Geophysical Research Abstracts
Vol. 16, EGU2014-11178, 2014
EGU General Assembly 2014

Arctic winter sea ice collapse in MPI-ESM – ice-albedo vs. cloud radiative feedback

Sebastian Bathiany and Victor Brovkin
Max Planck Institute for Meteorology, Hamburg, Germany (sebastian.bathiany@mpimet.mpg.de)

The existence of potential tipping points in the climate system is still subject to large uncertainty. Tipping points can arise due to positive feedbacks and imply an abrupt climate change when a certain forcing is reached. A systematic analysis of the CMIP5 database reveals that most abrupt changes in earth system models are related to sea ice cover. In particular, two earth system models show a collapse of Arctic winter sea ice cover after 2100 when forced with increasing CO_2 concentrations in the extended RCP8.5 scenario.
It has been demonstrated that the warming effect of clouds in Arctic winter could constitute a substantial positive feedback. We investigate the importance of this feedback for the sea ice collapse in the MPI Earth System Model by analysing long simulations with slow changes in CO_2 concentration. The warming effect of clouds is strongest in the winter months, when sea ice disappears only gradually. In contrast, the collapse of the remaining sea ice occurs when there is only substantial ice left between March and May. In these months, the short-wave effect of the clouds dominates the cloud radiative forcing. Insofar, MPI-ESM coincides with conceptual models which demonstrate the importance of the time lag between ice cover and insolation for the existence of a tipping point. To separate ice-albedo and cloud radiative feedback more rigorously, we also present results from additional experiments with a prescribed cloud effect.