Geophysical Research Abstracts
Vol. 19, EGU2017-16019, 2017
EGU General Assembly 2017

The effect on Arctic climate of atmospheric meridional energy-transport changes studied based on the CESM climate model

Rune Grand Graversen
University of Tromsø, Department of Physics and Technology, Tromsø, Norway (rune.graversen@uit.no)

The Arctic amplification of global warming, and the pronounced Arctic sea-ice retreat constitute some of the most alarming signs of global climate change. These Arctic changes are likely a consequence of a combination of several processes, for instance enhanced uptake of solar radiation in the Arctic due to a decrease of sea ice (the ice-albedo feedback), and increase in the local Arctic greenhouse effect due to enhanced moister flux from lower latitudes. Many of the proposed processes appear to be dependent on each other, for instance an increase in water-vapour advection to the Arctic enhances the greenhouse effect in the Arctic and the longwave radiation to the surface, leading to sea-ice melt and enhancement of the ice-albedo feedback.

The effects of albedo changes and other radiative feedbacks have been investigated in earlier studies based on model experiments designed to examine these effects specifically. Here we instead focus on the effects of meridional transport changes into the Arctic, both of moister and dry-static energy. Hence we here present results of model experiments with the CESM climate model designed specifically to extract the effects of the changes of the two transport components.

In the CESM model the moister transport to the Arctic increases, whereas the dry-static transport decreases in response to a doubling of CO_2. This is in agreement with other model results. The model is now forced with these transport changes of water-vapour and dry-static energy associated with a CO_2 doubling. The results show that changes of the water-vapour transport lead to Arctic warming. This is partly a consequence of the ice-albedo feedback due to sea-ice melt caused by the change of the water-vapour advection. The changes of the dry-static transport lead to Arctic cooling, which however is smaller than the warming induced by the water-vapour component. Hence this study support the hypothesis that changes in the atmospheric circulation contribute to the Arctic temperature amplification of the ongoing global warming.