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Millennial-scale interactions of the Antarctic Ice Sheet and the global ocean

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Increased sub-shelf melting and ice discharge from the Antarctic Ice sheet has both regional and global impacts on the ocean and the overall climate system. Additional meltwater, for example, can reduce the formation of Antarctic Bottom Water, potentially affecting the global thermohaline circulation. Similarly, increased input of fresh and cold water around the Antarctic margin can lead to a stronger stratification of coastal waters, and a potential increase in sea-ice formation, trapping warmer water masses below the surface, which in turn can lead to increased basal melting of the ice shelves.

So far these processes have mainly been analysed in simple unidirectional cause-and-effect experiments, possibly neglecting important interactions and feedbacks. To study the long-term and global effects of these interactions, we have developed a bidirectional offline coupled ice-ocean model framework. It consists of the global ocean and sea-ice model MOM5/SIS and an Antarctic instance of the Parallel Ice Sheet Model PISM, with the ice-shelf cavity module PICO representing the ice-ocean boundary layer physics. With this setup we are analysing the aforementioned interactions and feedbacks between the Antarctic Ice Sheet and the global ocean system on multi-millenial time scales.