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Sensitivity of near field GIA response with respect to rheological features of the Earth structure

Jan M. Hagedoorn (1), Volker Klemann (1), Ingo Sasgen (2), and Maik Thomas (1)

(1) Helmholtz Centre Potsdam German Research Centre for Geosciences, Department 1: Geodesy, Germany, (2) Alfred Wegener Institute (AWI), Helmholtz Centre for Polar and Ocean Research, Bremerhaven, Germany

One task of the German National Climate Modeling Initiative PalMod will be to couple earth system models representing the atmospere, ocean and ice dynamics during the last glacial cycle with the dynamic loading response of a viscoelastic earth model. In preparation, we discuss in this study the influence of viscosity stratification and of lateral heterogeneities in the Earth structure on the solid-earth response to glacial loading.

As discussed in literature, there is a controversy about the impact of lateral heterogeneity on the prediction of present and past GIA signals. The influence of the Earth structure on the far-field response is governed by the flexural behaviour of the regional lithosphere and upper-mantle structure in response to the varying ocean load. The influence at and around the glacial ice sheets is substantial with respect to the amplitudes and also with respect to the temporal evolution of the earth's response. Depending on the region of interest, lithospheric variations are present over the extent of the glacial ice sheets varying between 40 and 200 km, and lateral variations in viscosity can vary by one or two orders of magnitude.

The focus will be to what extent the behaviour of a laterally heterogeneous viscosity structure can be parameterised by an adjusted spherical earth model representation. Accordingly, we apply predefined ice-sheet histories (like ICE5G and ICE6G) and analyse ensemble runs representing the variability of relative sea-level and palaeo-topography predictions. Spatial pattern of deformation fields will be discussed as the behaviour at specific sea-level curves. Furthermore, we compare the sensitivity on earth structure during the evolution of sea level and palaeo topography during the termination phase of the last glaciation to present-day rates of relative sea-level height and radial displacement.