Atmos. Chem. Phys. Discuss., 6, S7331–S7334, 2007
www.atmos-chem-phys-discuss.net/6/S7331/2007/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Interference errors in infrared remote sounding of the atmosphere" *by* R. Sussmann and T. Borsdorff

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Received and published: 23 March 2007

Final Response to Anonymous Referee #2

We like to thank Referee #2 for carefully reading this manuscript and making very helpful suggestions for improvements to this paper. In final response, we thereafter provide positive point-to-point replies to all referee comments (given in italics).

"... it should be noted, that the H2O interference for the Zugspitze is weaker, than for spectra, recorded from the sea level. Results of a similar study for those spectra would be different."

We agree, and amended the manuscript accordingly (within Section 3.5.3 of the revised manuscript):

"... We note that the Zugspitze is a dry site and CO-H_2O interference errors would be

even higher for low altitude sites."

"A weak point of the paper is a "bulk" consideration of the retrieved and aircraft profiles. Meanwhile, special cases of high humidity, layers polluted by forest fires, etc., should be selected and analysed separately, with references to back trajectories and/or satellite data."

We agree that the errors would be different in magnitude for the mentioned situations. However, we feel that treatment of different geophysical case studies would not necessarily support the insight to the basic method we are presenting in this paper, and should therefore be subject of upcoming applications of the method.

"A proper choice of microwindows is important. A result of an experiment with widening a standard RRC microwindow to include 2158.11 cm-1 H2O line can be easily predicted, it looks trivial, but, probably, this exercise is useful as an illustration. It may be noted that an optimisation of microwindows would be a matter of a special publication. Moreover, this would be the best way to minimize all retrieval errors, including interference errors."

We thank for this comment. In fact our initial text has been rather short with respect to this important point, which is nontrivial in fact. To clarify, we amended the revised manuscript this way:

"...
2.4.3 Impact of microwindow selection

The question is whether the interference errors as well as the overall (smoothing and interference) error are decreased or increased by widening microwindows. The answer is nontrivial, i.e., the sign of the net effect depends on the type of constraint applied to the interfering species, in detail as follows.

2.4.3.1 Impact in case interfering species are not retrieved

If the interfering species are not retrieved, the interference error will dramatically in-

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crease for a widened microwindow which is additionally including significant signatures of the interfering species. At the same time, a widened microwindow increases information content for the target species slightly, i.e., the smoothing error is slightly decreased. The net effect will be a significant increase of the combined error (comprising smoothing error and interference errors). Therefore, if the interfering species cannot be retrieved due to computation power limitations (e.g., this is the case in some satellite retrievals), minimization of the interference effect can be taken care of by systematic microwindow selection, targeting at minimal inclusion of strong signatures of the interfering species, while preserving the main features of the target species as well as possible (e.g., von Clarmann and Echle, 1998; Echle et al., 2000; Dudhia et al., 2002).

2.4.3.2 Impact in case the optimum strategy for retrieval of interfering species is applied

In case the optimum strategy (proposed in Section 2.4.2) is implemented for retrieval of the interfering species, a widening of microwindows is uncritical, i.e., it does not increase the combined error (comprising smoothing error and interference error), and it leads to a slightly smaller combined error instead. Note that this is just the opposite of what holds true for the case of unretrieved interfering species (Section 2.4.3.1).

The reason for this is that in case of a fine-grid profile retrieval of the interfering species with minimized regularization strength, the interference error has been reduced below the smoothing error (optimum strategy proposed in Section 2.4.2). Therefore, widening microwindows now has the main effect of increasing the information content for the target species, and a new optimization will again reduce the interference error below the smoothing error. The net effect will be that the combined error (from interference and smoothing) will be (slightly) reduced by widening microwindows (at the cost of increased computation time). In other words, the details of microwindow selection become uncritical for a setup using fine-grid profile retrieval of the interfering species with minimized regularization strength (optimum strategy proposed in Section 2.4.2). This is a crucial point of our paper. It will be demonstrated for a real sounding in Section 4.3.2.

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..."

End of response.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 13027, 2006.

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