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Uncertainty of GIA models across the Greenland

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In the last years various remote sensing techniques have been employed to estimate the current mass balance of the Greenland ice sheet (GIS). In this regards GRACE, laser and radar altimetry observations, employed to constrain the mass balance, consider the glacial isostatic adjustment (GIA) a source of noise. Several GIA models have been elaborated for the Greenland but they differ from each other for mantle viscosity profile and for time history of ice melting. In this work we use the well know ICE-5G (VM2) ice model by Peltier (2004) and two others alternative scenarios of ice melting, ANU05 by Lambeck et al. (1998) and the new regional ice model HUY2 by Simpson et al. (2009) in order to asses the amplitude of the uncertainty related to the GIA predictions. In particular we focus on rates of vertical displacement field, sea surface variations and sea-level change at regional scale. The GIA predictions are estimated using an improved version of SELEN code that solve the sea-level equation for a spherical self-gravitating, incompressible and viscoelastic Earth structure. GIA uncertainty shows a highly variable geographic distribution across the Greenland. Considering the spatial pattern of the GIA predictions related to the three ice models, the western sector of the Greenland Ice Sheets (GrIS) between Thule and Upernavik and around the area of Paamiut, show good agreement while the northeast portion of the Greenland is characterized by a large discrepancy of the GIA predictions inferred by the ice models tested in this work. These differences are ultimately the consequence of the different sets of global relative sea level data and modern geodetic observations used by the authors to constrain the model parameters. Finally GPS Network project (GNET), recently installed around the periphery of the GrIS, are used as a tool to discuss the discrepancies among the GIA models. Comparing the geodetic analysis recently available, appears that among the GPS sites the northern portion of the GrIS is sensitive to the GIA component of vertical deformations in contrast with the remaining area that undergoes the elastic deformation related to the present-day ice melting of the GrIS.