Transient ice sheet simulation of the Ross Ice Shelf deglaciation

Daniel Lowry[1], Nicholas Golledge[1,2], Nancy Bertler[1,2]

[1]Antarctic Research Centre, Victoria University of Wellington, Wellington, New Zealand; Dan.Lowry@vuw.ac.nz
[2]GNS Science, Lower Hutt, New Zealand

Abstract

As the largest ice shelf of Antarctica, the Ross Ice Shelf (RIS) plays an integral role in buttressing both the east and west Antarctic ice sheets and thus has strong potential to control future sea level rise. Here, we perform ice sheet model simulations forced by two transient climate model simulations to investigate past grounding line migration in the Ross Sea. These model experiments attempt to better understand how the ice shelf system responds to environmental drivers and help interpret the proxy record of the RIS deglaciation. Present-day (PD) and Last Glacial Maximum (LGM) RIS conditions are simulated using the Parallel Ice Sheet Model (PISM) according to modern observations and past estimations of grounding line position and ice thickness. We then perform 5km resolution climate-forced ice sheet simulations from the LGM to PD using climate anomalies to a modern climatology based on the LOVECLIM deglacial experiment (Menviel et al., 2011) and the TraCE 21ka experiment (Liu et al., 2009; He, 2011) to explore past ice shelf dynamics and grounding line migration. Our simulations are analysed in the context of the Roosevelt Island Climate Evolution project (RICE) ice core and sediment cores from the Ross Sea and wider region. Together, these results provide insight into the environmental conditions that most strongly control grounding line changes, allowing inferences to be made for future controls on sea level rise.

Keywords: Ross ice shelf; ice sheet modelling; grounding line; deglaciation

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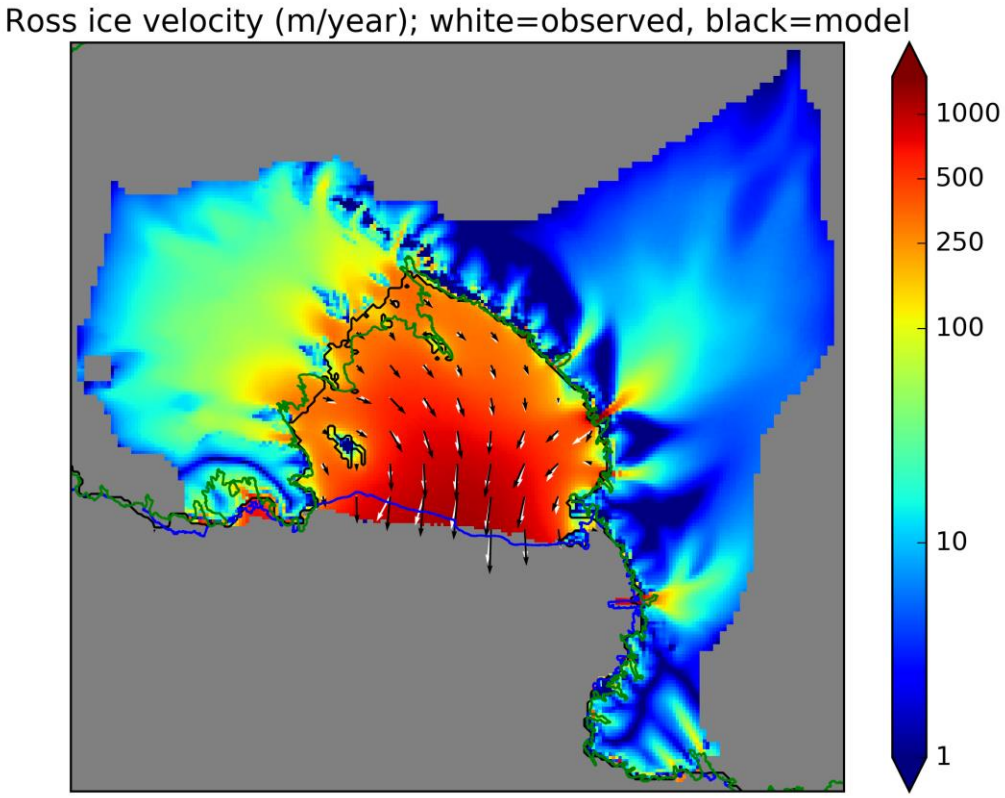
Ross ice velocity (m/year); white=observed, black=model
1000
500
250
100
10
1