

# **Tuning The Sea-Ice Seasonal Cycle Of HadCM3: Can It Reproduce Observed Trends In Sea-Ice?**

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## **Abstract**

Since high quality satellite observations of sea-ice begin in 1979 Arctic sea-ice extent has declined. Observed losses in Arctic sea-ice during September are greater than the majority of models in the CMIP5 archive and the multi-model average. In contrast Antarctic sea-ice has increased in contrast to an expected decline.

We have carried out a set of perturbations to the HadCM3 model in which we changed the maximum ice area (a proxy for ice leads), albedo parameterizations, ice thermal conductivity and ocean diffusion. Changes in these parameters affected ice extent in both the Arctic and Antarctic. We used these simulations to identify four parameters that had most impact on minimum and maximum sea-ice extent in both hemispheres. To tune the model we used a Gauss-Newton algorithm to adjust those four parameters to minimize differences between simulated and observed sea-ice extents. With this new parameter set we then simulated the period 1940 to 2015 and compared with the default configuration of HadCM3.

Compared to the default configuration the perturbed model had greater summer sea-loss in the Arctic and is consistent with observed loss estimates. However, in the Antarctic neither the perturbed or default simulations show an increase in sea-ice extent. This is in contrast to the observations, which do show an increase in sea-ice extent.

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