ARCSCM Description

The Arctic Single Column Model (ARCSCM) was developed as a single-column version of the Arctic Regional Climate System Model (ARCSyM; Lynch et al. 1995) and the Penn State/NCAR Fifth-Generation Mesoscale Model (MM5; Grell et al. 1994). It was originally designed to simulate 1D thermodynamic feedbacks and to test physical parameterizations in the context of the Arctic system (Morrison et al. 2003). Physical parameterizations include the Rapid Radiative Transfer Model for longwave radiation (Mlawer et al. 1997), CCM2 for shortwave radiation (Briegleb 1992), a nonlocal first-order boundary layer scheme (Holtslag and Boville 1993), and large-scale cloud microphysics (Morrison et al. 2005). For the MPACE intercomparison the convective parameterization is not used. Fractional cloudiness is not considered; cloud fraction is unity if condensate is present (> 10^-5 g m^-3), and zero otherwise.

The cloud microphysics scheme is a two-moment bulk parameterization that predicts the mixing ratios and number concentrations of cloud droplets, cloud ice, rain, and snow. Gamma functions are assumed for the shape of the hydrometeor size spectra. A number of microphysical processes transfer water between the various hydrometeor species and water vapor, including freezing, riming, accretion, and autoconversion. Droplet activation is calculated using the Abdul-Razzak and Ghan (2000) scheme coupled to a sub-grid vertical velocity diagnosed from the turbulent eddy diffusion coefficient.

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