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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of Atmospheric and Aerosol Optical Depth Observations on Aerosol Initial Conditions in a strongly-coupled data assimilation system" *by* Milija Zupanski et al.

Anonymous Referee #2

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This article is ostensibly about the impact of using a coupled aerosol-atmospheric model in data assimilation. Unfortunately, one can not measure the impact of a change on a data assimilation system without proper verification. The "Degrees of Freedom for Signal", which is used as the dominant metric for success in this article, is not a sensible measure to use for verification as it does not measure ones distance from truth (or, in practice, observations). I suppose one could use this measure in a secondary role if one had already proven through traditional verification that the system was performing very well. The authors attempt to side step this issue on page 8 by stating that verification poses a "challenge", and while I agree it does in this case, it nevertheless still stands that we can't know the impact without verification against observations.

Similarly, showing analysis increments and measures of ensemble derived uncertainty misses the mark as these two measures as well as the DFS all can be manipulated to appear successful even when a data assimilation system is doing poorly. For these reasons I must recommend rejection of this article, but also I would encourage the author's to spend the time to construct proper verification against observations.

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