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Interactive comment on "A better understanding of POLDER's cloud droplet size retrieval: impact of cloud horizontal inhomogeneity and directional sampling" _by_ H. Shang et al.

Anonymous Referee #2

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General comments: The study investigates the effects of cloud inhomogeneity and directional sampling on the POLDER's cloud droplet size retrieval and comes to several interesting findings: (1) the sub-scale variability of in CDR and EV should be considered in the application; (2) the primary rainbow region measurements should employed so as to ensure the large droplet retrievals; (3) the retrieval can be applied with limited observations. These three findings have directive significance in improving the resolution of cloud droplet size retrieval of POLDER. A higher resolution is recommended in this work, and the newly derived CDRs are compared with official estimates. I recommend the manuscript to be published with the following minor revisions.

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Specific comments:

1. Page 6561, line4. The radiative properties of liquid water clouds depend both on the optical thickness and on the droplets size distribution parameters.

2. Page 6561, line6-8. The sentence brought the same meaning with the following one.

3. Page 6561, line 15. "Remote sensing of droplet size distribution" should be replaced by "the droplet size distribution retrieval from passive sensors".

4. Page 6561, line 21-23, the sentence is hard to understand: how to get the COT retrievals without measurements in visible bands?

5. Page 6562, line 2-3, the band used should be provided.

6. Page 6562, line 11, "However" is better than "Nevertheless"

7. Page 6562, line 27-28, this sentence is not necessary.

8. Page 6563, line 4. The sentence "allowing the CDR and EV to be determined simultaneously" should be removed.

9.Page 6563, line 8-13. This part need to be compressed.

10. Page 6563, line 17. Grammar error, please use conducted instead of conducting.

11. Page 6563, line 14-24. The overview of Alexandrov et al. (2012) is too long, and the sentence in line 20 brought no useful information. Please rewrite this part.

12. Page 6563, line 24. This paragraph seems has no relate with the former one, I suggest to add a transition sentence at the beginning.

13. Page 6564, line3, line 10. Please be consistent with the area units, do not use 150 km × 150 km and 25 pixel × 25 pixel alternately.

14. Page 6565, I suggest to add a subsection in Section 2 to illustrate the simulation

of the POLDER-like polarized reflectances.

15. Page 6565, line20. I think the sentence should be moved to the next paragraph as to fully describe Rp.

16. Page 6566, line 15. A reference is needed.

17. Page 6567. Please unite the last paragraph in Page 6567 and the first paragraph in Page 6568, and remove the duplicate content that already described in Instruction (page 6563, line 2-8). The structure of section 2.3 is not clear. I suggest to emphasize "what should do in every step of your retrieval", rather than just introduce the equations used.

18. Page 6568, line 14. Please summarize the improvements at the end of section 2.3.

19. Page 6569, line 3. The reference is needed for the linear regression fit method.

20. Page 6569, line 14-22. The part should be moved to the Section 2.

21. Page 6571, line 2-3. "Primary rainbow" is better than "main rainbow", remove "content".

22. Page 6571, line 20. It should be "POLDER CDR retrievals".

23. Page 6572, line 10-14. The two sentences have almost the same meaning. Please remove one.

24. Page 6572, line 24-25. The sentence is not clear, I guess you mean 32 observations along the whole scattering angle region. Also, this limitation need to be described when introducing RT3 model.

25. Page 6573, line 20. One cannot predict the results before applying tests, I suggest to add "may" before "also". Line 22-27. The language needs to be improved.

26. Page 6574, line 2-3. "The performance for 490nm is better than 670nm is attributable to..." can be short as "Better performance in 490 nm than that in 670 nm is

attributable to. . ."

27. Page 6574, line 5. Please leave a blank space behind "11". Line 7. I suggest to use "caused by" instead of "because".

28. Page 6574, line 17-18. I believe that the conclusion is in case that the measurements are limited.

29. Page 6576, line 23. "were" should be "are"; line 13. The degree symbol is missing; line 15. It is not clear to use "our results and the POLDER data".

30. Page 6576, line 19-21. The sentence is hard to understand, line 25. "leaded" should be "lead".

31. The first three paragraphs of Section 5 needs to be reorganized. The improvement of using primary rainbow region in Page 6577, line 19-21 should be discussed together with the content in Page 6578, line 13-20; the effects of directional sampling should be discussed together with the sub-scale retrieval tests using 7×7 pixels.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 6559, 2015.

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