Geophysical Research Abstracts
Vol. 20, EGU2018-1321, 2018
EGU General Assembly 2018

The Role of Interactive Stratospheric Chemistry in Producing Regional Antarctic Sea Ice Variability in the HadGEM3- AO UKCA Model

Amna Jrrar (1), N. Luke Abraham (2,3), Peer J. Nowack (4), John A. Pyle (2,3)

(1) Amman, Jordan. amna.jrrar@gmail.com, (2) Centre for Atmospheric Science, Department of Chemistry, University of Cambridge, (3) NCAS – Climate, University of Cambridge, UK, (4) The Grantham Institute for Climate Change, Imperial College London, London, UK

Stratospheric ozone depletion is an important driver of climate change in the Southern Hemisphere.
Some studies have also proposed that observed regional trends in Antarctic sea ice might have been caused by the formation of the ozone hole in the late 20th century.
Despite the perceived importance of a realistic representation of ozone chemistry, few models use interactive chemistry schemes in which ozone changes are allowed to feedback into the climate system. In many models, ozone and other major radiatively active trace gas species are imposed as fixed climatologies that cover both the seasonal cycle and the model's spatial dimensions.
Here we explore the impact of using prescribed versus interactive stratospheric chemistry on Antarctic sea ice variability using the HadGEM3-AO model. The atmospheric chemistry is represented by the United Kingdom Chemistry and Aerosols (UKCA) model which is coupled to the MetUM.
We run two versions of the model; one with the UKCA fully coupled to HadGEM3-AO model and another with fixed climatologies from the interactive runs. For each version, we run two time slice integrations one forced with 1850s climate (pControl) and another with the year 2000 climate (TS2000).

Our analysis of the pControl integrations shows that the model calculates more extensive SH sea ice extent in the non-interactive set-up. On the other hand, the TS2000 simulations show similar net sea ice extent in both versions, but with slightly different regional sea ice variability.
Examining the impact of the change in the forcing (TS2000 minus pControl) on the spatial distribution of sea ice, the non-interactive version shows a near-circumpolar decrease in sea ice in TS2000 compared to pControl. In the interactive simulations, the sea ice distribution is different with sea ice increasing in the Eastern Ross - Amundsen seas and the Indian ocean in TS2000 compared to pControl. The different patterns of spatial variability of sea ice in the two versions of the model are consistent with different atmospheric circulation responses to the change in forcing.
Our results demonstrate that including interactive stratospheric chemistry has an impact on regional Antarctic sea ice variability in our model.