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Atmospheric Measurement Techniques Discussions

Interactive comment on "Smoothing error pitfalls" *by* T. von Clarmann

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John,

thanks a lot for your comments!

My mentioning of the SPARC Data Initiative refers to the first project meeting at ISSI, Berne, where it was discussed if and how the different content of prior information of the different climatologies should be taken into account.

You suggest that the smoothing error is still a useful quantity. This contradicts my recommendation that the smoothing error should not be part of the error budget but that the averaging kernel should be provided instead. I tend to maintain my recommendation for the following reasons: (1) with the averaging kernel available, the data user can calculate a diagnostic quantity like the 'smoothing error' for the preferred altitude

grid, using Eq (16) of my paper. With the smoothing error provided instead, the user is forced to work on the native grid of the original data. (2) For the examples you mention, I think that it is not the 'smoothing error' in absolute terms (viz. the expected a priori induced difference between the true atmospheric state and the retrieval) what you actually need but the 'smoothing difference' as discussed in Section 6 of my paper. In my paper I do not criticize the latter application but I confirm that it is a powerful tool for profile intercomparison.

The smoothing error is discussed in the methodical framework of linear theory, and its refutation by a reductio ad absurdum takes place within the framework of linear theory. I do agree that there are issues with the averaging kernel which are not trivial to solve. Most of these problems, however, have to do with the fact that linear methods are pushed towards (or beyond) the limits of linear theory. Log retrievals or prior information orders of magnitude off the comparison profile raise problems due to the state dependence of the Jacobian K (otherwise it would be easy to transform the retrieval to another a priori). A thorough discussion of these issues, however, would force me to replace the framework of linear theory (in the narrow sense of this term) by a theoretical framework allowing state-dependent Jacobians where the linearization point has to be considered. I do not think that it is adequate to add that additional complication to the discussion since all this is not needed for the title issue of the paper. Workarounds to cope with such problems have already been developed and reported in the literature, and I do not think I should review these here. Instead, I will add a short caveat on the averaging kernel issue, along with some related references.

I cannot quite agree that it is only a subtle aspect that error budgets often contain quantities which do not propagate according to error propagation laws. Interpolation to another grid usually is one of the first things a data user does with the data, and in cases when the error bars of the original data contain the smoothing error, it will not be possible for the user to assign meaningful error bars to the interpolated profiles.

Thomas

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