EGU22-5374
https://doi.org/10.5194/egusphere-egu22-5374
EGU General Assembly 2022

Southern Ocean cloud reductions in CMIP6 forcing experiments as a contributor to intermodel spread in Antarctic warming

Aiden Jönsson[1] and Frida Bender[2]
[1]Department of Meteorology, Stockholm University and the Bolin Centre for Climate Research (aiden.jonsson@misu.su.se)
[2]Department of Meteorology, Stockholm University and the Bolin Centre for Climate Research

It is now well known that CMIP6 models have a higher average and range of climate sensitivities than previous generations of models, which has been shown to be in part caused by weaker negative short wave radiative cloud feedbacks in response to greenhouse gas (GHG) forcing. These weaker negative cloud feedbacks are understood to be caused by a number of factors, including warm rain precipitation bias and Southern Ocean (SO) deep convection slowdown.

We find that coupled models in strong forcing (abrupt quadrupling of CO_2) experiments with greater reductions in Southern Hemisphere (SH) extratropical and SO cloud cover and thus albedo also exhibit greater polar amplification in the SH, namely: increased poleward heat transport, greater surface warming at high latitudes, and a decrease in Antarctic surface albedo. Precipitation increases in the Antarctic polar region with warming, but not evenly; liquid-phase precipitation increases in the Antarctic sea ice zone while ice-phase precipitation increases on the continent. These responses occur roughly three decades after the onset of forcing, and continued surface warming in models with greater SH extratropical cloud loss beyond this point occurs mainly in the SH extratropics, especially at high latitudes, rather than globally.

Here, we aim to explore the connection between Antarctic warming and cloudiness in the SH extratropics and SO. Detailing the process of Antarctic warming in these models can help to explain some of the intermodel spread in Antarctic polar responses to GHG forcing, as well as to further constrain predictions of future climate changes in response to anthropogenic forcing, as these models also include some of the highest climate sensitivities of the CMIP6 ensemble.