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Interactive comment on "Multi-year comparisons of ground-based and space-borne Fourier Transform Spectrometers in the high Arctic between 2006 and 2013" *by* Debora Griffin et al.

Anonymous Referee #1

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A useful paper which clearly fits in the scope of AMT. Well organized an well written. I have just a couple of issues wrt language and method.

Method:

Sect 2: I understand that VMR is retrieved directly and I assume that you would have mentioned if one of the retrievals was in the log domain. If you have used direct VMR fits then everything is ok. If log(VMR) is retrieved for some instruments, then it should be mentioned and might add some complication in the inter-comparison and interpretation of averaging kernels etc.

p7 l33 - p8 l2. I am a bit confused because I thought that the formalism for error

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Discussion paper

C1

estimation in Rodgers 1976 where the error is directly inferred from the information matrix automatically includes the smoothing error (Eq 18 in Rodgers 1976). In contrast, in Rodgers 1990 the retrieval noise and the smoothing error (called null space error in Rodgers 1990) are evaluated separately. To my understanding only the Rodgers 1990 formalism allows to evaluate the pure noise without any smoothing error component (see also Eqs. 3.19 and 3.29-3.31 in the Rodgers 2000 book; 3.31 seems to be the one reported in Rodgers 1976, and it includes the smoothing error). Please clarify which error estimation formalism has been used and verify that the smoothing error has really not been included, not even implicitly via Eq 18 in Rodgers (1976).

p10 l22 and elsewhere: To judge how significant a correlation coefficient larger than 0.95 actually is, it would be necessary to also report the sample size along with the value. By the way, I suggest to mention somewhere that R is the correlation coefficient.

p10 l29 and elsewhere: There is a trap in comparing smoothed higher-resolution profiles with coarser resolved profiles. The application of the averaging kernel (Eq. 1) has considered also for the error of the better resolved profile (i.e. multiply the groundbased error covariance matrix from the left and the right (transposed) by the averaging kernel, $(S_{new} = AS_{old}A^T$, smoothing typically makes the errors smaller). Without consideration of the error propagation through the smoothing process, the conclusion from the comparison will be too optimistic. Please check if this propagation has been considered. This is relevant to all conclusions where the combined retrieval uncertainties are mentioned. Please verify that this error propagation of the smoothing operation is considered in the error estimates used, and mention this, because this is often forgotten.

Language:

p2 l24: "next" is ambiguous. I think it is typically understood as the one after the current (i.e. in this case the intro) but is used here for the one after the last mentioned. Perhaps "following" might be clearer.

p5 l20: "take approximately every 7 min". Here it is not quite clear to me if this is the

time for a single spectrum or for the resulting spectrum after co-adding.

p10 l15: I am always confused how the word DOFS is correctly used, particularly if DOFS are "large" or "many". My intuition says me that the "number of degrees..." is "large" but that the "degrees..." are "many" but I may be wrong.

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