Modeled state of the Antarctic ice sheet during the Miocene

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Abstract

Information from benthic $\delta^{18}O$ records indicates that the size of the Antarctic ice sheet may have been smaller and more variable during the Miocene than in more recent times[1]. Rising atmospheric CO_2 levels may return the Antarctic ice sheet to this sensitive state in the future. Therefore, more thorough knowledge of the currently understudied Miocene is desirable. Here, we take a model approach to this issue. We simulate the Antarctic ice sheet including ice shelves using the ice dynamical model PISM[2], which combines the shallow ice approximation and shallow shelf approximation. By using a suite of Miocene climatic forcings, we investigate the influence of atmospheric CO_2, solar insolation, global topography and bathymetry on the dynamical state of the Antarctic ice sheet. Furthermore, we study the effect of using different parameter settings and basal conditions in the ice model setup. A comparison is made to results of other models[3,4]. We conclude that CO_2 is the strongest driver of the Antarctic ice sheet on long time scales, but its effect is mitigated or amplified by changes in solar insolation, basal conditions, and global topography and bathymetry.

Keywords: Miocene, inception, variability, topography

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