GRACE constraints on ice models in North America

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The GRACE satellites provide spatially homogeneous monthly global gravity fields. Therefore, the secular gravity rate derived from the GRACE data can contribute to GIA studies in areas that are not well covered with terrestrial measurements, such as Northern Canada. Previous studies did not focus specifically on the comparison of GRACE with ice models. This presentation will focus on the uncertainty in GRACE data when it is used in GIA studies, and the comparison of GRACE data with GIA models with existing ice models ICE-3G, ICE-4G and ICE-5Gv1.2.

It is found that measurement errors as well as filtering have small effects on the secular gravity rate. Continental water storage effects as represented by models are large (~ 0.5 microGal/year. The GLDAS model is found to agree best with GRACE data over the Nelson River basin, but the difference with other available hydrology models is large. Estimation of a trend over varying GRACE time periods shows evidence of inter-annual signal in GRACE which is as of yet unexplained.

Misfit comparisons are performed with GIA models in which upper and lower mantle viscosities are varied from 1 x 10^{20} Pa-s to 256 x 10^{20} Pa-s and Gaussian filter half width is varied from 200 to 1000 km. The smallest misfit is obtained for the ICE-3G and ICE-4G models, even though these models do not have two domes as is observed in the GRACE data. The worse misfit of ICE_5Gv1.2, which does contain two domes, is likely due to too large ice heights west and south-west of Hudson Bay in this model. Finally, it is shown how GRACE can be used to modify ice heights in an existing model such that a better fit with terrestrial data is obtained.