

Interactive comment on “Satellite retrieval of aerosol microphysical and optical parameters using neural networks: a new methodology applied to the Sahara desert dust peak” by M. Taylor et al.

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I would like to thank Alexandra Tsekeri for kindly suggesting some small modifications to the manuscript. In answer to your individual points:

1. "Page 10956, lines 24-26, 'The network...daily timescale': The data that fall in the acceptable uncertainty (39-45%) refer to the dataset used for the NN testing, which is far from broad to be able to deduce such a general remark."

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Thank you for this comment. Referring to Fig. 10 of the manuscript which shows the difference between the NN and AERONET for the simulation case of SSA at Dakar, the uncertainty limits of Mishchenko et al. (2007) are presented as a shaded grey band (± 0.02). In the case of this parameter (the SSA at 440nm) over 73% of the test data is within the uncertainty level. In the case of the real part of the refractive index (described in the introduction), the percentage of the test sample (simulated at Dakar) that falls within the uncertainty level (± 0.02 for the real part of the refractive index) is in the range: 38.922% to 44.910% as stated in the introduction and shown in the attached figure 1. The statement in the abstract does not need correction.

2. "[Page 10967, lines 9-14], 'While we are conscious...presented here'..."

Thank you for this edit. This will be revised as proposed in the revised manuscript.

3. "Page 10972, lines 20-24, 'In Table 3...the AERONET AAOD at 440 nm' Page 10974, lines 2-8, 'Finally,... on the scale of radial bins': The mean value of all correlations $\langle AVSD \rangle$ is obviously not calculated right." ...

Thank you for your comment. Unfortunately, you have misunderstood what $\langle AVSD \rangle$ refers to. It is described in detail in the section spanning lines 19-30 of page 10978 and continues on lines 1-15 of page 10979. While you are correct in pointing out that the individual regressions for each radial bin peak at approximately $R=0.47$, the $\langle AVSD \rangle$ measures the correlation between the entire 22-bin AVSD from NN and the entire 22-bin AVSD from AERONET on each day. The $\langle AVSD \rangle$ measures the mean value of these (entire AVSD) correlations. Fig. 7 shows the behaviour of these correlations with AOD(470). The stated mean is $R=0.918$ on the plot. Note the sizeable value of the standard deviation = 0.174.

4. "Page 10973, lines 9-14, 'As described in Appendix A,...that depend sensitively on it': I don't believe that the location of the mode separation point plays that big of a role."...

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Thank you for presenting your opinion. It is now known (especially in the case of the dust aerosol) that AERONET over-estimates the location of the mode separation point (see Taylor et al. Atmos. Meas. Tech. Discuss., 6, 10571–10615, 2013).

5. "Page 10975, lines 8-10, I don't think this is a valid conclusion considering the training performance. It varies too much with the case to be able to say."

Thank you for your comment. The stated conclusion still seems the most plausible here.

6. "Page 10976, lines 23-28 and Page 10977, lines 1-5, This is explainable...systematically lower than AERONET values (Remer et al., 2005)": The way the different instruments measure do not provide any explanation about the systematically lower AOD of MODIS and OMI compared to the AERONET AOD."

Thank you for your comment. The argument presented in the manuscript is a technical one attempting to provide an explanation for the under-estimation. An updated global validation between MODIS, OMI and AERONET as per the work of Remer et al. 2005 may help contribute to this important issue.

7. "Page 10981, lines 21-23, Exactly because the sample is small (and probably a subset of the training dataset), the NN testing performance can be better than testing it with a broader range of cases. Re-place as: "For all of the other parameters at least 60% of the retrieved daily-averages are within the accepted level of difference, which is a satisfactory result."

Thank you for your comment. I would like to point out that the NN was trained on NAF sites excluding Dakar. The testing sample at Dakar is unseen data as far as the NN is concerned and is therefore not a subset of the training dataset. Otherwise, your amendment to the end of the sentence in the text is fine and will be made in the revised version.

8. "Page 10982, lines 13-15, 'This error... (Dubovik and King, 2000)' Delete this, since

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the two errors are not really comparable (the error reported from AERONET denotes the difference from the "true" value, whereas the NN error denotes the difference from the AERONET value)."

Thank you for your suggestion. While the MARE and the MAE measure the difference between the NN simulated output and AERONET, the intention in the phrase you refer to was to place the size of the error that measure the simulation performance of the NN in a context (the error on the AERONET data was used as a point of reference).

9. "Page 10984, line 3, 'With regard to testing the ability of the NNs to extrapolate to unseen data at Dakar... ': There is no proof provided that the dataset from Dakar is out of the range of the training dataset. If it is a subset of the training dataset, there is not "extrapolation". Just to be on the safe side, the above should be written as: "With regard to testing the ability of the NNs to perform to unseen data at Dakar..."

Thank you for your observation. Yes, you are right here, the manuscript does not provide proof that the dataset from Dakar is outside the range of the training dataset. If the reviewers' request, I can provide the exact min-max ranges of the data at the NAF sites and at Dakar for clarification. Otherwise, your edit is fine.

10. "[Page 10984, lines 6-8], 'Having said this,...a near-zero mean error.' Replace with "Having said this, the histogram of the differences between NN PC outputs and PC targets at the training stage was found to present a sharply-peaked Gaussian having a near-zero mean error."

Thank you for this edit. This will be made in the revised version.

11. "Page 10984, lines 12, '... with known a priori AERONET data...' Write instead "...with AERONET data..."

Thank you for your suggested edit. It will be considered during preparation of the revised version.

Kind regards,

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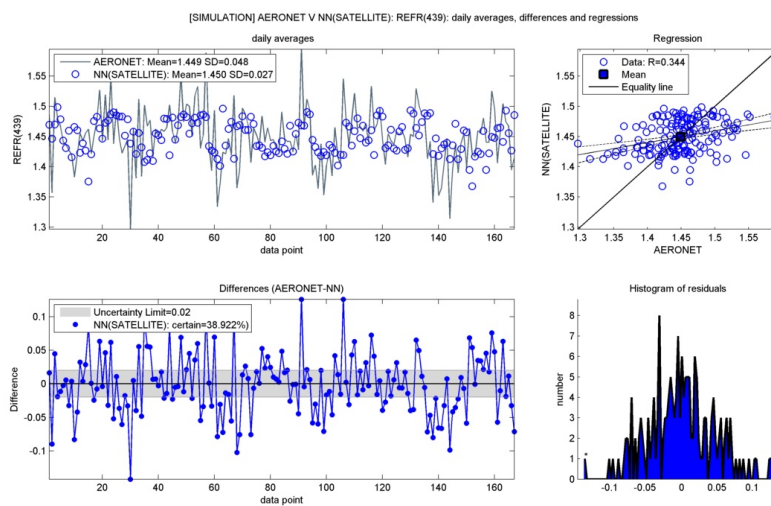


Fig. 1. The retrieval of the real part of the refractive index at Dakar

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