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Microphysical modelling of a mid-latitude polar stratospheric cloud event: Comparisons against multiwavelength ground-based and spaceborne lidar data

J. Jumelet (1), S. Bekki (1), P. Seifert (2), and J. Pelon (1)

(1) IPSL/CNRS, Service d'Aéronomie, Paris, France (julien.jumelet@aero.jussieu.fr), (2) Leibniz Institute for Tropospheric Research, Leipzig, Germany

A newly developed high resolution transport model containing a size-resolving microphysical scheme is used to study a large-scale polar stratospheric cloud (most certainly a liquid PSC) case detected by lidar at mid-latitudes between February 17th and 23rd, 2008. The model simulations are validated locally against ground-based lidar (IfT MARTHA lidar, Leipzig, Germany) and globally against spaceborne lidar (CALIOP/CALIPSO) backscatter measurements. The comparison between the spaceborne and ground-based lidar measurements above Leipzig is satisfactory with an average backscatter ratio of 3.1 observed on February 20th. The microphysical-transport model is found to be able to reproduce the lidar measurements when a 1 K cold bias is assumed for the ECMWF temperatures. Assuming a cold bias and equilibrated PSC particles, our model produces time-evolving fields of optical and geometrical parameters such as the total surface area density (A) and volume (V). A, V, and the median radius of the model-calculated PSC size distribution are compared to the corresponding values derived from the ground-based multiwavelength lidar backscatter measurements. Overall, a good agreement is found between the model calculations and the Leipzig lidar-derived size distribution parameters, with A and V around 10 μm2.cm-3 and 1 μm3.cm-3 respectively and a median radius of around 0.3 μm at 21 km. The horizontal extension of the cloud is analysed. Again, our model calculations are found to be in a good agreement with CALIOP/CALIPSO PSC fields. This type of successful validation of PSC parametrisations in chemistry-transport models is a prerequisite for the calculations of ozone depletion potential.