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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Size-resolved aerosol and cloud condensation nuclei (CCN) properties in the remote marine South China Sea, Part 1: Observations and source classification" *by* Samuel A. Atwood et al.

**Anonymous Referee #2**

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General comments:

The paper presents a comprehensive and state-of-the-art aerosol size distribution and CCN dataset taken during a research cruise in the South China Sea. The aerosol cluster analysis in combination with the attribution of aerosol types to air masses and sources is interesting and relevant. The report of representative hygroscopicity values is very useful for the community. The paper is written in a good and clear language, but could be made more concise by dropping repetitions of observations. The scientific content is largely descriptive and should be made stronger by putting the results into



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Discussion paper

context. This is particularly important for the following sections:

Conclusions: The meaning of the results should be carved out better and the conclusions made more specific. E.g. p.13, line 31: How exactly do the authors arrive at the conclusions that results are regionally and temporally representative (p. 13, line 31), and what are the further implications? What time period is meant by "temporally" – the season, a whole year? What "previous study"?

Aerosol Hygroscopicity: It would be nice if more of the CCN data and their significance were discussed and if they were put into more context. What supersaturations are expected to be relevant in the regionally typical cloud cover; are the ones chosen here representative? It would be nice if the impact of biomass burning and anthropogenic emissions on all CCN parameters (not just kappa) were carved out a little more.

Introduction: The first paragraph (especially up to line 11) should be made more specific. For example, lines 7 and 8: Which additional questions? Representativeness of which results? Also, the first sentence of the introduction is somewhat unfortunate. It begs the question: Why is it important to assess aerosol properties there in the first place? The region and its significance to aerosol research need to be more clearly introduced to the reader.

Discussion: Currently, the section contains mostly repetitions of observations discussed earlier in the paper, and a couple new observations and interpretations. It should be re-worked such that it ties up the results in a way that leads to the conclusions. Alternatively, it could simply be eliminated (the new observations could be discussed in the "results" section).

Specific comments:

Abstract, line 19: this needs to be re-worded. Right now, the reader might get the impression that the "additional onboard (. . .) model products for the region" somehow entered the cluster analysis.

Page 3, lines 16-19 should be moved to section 2.2. What time of day was chosen for the HYSPLIT trajectory arrival? How were the other initial conditions (especially arrival height) motivated?

Page 3, line 21: What was the height of the mast above the water?

Page 3, line 29: What % relative humidity was ensured with this system?

Page 4, line 4 and 8: When and where were the calibrations performed?

Page 4, line 10: Can you comment on the stability of the supersaturation settings throughout the cruise?

Page 4, line 25: What was the temporal resolution of the filter samples? Are the analysis methods described in more detail in Reid et al., 2016? If so, the reference should be added to this sentence, too.

Page 5: please state the specific products used in this study (for example, where does the AOD mentioned in page 6, line 13, come from)?

Page 6, line 8: How were “surface winds” averaged, over what period or area?

Page 6, line 16: Why was only this one density used - fire emissions were presumably not the only coarse aerosol type in the region?

Page 6, line 28-29: It would be helpful to label these locations in the map in Figure 1.

Page 7, line 3: perhaps specify “biomass burning smoke”. Are there any filter analyses for this period?

Page 9, line 7: it would be nice to see the tri-modal fit included in Figure 4

Page 10, lines 23 – 33: This paragraph should be moved into the introduction. If a comparison of literature kappa values to this study’s was intended, this comparison should be done more directly, rather than expecting the reader to jump back and forth between paragraphs.

Page 11, lines 23: -29: How can it be stated that the Aitken mode during the biomass burning period be derived from the background aerosol, when it is actually more hygroscopic than the Aitken mode of the marine background and precipitation clusters? Why would the biomass influence be confined to particles >100nm? (Surely not all biomass burning particles are primary?)

Language/typos:

Abstract, line 20: “aerosol population that” should be “aerosol population and”

Page 2, line 31: “in situ” is not the right expression here, I believe. “In the area” or “in the SCS” would be better.

Page 4, line 15 and 16: choose one, “CCN activation spectrum” or “activated fraction spectrum”

Page 4, line 25: “that were analyzed” should be “and were analyzed”.

Page 4, line 14: A new sentence would be better than the hyphenation-clause combination: “number concentration ). Two modes were identified as the best fit. . .”

Page 4, line 16 and line 25: Start a new sentence instead of the hyphenation.

Page 4, line 22: “shortest” instead of “closest”?

Page 8, line 31: Start a new sentence after “(Figure 2d)”.

Page 11, line 12: “lower (. . ..) than in the precipitation (. . .) populations”

Page 12, line 1: What does “from the entire study” mean?

Caption of figure 4: “each spectrum”

Figures/Tables:

Figure 1: The tick marks on the time axis would be easier to identify if they pointed outward

Table 1: The font size is too small.

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