Geophysical Research Abstracts
Vol. 21, EGU2019-9693, 2019
EGU General Assembly 2019

Investigation of photon path length distributions derived from oxygen A-band measurements of GOSAT

Beke Kremmling (1), Steffen Beirle (1), Marloes Penning de Vries (2), and Thomas Wagner (1)
(1) MPI für Chemie, Mainz, Germany (beke.kremmling@mpic.de), (2) MPI für Chemie, Mainz, Germany (now at DWD, Offenbach am Main, Germany)

Photon path length distributions in the atmosphere are significantly affected by multiple scattering events in the presence of clouds. Here, we present an investigation of photon path length distributions for different cloud situations by combining high resolution space based measurements of the oxygen A-band with radiative transfer simulations. The measured spectra originate from the GOSAT TANSO-FTS instrument whose high spectral resolution allows to almost entirely resolve individual absorption lines, which is a prerequisite to our study. The spectra are compared to radiance simulations from the Monte Carlo Model McArtim. The simulation output provides information on each simulated scattering event which is used to infer photon path length distributions.

The agreement of the simulations to the measurement is evaluated using a fit function which considers small wavelength shifts and a correction of the simulated oxygen absorption. To verify the retrieval method, clear sky situations and well characterized cloud situations have been selected using collocated measurements of TANSO-FTS, CALIOP (CALIPSO) and CPR (CloudSat). The selected cloud situations include two one-layer cloud cases and one multiple layer cloud system. We have observed an overestimation of the simulated oxygen absorption by 5-10% for the clear sky measurement over bright surface and the one-layer cloud scenarios. This observed overestimation is currently investigated by considering a larger number of case studies. The multiple cloud layer system yields multiple results, two of the resulting cloud scenarios having a high resemblance to the collocated radar-based cloud profile. This shows that the retrieval can be used to determine basic properties of the cloud system. Overall, the results are promising and demonstrate that oxygen A-band measurements of GOSAT can provide information on the photon path lengh distributions in clouds.