EGU2020-7540
https://doi.org/10.5194/egusphere-egu2020-7540
EGU General Assembly 2020

Coupling subglacial hydrology to basal friction in an Antarctic ice sheet model

Elise Kazmierczak, Lars Zipf, and Frank Pattyn
Université Libre de Bruxelles, DGES, Brussels, Belgium (elise.kazmierczak@ulb.ac.be)

Due to the lack of direct observations, subglacial hydrology is still marginally considered in Antarctic ice sheet modelling studies, albeit that several approaches exist (e.g., LeBrocq, Bueler and Van Pelt). Subglacial hydrology impacts basal friction through a reduction in effective pressure and through changing properties of subglacial sediments, both factors influencing the lubrication at the bottom of the ice sheet. Several approaches exist to represent subglacial hydrology in ice sheet models (Bueler and Brown, 2009, Goeller et al., 2013) and are generally coupled to either a Coulomb or a Weertman friction law. However, the type of subglacial process determines to a large extent the sensitivity of Antarctic mass change (Sun et al, submitted).

In this study we investigate the sensitivity of subglacial dynamics on the behaviour of the Antarctic ice sheet on centennial time scales. For this purpose we employ a subglacial hydrology model for subglacial water routing (Lebrocq et al., 2009) coupled to a thermomechanical ice-sheet model (f.ETISh; Pattyn, 2017). We consider different parametrizations and representations of effective pressure and till water content at the base. We also consider the combination of different friction laws and hydrological models (sheet flow, till deformation) depending on estimates of the subglacial conditions of the Antarctic ice sheet. Results show that the way of coupling subglacial hydrology influences the sensitivity of the ice-sheet system on centennial time scales. However, the type and power of the friction law (Coulomb versus Weertman) has the most dominant impact on ice sheet sensitivity.