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A Tale of Two Forcings: Present-Day Coupled Antarctic Ice-sheet/Southern Ocean dynamics using the POPSICLES model.

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We present POPSICLES simulation results covering the full Antarctic Ice Sheet and the Southern Ocean spanning the period 1990 to 2010 resulting from two different choices of climate forcing: a "normal-year" climatology and the CORE v. 2 interannual forcing data (Large and Yeager 2008). Simulations are performed at 0.1^o($\sim$5 km) ocean resolution and adaptive ice sheet resolution as fine as 500 m. We compare time-averaged melt rates below a number of major ice shelves with those reported by Rignot et al. (2013) as well as other recent studies. We also present seasonal variability and decadal melting trends from several Antarctic regions, along with the response of the ice shelves and consequent dynamics of the grounded ice sheet.

POPSICLES couples the POP2x ocean model, a modified version of the Parallel Ocean Program (Smith and Gent, 2002), and the BISICLES ice-sheet model (Cornford et al., 2012). POP2x includes sub-ice-shelf circulation using partial top cells (Losch, 2008) and boundary layer physics following Holland and Jenkins (1999), Jenkins (2001), and Jenkins et al. (2010). Standalone POP2x output compares well with standard ice-ocean test cases (e.g., ISOMIP; Losch, 2008) and other continental-scale simulations and melt-rate observations (Kimura et al., 2013; Rignot et al., 2013). BISICLES makes use of adaptive mesh refinement and a 1st-order accurate momentum balance similar to the L1L2 model of Schoof and Hindmarsh (2009) to accurately model regions of dynamic complexity, such as ice streams, outlet glaciers, and grounding lines. Results of BISICLES simulations have compared favorably to comparable simulations with a Stokes momentum balance in both idealized tests (MISMIP-3d; Pattyn et al., 2013) and realistic configurations (Favier et al. 2014).