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The effect of uncertain historical ice information on GIA modelling

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When inferring mantle viscosity by modelling the effects of glacial isostatic adjustment (GIA) a necessary constraint is the external forcing by surface loading. Such forcing is usually provided by a glaciation history, where the mass-conserving sea-level changes are considered solving the sea-level equation. The uncertainties of glaciation history reconstructions are quite large and the choice of a specific history strongly influences the deformation response obtained by GIA modelling. The reason is that any history is usually based on a certain Earth rheology, and mantle viscosity inversions using such models tend to resemble the viscosity structure used for the glaciation history (Schachtschneider et al., 2022, in press). Furthermore, uncertainties of glaciation histories propagate into the respective GIA modelling results. However, to quantify the impact of glaciation history on GIA modelling remains a challenge.

In this study we investigate the effect of uncertainties in glaciation histories on GIA modelling. Using a particle-filter approach we study the effect of spatial and temporal variations in ice distribution as well as the effect of total ice mass. We quantify the effects on a one-dimensional viscosity stratification and derive measures to which extent changes in sea-level pattern and surface deformation depend on variations in ice loading.

References:

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