Geophysical Research Abstracts
Vol. 19, EGU2017-795-1, 2017
EGU General Assembly 2017

Response of Antarctic ice shelf melt to SAM trend and possible feedbacks with the ice-dynamics

Marion Donat-Magnin (1), Nicolas C. Jourdain (1), Hubert Gallée (1), Paul Spence (2), Stephen L. Cornford (3), Julien Le Sommer (1), and Gaël Durand (1)

(1) IGE, CNRS/Univ. Grenoble Alpes/IRD, Grenoble, France, (2) ARC Centre of Excellence for Climate System Science, University of New South Wales, Sydney, New South Wales, Australia, (3) Centre for Polar Observation and Modelling, School of Geographical Sciences, University of Bristol, Bristol, BS8 1SS, UK

The observed positive trend in the Southern Annular Mode (SAM) may warm the Southern Ocean sub-surface through decreased Ekman downward pumping. Subsequent change in ice-shelves melt has been suggested to trigger glacier acceleration in West Antarctica. Here we use a regional ocean model configuration of the Amundsen Sea that includes interactive ice-shelf cavities. Our results show that the inclusion of ice-shelves changes the ocean response to the projected SAM trend, i.e. it typically inhibits a part of the SAM-induced subsurface warming. Heat budget analysis has been used to propose responsible mechanisms. Regarding Thwaites and Pine Island, sub ice-shelf melt increases above 400m by approximately 40% for Thwaites and 10% for Pine Island and decreases by up to 10% below in response to ocean temperature changes driven by the projected SAM trend. The melt sensitivity to poleward shifting winds is nonetheless small compared to the sensitivity to an ice-sheet instability, i.e. to a projected change in the shape of ice-shelf cavities. For instance, the sub ice-shelf melt are doubled near the grounding line of some glaciers in response to the largest grounding line retreat projected for 2100. Large increase in basal melt close to the grounding line could largely impact instability and glacier acceleration. Our work suggests the need for including ice shelves into ocean models, and to couple ocean models to ice-sheet models in climate projections.