Sensitivity studies of ice flow acceleration in response to increased ice shelf melting in the region of Pine Island Glacier

Eric Larour[1], Dimitris Menemenlis[1], Eric Rignot[2,1], Michael Schodlok[3,1], Helene Seroussi[4,1] and Mathieu Morlighem[4,1]

[1]Jet Propulsion Laboratory
[2]University of California at Irvine
[3]JPL/UCLA, Joint Institute For Regional Earth Science and Engineering
[4]Ecole Centrale Paris

The acceleration of Pine Island Glacier in the last decade correlates significantly with an increase in ocean temperatures in the Amundsen Sea during the same period. Although studies have been carried out to try and link both phenomenon, the demonstration of a significant link between sub-cavity ice shelf melting and ice flow acceleration remains an open question. Here, we present a new offline coupling of an ocean circulation/ice flow model, based on the MITgcm and ISSM models, that includes significant forcing between the sub-ice shelf cavity ocean circulation and the glacier ice flow. Computed melting rates are used to constrain ice flow, which in turn is used to constrain geometry of the sub-ice shelf cavity. The model is applied to the Amundsen Sea/Pine Island Glacier, to try and assess the sensitivity of ice flow acceleration to a scenario of increased melting under the ice shelf. The results show significant ice flow acceleration on a short term basis (10 to 100 years), as well as modification of the ocean circulation under the ice shelf, in response to a changing sub-ice shelf cavity geometry. These results demonstrate that there are significant links between changing ocean circulation patterns in the Amundsen Sea and sudden ice flow acceleration of Pine Island Glacier in the last decade.

Session: Multi-discipline system science in WAIS: PIGð LARISSAð WISSARDð Ice2Sea

This work was performed at the California Institute of Technology's Jet Propulsion Laboratory under a contract with the National Aeronautics and Space Administration's Cryosphere Science Program.