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Interactive comment on “Shortwave direct radiative effects of above cloud aerosols over global oceans derived from eight years of CALIOP and MODIS observations” by Z. Zhang et al.

Anonymous Referee #2

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The authors present a thorough multi-year investigation into the frequency of occurrence, and radiative forcing due to, above-cloud-aerosols (ACA) over global oceans. The topic is of high relevance as, amongst other things, this is an area where global models show large diversity and, as shown in the present paper, the radiative effects can be significant. The study is well documented and presented, and includes some relevant sensitivity studies. I recommend publication in ACP, although with one important comment:

As the authors themselves point out, even in their conclusions, the necessary assumption that aerosols and clouds do not have diurnal variations may introduce significant

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biases. Would it not be possible to assess the importance of this e.g. using the PDFs used for Equation 10 as input to a simple MonteCarlo scheme? If so (and if I have understood their methods for calculating DRF correctly), this should not be much more work than the two other, very useful sensitivity studies already presented.

Also: In the present analysis, little use is made of the altitude of the aerosol layer. For absorbing aerosols, the radiative efficiency is expected to increase with altitude, which may be a significant part of regional DRF variations for smoke aerosol if there are difference in mean altitude of the aerosol layer. Is this possible to diagnose from the present dataset?

Minor comments:

- Throughout the manuscript, and especially in the figure captions, key terms such as “global mean” or “annual mean” are often missing. The meaning is clear from the context, but not always if one just looks up a figure.
- The region boxes are not drawn on Figure 1.
- P2636 | 12-17: If CALIOP proves AOT of ACA, what do the regional research algorithms provide in addition? The sentences seem to contradict each other.
- P26361 | 24: ? should be ‘s (Earth’s)

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 26357, 2015.

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