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Simulating changes in the Antarctic ice sheet using a higher-order thermomechanical model

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Many current ice sheet models use the "shallow ice approximation" (SIA) in which longitudinal stress gradients are neglected. These types of models are unable to simulate ice flow at the grounding region, near the surface and at ice divides where longitudinal stresses are important. In order to reconstruct changes in the Antarctic ice sheet and to predict its future response to the climate, higher-order models are required. We use the Glimmer community ice sheet model (Rutt et al., 2009) to simulate changes in the Antarctic ice sheet. Higher-order ice dynamics have been integrated into the model. Three dimensional ice velocities are calculated using a scheme by Payne and Price (in prep.). Here we report initial work aimed at generating a suitable initial condition for simulations of the ice sheet over the next 200 years. This work forms part of a wider collaborative project called ice2sea. ice2sea aims to reduce uncertainty in estimates of future sea level rise using a range of models and future climate scenarios.

Rutt, I.C., M. Hagdorn, N.R.J. Hulton and A.J. Payne. 2009. The 'Glimmer' community ice
19 sheet model. Journal of Geophysical Research., 114 (F2), F02004. (10.1029/2008JF001015.)