Effects of Greenland's Runoff in a Regional Arctic System Model

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Correctly understanding and modeling the evolving thermal properties and dynamics of ocean conditions that reach the Greenland coast are necessary to accurately force marine terminating glaciers of the island. In this study, we use the high-resolution Regional Arctic System Model's (RASM) unique capability to more realistically simulate the role of fresh water fluxes from pan-Arctic land runoff and glacier ice discharge into the Arctic oceans. RASM is a coupled regional model, including ocean (Parallel Ocean Program - POP), sea ice (Community Ice - CICE), atmospheric (The Weather Research and Forecasting Model - WRF) and land hydrology (Vertical Infiltration Capacity - VIC) model components. The freshwater fluxes enter the pan-Arctic seas as a buoyancy forcing with interannual variability. The runoff data are provided by the Coordinated Ocean-ice Reference Experiments version 2 (CORE2). Experiments are conducted for 1948-2009 with active ocean and sea ice models, while the atmospheric model is replaced with a forcing provided by the CORE2 reanalysis. The default set-up, with no runoff from land to the ocean, is compared against results from simulations with freshwater fluxes equivalent to the volume of runoff in the Arctic region given by the CORE2 data interpolated to the RASM's 1/12 degree ocean model grid. Experiments are set up with incremental increases in Greenland's freshwater flux to the ocean to mimic past rates of discharge after the Last Glacial Maximum and to evaluate the sensitivity of the ocean and sea ice systems to such forcings. Ultimately, the ocean and sea ice evolving conditions will provide insight into what role fresh water fluxes play in the resulting Arctic climate system and on glacier terminus forcings in particular.