Geophysical Research Abstracts
Vol. 12, EGU2010-5000, 2010
EGU General Assembly 2010

Horizontal gradient studies for SCIAMACHY trace gas measurements in limb only mode

Janis Pukite (1), Sven Kühl (1), Tim Deutschmann (2), Steffen Dörner (1), Patrick Jöckel (3), Ulrich Platt (2), and Thomas Wagner (1)

(1) Max Plank Institute for Chemistry, Satellite Remote Sensing, Mainz, Germany (janis.pukite@mpic.de, +49 6131 305 382), (2) Institute of Environmental Physics, University of Heidelberg, Heidelberg, Germany, (3) Institute for Atmospheric Physics, German Aerospace Center (DLR)

Limb measurements provided by the Scanning Imaging Absorption spectroMeter for Atmospheric CHartographY (SCIAMACHY) on the ENVISAT satellite allow retrieving stratospheric profiles of various trace gases on a global scale. Combining measurements of the same air volume from different viewing positions along the orbit, a tomographic approach can be applied and 2D distribution fields of stratospheric trace gases can be acquired in one inversion. With this approach, it is possible to improve the accounting for the effect of the horizontal gradients in the trace gas distribution on the profile retrieval. This was shown in a previous study for the retrieval of NO2 and OClO profiles in the Arctic region near the polar vortex boundary.

In this study, we investigate the improvement for the profile retrieval also for midlatitudes and tropics: the tomographic retrieval is applied on measurements during special "limb-only" orbits performed on 14 December 2008. For these orbits the distance between consecutive limb scanning sequences was reduced to $\sim$3.3° of orbital circle (i.e. more than two times with respect to nominal operational mode). Thus the same air volumes are scanned successively by more than one scanning sequence. It is found that the profiles obtained by the tomographic 2D approach show significant differences to those obtained by the 1D approach, in particular for regions close to the stratospheric transport barriers (edge of polar vortex and subtropical transport barrier). Depending on the sign of the gradient along the line of sight, up to 50% higher or lower number densities of nitrogen dioxide for altitudes below the peak of the profile (around 20 km) occur.

The obtained data also allows to examine the systematic error if the horizontal gradient is neglected and to study the impact of the gradient strength on the profile retrieval. These findings for the actual SCIAMACHY observations are verified by sensitivity studies for simulated data. In addition, the impact of the horizontal distance between consecutive limb scanning sequences on the quality of the tomographic 2D retrieval is investigated and a possibility to take into account the horizontal gradients by an interpolation approach is studied.