Modeling the evolution of the Antarctic ice sheet driven by basal melting using the three-dimensional ice sheet model SICOPOLIS

*Kaho Harada[1], Ayako Abe-Ouchi[1,2], Takashi Obase[1], Fuyuki SAITO[3], Ralf Greve[4]

1. Atmosphere and Ocean Research Institute, The University of Tokyo, 2. National Institute of Polar Research, 3. Japan Agency for Marine-Earth Science and Technology, 4. Institute of Low Temperature Science, Hokkaido University

The Antarctic ice sheet is the largest fresh-water storage at present, whose geometry and volume have changed in response to climate changes like glacial-interglacial cycles. These changes are controlled by the surface and basal mass balance of the Antarctic ice sheet, which also affect grounding line migration. The basal melting beneath ice shelves is one of the dominant drivers for mass loss from the Antarctic ice sheet as it causes ice shelves to thin and reduce their buttressing effect on the upstream grounded ice, which leads to accelerated ice drainage and thus mass loss. However, the relative importance of basal melting on the response of the Antarctic ice sheet to climate change is still not clear.

In this study, we use the three-dimensional ice sheet model SICOPOLIS to investigate steady states of the Antarctic ice sheet with various basal melting rates beneath ice shelves, starting from the present-day ice sheet as initial condition. We analyze the response of the whole Antarctic ice sheet as well as that of specific areas, namely the Siple Coast, Wilkes, Aurora and Recovery subglacial basins. Siple Coast is located in West Antarctica, at the east side of the Ross Ice Shelf, while the other basins are located in East Antarctica. All areas have large ice shelves, so that they are highly sensitive to the basal melting beneath ice shelves. We also investigate steady states of the Antarctic ice sheet at various sea levels relative to the present to take into account the influence of glacial-interglacial cycles.

Keywords: Antarctic ice sheet, ice shelf, basal melting, ice sheet model