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Ice loading model for Glacial Isostatic Adjustment in the Barents Sea constrained by GRACE gravity observations

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The global ice budget is still under discussion because the observed 120-130 m eustatic sea level equivalent since the Last Glacial Maximum (LGM) can not be explained by the current knowledge of land-ice melt after the LGM. One possible location for the missing ice is the Barents Sea Region, which was completely covered with ice during the LGM. This is deduced from relative sea level observations on Svalbard, Novaya Zemlya and the North coast of Scandinavia. However, there are no observations in the middle of the Barents Sea that capture the post-glacial uplift. With increased precision and longer time series of monthly gravity observations of the GRACE satellite mission it is possible to constrain Glacial Isostatic Adjustment in the center of the Barents Sea. This study investigates the extra constraint provided by GRACE data for modeling the past ice geometry in the Barents Sea.

We use CSR release 5 data from February 2003 to July 2013. The GRACE data is corrected for the past 10 years of secular decline of glacier ice on Svalbard, Novaya Zemlya and Frans Joseph Land. With numerical GIA models for a radially symmetric Earth, we model the expected gravity changes and compare these with the GRACE observations after smoothing with a 250 km Gaussian filter. The comparisons show that for the viscosity profile VM5a, ICE-5G has too strong a gravity signal compared to GRACE. The regional calibrated ice sheet model (GLAC) of Tarasov appears to fit the amplitude of the GRACE signal. However, the GRACE data are very sensitive to the ice-melt correction, especially for Novaya Zemlya. Furthermore, the ice mass should be more concentrated to the middle of the Barents Sea. Alternative viscosity models confirm these conclusions.