Geophysical Research Abstracts
Vol. 21, EGU2019-3909, 2019
EGU General Assembly 2019

Basal properties of Recovery Glacier, Antarctica, from inverse modelling

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Recovery Glacier drains about 8% of the Antarctic ice sheet and feeds the Filchner Ice Shelf, that is suggested to be prone to changes in the oceanic forcing in future. Recent studies have used radar data to infer basal properties in particular with respect to the existence of subglacial water and its role in the genesis of the ice stream. Here, we take a different approach and use inverse modelling to infer the basal friction coefficient and basal drag. For this purpose, we apply the ice sheet model ISSM in higher order Blatter-Pattyn approximation using unstructured grids in high resolution in the main trunk and moderate resolution in the surrounding region ranging as far as adjacent ice streams. The temperature field is adopted from a paleo-spin up developed using PISM. Optimisation of the cost function is based on linear and logarithmic misfit of surface velocity and a regularisation of the friction parameter. We conducted a sensitivity study to various parameters, including the enhancement factor in the flow law to assess the role of deformation versus sliding, as well as initial parameters testing the robustness of the minimum. The general pattern of the distribution does not depend on minor variations in the parameters giving a high reliability of the solution. The main trunk is as expected found to have a smooth bed beside the ice falls, whereas we find a clear transition into a low friction regime just upstream the formerly suggested large lakes. Finally, we compare this to inferences of basal properties based on radar data.