



Modelling snow-ice cover evolution and associated gravitational effects with GOCE constraints (ICEAGE)

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The aim of the project ICEAGE is determining, interpreting and mapping the present state and fluctuations of snow and ice resources in the Eurasian Arctic Sector about 31° to 81° east and 73° to 82° north, based on terrestrial, space-borne interferometric, altimetric, and gravity field data. Special emphasis shall be given to estimating the impact and scientific contribution of ESA's satellite gravity gradiometry mission GOCE to regional inland cryospheric studies. The Northern Glacial Complex in Novaya Zemlya (22.000 km^2), the largest glacier in Europe, is defined as main study area. Digital elevation and change models of this glacier available from previous studies will be upgraded, merged and jointly interpreted with gravity data in order to explain the glacier dynamics and spatial asymmetry in the present glacier regime. To produce a suite of cryogravic models, a gravity field solution will be calculated by Least Squares Collocation (LSC), which is capable of combining gravity anomaly data derived from the newest EGM2008-WGS84 version and gravity gradients observed by GOCE. Using GOCE gravity gradients within the LSC method requires the derivation of suitable covariance expressions for second and lower order derivatives of the anomalous potential in an arbitrary reference frame. For convenient results, gradient data errors in form of coloured noise have to be reduced by means of an adequate Wiener filtering. First feasibility studies using simulated GOCE gradients demonstrated essential improvements to the product quality. To estimate the impact of ice mass variations on the gravity field signal a software for gravity field forward modelling based on given ice mass distributions, digital elevation models and density models is currently under development. By analysis of the results and comparison with former geometric and rheological models, new cryogravic aspects and coherences between gravity and ice mass variations should be detected at the final stage of this project.