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Interactive comment on "Seasonal contrast in size distributions and mixing state of black carbon and its association with PM1.0 chemical composition from the eastern coast of India" *by* Sobhan Kumar Kompalli et al.

Anonymous Referee #2

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This paper describes measurements of black carbon (BC) containing particles and of non-refractory PM1 over 9-10 months at an urban site on the east coast of India. The data show some interesting seasonal trends and are worth publishing. However, the paper itself needs significant work. There are many missing words, misused words, confusing sentences and repetitive sections. It should not be such hard work to figure out what the authors are trying to say. Since the paper has several UK co-authors, I am surprised that it was not carefully edited by a native English speaker before submission. This paper needs major revisions before it is accepted for publication.

C1

Specific comments:

1- The introduction is rather repetitive and does not mention the second instrument, the ACSM. Please tighten up the language.

2- page 2, lines 17 -25. It would be helpful to mention which months are included in each season.

3- page 2, lines 28 - 33: The statement "The diurnal pattern of sulphate resembled that of the RCT" and the statement "the coating on BC showed a negative association with sulphate" contradict each other. The association plot in Figure 11 is an interesting way to present the data, but the conclusions are tenuous and don't belong in the abstract. I would delete the sentence starting "Though the pre-monsoon. . ." and ending ". . .mixing state of BC."

4- page 4, line 6: VOCs are not an aerosol species.

5- page 4, line 19: A diameter of a few tens of nanometers is more likely for the primary spherules than for the chain agglomerates. Please cite a reference or correct the text.

6- page 4, line 27: Paragraph starts with the word "These," but it is not clear what "these" is referring to.

7- page 6, line 9: Figure 1b can be removed. No-one needs to see a picture of a shipping container.

8- page 6, line 11: Example of poor English usage "away from the proximity of." Just say "not near."

9- page 6, line 25: You refer to Figure S1, but the extra figures are in an appendix. Please label extra material consistently.

10- page 6, line 30: I don't understand what the words in parentheses are conveying. If you mean that there are more fire events in those regions, please rephrase the sentence.

C2

11- page 7, lines 10-14: What about the 6-week gap in November-December? That is more than a brief gap and needs some explanation.

12- page 7, lines 17-18: Why mention instruments that are not relevant to this study?

13- page 7, lines 31 – page 8, line 4: What do you mean by scattering enhancement? I think you are deriving the optical diameter of the coated particle from the scattering signal using a Mie Scattering model, but this description is garbled. Please phrase this more clearly.

14- page 8, line 15: Specify that this size range is vacuum aerodynamic diameter. The range is really more like 80 nm – 800 nm.

15- page 8, lines 19-20: It really doesn't seem necessary to discuss the pumps on the ACSM.

16 – page 10, lines 6-7 and elsewhere: Please pick one term, either counts or number, and use it consistently throughout the paper including the figures.

17- page 10, first paragraph: Why is there a distinct jog at 40 nm in the number size distributions?

18- page 16, line 16: What does "evolving least-squares fitting" mean?

19- pages 10-11: I find this discussion extremely confusing and repetitive. The most important data is displayed in Figures 3 and 4 (and Table 4). I do not understand the point of averaging the size and number distributions over a season, taking the mode and getting a slightly different number than the average of the mode for individual data points. This does not add any new information and leads to repetitive discussion of the results. I would remove Figure 5, Table 2 and the associated discussion. Similarly, with the peak of the seasonal number size distributions – what new information does this give you beyond what you already know from the BC mass loading? The discussion about previous work is split between page 10, lines 18-22 and page 11, line 29 - page 12 line 4. Please consolidate. Finally, if you think you can tell the difference between

C3

local emissions during SMS with a smaller size and continental outflow with a larger size, why not make two entries in Table 3 for this study?

20- Pages 12-13: The discussion of RCT and ACT is confusing and repetitive. You are making a major assumption of core-shell morphology in order to calculate Dp and therefore RCT and ACT. Really all you can say is that you have a ratio that represents the amount of non-BC material associated with BC – you don't know the morphology of the particles nor how it changes with season. Morphology is likely to be quite different between fresh emissions during SMS and aged emissions during other seasons. I would not interpret RCT and ACT as literal diameters and coating thicknesses. In fact, I do not think ACT adds to the discussion. I would rewrite this section to present only the RCT data and include enough caveats that it is clear RCT is a representation, not an actual ratio of diameters. I also don't understand the point of Figure 7. You already have the information about the width of the distributions in Table 4. You mention multiple maxima, but have no interpretation. The discussion of Figure 7 on page 13 repeats the same information about sources and processing as on page 12, making this section very repetitive. I would remove Figure 7 and the associated discussion.

21- Page 12, lines12-14: "Both of these parameters…mixing state of the particles." I do not understand this sentence. Does "both" refer to RCT and ACT or to Dp and Dc? Either way, how can Dp not depend on the mixing state?

22- Page 13, lines 1-2: "Intra-seasonal variability…Figure 6) is also higher during PoMS." I do not understand this sentence. Figure 6 shows daily values, not seasonal values. By eye, the variation in the daily points and the spread of the error bars looks very similar across PoMS, Winter and PMS. There are very few points during SMS, so it is hard to draw conclusions for that season.

23- Pages 15-17, Section 3.5: I have several questions about the ACSM data analysis. Why is ammonia so low? Was the aerosol not neutralized and do you have corroborating evidence? Or was the RIE_NH4 incorrect for this instrument? Why not estimate

C4

OOA and HOA using the parameterization in Ng et al. (EST 2011)? This would give you additional information about local and regional sources.

24- Page 17, lines 1-7: "Even though...coating." I do not understand this sentence, partly because it is too long and convoluted, but also because the two parts contradict each other. You say in part a that concurrent peaks in RCT and sulphate suggest that sulphate is mixed with BC, but in part b, you say the opposite. You can't have it both ways. Or are you saying that the ACSM detects sulphate when it is mixed with BC, but not organic? That does not make sense.

25- Pages 17-18, Section3.7: Figure 11 is another way of comparing the diurnals for RCT and MF. While it is a nice visualization, I don't think it needs a new section repeating much of the discussion as in Section 3.6. I would combine the discussion in Sections 3.6 and 3.7. I also wonder if you have thought about the fraction of particles containing BC (i.e., BC number con./(BC num conc. + scatt num conc.))? This fraction is much higher in SMS than in PoMS or Winter and is lowest in PMS. The low value in PMS might be part of the reason that the association in Figure 11d and h is so poor since there is less overlap between the particle population detected with the ACSM and the population detected with the SP2.

26- Figure 1: It is very hard to see the circle indicating the IGP in panel (a). I would delete panel (b). There is no need for a picture of a shipping container.

27- Figure 2: The star symbol is not visible.

28- Figure 3: Indicate the seasons in panels (a) and (b).

29- Figure 4: Include the dashed lines in the legend. Panel (b) has circles not triangles. Please use either number or count, but not both. Do you have any data covering the gap between end of May and August? Do the MMD and CMD really drop from PMS to SMS values over 6 weeks? Or could you have some kind of instrumental drift that causes both to increase over the displayed 10 months of data? 30- Figure 11:

"Speices" is mis-spelled in the x-axis label.

31- Table 1: "metrological" should be "meteorological"

32- Table 3: "Shangai" is mis-spelled.

33- Table 4: Are these averages of the daily values shown in the figures, or averages of all the underlying data? Please specify. Also, somewhere in the text you should state the time-base of the SP2 data.

34- Figure A1 (or S1?): Please decide if this section is an appendix or supplemental information. Please label the panels with the season. It's not clear what the words in parentheses in the last sentence are supposed to mean.