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Interactive comment on “Smoothing error pitfalls” by T. von Clarmann

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Thomas,

Please consider this as "iteration 1" on my review as I wanted to make a suggestion first based on my experience and get your response before formally going through the paper and making comments (so for now please ignore the odd ratings I gave your paper as there does not appear to be a way for me to make a comment without rating your paper)

You mentioned in the acknowledgements that you were inspired to write this paper as a result of the SPARC intercomparison activities (which I was also involved in via Jessica Neu's inter-comparison paper). I think this paper would be quite a bit more useful if you added a few examples on why this subtle aspect of the smoothing error is important.

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I agree that most of these issues are resolved by simply supplying an averaging kernel associated with the measurement. That said, a bound on the smoothing error is still important when encountering logarithmically large differences between a remotely sensed measurement and a model or comparing measurements with very different sensitivities.

For example, in my recent methane papers using TES methane and CO (see Worden et al. ACP 2013), we could not directly use GEOS-Chem profiles through the stratosphere because the differences between GEOS-Chem and our a priori were orders of magnitude different in the stratosphere and these differences propagate into the altitude region of interest (in our case the troposphere) via the averaging kernel.

The approach we took to address this issue is to truncate at the tropopause which introduces an error equivalent to the cross-term $A_{\text{strat_trop}}^T S_{\text{strat_strat}} A_{\text{strat_trop}}$, where $A_{\text{strat_trop}}$ is the influence of stratosphere on troposphere.

A similar problem occurs in the SPARC inter-comparison problem in which limb measurements are being compared to TES nadir profiles but the stratospheric limb measurements are not sensitive to the mid and lower troposphere. Using the approach above introduces an error that is too large so in that case Jessica has to scale to scale an a priori in the troposphere so that it matches the limb estimate.

In both of these cases an error associated with limited vertical resolution (or lack thereof) affects the comparison and hence it is useful to at least bound the smoothing error to determine if the estimates are consistent to within the observation error plus this component of the smoothing error.

For these reasons, I would recommend that you augment your paper with some practical examples of this nature so that the paper becomes more useful for the remote sensing community.

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John Worden

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 3301, 2014.

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