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Optimizing the initialization of basal sliding coefficients for Antarctica, A Lyapunov based approach

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Models describing natural phenomena can depend on parameters that cannot be directly measured, hence the necessity to develop inverse techniques to determine them. The goal of this work is to utilize such a technique to enable better initialization of ice sheet models for Antarctica. This will enable models to produce better forecasts as part of climate studies. The parameter of interest is the basal sliding coefficient which characterizes the contact of the ice sheet with the bed underneath. A Lyapunov based approach utilizing the misfit between observed and simulated ice thickness is proposed to control the convergence of the 1D inhomogeneous transport model toward a feasible equilibrium matching the measurements. The utilized model is based on the shallow-ice approximation with a sliding law. This results in a new update method for the coefficient inversion. Tests are carried out on various flowlines and the results, which are compared to a currently used inverse method, show an improved convergence toward the observed ice thickness.