Geophysical Research Abstracts
Vol. 18, EGU2016-16004, 2016
EGU General Assembly 2016

Evaluation of Antarctic polar stratospheric clouds data obtained by ground based lidars (at Dome C, McMurdo and Dumont D'Urville) and the satellite based CALIOP lidar system versus a subset of CCMVAL-2 chemistry-climate models.

Marcel Snels, Federico Fierli, Mauro de Muro, Chiara Cagnazzo, Francesco Cairo, and Luca Di Liberto
CNR, ISAC, Rome, Italy (m.snels@isac.cnr.it)

Polar stratospheric clouds play an important role in the ozone depletion process in polar regions and are thus strongly linked to climate changes. Long term observations are needed to monitor the presence of PSCs and to compare to climate models. The last decades PSCs in Antarctica have been observed by using the CALIOP lidar system on the CALIPSO satellite and by ground based lidars at Dumont D'Urville, McMurdo, Casey, and since 2014 at Dome C.
We evaluate the Antarctic PSC observational databases of CALIPSO and the ground-based lidars of NDACC (Network for Detection of Atmospheric Composition Changes) located in McMurdo and Dumont D'Urville and Dome C stations and provide a process-oriented evaluation of PSC in a subset of CCMVAL-2 chemistry-climate models. Lidar observatories have a decadal coverage, albeit with discontinuities, spanning from 1992 to today hence offering a unique database. A clear issue is the representativeness of ground-based long-term data series of the Antarctic stratosphere conditions that may limit their value in climatological studies and model evaluation. The comparison with the CALIPSO observations with a global coverage is, hence, a key issue. In turn, models can have a biased representation of the stratospheric conditions and of the PSC microphysics leading to large discrepancies in PSC occurrence and composition.

Point-to-point comparison is difficult due to sparseness of the database and to intrinsic differences in spatial distribution between models and observations. However, a statistical analysis of PSC observations shows a satisfactory agreement between ground-based and satellite borne-lidar. The differences may be attributed to averaging processes for data with a bad signal to noise ratio, which tends to smear out the values of the optical parameters.

Data from some Chemistry Climate models (CCMs) having provided PSC surface areas on daily basis have been evaluated using the same diagnostic type that may be derived CALIPSO (i.e. frequency of PSC occurrence function of lon-lat, height and temperature) showing large differences that may be explained by the interplay of model temperatures that may show a large bias and the microphysical scheme itself. Models may indeed show an excess of NAT formation relative to ice clouds or an unrealistic dominance of ice. In general, they show a somewhat too efficient PSC production with temperature decrease below NAT formation temperature. Evaluation CCMs with ground-based instruments databases should be done with great care due to the large spatial differences inside the polar vortex that are not fully reproduced by the models. In turn, longer series as provided by NDACC should be used to evaluate interannual variability and trends that is difficult to identify in the shorter CALIPSO database.