Geophysical Research Abstracts
Vol. 19, EGU2017-19138, 2017
EGU General Assembly 2017

Impact of sea ice on surface wind over the North Atlantic: dependence on background ice sheet configurations

Sam Sherriff-Tadano and Ayako Abe-Ouchi
University of Tokyo, Atmosphere and Ocean Research Institute, Kashiwa, Japan

Simulating and understanding the dynamics of glacial Atlantic meridional overturning circulation (AMOC) is one of the main targets in the PMIP community. Since surface wind over the North Atlantic affects the strength, stability and variability of the AMOC, a better understanding of processes that control the glacial surface wind is important. Recent studies show that changes in sea ice over the North Atlantic play an important role in modifying the surface wind. In this study, we assess the impact of changes in sea ice on the surface wind under several background climate and ice sheet configurations, which remains elusive in previous studies. For this purpose, we analyze impact of sea ice expansion on surface wind under three different background climate (interglacial, mid glacial and full glacial conditions) and ice sheet configurations. Simulated results from MIROC4m are utilized, which was recently published (Dome F members, 2017). To clarify the impact of changes in sea ice and associated changes in diabatic heating, additional sensitivity experiments are conducted with an atmospheric general circulation model and a linear baroclinic model. Results show that expansion of sea ice weakens the surface wind in all experiments. However, changes in the surface wind are larger when the glacial ice sheets exist. Analysis shows that vigorous cold advection from the Laurentide ice sheet plays a role. When the northern North Atlantic is widely covered by sea ice, vigorous cold advection from the ice sheet enhances surface cooling over sea ice. As a result, the stability of the boundary layer increases and thus reduces the momentum transport from the free troposphere, leading to a further weakening of the surface wind. On the other hand, when the northern North Atlantic is not widely covered by sea ice, the cold advection from the ice sheet induces large heat flux from the ocean, leading to a strengthening of the surface wind. Our results suggest that interaction of sea ice and cold advection from the Laurentide ice sheet plays an important role in modifying the glacial surface wind in the North Atlantic.