底面滑り速度係数の最適化とそのグリーンランド温暖化応答実験への影響

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Inclusion of an optimization of the basal sliding coefficients field and its impact on the simulated projection of Greenland ice sheet

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One of the major uncertainties in the numerical simulation of ice-sheets is the way to describe the basal sliding because of difficulty in its observation. Recently more and more modeling studies use a technique to adjust the coefficients of their basal sliding parameterization to obtain particular data fields, such as geometry and/or surface velocity, which are acceptably close to the observation. Although there may be a certain limit of its application, such methods to optimize the present-day simulation will be more an important technique, especially for a short-term (century-scale) future projection of the Greenland ice sheet.

There have been several techniques to 'inverse' the basal sliding coefficients field. Pollard & DeConto (2012) present a general and simple method to deduce spatial distribution of basal sliding coefficients to reduce the errors in simulated surface topography that can be applied to any type of ice sheet model. In this method, the model is run forward in time, and the basal sliding coefficient at each grid point is periodically adjusted depending on the amount of error in the ice surface elevation compared to the observation.

This study revisits the future surface-climate experiments of Greenland ice sheet proposed by the SeaRISE (Bindschadler et al., 2013). Series of the sensitivity experiments are reexamined using an ice-sheet model $\boldsymbol{I_C IES}$ with replacing the spatially uniform basal sliding coefficients to a field obtained by the optimization following Pollard & DeConto (2012). Results will be presented in comparison to the impact on the simulation due to other uncertainties such as initialization methods, surface mass balance methods and so on.

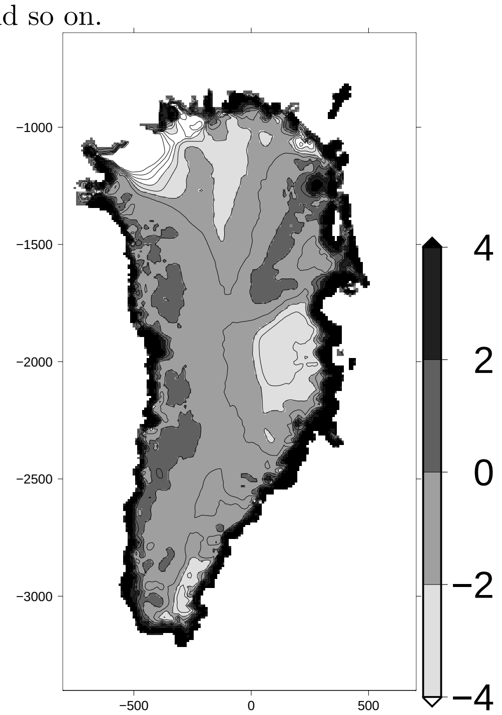

Figure. An example of horizontal distribution of the optimized basal sliding coefficients followind Pollard & DeConto (2012). The ratio relative to the $\boldsymbol{I_C IES}$ default value ($3.6 \times 10^{-10}\,\mathrm{N^{-3}\,yr^{-1}\,m^8}$) is shown in the logarithmic scale. The basal sliding parameterization is a Weertman-type formulation with 3rd power.

References

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