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The evolution of the Antarctic Ice Sheet under different climate boundary conditions

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The widespread glaciation of Antarctica and the associated shift towards colder temperatures at the Eocene-Oligocene boundary (about 35 million years ago) represents one of the most fundamental reorganisations of global climate in Earth's history. The Antarctic ice sheet is therefore of large interest because changes in its elevation and extention have an important role in global atmospheric and oceanographic fluctuations which contribute to world-wide sea level. The formation and evolution of the Antarctic ice sheet is here investigated using a 3-dimensional dynamical ice sheet model. The model incorporates grounded ice dynamics, basal sliding and isostatic bed adjustment and it has a full coupling between thermal field and ice flow. The geometry of the ice sheet is generated in response to environmental conditions. The model is forced with output of an atmospheric GCM (ECHAM5) using simulated surface temperature and precipitation as input parameters. Present day and Miocene (formation of Antarctic ice cap) ice sheet conditions are represented and warming as well as cooling scenarios for Antarctica are investigated. Ice dynamics, mass balance and the steady state ice sheet shape are assessed. Studies with different spatial resolution of the atmospheric data show the influence of the forcing data on the ice sheet evolution.