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Climate and ice sheet modelling of mid-Pliocene East Antarctica

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Evidence for the state of Antarctic glaciation during the Neogene is geographically and temporally limited. Much of the available evidence suggests that the Early and Middle Pliocene were particularly warm Stages with possibly significant changes in the Antarctic cryosphere. This is particularly important as this is the last period of Earth History when global temperatures were greater than today over whole glacial cycles. Indeed proxy reconstructed and modelled global mean mid-Pliocene temperatures are comparable to those predicted for the end of the century.

While the warmth of the Pliocene is well established the effect of the higher than modern temperatures on the Antarctic cryosphere is much more controversial. Evidence from the marine margins of Antarctica suggests open water conditions and significant fluctuation of the ice sheet margin. However this data seems to contradict onshore evidence from the Transantarctic Mountains of landscape stability and is hampered by a lack of other terrestrial data. In order to constrain the wider consequences of Pliocene warmth on the Antarctic Ice Sheets we must turn to physical models of the climate and ice sheets.

The mid-Pliocene (3.29-2.97 Ma) is a particularly well studied warm interval of the Neogene. Global palaeoenvironmental reconstructions of the mid-Pliocene have been produced by the PRISM (Pliocene Research, Interpretation and Synoptic Mapping) group of the USGS (United States Geological Survey), enabling well constrained GCMs (General Circulation Models). A broad suite of GCMs have been run for the mid-Pliocene interval and these can be used as climatological input into the British Antarctic Survey Ice Sheet Model (BASISM), to examine the consequences of the

modelled Antarctic climate on the cryosphere.

Presented here are the results of ensemble modelling of the mid-Pliocene East Antarctic Ice Sheet (EAIS). These experiments allow us to examine the effect of different GCM configurations and boundary conditions on the resultant ice sheet predictions, as well as testing the range of results caused by uncertainties in climate coupling (positive degree-day) parameters and initial ice sheet configurations. The results show significant differences in ice sheet extent between mid-Pliocene and today's EAIS, but suggest that this may not be incompatible with landscape stability in the Transantarctic Mountains.