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Cool episodes in the Late Cretaceous - exploring the effects of physical forcing on Antarctic snow accumulation

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Until recently it was assumed that the major modern ice sheets on Antarctica became established around the Eocene-Oligocene boundary about 34 Ma ago. But new evidence (e. .g. Miller et al., 2008) indicates that continental ice may have been present much earlier, some of it probably even since the greenhouse times of the Late Cretaceous. Deep sea drilling data suggest changes in sea-level during the Late Cretaceous that could have been caused by the melting and freezing of vast ice sheets on Antarctica.
Using a GCM approach to test the whether it would be possible to generate the described high-amplitude sea-level falls is one additional way to test this vigorously discussed issue. As shown above, our numerical approach indicates the possibility of a substantial Antarctic glaciation by changing the physical boundary conditions, eccentricity, pCO2, and elevation within reasonable Late Cretaceous ranges.
Our simulations suggest that simulated snowfall and consecutive ice formation on Antarctica might yield sufficient volumes to account for the documented rapid, low-amplitude Cretaceous sea-level fluctuations. Based on cautious assumptions and possible errors the model results show that ice build-up could take place in realistic time spans and in accordance with the proxy records. Thus, the possibility of an Antarctic ice shield build-up large enough to drive sea level fluctuations on the order of tens of meters within 20,000-220,000 years is supported. The initial snow accumulation and following growth of Antarctic ice-sheets in the Cretaceous can be attributed to changes in southern hemisphere summer insolation due to reduced orbital eccentricity. Alternatively and/or additionally, declining atmospheric CO2 values caused further cooling.