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Mitigating the impact of surface reflectivity inhomogeneities on limb scattering ozone retrievals from OMPS

The focus of this study is the investigation and the mitigation of a retrieval artefact identified in tropospheric ozone data and ozone limb profiles retrieved from OMPS-LP observations at the University of Bremen (IUP). This artefact is associated with inhomogeneities in the surface reflectivity along the satellite line of sight (LOS). At IUP, a tropospheric ozone column (TrOC) product has been produced by exploiting the limb-nadir matching technique applied to OMPS observations. In this data set, we noticed an artefact in the tropical Pacific region, i.e. higher ozone columns in the [0°N, 5°N] latitude band, where the tropospheric ozone is expected to be fairly homogeneous. This issue was traced back to the stratospheric profiles, which show a lower ozone content at their peak altitude. This feature is also visible in the Atlantic, though less pronounced, and exceeds the typical uncertainty of the TrOC, being of the order of 5-7 DU. Other stratospheric ozone column (SOC) and TrOC data sets, e.g. the NASA OMPS and SCIAMACHY TrOC products show a similar pattern in the tropical Pacific. In preliminary studies, we associated this pattern with the semi-permanent presence of the Inter-Tropical Convergence Zone (ITCZ), a region of high surface reflectivity that crosses the satellite LOS.

The present contribution belongs to the ESA ENFORCE project, which has the aim of implementing in the radiative transfer model SCIATRAN at IUP the possibility of taking into account variations of the surface reflectivity along the satellite LOS (2D mode) to mitigate the described artefact. The final goal is the improvement of the TrOC product derived from satellite limb scattering measurements, and the outcome could be of interest to any limb scattering instrument, e.g. SCIAMACHY and ALTIUS.
We present the first results of the retrievals performed using the SCIATRAN 2D mode. First, we used simulated case studies to better investigate the impact of different idealized distributions of surface reflectivity on the retrieved profiles. Then, we compare the results obtained with the SCIATRAN 2D mode on a subset of OMPS observations with the standard 1D SCIATRAN retrievals and with collocated MLS observations. Finally, we address the impact of the implemented correction on TrOC derived using the limb-nadir matching technique.

Topic

Current and past limb and occultation instruments: algorithms, products, validation

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