



## **Rapid response of Antarctica and Greenland to external forcing and potential freshwater fluxes**

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The recently published fourth assessment report of the IPCC could not reach a consensus on the future response of the ice sheets to external forcing and their contribution to sea level rise in the 21st Century. This is because recent results, based on remote sensing, in-situ observations and modelling studies, have challenged our understanding of, and ability to reproduce, observed ice sheet behaviour. The results suggest that there may be a range of mechanisms that could induce a rapid (years rather than millennia) dynamic response of both the Antarctic and Greenland ice sheets to small perturbations in the climate system. The mechanisms proposed for Antarctica and Greenland have different origins but potentially similar consequences. They include the influence of ice shelf back-pressure on grounded ice velocities, surface melt percolating through ~1 km thick ice resulting in increased basal sliding and tidally-induced changes in basal drag. Here, I discuss the observations and model results and the possible mechanisms that have been proposed and consider what implications they may have for the stability of the ice sheets in a warming world. Whether the present generation of GCMs and ice sheet models, and predictions based on them, adequately represent the envelope of possible responses is also considered. This potentially rapid response of the ice sheets can be considered a rapid climate change in its own right and could have a profound influence on future sea level rise. I also consider, the more commonly attributed impact of ice sheet changes, which is whether the potential freshwater fluxes that could be produced by the Greenland ice sheet over the next 200 years could impact the MOC in the North Atlantic.