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# Testing scenarios of Pliocene East Antarctic Ice Sheet behaviour: towards a coupled ice sheet-climate modelling approach

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Current evidence for Antarctic ice volume change during the late Cenozoic does not provide a clear picture of the behaviour or extent of the East Antarctic Ice Sheet (EAIS). The seemingly irreconcilable palaeontological and geomorphological records of the Transantarctic Mountains sustain two very different scenarios for the extent of the EAIS during the Pliocene. The 'dynamists', on the basis of marine diatoms and other palaeontological evidence derived from the Sirius Group sediments, require large scale fluctuations of East Antarctic ice volume in the recent geological past, whilst the 'stabilists', on the basis of geomorphological and other evidence, require a stable EAIS since the mid Miocene. Definitive answers from marine records remain elusive due to availability and resolution issues. Therefore the stability of the EAIS during the Pliocene remains unresolved.

The mid-Pliocene ($\sim$3 Ma B.P.) is a well-studied period of geological time. Broadly it appears to have been a period of sustained warming, compared to the pre-industrial, particularly at high latitudes. It is unique in that continental configurations were relatively unchanged from the modern, and geological proxies are superior to preceding warm periods due to improved geographic distribution, biota-environment correlations and stratigraphy which make it an ideal interval for study. Numerous General Circulation Model (GCMs) experiments have been run for the period using boundary conditions derived from the USGS PRISM2 (Pliocene Research, Interpretation and Synoptic Mapping) data set. The most advanced mid Pliocene simulations have utilised a fully coupled atmosphere, ocean, sea ice and vegetation models, however ice sheet extents must still be prescribed.

In an effort to remedy this problem an existing suite of GCM climatologies has been used to drive a 3-D, thermomechanical ice sheet model, allowing us to predict rather than prescribe the range of equilibrium ice sheets that could have existed at this time. The dependence of these results on the GCM boundary conditions and the initial state of the ice sheets leads to a range of plausible ice sheet reconstructions, but it seems likely that the EAIS was, to some extent, smaller than it is today. Nevertheless, even in the most extreme case the predicted EAIS still covers all but the northernmost reaches of the Wilkes sub-glacial basin, suggested to be the source of the diatoms found within the Sirius Group sediments. The geological and climatological conditions that would be necessary to generate the widespread deglaciation of East Antarctica suggested by the dynamists can be investigated using modelling sensitivity studies. These can then be compared to the geological record to see if the mid Pliocene is indeed a suitable candidate for such large-scale deglaciation.