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An explicit surface mass balance scheme for ice sheets in EC-Earth

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According to observations and model studies, the Greenland Ice Sheet is sensitive to the climate forcing including temperature and surface mass balance (SMB). In this study, we have compared the calculated SMB from a number of EC-Earth simulations constrained by the ERA-Interim reanalysis data set for the period 1989-2008, using a series of surface parameterization schemes. The land surface scheme of the EC-Earth global climate model has been modified to explicitly include land ice processes. The motivation is to obtain a more realistic surface mass balance and thereby improve the interface to the Parallel Ice Sheet Model (PISM) in the coupled model system. The new land surface scheme includes melting of land ice and a separate albedo parameterization. Simulations are performed with and without explicit land ice treatment and using different initial states of the ice sheet. The sensitivity of the calculated SMB to small changes in the snow/ice albedo scheme, the snow parameterization and the extent of the initial ice sheet is investigated. The EC-Earth forcing fields (Tl159L62) are downscaled to the PISM grid (20kmx20km) using simple elevation corrections and the sensitivity of the response of the Greenland ice sheet to the different SMB fields is investigated by comparing the steady-states.