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Interactive Comment

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

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Thomas,

My apologies for lateness in commenting on this paper. Here are some quick comments - it will be a couple of weeks before I can do a detailed job. I don't want to rate the paper yet.

I agree that smoothing error covariance is difficult to evaluate correctly, because S_e is usually not well enough known. I regard it as a qualitative measure, giving an indication of the magnitude of the difference between the retrieval and the true state due to the finite width of the averaging kernel. The averaging kernel itself is more helpful. (**GK**, not **GKV**)

Smoothing error, like the averaging kernel, is properly only defined on a 'fine' grid. Any attempt to evaluate it on a coarse retrieval grid is doomed to failure, for the reasons given in the paper. However the expression for smoothing error covariance given in eqn (16) appears to be in error. Rodgers (2000) eqn 10.3 leads to

$(WG_zK - I)S_e(WG_zK - I)^T$
whereas (16) would give

$(WG_zKWV - I)S_e(WG_zKWV - I)^T$
but WV is not a unit matrix. Effectively (16) strips out the fine scale variation from S_e.

The discussion about the possibility of arbitrarily large variation in the state vector at fine scales seems to be a red herring. Agreed it is conceivable, but no evidence is given that it actually happens, and experimental evidence from gravity waves seems to show the opposite. I haven't done an exhaustive search of the literature, but the first paper I turned up (http://www.atmos-meas-tech.net/4/1627/2011/amt-4-1627-2011.pdf) fig 5 shows a decrease with wavenumber in the region of k^{-3} towards small scales, which I think is typical of the scale of variation of atmospheric quantities. Incidentally, his can be used as a basis for extrapolating S_e to finer scales than have been measured, by considering a fourier representation.

Clive

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