



Analysis of the projected regional sea-ice changes in the Southern Ocean during the 21st century

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Using the set of simulations performed with atmosphere-ocean general circulation models (AOGCMs) for the Fourth Assessment Report of the International Panel on Climate Change (IPCC AR4), the projected regional distribution of sea ice for the 21st century has been investigated. Averaged over all those model simulations, the current climate is reasonably well reproduced. However, this averaging procedure hides the errors from individual models. Over the 20th century, the multimodel average simulates a stronger warming around the peninsula compared to other regions, which is in qualitative agreement with observations. This is probably related to the positive trend in the Southern Annular Mode (SAM) index over the 20th century, in both observations and in the multimodel average. Despite the simulated positive future trend in SAM, such a regional warming is absent in the projected temperature change for the end of the 21st century. The maximum warming is indeed located over the continent and over the Weddell Sea. In this latter region the warming is associated with a large reduction of the ice cover in the multimodel average. Another large reduction of the sea-ice cover can be found in the Amundsen-Bellingshausen Seas. There are two important oceanic phenomena influencing the projected regional distribution of the changes in sea-ice concentration during the 21st century. First of all, most models show changes in the oceanic currents, especially in the Ross Sea. Secondly, changes in the mixed layer depth can be found in some models, inducing locally strong changes in the sea-ice concentration. However, due to the differences between the different model responses, it is not possible to draw clear and significant conclusions on the exact strength and location of these changes.