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Simulating the Antarctic ice sheet in the Late-Pliocene warm period: PLISMIP-ANT, an ice-sheet model intercomparison project

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In the context of future climate change, understanding the nature and behaviour of ice sheets during warm intervals in Earth history is of fundamental importance. The Late-Pliocene Warm Period (also known as the PRISM interval: 3.29 to 2.97 million years before present) can serve as a potential analogue for projected future climates, with a global annual mean surface-air temperature warming of 1.76 °C. Although Pliocene ice locations and surface extents are still poorly constrained, a significant contribution to sea-level rise should be expected from Greenland and West and, possibly, East Antarctica based on palaeo sea-level reconstructions. Here, we present results from simulations of the Antarctic ice sheet by means of an international Pliocene Ice Sheet Modeling Intercomparison Project (PLISMIP-ANT). We include an overview of the different ice-sheet models used and how specific model configurations influence the resulting Pliocene Antarctic ice sheet. For the experiments, ice-sheet models including the shallow ice and shelf approximations have been used to simulate the complete Antarctic domain (including grounded and floating ice). We compare the performance of the ice-sheet models in simulating modern control and Pliocene ice sheets by a suite of sensitivity experiments. Ice-sheet model forcing fields are taken from the PlioMIP results incorporating multiple coupled atmosphere-ocean general circulation models (GCM). We show that ice-sheet models simulate a present-day ice sheet which is comparable to the observations, and find no systematic biases introduced when using different GCM forcing relative to observational climate forcing. This project includes multiple ice-sheet models forced with multiple climate model output, from which a comprehensive assessment can be made as to the uncertainties of ice-sheet extent on Antarctica. These results may eventually serve as a new constraint on the extent of the Antarctic ice sheet during the Late-Pliocene Warm Period for use in climate modelling experiments.