

Assimilating geodetic data into model estimates of GIA

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With the increasing number and spatial distribution of geodetic measurements in formerly glaciated regions, there is the possibility of improved regional models of GIA. However, even with this increase of data, there is not enough to fully constrain the spatial and temporal history of the ice sheet along with the three dimensional (3-D) variations in mantle viscosity and lithospheric thickness. In addition, many forward GIA model predictions are based on spherically-symmetric earth models, which may not fully capture the behaviour of the earth. In this presentation, we explore the possibility of assimilating geodetic data into a forward model of GIA without relating these changes back to specific ice-sheet or earth-model parameterizations. This technique utilizes the covariance of the crustal motion, gravity and sea level changes derived from a series of forward model predictions. Thus, we are able to self-consistently compare the different types of data, such as GRACE-derived gravity changes and GPS-derived crustal motion, while taking into account inherent uncertainties in each data type such as reference frame parameters and GRACE processing procedures. We first demonstrate the ability of the method to recover various GIA forward models. We then show results of the assimilation of the GRACE, GPS, and tide-gauge data into GIA models for Laurentia and Fennoscandia.