Geophysical Research Abstracts
Vol. 18, EGU2016-948, 2016
EGU General Assembly 2016

Glacial Inception in north-east Canada: The Role of Topography and Clouds

Leah Birch, Eli Tziperman, and Timothy Cronin
Harvard University, United States (lbirch@seas.harvard.edu)

Over the past 0.8 million years, ice ages have dominated Earth's climate on a 100 thousand year cycle. Interglacials were brief, sometimes lasting only a few thousand years, leading to the next inception. Currently, state-of-the-art global climate models (GCMs) are incapable of simulating the transition of Earth's climate from interglacial to glaciated. We hypothesize that this failure may be related to their coarse spatial resolution, which does not allow resolving the topography of inception areas, and their parameterized representation of clouds and atmospheric convection. To better understand the small scale topographic and cloud processes mis-represented by GCMs, we run the Weather Research and Forecasting model (WRF), which is a regional, cloud-resolving atmospheric model capable of a realistic simulation of the regional mountain climate and therefore of surface ice and snow mass balance. We focus our study on the mountain glaciers of Canada's Baffin Island, where geologic evidence indicates the last inception occurred at 115kya. We examine the sensitivity of mountain glaciers to Milankovitch Forcing, topography, and meteorology, while observing impacts of a cloud resolving model. We first verify WRF's ability to simulate present day climate in the region surrounding the Penny Ice Cap, and then investigate how a GCM-like biased representation of topography affects sensitivity of this mountain glacier to Milankovitch forcing. Our results show the possibility of ice cap growth on an initially snow-free landscape with realistic topography and insolation values from the last glacial inception. Whereas, smoothed topography as seen in GCMs has a negative surface mass balance, even with the relevant orbital parameter configuration. We also explore the surface mass balance feedbacks from an initially ice-covered Baffin Island and discuss the role of clouds and convection.