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Interactive comment on “Time series inversion of spectra from ground-based radiometers” by O. M. Christensen and P. Eriksson

Anonymous Referee #2

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This paper presents a very nice method for optimizing the temporal resolution of vertical profile measurements for which the sensitivity varies as a function of altitude. It not only presents the theoretical framework, but also addresses a specific case of ground-based microwave water vapor measurements. It should certainly be published, with a few clarifications and corrections.

1560- line 14: It would be good to clarify here that a diagonal S_e for this system implies both that there is no channel-to-channel correlation (instrumental baseline) and (I would think) no long-term bias. I don't think that it would be a good idea to include a bias, but, formally, wouldn't that be appropriate?

1562- line 13-24: Why is there a correlation length associated with the error in the mean? If something is truly an “error in the mean”, doesn't that imply that (in the mean)

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the error is true always, not just for a long temporal period? E.g., if a particular instrument always measures 5% too low I don't see that this has any temporal correlation length. Perhaps the authors are trying to make a point here about seasonal variations (where the a priori might come from a climatology), but I'm not sure.

Figure 2 is a very nice illustration of the method.

1566- line 20: Assuming by averaging spectra together the sensitivity is increased (as shown in Figure 2), the reduction in the AVK should not be quite 1/16.

Figure 6 – What exactly does “H₂O [relative]” mean? Based on the fact that the 1-D measurements are more nearly ~ 1 , I would guess that a value of “1” implies that the retrieval is giving the a priori. Please provide the defining mathematical expression for this.

1573- line 8: Given the choices made for the errors in the NatMean method, the temporal resolution and the retrieval noise (as shown in Figure 5) actually are quite different from that of the averaging method even at 76km. Hence the results in Figure 6 between the two methods actually look quite different at this altitude; in contradiction to the statement made here. It's unfortunate that the authors did not choose an altitude where the retrieval noise was similar, but they should point the difference and explain it.

1573- line 21: How is the decreased measurement response due to the fitting of base-line polynomials taken into account in the method presented here? Does this mean that off-diagonal Se terms are now included?

Typos:

1557 – line 6: an “are” is missing after “altitudes”

1566- line 24: drop the “s” on “corresponds”

1575- line 12: drop the “s” on “makes”

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1577- line 14: drop the “s” on “applications”

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