

Interactive comment on “Inter-comparison between the Aerosol Optical Properties Retrieved by Different Inversion Methods from SKYNET Sky Radiometer Observations over Qionghai and Yucheng in China” by Zhe Jiang et al.

Anonymous Referee #2

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The present study is highly important for both SKYNET products and for other sun-photometric instruments and networks that could potentially benefit from the enhanced approach of SKYRAD inversions methodology. A detailed comparison between the two versions of SKYRAD is missing from the literature and it is always a question for scientists handling SKYNET data. Stations selected for the study seem to provide a sufficient amount of data for this comparison. Additionally, authors have exploited these datasets to provide a climatology of aerosol properties at both measuring locations. However, the manuscript lacks of explanations on the causes of differences between

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the v4.2 and v5.0 retrievals and sufficient evidence on the actual seasonal variability of aerosols in the two regions. Algorithms of both versions are clearly described, but it is crucial to pinpoint and discuss the way the differences between the versions affect the retrievals. Since the two algorithms are not treated as a “black box”, it should be more clear which physical processes affects the retrievals and which atmospheric conditions could lead to highest uncertainty. At least some discussion on the uncertainty of each variable in each approach should be provided. Also, the part about the seasonal variability of aerosols properties, results are presented but not investigated and discussed in the level expected for a scientific study. Majority of readers are not unfamiliar with local weather systems and patterns, emissions, and these should be described in the manuscript. ÆThus, I suggest that the manuscript should be considered for publication in AMT after a major revision addressing these concerns.

Specific comments

P2 l5-7 This should be divided in two sentences because it is confusing. P3 l17 I assume this precision is for the sky radiance measurement, but it should restated to be clear. P3 l18 Some details on the calibration of these instruments should be added. P3 l19-24 More detailed description of the locations is needed. P5 l10 More details on the quality control and cloud screening procedures should be provided. P5 l5 Since the algorithm uses a priori a bimodal SDF, it should be presented as a finding that the retrieved SDF is bimodal (in abstract, conclusions and discussion of seasonal variations) P5 l17. I It would be useful to report the number of measurements fulfilling this criterion at both sites P5 l27 This sentence indicates that v 5.0 is more erroneous in coarse mode. Is there more evidence on that? Is that strictly due to algorithmic reasons? More discussion is needed on this effect.

Figure 1. It is really difficult to visually distinguish the differences between the two versions for most bins. Probably a different approach should be also demonstrated here (absolute differences, relative differences? histogram?) to facilitate reader’s comprehension. Also a x axes label is missing.

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Paragraph 3.2 Some physical interpretation and discussion about these differences is missing. Are they explained strictly algorithmically or is there some natural process driving them? Differences of SSA are really high, and have opposite behavior (more absorbing for v 5.0 in Qionghai and more scattering in Yucheng). Keep in mind that SSA values in the atmosphere have a very small range, and these differences are very high. SSA at 0.92 and 0.86 (example at Qionghai at January) indicate totally different types of aerosol. In addition, the different behavior at the two sites, makes it difficult to assume some systematical bias. Since there are no other independent data to validate which version is closest to the actual condition, I strongly suggest to investigate further this behavior. In the scientific literature you could find a number of approaches to select depending on the data available, but it is crucial at this point to have some evidence on the validity of the retrievals.

Figure 2. bar plots for mean monthly values and showing only the higher part of the error bar (which I assume is standard deviation but nowhere stated) is confusing. I suggest to visualize in another way. P7 I17 Frequency distributions are plotted in figure 3. Where probability distributions mentioned here could be found?

Figure 3. x axis label is missing Figure 4. x axis label is missing

General comment for 3.2-3.3. First, a more uniformly approach on the presentation of results should be applied. Treating histograms for refractive index and monthly averages for ssa, makes the datasets incomprehensible, since cannot be easily combined and provide a conclusion on the behavior. Also, some conclusions should be reached linked to the differences of the two versions and the causes of the variations. For that purpose, there should be some discussion about the algorithmic differences and the outputs. Finally, It is important to understand whether other parameters are linked to the differences. At least it should be investigated the corresponding aerosol loads (AOD) for each case. Does the difference increase/decrease with higher AOD? Is the elevation of the sky radiance measurements linked to the differences between the two versions?

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P9 I16-17 Some reference or some data are needed to provide evidence about the meteorological argument.

P9 I20 Further discussion and evidence are needed to support this argument.

P10 I14. By definition, SSA will decrease when absorbing aerosols increase. This sentence does not provide any explanation on the behavior. More detailed discussion should be added on these results.

Paragraph 3.4.2 Since for SSA the selection of version 4.2 or 5.0 could lead to different conclusions on the type of aerosols, some discussion on that issue should be added here. P10 I26-17 Since the algorithm uses bimodal fits, there was no way to find a different distribution

P11 I2-4. Why anthropogenic aerosols should decrease in winter/spring ? Are there any information on the human activities in the area? Why sea salt aerosols increase? Also, some information about the monsoonal influence in the region should be added for the readers that are unfamiliar with local climatology (preferably at the site description section at page 3)

P11 I6-8 Also fine mode is very high in summer (compared to Qionghai). Any interpretation on that? The only source of large particles in the area is dust long transport or are there any other sources? P11 I8. Also fine mode seemed to peak to almost double values in summer/winter compared to spring/autumn. Is there are any explanation for this behavior?

Figure 6. X axes label is missing

General comment for 3.4 I suggest to summarize the types and variations of aerosols in both sites in a more descriptive way at the end. Also, It would be very useful a discussion –based on earlier paragraphs- on the properties and conditions that both version come together and the conclusions that have higher uncertainties due to the deviations between the algorithms.

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P12 I16-18 There is no evidence in the study of the cause of this behavior (algorithm or type of aerosols?). More work should be done before coming to this conclusion.

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