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Team MIROC: Impact of the assimilation of sea ice concentration data on an atmosphere-ocean-sea ice coupled simulation of the Arctic Ocean climate

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We have investigated the effects of assimilating sea ice concentration (SIC) data on a simulation of Arctic Ocean climate using an atmosphere-ocean-sea ice coupled model. Our results show that the normal overestimation of summertime SIC in the East Siberian Sea and the Beaufort Sea in simulations without sea-ice data input can be greatly reduced by assimilating seaice data and that this improvement is also evident in a following hindcast experiment for 3−4 years after the initialization of the assimilation. In the hindcast experiment, enhanced heat storage in both sea ice and in the ocean surface layer plays a central role in improving the accuracy of the sea ice distribution, particularly in summer. Our detailed investigation suggests that the ice-albedo feedback and the feedback associated with the atmospheric pressure pattern generated by the improved estimation of SIC work more effectively to retain the heat signal after initialization for a coupled atmosphere-ocean-sea ice system prediction. In addition, comparison with field observations confirms that the model fails to produce a realistic feedback loop, which is (presumably) due to inadequacies in both the ice-cloud feedback model and the feedback via the Beaufort Gyre circulation. Further development of coupled models is thus required to better define Arctic Ocean climate processes and to improve the accuracy of their predictions