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Glacial Isostatic Adjustment with ICE-6G_C (VM5a) and Laterally Heterogeneous Mantle Viscosity

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Recently, Peltier et al. (2015) introduced the ICE-6G_C (VM5a) ice-earth model pair, which has successfully explained many observations of Glacial Isostatic Adjustment (GIA) simultaneously. However, their earth model used (VM5a) to infer the ice history (ICE-6G_C) is laterally homogeneous with viscosity profile varying in the radial direction only. Since surface geology and seismic tomography clearly indicates that the Earth's material properties also vary in the lateral direction, laterally heterogeneity must be included in GIA models. This can be achieved by using the Coupled-Laplace-Finite-Element method (Wu 2004) to model GIA in a spherical, self-gravitating, compressible viscoelastic Earth with linear rheology and lateral heterogeneity. In fact, Wu et al (2013) have used such model with GIA observations (e.g. global relative sea level data, GRACE data with recent hydrology contributions removed and GPS crustal uplift rates) to study the thermal contribution to lateral heterogeneity in the mantle. Their lateral viscosity perturbations are inferred from the seismic shear wave tomography model S20A (Ekstrom & Dziewonski 1998) by applying a scaling law, which includes both the effect of anharmonicity and anelasticity. The thermal contribution to seismic tomography, which is represented by the beta factor in the scaling relationship, is searched in the upper and lower mantle, for the best combination that gives the best fit between GIA predictions and observations. However, their study is based on ICE-4G only, and the new ice-earth model pair may give other best beta value combinations in the upper and lower mantle.

Here, we follow the work of Wu et al (2013) but use the new ICE-6G_C ice model instead. The higher resolution seismic tomography model by Bunge & Grand (2000) substitutes S20A. Earth model VM5a is used as the reference background viscosity model. The full viscosity model is obtained by superposing the background model with the lateral viscosity perturbations inferred from the seismic tomography model (Bunge & Grand 2000) logarithmically. The preliminary results of these and other background viscosity profiles will be presented.

References:

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