

Impacts of marine instability across the East Antarctic Ice Sheet on Southern Ocean dynamics

Steven Phipps (1,2), Christopher Fogwill (2,3), and Christian Turney (2)

(1) Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Tasmania, Australia

(Steven.Phipps@utas.edu.au), (2) Climate Change Research Centre, School of Biological, Earth and Environmental Sciences, UNSW Australia, Sydney, NSW 2052, Australia, (3) PANGEA Research Centre, UNSW Australia, Sydney, NSW 2052, Australia

Recent observations and modelling studies have demonstrated the potential for rapid and substantial retreat of large sectors of the East Antarctic Ice Sheet (EAIS). This has major implications for ocean circulation and global sea level. Here we examine the effects of increasing meltwater from the Wilkes Basin, one of the major marine-based sectors of the EAIS, on Southern Ocean dynamics. Climate model simulations reveal that the meltwater flux rapidly stratifies surface waters, leading to a dramatic decrease in the rate of Antarctic Bottom Water formation. The surface ocean cools but, critically, the Southern Ocean warms by more than 1°C at depth. This warming is accompanied by a Southern Oceanwide “domino effect”, whereby the warming signal propagates westward with depth. Our results suggest that melting of one sector of the EAIS could result in accelerated warming across other sectors, including the Weddell Sea sector of the West Antarctic Ice Sheet. Thus, localised melting of the EAIS could potentially destabilise the wider Antarctic Ice Sheet.