

# ***Interactive comment on* “Low cloud reduction within the smoky marine boundary layer and the diurnal cycle” by J. Zhang and P. Zuidema**

**Anonymous Referee #3**

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## **1 General comments**

1. The manuscript presents comprehensive observations of the boundary layer from a field campaign in Ascension Island, together with an analysis of the links between smoke and the diurnal cycle of low clouds. The paper is marked by a detailed and careful analysis.
2. The 'Introduction' section is a mixture of state-of-the-art review and motivation. In my view, a better separation of both would be helpful for the reader. After a literature review the open questions to be addressed here should be stated clearly, along with the hypotheses. Also, it did not become entirely clear to me why the diurnal cycle is of particular relevance.

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3. The paper is structured into a multitude of sections of markedly differing length. While this may make it easy for a reader to find specific information, it might help to further aggregate sections under unambiguous headings such as 'results' and 'discussion', or at least to make clear in the section headings which belongs to which category. My preference is aggregation.

## 2 Specific comments

1. page 1, line 0 (henceforth 1-0 etc.): In the title, it is not clear what "the diurnal cycle" refers to (clouds, obviously, from the text). Also, it is not clear that the link between smoke and clouds is at the center of this study. Suggestion "Smoke impacts on amount and diurnal cycle of low marine boundary layer clouds in the SE Atlantic" – or something similar.
2. 1-4: awkward sentence. Smale is not only "highly absorbing" in August. Please try rewording.
3. 1-9: What is a "surface-based" mixed layer?
4. 1-11: I don't understand what is meant by "increasing the moisture stratification" – how can a stratification increase?
5. 1-15: This sentence seems confusing and counter-intuitive to me. Absorbing aerosol decreases radiation at TOA, correct? So taking the difference between the least and most smoky terciles will yield a negative figure, i.e. a reduction. I suggest presenting this fact in this way.
6. 4-4: The subsection beginning here seems a mixture of process discussion ("orographic lifting clearly induces...") and a description of the context of the measure-

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- ments. I suggest moving the former to the state-of-the-art section, and giving the remainder a sub-title (2.1 Context of measurements, or similar)
7. 6-3: "suspected water" – I assume this refers to liquid water?
  8. 6-5: apparent LIQUID-water clouds (?)
  9. 6-7: How is this evaluated?
  10. 6-9: "For context" – what does this mean?
  11. 7-3: sunrise and sunset are not indicated in figure 7.
  12. 7-3: The peak is barely visible, therefore the reader cannot be sure that this 'peak' actually represents all or most individual days. One solution to this might be to show deviation from the mean cloud fraction of each day (daily cloud fraction anomaly) on the vertical axis instead of the actual cloud fraction.
  13. 7-9: See comment on cloud fraction, line 7-3.
  14. 8-13: What is a 'surface-based' layer?
  15. Fig. 21: I very much like this conceptual summary of your work. However, I ask you to consider the following points: Within each of the four phases, can the blue and red clouds be placed next to each other for visual clarity? 1) In the morning I find it hard to make out the exact borders of the blue clouds. 2) blue is in front of red in the first panel, behind in all others. 3) placing 'mignight', 'noon' and 'midnight' on the horizontal axis might help the reader. 4) the warming of the BL progresses during daytime. The red horizontal arrow in the morning should therefore point to the right. 5) Please explain all abbreviations in the caption.

### 3 Technical details

1. 1-3: "free troposphere" (no hyphen)
2. 1-6: "low-cloud cover" (cover of low clouds, not low cover of clouds). Also in other locations around the manuscript (e.g. 2-8, 6-12)
3. 2-3: deckS
4. 4-4: volcanically produced → volcanic
5. 4-15: remove "local"
6. 4-22: measureMENT
7. 4-22: concentration (no s)
8. 5-2: ...airport, yielding profile measurements of the complete boundary layer in 357 successful...
9. 6-18: August
10. 8-2: larger instead of higher
11. 8-23: warmest instead of 'the most warm'
12. 9-13: 'retrieved' instead of 'inferred'
13. 10-4: 'analyzed' instead of 'interrogated'
14. 12-15: 'infer' instead of 'intuit'
15. 15-1: 'is reduced' instead of 'reduces'

16. Fig. 13: 'means of' instead of 'mean'
17. Fig. 1: introduce 'rBC' in the caption
18. Fig. 10: harmonize size of labels between figures

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