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Climate Response to Projected Antarctic Sea Ice Loss

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Since accurate satellite records began, Antarctic sea ice cover has slightly increased, but with significant regional variation. Despite this overall increase, Antarctic sea ice is projected to dramatically decrease by the end of the 21st century if greenhouse gas concentrations continue to rise. Antarctic sea ice plays a key role in climate of the high latitudes of the Southern Hemisphere. Changes in sea ice may have resultant consequences on the large-scale atmospheric circulation, such as the Southern Annular Mode (SAM). Other impacts may include changes to the Meridional Overturning Circulation and further afield climates. The aim of this project is to better understand the coupled climate response to projected Antarctic sea ice loss. This has been done in two ways. First, we inferred the response to sea ice loss from the CMIP5 multi-model ensemble. Results show that the surface temperature response is confined to regions of sea ice loss and does not extend to the Antarctic continent. The largest temperature response is in austral autumn-winter. Sea ice loss and the resultant heat flux changes led to a negative SAM index, associated with an equatorward shift in the westerly jet, which is most prominent in late winter and spring. In general, the response to sea ice loss appears opposite to the total response to greenhouse gas forcing. Therefore, sea ice loss acts to damp the climate change response, but the response to sea ice loss is of insufficient magnitude to fully offset greenhouse-gas-induced changes. Our second approach is to explicitly simulate the climate response to Antarctic sea ice loss. We have conducted simulations with the UK Met Office HadGEM3 model in which the sea ice albedo is reduced (only in the Southern Hemisphere), thereby reducing Antarctic sea ice in the coupled climate system.

Key words - Sea Ice, Antarctic, Climate Change, Modelling, Atmospheric Response, Southern Hemisphere Climate.