Geophysical Research Abstracts
Vol. 13, EGU2011-7801, 2011
EGU General Assembly 2011


# Greenland ice-mass balance from satellite gravimetry: re-assessing the influence of glacial-isostatic adjustment

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For nearly a decade, the Gravity Recovery and Climate Experiment (GRACE) satellite mission has provided unique observations of the temporal variations in the Earth's gravity field that have allowed us constrain ice-mass changes in the Polar Regions. However, in the linear trends of the GRACE time series, ice-mass changes are superimposed with signals associated with the mass redistribution in the Earth's mantle caused by retreat of the large ice sheets succeeding the last glacial-maximum, i.e. the glacial-isostatic adjustment (GIA). Due to sparse direct observations, the GIA-induced gravity field changes have to be modeled and subtracted from the GRACE observations – the quality of ice-mass balance estimate for some regions depending essentially on the accuracy of this GIA correction.

Here, we re-assess current GIA models for Greenland and discuss their influence on ice-mass balance estimates from GRACE. For this, we perform forward modelling of GIA with a viscoelastic Earth model that includes an implementation of the sea-level equation and a description of Earth's rotational variations, employing a range of plausible viscosity distributions in the Earth's mantle. The model is subjected to reconstructions of the Greenland and Laurentide ice sheets covering the last glacial-interglacial transition, which allows us to determine the near-field and far-field GIA contributions, respectively, that are present in GRACE gravity field signals over Greenland. Then, the GIA models are evaluated with regard to simultaneously fitting the GRACE gravity fields, as well as indicators of Paleo sea-level. Finally, we present the influence and uncertainty of the best-fitting GIA correction on the