TerraSAR-X observations of ice velocities in Antarctica, Patagonia and Iceland

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1. Antarctic ice sheet

Under the scientific auspices of the GIIPSY project (Global Inter-agency IPY Polar Snapshot Year) end of October 2008 marked the beginning of the IPY coordinated activities for TerraSAR-X with acquisitions over a tributary ice stream feeding into the Recovery Glacier (81°S, 20°W) in Antarctica.

Up to now, the only available SAR mapping of the Recovery Glacier system was carried out in 1997 with Radarsat-1. The planned TerraSAR-X acquisitions repeated at 11 day intervals will allow decadal scale comparison to the 1997 data for change detection and will also provide for the first time the surface velocity field of the entire glacier. Preliminary results of ice stream velocity over a small area are shown below.

The SAR amplitude correlation technique was applied to map ice motion in the ablation area of fast moving glaciers in Patagonia and the Antarctic Peninsula. With TerraSAR-X data the first velocity field of the entire terminus of Upsala glacier could be derived. The frontal velocities reach maximum values of 5.6 m/day. Velocity measurements at stakes in 1993 reveal an acceleration of this glacier.

In the Antarctic Peninsula the changes in ice dynamics after the collapse of Larsen-A and –B ice shelf are of particular interest. For Drygalski glacier TerraSAR-X enabled for the first time since 1995 the mapping of ice motion down to the glacier front showing a significant increase of ice export.

2. Outlet glaciers in Patagonia and Antarctic Peninsula

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3. Outlet glaciers of Vatnajökull ice cap

For Vatnajökull the TerraSAR-X acquisitions are focusing on three outlets: Breidamerkurjökull, Skeiðarárjökull and Tungnaárjökull. On the last TerraSAR-X data were collected in September 2008 during a jökulhlaup (glacier outburst flood) draining underneath the glacier from subglacial lakes, which is known to significantly effect the glacier ice-flow. Simultaneous GPS-observation during the TerraSAR-X mission are carried out to get further insight into the temporal variations of the ice flux as well as for validation of TerraSAR-X derived glacier velocities.

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