Coupled Long-Term Evolution of Climate and the Greenland Ice Sheet During Past Warm Periods: A Comparison for the Last Interglacial and the Late Pliocene

Otto-Bliesner, Bette (1); Lofverstrom, Marcus (1); Lipscomb, William (2); Fyke, Jeremy (2); Marshall, Shawn (3); Sacks, William (1)

1: National Center for Atmospheric Research, United States of America; 2: Los Alamos National Laboratory, United States of America; 3: University of Calgary, Canada

E-Mail: ottobli@ucar.edu

The Greenland Ice Sheet (GrIS) is expected to contribute increasingly to global sea level rise by the end of this century, and potentially several meters in this millennium, but still with considerable uncertainty. The rate of Greenland melt will impact on regional sea levels. To understand the response of the GrIS to future warming, we are studying two warm periods in the past, from which there are relatively abundant and well-dated proxy records: e.g. the last interglacial (LIG) warm period and the late Pliocene, as potential process analogues for centuries to come. The LIG warming is primarily attributed to high boreal summer insolation. The late Pliocene is thought to represent the long-term climate response to near-current concentrations of CO2, though the North Atlantic region may also have been influenced by altered ocean heat transports in response to closed Arctic gateways. Here we examine the transient climate system response to the late Pliocene high CO2 and LIG high boreal summer insolation in two parallel multi-millennial experiments. We use the Community Earth System Model, version 2 (CESM2) fully coupled to the Community Ice Sheet Model, version 2 (CISM2), simulating the GrIS as an interactive component of the coupled climate system. The main focus of the analysis is on how the GrIS responds to differences in the imposed radiative forcing. Results will highlight the transient evolution of the ice sheet and how the surface mass balance (patterns of ablation and accumulation) and mass loss compare to data-based reconstructions of past climate states. We also discuss how these well studied past climate states may be informative in order to constrain the future evolution of the ice sheet.

Keywords: Greenland Ice Sheet, Last Interglacial, Pliocene, Climate-Ice Sheet Modeling