EGU2020-9749
https://doi.org/10.5194/egusphere-egu2020-9749
EGU General Assembly 2020

Glacier-plume or glacier-fjord circulation models? A model intercomparison for Hansbreen-Hansbukta system, Svalbard

Eva De Andrés, Jaime Otero, and Francisco Navarro
Universidad Politécnica de Madrid, ETSI de Telecomunicación, Applied Mathematics, Madrid, Spain (eva.deandres@upm.es)

Up to 30% of the global tidewater mass loss corresponds to frontal ablation through submarine melting and calving. However, the glacier-fjord interactions remain poorly understood and challenging to constrain in the models. We have developed a 2D glacier flowline-plume coupled model that includes subglacial discharge, submarine melting and iceberg calving to simulate Hansbreen-Hansbukta system (SW Svalbard). We run the model for 20 weeks, from April to September of 2010, with weekly information exchange between glacier and plume models. The same set up and constraints of a previous glacier-fjord circulation model are used here, making the results of both simulations comparable. We consider a 200 m-width subglacial discharging channel, which was found to be a good approximation in the previous glacier-fjord model. Submarine melt rates show high sensitivity to the subglacial-discharge and ambient fjord-temperature intraseasonal evolution. Calving rates are highly dependent on both submarine melting and crevasse water depth. Glacier-plume and glacier-fjord coupled models differ in vertically-accumulated submarine melt rates (up to 30 % higher for the glacier-plume model) and show different melt-undercutting front shapes, which have an influence on the net stress fields near the glacier front. The quasi-linear melt-undercutting morphology exhibited by the glacier-plume model promotes higher calving rates than the quasi-parabolic front shape resulting from the glacier-fjord model, although both models predict similar front positions. Given that the glacier-plume model diminishes the computational cost by a factor of >50, we think that it is a good option for projection studies, as long as we apply appropriate constraints to subglacial discharge fluxes and ambient fjord temperatures.