The authors have generally addressed my original comments sufficiently, there is just one slight point I would like to comment on. My original comment and the author's reply:

Comment: Related to the above point, I have to wonder, is the covariance profile useful beyond a correction when applying the mean averaging kernel? My (perhaps wrong) interpretation is that when the covariance profile is 0, the mean of the retrieved profile is a smoothed version of the true mean atmospheric state. I suppose what I am asking is that if the covariance profile is not 0, is it wrong to interpret the retrieved mean as a smoothed version of the true atmospheric mean? If so, I would like to see a discussion of this included in the manuscript.

Reply: We are not aware of any other interpretation beyond the one offered. The interpretation that zero covariance means that the mean of the retrieved profiles is a smoothed version of the true mean atmospheric state is not true, at least not in a general sense. Assume a case with infinite noise, i.e., no measure ment information. The retrieval will then be identical to the a priori. Assume further that a constant (e.g. climatological) a priori has been chosen. The result will not vary at all. Thus also the covariance will be zero although the mean result is fully determined by the a priori, in shape and values.

The author's are certainly correct with their example, but I think the confusion comes from my (mis)use of the word "smoothing". If you take Eq. 6 from the manuscript and set the covariance terms to 0, you obtain

$$\langle \hat{x} \rangle = \langle x_a \rangle + \langle A \rangle (\langle x \rangle - \langle x_a \rangle).$$

This is the same as the standard "smoothing" equation that you would get for a single profile, with all of the quantities replaced by their means. So the point that I was trying to make is that if the covariance terms are zero there is an analogous interpretation for the mean profile compared to a single profile, which is no longer the case if the covariance terms are non-zero. I think that a statement to this effect in the manuscript would be helpful for the reader to better understand the implications of the covariance terms being zero or non-zero.