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Atmospheric Measurement Techniques Discussions

Interactive comment on "MISR Dark Water aerosol retrievals: operational algorithm sensitivity to particle non-sphericity" *by* O. V. Kalashnikova et al.

Anonymous Referee #1

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Summary: This paper investigates the sensitivity of MISR retrieval to non-spherical aerosol over dark water. Specifically, it is noted that there is a significant amount of "non-spherical" aerosol retrieved over regions (e.g. southern oceans) where non-spherical aerosol is not expected. It is believed to be an artifact of the retrieval. Why? Four hypotheses are tested. In the end, the non-spherical artifact is shown to be primarily a result of cirrus clouds that are mistakenly retrieved as aerosol.

Assessment: While I have experience in satellite algorithm development, I am relatively unfamiliar with the details of the MISR aerosol retrieval algorithm. This was a very, very dense paper, with heavy use of MISR-specific jargon. It required more than average

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attention, which continues to explain why MISR data is not as popular as it should be. However, I think this to be a very good study, and I think is very publishable. I have no problem with the logic of the experiments and the conclusions that were made. I would like to suggest some effort be made to present using flow diagrams and bullets instead of long prose. Sometimes I would be reading along and have a question, only to find it considered later in the paper; some foreshadowing would be appropriate (see specific comments below). Finally, I find the color scale used (e.g. the green/purple/peach combinations) to be completely maddening.

Specific comments:

Page 1594: Lines 4-11: A very long sentence, should be split.

Page 1594: lines 15: With so many (74) aerosol mixtures, how sure are you that you don't already have too many? Or why not 75? Is MISR sensitive to all of these? Probably published in other papers, but maybe small description of what is here and what isn't might be helpful.

Page 1595: lines 12-16: The statement about size truncation is more important than should be simply referenced. My experience is that truncation is leads to missing radiation, especially as you go to longer wavelengths (e.g .NIR). Also Mie theory is not appropriate for non-spherical particles so truncation may lead to other artifacts.

Page 1595: Noting Figure 2: I can't read the text on the figure.

Pages 1596-1597: Thinking about what is plotted and discussed related to Figs 3-4. Really what we care about is "nonspherical AOD", not total AOD or non-spherical fraction. Who cares about nonspherical fraction when AOD is low? (Of course later discussion illuminates, but I would like to see a combined Fig 3-4 plot. Plus, since all panels look so similar (and are so small), maybe four seasons for each plot instead of 12 months.

Page 1597: Line 14: The word "true" bothers me. Either remove it, or use "expected".

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Page 1599: Lines 16:20: I don't follow this discussion. What about East/West position of sun? it will definitely change azimuth angles, and thus scattering angles.

Page 1599: This is an example where I would like some foreshadowing. Range of scattering angle is important, but so is where within the angle range. There should be difference whether measuring 130°-155° as compared to 110°-135°, as you wait three pages before getting to this.

Page 1600: Lines 5-10: Talking about sunglint. Both glint and scattering angles should be important. They are related, and are easily confused. Maybe plot of glint angle (nadir viewing) would help.

Page 1603-1604: Small spheres "looking" like large non-spheres has been a problem forever (known by AERONET, MODIS, etc).

Page 1606: Lines 5-16: This paragraph has redundant thoughts, and does not need so many repeated citations.

Page 1607: Thinking about MISR wavelength/channel/"bands" versus "bands" of retrievals on your hovemuller diagrams. Maybe use "channel" here (and furthermore) instead of "bands".

Page 1607: What is physical reason for channel weightings and not using blue or green bands in retrieval? Also noting equation (2), if for some reason instrument uncertainty was to approach zero.

Page 1608 : (line 20). In other words, statistically significant at 95% level.

Page 1609-1610: Would like some physical explanation for these chi-squared metrics. Also, why not use l=3 and l=4 for equations (4) and (5) like for equation (2)?

Page 1611: Equation (4). This 0.04 seems like a large number over black ocean surface. Should it be at least be dependent on wavelength? I understand that this is part of the discussion in this section, but the 0.04 seems wrong to begin with.

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Page 1618: Lines 16-18. This sentence makes no sense.

Page 1621: Good idea to use MODIS to identify cirrus. There really should be a joint MODIS/MISR retrieval. Can MISR stereo help define cirrus (which is presumably even higher in altitude than dust)?

Tables/Figures:

Table 1: Of course wondering about the rest of the MISR aerosol models. Which ones are #19 and #21? Finally, seems like super non-absorbing particles. What happens if the dust is a little "dirtier"?

Fig 2: Cannot read txt on images.

Fig 3-4: Very small figures. Is it necessary to have twelve months, rather than 4 seasons? Also would be nice to see AOD x Non-SphericalFraction = Nonspherical AOD

Fig 5: A clue that cirrus is a problem is that there are cases of >0.5 in the southern oceans. There is no significant source of high AOD.

Fig 6: (And many others). This color scale does not show dynamic range well. Maybe a standard EOS color scale would be better (or at least scale used by Fig 10). For aerosol 90° is not an important value.

Fig 11 (panel A): Why are the cameras overlapping?

Figs 13-18: Colorscale is not monotonic. Again suggest EOS of blue to green to yellow to red.

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