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Coupling the Parallel Ice Sheet Model with the Modular Ocean Model via an Antarctic ice-shelf cavity module

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Ocean-ice shelf interactions are the main drivers for the current mass loss from the Antarctic Ice Sheet. Recent studies have shown that increased continental meltwater input can enhance discharge through ice-ocean feedbacks. This raises the need for interactive modelling between ocean and ice-sheet systems to assess the consequences of additional freshwater input on the Antarctic region and beyond. While high-resolution simulations (1/4 degree or greater) can resolve detailed interactions between the ocean and ice shelf, the computational costs make them applicable only for regional studies or decadal to centennial time scales. In this study we present a framework for coupling a coarse resolution ocean model (MOM) to the Parallel Ice Sheet Model (PISM) via the Potsdam Ice-shelf Cavity mOdel (PICO). The intermediate model PICO approximates the overturning circulation in ice shelf cavities and includes ice-ocean boundary layer physics. We present this offline coupling approach and discuss the fluxes exchanged between the distinct model runs as well as energy and mass conservation. Using this flexible and computationally efficient framework, feedbacks between the ice and ocean can be analysed on a global spatial scale and paleoclimate time-scales.