Geophysical Research Abstracts
Vol. 20, EGU2018-10156, 2018
EGU General Assembly 2018

Impact of natural variability in the North Atlantic ocean-atmosphere system on the emergence of widespread Greenland ice sheet melt in the 21st century

Lily Hahn, Caroline Ummenhofer, and Young-Oh Kwon
Woods Hole Oceanographic Institution, Physical Oceanography, United States

Record-breaking melt over the Greenland Ice Sheet (GrIS) in recent decades has been linked both to persistent high pressure, atmospheric blocking conditions and to variability in the Atlantic Multidecadal Oscillation (AMO), motivating the question of how important these modes of internal variability remain under varying degrees of greenhouse forcing. Using 2-meter temperature as a proxy for melt, the 40-member Community Earth System Model version 1 Large Ensemble (CESM1-LE) and the 10-member CESM1 Global Ocean and Global Atmosphere (GOGA) experiment with prescribed sea surface temperatures and sea ice enable investigation into atmospheric and oceanographic links to GrIS melt under preindustrial, historical, and RCP8.5 forcing. High (low) pressure conditions associated with the negative (positive) phase of the North Atlantic Oscillation (NAO) are found to be connected to heightened (reduced) summer melt in all forcing scenarios, with warmer GrIS temperatures occurring when summer blocking coincides with an extremely positive AMO index. Moreover, CESM1-LE ensemble members exhibiting relatively early emergence of a consistent, widespread signal in extreme GrIS melt in the 21st century are linked with higher pressure conditions and a warmer North Atlantic subpolar gyre relative to the ensemble mean in the decade bookending this signal. In contrast, late emergence ensemble members demonstrate opposite conditions enveloping extreme melt emergence. These results indicate the significance of natural modes of variability, such as the AMO and NAO, across a range of external forcing conditions for interannual melt variability, as well as for the early emergence of extreme melt over the GrIS.