Antarctic ice-sheet interactions during the last Deglaciation

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The climatic system includes several components with different characteristic time scales (i.e. the atmosphere, the hydrosphere, the biosphere, the lithosphere and the cryosphere). The Antarctic ice-sheet represents the main contribution of the latter component. The south pole continent contains 70% of the fresh water supply of the Earth and 91% of the ice on Earth. If all the ice were melt, it would lead to a sea level rise of about 60 m. Within the content of global warming of the Earth, the polar regions are very sensitive. Observations by satellites show that the Antarctic continent is subjected to abrupt temperature changes which are likely to be induced by atmospheric greenhouse gases. This implies large ice collapses and a great acceleration of the ice flow, which then goes to the ocean. To better study the evolution of future climate, one can look in the past whether such collapses ever happened. The aim of this work is to study the interactions between climate and ice sheets, especially the Antarctic ice sheet. I have developed a coupling method between an antarctic ice sheet model and a climate model of intermediate complexity, which was first coupled with a northern hemisphere ice sheet model. In the first part, I have tested this new tool to understand processes occurring during the last major collapse of northern and southern ice sheets (i.e. the last deglaciation, 21 kyr BP). The ice sheets seem sensitive to the climate forcing (insolation and CO2) and respond also to the climatic variability induced by ice melting itself. The Quaternary period is one of the rare period in the Earth history where such ice sheets were present. Studying the interactions of these ice sheets with the climate is therefore an important challenge, both for past and future climate investigations.