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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A self-adapting and altitude-dependent regularization method for atmospheric profile retrievals" *by* M. Ridolfi and L. Sgheri

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A method for calculating altitude dependent Tikhonov constraints for atmospheric retrievals was previously introduced in Kulawik et al. (2006), "Calculation of Altitude-Dependent Tikhonov Constraints for the Tropospheric Emission Spectrometer (TES) Nadir Retrievals". In this paper, the vector you have called lambda was selected to optimize a function of the mean a posteriori error covariance and degrees of freedom, and combinations of 0th 1st, and 2nd order Tikhonov constraints were considered. Pre-determined altitude-dependent 0th and 1st order Tikhonov constraints are currently used for temperature, water, ozone, methane, and carbon monoxide nadir TES

retrievals, as described in Bowman et al. (2006).

Unlike Kulawik et al. (2006) the cost function in Equation 7 does not use the a priori covariance but instead has the tunable parameters w_e and w_r. How much must these be tuned for different species or atmospheric conditions to obtain optimal retrievals? Is my understanding correct that the results were validated using a single simulated retrieval, and one orbit of real MIPAS data? I would be interested in seeing results (retrieved vs. true) for an orbit of simulated data.

One of the challenges of TES water is the drop-off in sensitivity for pressures less than about 100 hPa to essentially zero. Does the form of Equation 7 allow for markedly different sensitivities at different altitudes? In other words, does the constraint tend towards a 0th derivative Tikhonov in altitude regions of zero sensitivity?

Was there a unique solution for Lambda (the constraint strength) at each altitude level? We set the constraint strength to a 2nd order polynomial as a function of altitude to reduce the number of parameters to solve for, otherwise the solution was unstable.

The results for MIPAS look very promising! Congratulations on the work so far, and good luck with the implementation for the MIPAS 2-D retrieval scheme.

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Kulawik, S. S., Osterman, G., Jones, D. B. A. and Bowman, K. W.: Calculation of altitude-dependent Tikhonov constraints for TES nadir retrievals, IEEE Transactions on Geoscience and Remote Sensing, 44 (5), 1334-1342, 2006.

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