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# Ice-Ocean-Atmosphere interactions at the Oligocene-Miocene Transition

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The major advance and retreat of the Antarctic ice sheet across the continental shelf at the Oligocene-Miocene Transition was associated with sea level changes on the order of several tens of metres (Mawbey and Lear, 2013). The climate transition was apparently paced by ~100kyr orbital cycles and associated with moderate variability in $pCO_2$ (Liebrand et al., 2017; Greenop et al 2019). Satisfying these proxy constraints is challenging for most ice-sheet models. One solution may be incorporating the marine ice cliff instability mechanism into models (Pollard et al., 2015), with significant implications for future sea level projections (DeConto and Pollard, 2016). Another solution could be that the transient glaciation included some northern hemisphere ice, which would lack the strong hysteresis effect that characterises the Antarctic Ice Sheet.

Here we present benthic foraminiferal trace metal and stable isotope records from Newfoundland Drift IODP Site 1406, and Ceara Rise ODP Sites 926 and 929. We also present new planktonic foraminiferal trace metal and stable isotope records from Ceara Rise ODP Site 926. Our records imply a major ventilation event in the north Atlantic at the onset of the Oligocene-Miocene glaciation, and a marked freshening of low latitude waters during the glacial maximum.

We use the HadCM3BL model following Lauretano et al. (2021) with Chattian paleogeography to generate a series of equilibrium simulations with varying $pCO_2$ (280ppm, 560ppm, 1120ppm) and global ice volume (ice free, East Antarctica glaciated, full Antarctic glaciation, full Antarctic glaciation plus northern hemisphere glaciation). We use these model results and our geochemical records to discuss the possibility of northern hemisphere glaciation at the Oligocene-Miocene boundary, and ice-ocean-carbon cycle feedbacks in the climate system.

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