



Gravity changes in mid-west Greenland from GOCE gravity model and gradient data using ground and airborne gravity.

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GOCE (ESA's Gravity and Ocean Circulation Explorer) TRF (terrestrial reference frame) vertical anomalous gradients (T_{zz}) from the periods winter 2009 and summer 2012 have been used to determine gravity anomalies in mid-west Greenland, where a large mass-loss has been detected using GRACE. As additional data were used the GOCE DIR-3 model and ground gravity at the coast on solid rock, where no mass loss is expected.

The methods of Least-Squares Collocation (LSC) and the Reduced Point Mass (RPM) methods have been used, however only LSC included the ground data. The latter method also permits the computation of error-estimates, which range from 3 mgal at the coast to 19 mgal 75 km from the coast in Eastern direction towards the ice-cap. The gravity anomaly differences vary from -30 mgal to 30 mgal. It is negative (showing mass loss) around the Jacobshavn Isbrae (latitude $69^{\circ}15'$, longitude $49^{\circ} W-50^{\circ}W$, where the yearly mass-loss has been estimated to correspond to -2 mgal, i.e. about -7 mgal for the period considered. The computed change range from 0 to -10 mgal in the area, with the error estimated to increase from 4 mgal to 15 mgal from West to East. This shows the capability of using GOCE T_{zz} and ground gravity to determine mass changes.

The GOCE DIR-3 model was also used to evaluate gravity values in the points of the Greenland airborne gravity survey performed in 1991 and 1992. The differences had a mean value of 0.9 and a standard deviation of 17.3 mgal for all of Greenland. In the South-West area the mean of the differences was 0.15 and the standard deviation 7.14. This indicate that possibly no total mass loss has occurred in Greenland from 1992 to 2012.