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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An online aerosol retrieval algorithm using OMI near-UV observations based on the optimal estimation method" *by* U. Jeong et al.

Anonymous Referee #2

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This manuscript describes an OE-based approach to retrieve AOT and SSA using OMI near-UV channels. Conceptually, it is a good idea to take into consideration the inherent measurement/retrieval uncertainties and a priori knowledge; however, it is not convincing that this approach is superior and has the potential to replace the current operational algorithm. My general comments are the followings:

1. This OE-based approach doesn't address the root of the retrieval problems by improving the cloud screening, using more accurate surface reflectance, vertical profile, and aerosol models. It appears that, in terms of retrieval, other than introducing a statistically based cost function, the basics are the same as the operational algorithm. If

this new cost function (Eq. 2) is dominated by the difference from the measurement which I assumed the operational algorithm tries to minimize, then it is not surprise that the OE retrievals are not quite different from the operational results. Figures 6 and 7 show the similar results from the operational and OE-based algorithms other than some outliers are eliminated by the latter.

2. For the error characterization, the merit of this OE-based approach should be a more accurate estimation of error for individual retrievals, i.e., the points on Figure 8b should be more or less along the dotted lines. More than 80% of retrievals falling between the dotted lines actually indicate a general overestimation of retrieval errors. It is disappointing that the OE-estimated errors are interpreted as the upper limit (envelope curve) instead of actual retrieval uncertainties; Also the claim of better performance of this error estimation is a little misleading since the error range is actually wider than the operational uncertainty envelope ($\pm$30% or 0.1). Based on Figure 8b, the estimated error for AOT of 1.5 is about 0.6 which gives an uncertainty range of about 40% of retrieved AOT.

3. For the online radiative transfer calculations, it is not clear how significant the improvements (eliminate interpolation errors and improve stability) are than using the traditional lookup tables. I hope the authors can have a discussion about the tradeoff between increase of accuracy and loss of efficiency, and whether it is recommended to use this method in operational retrieval.

4. Another general comment is about the comparison between the operational and OE-based retrieval results. Since this manuscript has so much focus on statistics, it is a bit disappointing to see the comparison is not examined in terms of statistical significance, it would be more convincing that "the OE method showed better results" if the difference is statistically significant.

My specific comments:

1. Line 65, delete "(2013)"

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2. Line 119, “and spectral contrast, I354/I388, for the measurement vector”

3. Line 133-160, in this section, there is confusion about the terms of “uncertainty” and “error” and symbols of σ and ε. For example line 138 says $\varepsilon\lambda$ is “the absolute uncertainty” which is the “square root of the sum of squared radiometric random noise and calibration accuracy” (line 133), while Eq. 6 indicates it is the sum of “the random and system components radiometric error” (line 145).

4. Line 211, the references are missing.

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