Simulating Antarctic ice-sheet variability of the past 3 million years

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Little is known about the evolution of the Antarctic ice-sheet (AIS) during the Pleistocene and its response to external drivers, such as CO\textsubscript{2}, orbital and sea-level forcing. Here, we apply realistic transient climate forcings generated by the 3Ma Community Earth System model (CESM, version 1.2) simulation \cite{yun1, yun2} to the bi-hemispheric Pen State University ice-sheet shelf model (PSUIM). The CESM-simulated surface air temperature, surface solar insolation, precipitation, and sub-surface ocean temperature serve as inputs for PSUIM. This application enables us to simulate a more reliable variability of the AIS over the past 3 million years ago (Ma). Our simulation reveals a more pronounced precessional modulation of early to mid-Pleistocene AIS variability than previously suggested. The results further show the mid-Pleistocene transition (MPT, ~ 1Ma) of AIS, with dominant frequencies changing from 20-40 krys to 80-120 krys and a clear regime shift in its surface mass balance. We also find that the pre-MPT precessional variability is significant only in the marine (floating) ice-sheet, not in terrestrial (grounded) ice. This suggests the influence of competing ocean and atmospheric processes in controlling the AIS variability over the past 3Ma. We will further discuss the mechanisms of simulated AIS variability and its climate interactions on orbital timescales and compare our results with paleo reconstructions.

\cite{yun1, yun2}
