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A 3D-CTM with detailed online PSC microphysics : analysis of the Antarctic winter 2007 by comparison with CALIPSO satellite observations

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A 3-D Chemical Transport Model (CTM), with full stratospheric chemistry and driven by the ECMWF wind fields, is coupled to the PSC microphysical model PSCBox (F. Daerden et al., ACP, 7, 1755-1772, 2007). This interactively describes the formation and evolution of four types of PSC particles (STS, SAT, NAT, and ice) through relevant microphysical processes (condensation and evaporation of particles, sedimentation, etc.). The number density and composition of each type of particles are computed for a binned size distribution. As a result, the treatment of sedimentation as well as the calculation of surface area densities are accurately performed. One of the benefits is that these surface area densities are used to obtain the heterogeneous reaction constants. Moreover, PSCBox is able to compute the same optical properties as those measured by the so-called Cloud-Aerosol LIDAR with Orthogonal Polarization (CALIOP) onboard CALIPSO. Our model results of the evolution of PSC areal coverage and composition are compared to the CALIPSO observations during the 2007 Antarctic winter.