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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Retrieval of temperature profiles from CHAMP for climate monitoring: intercomparison with Envisat MIPAS and GOMOS and different atmospheric analyses" *by* A. Gobiet et al.

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In the following I would like to comment on the statement by reviewer#1 that the following sentence in the paper is misleading: "MIPAS data is not biased against ECMWF, since the latter is used as a smoothing constraint rather than for Bayesian combination".

With his/her comment, the reviewer claims that MIPAS retrievals are based on minimizing a cost function which penalises $(x - x_b)$ departures. This is not true. Our MIPAS re-

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trievals are based on a cost function which penalises $(x(i)-x(i-1))-(x_b(i)-x_b(i-1))$. This is achieved by using a smoothness constraint matrix of the type $\gamma L_1^T L_1$, where γ is a scaling factor and L_1 is a first order finite differences operator. The use of this matrix instead of an error covariance matrix **is** relevant to the basic mathematics of inversion. Contrary to a covariance matrix, the matrix used here is singular and thus behaves entirely different. It is easy to show that a, say, 10 K hypothetical bias of ECMWF would **not** map onto our retrieval, because this bias cancels out in the $(x_b(i) - x_b(i-1))$ term of the penalty function. In the appendix of the paper of von Clarmann and Grabowski, 2007 (Elimination of hidden a priori information from profile data, Atmos. Chem. Phys., 7, 397–408, 2007) it is shown that the use of the first order finite differences operator does not constrain the column information but only how this information is distributed over altitude. Probably the reviewer assumes that we use a $\gamma L_0^T L_0$ type regularization matrix, where L_0 is identity or any other diagonal matrix; in this case our constraint would indeed work similar as optimal estimation, with all involved biasing problems, but this is not the approach actually used. Our understanding of the term "smoothness constraint matrix" is clearly defined in the referenced paper by von Clarmann et al., 2003, along with a discussion of the impact of a priori information (which in this case of course is reduced to degradation of altitude resolution). Problem 10.2 in the Rodgers book treats the problem of implicit a priori information by choice of a too coarse retrieval grid and thus has nothing to do with the problem discussed here.

References:

T. von Clarmann, N. Glatthor, U. Grabowski, M. Höpfner, S. Kellmann, M. Kiefer, A. Linden, G. Mengistu Tsidu, M. Milz, T. Steck, G. P. Stiller, D. Y. Wang, H. Fischer, B. Funke, S. Gil-López, and M. López-Puertas, Retrieval of temperature and tangent altitude pointing from limb emission spectra recorded from space by the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS), J. Geophys. Res., Vol. 108, No. D23, 4736, doi:10.1029/2003JD003602, 2003.

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T. von Clarmann, and U. Grabowski, Elimination of hidden a priori information from remotely sensed profile data, Atmos. Chem. Phys., 7, 397-408, 2007.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 3229, 2007.