Geophysical Research Abstracts
Vol. 21, EGU2019-16968, 2019
EGU General Assembly 2019

Stabilizing the West Antarctic Ice Sheet by surface mass deposition

Johannes Feldmann (1), Anders Levermann (1,2,3), and Matthias Mengel (1)

(1) Potsdam Institute for Climate Impact Research, RD1 - Earth System Analysis, Potsdam, Germany (johannes.feldmann@pik-potsdam.de), (2) Lamont-Doherty Earth Observatory, Columbia University, New York, USA, (3) Institute of Physics, Potsdam University, Potsdam, Germany

Marine-based ice on Antarctica bears the potential to raise sea level worldwide by more than 20 m. It is prone to the marine ice sheet instability and increasing evidence from satellite observations and numerical simulations suggest that a self-sustaining discharge from West Antarctica has been initiated and might not be stoppable by reduction of greenhouse gas emissions. The associated sea level rise of more than 3 m would pose a serious challenge to highly populated areas including metropolises like Calcutta, Shanghai, New York City and Tokyo. Here we show that the West Antarctic Ice Sheet can be stabilized through mass deposition in coastal regions around Pine Island and Thwaites Glaciers. In our numerical simulations a minimum of 7400 Gt of additional snowfall stabilizes the flow if applied over a short period of 10 years onto the region. This is equivalent to a global sea-level drop of about 2 mm yr-1, if the mass is taken out of the ocean. Stabilization depends on the timing of the intervention. If the mass is deposited at a lower rate over a longer period an additional 500 Gt has to be added for each decade of prolongation. The power required to pump ocean water in the equivalent of 1 mm yr-1 to the medium height of the stabilization region in order to snow it on the ice sheet is approximately 90 GW and is available in the regional wind field. Although our findings suggest that the West Antarctic Ice Sheet can in principle be stabilized by mass deposition, we find that the precise conditions of the intervention are crucial and potential benefits need to be weight against environmental hazards, future risks and enormous technical challenges implied in such an operation.