Geophysical Research Abstracts, Vol. 7, 02341, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02341

Use of CO_2 Q branches for pressure and temperature retrieval in the Geo-fit analysis of MIPAS spectra

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Recently a new retrieval algorithm has been proposed for the MIPAS-ENVISAT instrument; the Geo-fit approach [1] based on the simultaneous analysis of spectra taken along the whole orbit. In this approach, that allows to model the horizontal variability of the atmosphere, the accuracy of pressure (p) and temperature (T) profiles retrieval is a crucial task for the correct modeling the limb-emission signatures. The inversion of MIPAS spectra is performed on selected narrow spectral intervals (micro-windows, MWs). For the retrieval of p and T, the intense CO_2 Q branches in the 15 μm region are the most interesting due to their high signal-to-noise ratio and to the high sensitivity to p-T parameters. Nevertheless they have been always avoided in MW selection due to the deficiency in modeling the line-mixing effect which strongly affects the Q branch. Nowadays, accurate line-shape models are available, therefore the effectiveness of using CO_2 Q branches for p-T retrieval can be finally considered. The inclusion of a recent line-mixing model [2] in the Geo-fit analysis of MIPAS spectra and the subsequent variation in the retrieval accuracy of p-T profiles will be the subject of this paper. The global improvement in reproducing the CO_2 IR spectrum will be shown in Q as well as in P and R branches affected by line-mixing. Furthermore, the increase in the accuracy of p-T profiles will be shown when adding to the analysis spectral points previously discarded because affected by the line-mixing. Finally, a new set of MWs will be proposed, considering only the two most intense Q branches of CO_2 in the 15 μm region. The use of this new set of MWs leads to a significant accuracy improvement of p-T profiles with respect to the previous MWs selection. Furthermore, the reduced number of spectral points in the new MWs gives a better trade-off between run time and retrieval precision.

References

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