Validation of the Limb-Nadir-Matching Method for the Determination of Tropospheric Ozone in the Subtropics and Middle Latitudes

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Introduction

SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric ChartographY) launched in March 2002 measures sunlight, transmitted, reflected and scattered by the earth atmosphere or surface (240 nm - 2380 nm) [Boenke mann et al. 1999, Gottwald et al. 2006]. SCIAMACHY Ozone (O3) Limb and Nadir measurements can be used to retrieve the tropospheric O3 column through Limb-Nadir-Matching [Sterk et al. 2006]. The thus retrieved results will be compared here with results determined by 6 Ozonesondes, which are part of the WOUDC Database (http://www.woudc.org), between the latitudes 20°N and 40°N. The positions of these Ozonesondes are shown in Figure 1.

Clouds

Clouds make it very difficult to determine the total column O3 directly as the view to the surface is obscured. In order to retrieve the total column O3 a ghost column [Lerot et al. 2009] signifying the amount of O3 under the clouds is often added. For Limb-Nadir-Matching this would mean that a significant part of the retrieved tropospheric column will be made up by ghost column. As this can significantly increase the errors in the tropospheric column retrieved through Limb-Nadir-Matching only Limb and Nadir pixels that are completely cloud free were used.

Figures 3a-f all show a good match determined from Limb-Nadir-Matching and Ozonesondes in 2005. However the focus on only completely cloud free pixels severely limits the number of measurements from Limb-Nadir Matching. This features prominently in Figure 3c-d. Figures 3c-d show a very limited temporal overlap between Limb-Nadir Matching and Ozonesondes

Results

These first results indicate that Limb-Nadir-Matching has the potential to retrieve tropospheric O3 globally outside the tropics, where the height of the tropopause is more or less constant. In order to use this method on a global scale further validation, in the tropics, sub tropics and higher latitudes, has to be conducted using additional Ozonesondes, longer time series as well as other satellite instruments. Additionally the effect of clouds on the retrieval has to be determined in order to get a better coverage.

Conclusions

References

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