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Press Release

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Alpine glacier shrinkage stronger than expected

At the Geography Department of the University of Zurich a new Swiss glacier inventory has been compiled within the framework of a study granted by the Swiss National Science Foundation. The related PhD thesis utilizes for the first time the automated evaluation of Landsat satellite data by combining modern methods of digital image processing and geo-informatics. The thesis is also a pilot study for the international program GLIMS (Global Land Ice Measurements from Space), which for the first time aims at a global glacier inventory from satellite data.

So far, most glacier inventories are based on aerial photography which record at a high spatial resolution (1 m) a comparable small region. The individual photos require a laborious geometric correction and manual analysis which could take several years for large regions or thousands of glaciers. During this period of time glaciers can change considerably. The sensor Landsat Thematic Mapper (TM) passes since nearly 20 years now every 16th day the same region and acquires a 185 km wide stripe at 30 m spatial resolution. This allows the registration of thousands of glaciers at the same time and an automated analysis with the newly developed methods in a few months. However, for the inclusion of debris-covered glacier parts manual delineation is still required.

The new study was performed as a PhD thesis by Frank Paul under supervision of Andreas Kääb. The analysis of the data revealed the following major findings: From 1973 to 1985 there was little change in the area of Swiss glaciers (-1%), however, from 1985 to 2000 glaciers lost about one fifth (-18%) of their area and even somewhat more on an Alpine wide scale (-22%). Thus, todays' glacier loss is already in the same order as expected for the year 2025 (-30%). Compared with the period 1850-1973 the mean glacier loss rate has greatly accelerated: by a factor of three for the period 1973-2000 and even by a factor of seven for the period 1985- 2000. Most remarkable is the large contribution of small glaciers to the total loss of area: although they cover only 18% of the total area, they contribute 44% to the area loss. This is a direct consequence of their large number combined with their high relative area losses. The increasing scatter of relative area changes towards smaller glaciers indicate, that from the behaviour of an individual glacier generally no conclusions should be drawn on climatic change.

Although changes in glacier surface elevation were not measured directly, the analysis of the satellite data indicate a massive down-wasting (i.e. decrease in thickness) instead of a dynamic glacier retreat during the last two decades. In particular emerging rock-outcrops and the separation from former glacier tributaries are clear evidences. As a result of various positive feedbacks (e.g. by

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additional heating of the rock outcrops) a continued disintegration of glaciers is expected in the coming years.

The general conclusion of the study is that the anticipated enhanced glacier loss, due to the currently increasing temperature, is not only a phenomenon of the future. In the Alps this is an ongoing process that is much more pronounced than expected.

References:
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Paul, F. (2003): The new Swiss glacier inventory 2000 - Application of remote sensing and GIS. PhD Thesis, Department of Geography, University of Zurich, 198 pp.
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Weblink: http://www.geo.unizh.ch/~fpaul/sgi

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