GTN-G. Other organisations involved in glacier remote sensing include FAO, IPCC, UNEP, NOAA, ICSU (WDS), IUGG IACS), UNEP, UNESCO, WMO, International Glaciological Society, International Work Group on Geospatial Analysis of Glaciated Environments (GAGE), International Union for Quaternary Research (INQUA), Scientific Committee on Antarctic Research (SCAR), SCAR Working Group on Glaciology, World Glacier Monitoring Service.

Earth observation satellites are being used for preliminary inventory of glaciers including aerial extent and position of large crevasses, and for mapping and monitoring glacial variations especially at the glacier margins and terminus location. Examples of satellite sensors that have been used for glacial monitoring include Landsat TM and ETM, Terra ASTER, SPOT Pan and XS, IRS Pan and LISS, ERS SAR and Radarsat SAR.

Because it is suggested that melting glaciers and ice caps might provide an even larger contribution to the global sea level rise in the coming decades than the two continental ice sheets Greenland and Antarctica, earth observation satellites are used to generate more complete and representative data to get a better understanding of this phenomenon. From the mid-1970s satellite images have been compiled in the Satellite Image Atlas of Glaciers of the World to establish baseline information for all glaciated areas world wide. ESA is currently operating the GlobGlacier project, a new data user element activity within ESA's Living Planet program.

The main objective of this project is to map glaciers from key regions all over the world and to generate digital glacier outlines in large quantities in order to fill data gaps in currently existing databases Global Land Ice Measurements from Space (GLIMS) and the World Glacier Inventory (WGI).



Glaciers and ice caps on Ellesmere Island, Canadian Arctic.
Credits: ASTER Image from 19.07.2000 - Courtesy of GLIMS

Products

Products	Source	Descriptions	Product Standards	Ref. Project
glacier products		based on high resolution multi-spectral optical satellite data and SAR data • Glacier Outlines • Snow / Ice Area Map • Late Summer Snow Line • Ice Velocity Map • Glacier Dammed Lakes		Cryoland

Success Stories

References

Topic	Description	Key words	References