Atmos. Meas. Tech. Discuss., 7, C3756–C3758, 2014
www.atmos-meas-tech-discuss.net/7/C3756/2014/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Use of neural networks in ground-based aerosol retrievals from multi-angle spectropolarimetric observations" *by* A. Di Noia et al.

Anonymous Referee #3

Received and published: 17 November 2014

1. This paper uses a neural net approach to determine a first guess for an iterative aerosol retrieval scheme. The authors demonstrate with simulated and ground-based sun photometer data that this approach can be computationally faster and less demanding of storage than look-up tables often used for such problems, and that the results are systematically better than using a look-up table (LUT). This paper is appropriate for AMT, but I have some questions, mainly about why the quality of the LUT approach seems so poor in this study.

2. Introduction, P. 9050, line 19. The following paper might also be worth citing here: Radosavljevic, V., S. Vucetic, and Z. Obradovic, 2010. A Data-Mining Technique for

Aerosol Retrieval Across Multiple Accuracy Measures. IEEE Geosci. Remt. Sens. Lett. 7, pp. 411-415.

3. P 9054, Table 1. The LUT values given here are not necessarily optimal. For example, there can be some advantage in creating tighter grid spacing in regions of scattering-angle space where particle single-scattering phase functions tend to vary most rapidly. Similarly, an adaptive grid in AOT space can also improve LUT performance. This comment does not detract from the neural net approach favored here, but does suggest that might be ways to obtain better results from a LUT as well. Some indication of the interpolation error tolerance for the LUT values chosen would be helpful.

4. P 9056, lines 17-20. Approximately 90% of the simulated data was used to train the NN, and only 10% to test the result. Do the 10% adequately cover the range of conditions in a statistically meaningful way?

5. P 9057, line 17. I'm wondering why the error is assessed against the generic, noise-free (y) rather than the original measurements. This seems to imply a very high confidence in identifying noise in the original data. (I see now that you get to this to some extent later in the paper.)

6. P 9064, line 14. I'm not surprised that the NN provides a better initial guess than the LUT, so convergence is faster, as expected. But why would the PT systematically not reach as good a solution when initialized by the LUT, if convergence is achieved? (According to Figure 3, convergence is achieved in essentially all cases before the 20-iteration cutoff.) Is it that the PT finds local minima when initialized by the LUT, whereas the NN finds a global minimum, and if so, why might the LUT guess wrong so consistently?

7. P 9065, lines 19-20. There might be a reason the AERONET Level 2.0 (quality assured) particle property data are not available. See Note 10 below.

8. P 9066, lines 11-14. Do the six points in Figure 4 having values <1 for the NN and values >6 for the LUT have some underlying characteristics in common? For example, are they all outside the range of applicability of the parameter space defined for the LUT? Similar question for the points that failed to converge altogether for the LUT but not the NN approach.

9. P 9066, Figures 6 and 7. It is difficult to see what is going on here in any detail. Perhaps you could plot the difference between the AERONET validation data and the LUT+PT or NN+PT values.

10. P 9067, lines 10-13. AERONET sky scan retrievals are not considered to be of good quality unless AOT_440 > 0.4 [e.g., Dubovik et al. JGR 2000]. Except perhaps for the AOT peaks on 07 and 09 July, this appears not to be true. This raises a question about the results of Figure 6 and especially 7, specifically for AERONET, but perhaps also for the other retrievals.

11. Maybe it would be worth comparing Angstrom exponents, as these are reported from AERONET direct sun measurements, which are Level 2.0, and although they are less specific than fine-mode AOT, etc., about particle size, they are also less dependent on the definitions of the modes.

12. P 9067, line 27 ff. What happens if an actual atmospheric column contains an aerosol mixture not consistent with the assumed bi-modal distribution, either because the individual aerosol components are not represented in the particle microphysical property parameter space, or because there are more than two modes present?

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 9047, 2014.