



The impact of climate-vegetation interactions on the onset of the Antarctic ice sheet

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A global coupled atmosphere/vegetation model and a dynamic ice-sheet model were employed to study the impact of climate-vegetation interactions on the onset of the Antarctic ice sheet at the Eocene/Oligocene boundary. We found that the CO₂ threshold for Antarctic glaciation is highly sensitive to the prevailing vegetation. In our experiments, the CO₂ threshold is less than 280 ppm if the Antarctic vegetation is dominated by forests, and between 560 and 1120 ppm for tundra and bare ground conditions. The large impact of vegetation on inception is attributed to the ability of canopies to shade the snow-covered ground, which leads to a weaker snow-albedo feedback and higher summer temperatures. However, ultimately the effect of canopy shading also depends on the local cloud conditions and the meridional heat transport. Our results suggest that vegetation feedbacks on climate are crucial for the timing of the Antarctic glaciation.