



INTEGRAL

Interferometric Evaluation of Glacier Rheology and Alterations

STUDYING GLACIER CHANGES

The INTEGRAL project dealt with spaceborne interferometric surveys and change analyses of the largest European glaciers. The general objective was to promote an advanced observation technology for the unsupervised detection, precise measurement and variational analysis of ice motion and deformation on large European glaciers. The central idea was to enhance the detail, accuracy and versatility of glacier interferometric models without involving complex process artifices and to demonstrate new utilities of differential radar interferometry to operational users working with SAR data from post-operational, operational and upcoming systems.

The INTEGRAL project focused on methodological aspects and empirical issues of glacier interferometry and major attention was paid to:

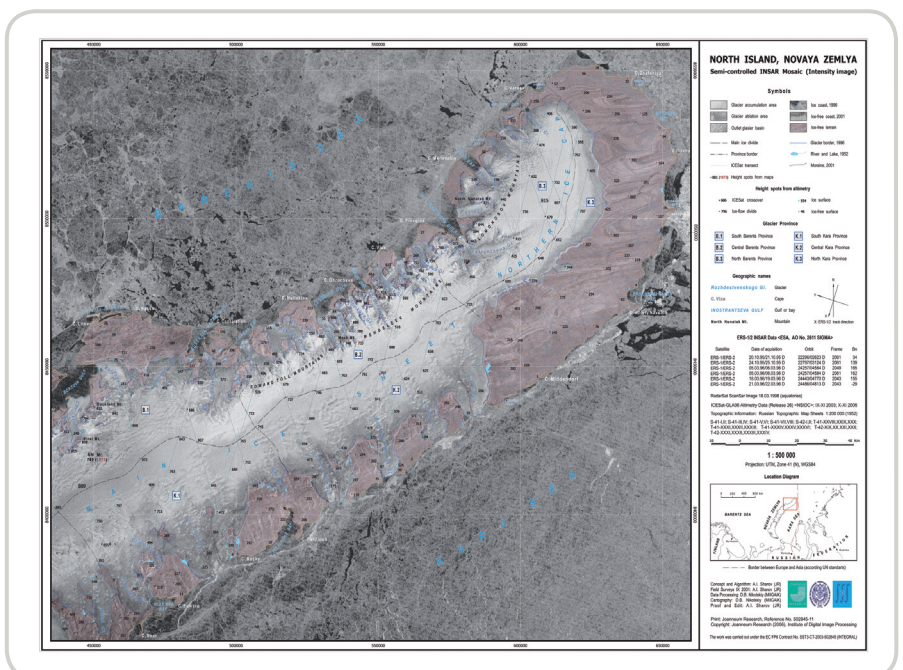
- design of enhanced algorithms and program tools for processing and fusing SAR interferograms, both air - and spaceborne, with radar altimetry data aimed at precise geocoding and upgrading the information content of glacier rheological models;
- practical application of phase-gradient, offset-tracking, transferential and combined interferometric techniques to the detection and interpretation of glacier activity, numerical modelling of the glacier regime, and assessment of main tendencies in the state of land ice resources in response to climate change;
- production, demonstration and implementation of the series of interferometric "snapshots" and value-added products showing the ice-surface velocity structure, glacier strain rate and fluctuations of the specific glacier mass balance.

BETTER UNDERSTANDING OF ICE FIELDS THROUGH SATELLITE INTERFEROMETRY

Spaceborne INSAR and altimetry data, both lidar and radar, were successfully used for studying glacier regime. Frontal velocities of 41 tidewater glaciers in the European High Arctic were precisely measured in laboratory for the first time in the history of their explorations.

Three ice caps and four outlet / valley glaciers were surveyed during the field campaigns using airborne systems and precise geodetic equipment. The existence of floating glacier parts have been proved and certain evidence on the surging character of ice flow at several glaciers was gained. It was concluded that the combination of satellite interferometry and altimetry offers a particularly efficient tool for conducting glaciological studies in Polar Regions and might substantially contribute to the maintenance of global environment observation systems.

The project results were discussed at 24 international congresses, conferences and workshops. The consortium published 35 scientific papers and produced a new series of 24 image-based maps representing glacier changes in the study regions. A new course of lectures on "Satellite rheology of ice fields" was prepared and given to students at the Helsinki University of Technology in Finland. Main output products can be accessed at the project homepage. Some of them were made also available in the regional reference database REGARD (<http://www.le-gos.obs-mip.fr/fr/equipements/glacio/integral.html>).



Main Ice Sheet, Novaya Zemlya - ERS-1/2 SAR image map (produced by Joanneum Research, 2006).

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- Joanneum Research Forschungsgesellschaft mbH, Institute of Digital Image Processing, Austria
- Centre for Polar Observation and Modelling, University College London, UK
- Laboratory of Geophysical and Oceanographic Studies, Toulouse University, France
- GAMMA Remote Sensing Research and Consulting AG, Switzerland
- Environmental Earth Observation Information Technology GmbH, Austria
- Norwegian Polar Institute, Norway
- Scott Polar Research Institute, Chancellors Masters and Scholars of the University of Cambridge, UK
- Laboratory of Radar Studies, Institute of Radioengineering and Electronics, Russian Academy of Sciences, Russia
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PROJECT INFORMATION

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Specific Targeted Research Project
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