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# The impact of 21st century sea ice decline on the mass balance of the Greenland Ice Sheet

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The Arctic is a region particularly susceptible to rapid climate change. General circulation models (GCMs) suggest a polar amplification of any global warming signal by about 1.5 due, largely, to sea ice feedbacks. The dramatic recent decline in multi-year ice cover lies outside the standard deviation of the ensemble GCM predictions and has lead to the suggestion that the Arctic Ocean could be ice free in summer as soon as $\sim$2014.

Sea ice acts as a barrier between cold air and warmer oceans during winter, as well as inhibiting evaporation from the water below during the summer. An ice free Arctic would likely have an altered hydrological cycle with more evaporation from the ocean surface leading to changes in precipitation distribution and amount.

Using the U.K. Met Office Regional Climate Model (RCM), HadRM3, the atmospheric effects of the observed and projected reduction in Arctic sea ice are investigated. The RCM is driven by the atmosphere only general circulation model HadAM3. Both models are forced with sea surface temperature and sea ice obtained by extrapolating recent changes into the future using bootstrapping based on the U.K. Met Office's HadISST (sea ice) climatology. Here we use an RCM at 50km resolution over the Arctic which captures well the present-day pattern of precipitation and provides a detailed picture of the projected changes in the behaviour of the oceanic-atmosphere moisture fluxes and how they affect precipitation.

These experiments show that the projected sea ice decline alone causes over 100% increase in precipitation over northern Greenland compared to the present day control experiment. An energy balance surface mass balance model based on SOMARS is asynchronously coupled to the RCM output to model the implications to the Greenland Ice Sheet.