Session: C9 Poster: M159A

The ECCO Consortium: Sensitivities of the ocean - ice shelf system in the ECCO2 data synthesis

Michael Schodlok[†]; Dimitris Menemenlis; Eric Rignot; Michael Studinger; Eric Larour
[†] JIFRESSE/UCLA, USA
Leading author: mschodlok@ucla.edu

This study concerns the role of the ocean in the recently observed mass loss and grounding line retreat of the Pine Island Ice Shelf, with emphasis on the importance of the sub-ice-shelf cavity configuration and surface forcing. We explore the sensitivity of Pine Island Ice Shelf melt rate and melting pattern to various cavity shapes and to spatial and temporal grounding line retreat using high resolution (~1 km horizontal grid spacing) configurations of the MIT general circulation model (MITgcm) and of the JPL/UCI Ice Sheet System Model (ISSM). A first sensitivity experiment pertains to replacement of the baseline BEDMAP-derived bathymetry with the most recent bathymetric data set obtained by the NASA IceBridge campaign. The IceBridge data for the Pine Island Ice Shelf suggest the existence of a trough from the ice shelf edge to the grounding line, enabling warm Circumpolar Deep Water to penetrate to the grounding line, hence leading to higher melt rates compared to previous estimates. The model results show a difference of about 10 m/a in area mean melt rates between the IceBridge and the BEDMAP-derived bathymetries. A second set of sensitivity experiments pertain to impact of grounding line retreat. To this end we coupled the MITgcm and the ISSM models. Heat fluxes and melt rates derived from the ocean model are used to constrain the ice sheet model. In turn, the ISSM-derived ice shelf thickness and grounding line location is used to modify the ice shelf cavity in the ocean model. Results of the coupled MITgcm/ISSM model show significant ice flow acceleration as well as modification of the ocean circulation under the ice shelf in response to a changing sub-ice shelf cavity geometry. These results suggest links between changing ocean circulation patterns in the Amundsen Sea and the sudden ice flow acceleration of Pine Island Ice Shelf during the last decade.