

Interactive comment on “Seasonal contrast in size distributions and mixing state of black carbon and its association with PM_{1.0} chemical composition from the eastern coast of India” by Sobhan Kumar Kompalli et al.

Anonymous Referee #1

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The size of BC clearly shows seasonal variation and emission sources of BC. They selected a suitable sampling location that gets plumes from both lands as well as from coastal/marine regions on different seasons. They used SP2 and ACMS to characterize the microphysical and chemical properties of BC and other aerosol particles. The research provides useful information on BC mixing with other aerosol components based on a diurnal and seasonal variation on the eastern coast of India. IGP is one of the regional hot spots for BC aerosol concentration in south Asia and the present research provides detail information on the mixing scenario of BC aerosol from the IGP

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and compares with the BC from other parts of India. They quantified the coating of BC in term of ACT and RCT and presented the influence of different coating materials and the discussed the preferential coating in different seasons. The language used is good but can be polished, especially, long sentences are used, and it makes difficult to communicate the message. I recommend the authors to shorten/split the long sentences. I recommend the publication of this article but after addressing the concerns listed below. How relevant is the discussion of mineral dust in the introduction section (paragraphs 1 and 2)? I understand that the authors highlight the light absorbing nature of minerals. But, I did not find any further discussion on minerals in the manuscript. In that context, the direct focus on BC mixing state is meaningful. The authors mention the use of 2 kinds of aerosol characterization instruments during the study. But there is no mention of one of the two instruments throughout the introduction section. I had to go through the method section to get information about the second instrument. Please mention a brief introduction on the second instrument used in this study. Regarding the use of SP2, a recent finding by Sedlacek III et al. (2018) cautioned about the charring of organic depending on the SP2 laser power (Sedlacek III, Arthur J., et al. "Formation of refractory black carbon by SP2-induced charring of organic aerosol." *Aerosol Science and Technology* 52.12 (2018): 1345-1350). It is worthy to mention this caveat as the ambient aerosol samples include organics. Clearly mention the power of the laser used during the operation of the SP2. Also, it is not always appropriate to assume core-shell structure for coated BC due to the complex mixing state of BC such as the case when BC is located off-center. Though the study did not utilize single particle off-line analysis to probe the complex internal mixing state of BC, it is useful to mention the effects from such BC structures on absorption and scattering signals (e.g., Sedlacek III, Arthur J., et al. "Determination of and evidence for non-core-shell structure of particles containing black carbon using the Single Particle Soot Photometer (SP2)." *Geophysical research letters* 39.6 (2012)). The authors should discuss how such non-core-shell particles would affect their results. For all instruments employed, also mention the model number in addition to the manufacturing company. Be consistent in the

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use of units such as for flow rate and BC concentration. The use of different units for the same quantity makes it difficult to infer the values. Minimize the use of numeral values for comparison all the times. It may appear to the authors that these numerals are useful for comparison, but to me, it is a source of distraction. I recommend listing the values in Tables which the authors have already done. Authors can infer Table for values and focus on their findings. General comments: Page4 line 19: Add some references on the size of monomers for nascent BC. Cite (2017): 166, Köylü, Ümit Özgür, et al. "Fractal and projected structure properties of soot aggregates." *Combustion and Flame* 100.4 (1995): 621-633; Bhandari, Janarjan, et al. "Effect of thermodenuding on the structure of nascent flame soot aggregates." *Atmosphere* 8.9. Page4 line19: Also, it is not correct to say that the coated BC is 'spherical' after coating. Rather I would prefer to use the term like 'compact' or 'collapsed' for coated BC core, though the core-shell model treats such coated BC as the spherical core for simplicity. Page 4 line 27: What are you referring to using "these"? I am not clear. Page4 line 32: What sources? Do you mean 'aerosol sources'? Be specific Page 5 line 24: Only one instrument is revealed. But the authors mention in the abstract that they used 2 instruments. What is the second instrument used? Specify the second instrument as well in the introduction section mentioning why the instrument was selected. Page 5 line 25: Do the authors mean to say that the working of SP2 is based on long-term measurements only? Please rephrase the sentence. Page 6 line 12: Do you mean to say 'above ground level' by acronym AGL? Please mention the full name for the first time. Page 6 line 28: By 'Supplementary Figure S1' are you referring for the figures in an appendix? If so rename the figure as A1. Page 7 lines 1-8: As the numeral values for meteorological parameters are shown in Table 1, avoid using all these numerals in the text for comparison. Please minimize the use of numeral values in the text. Include only those specific values that are striking to discuss. Page 7 lines 15-17: Include the model number and company name for each instrument Page8 line2: It is mentioned that the RI of 2.26 – 1.26i is used for BC. Is this RI representative for ambient BC aerosol in the region? I am aware of the use of the above-mentioned RI value for BC.

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However, the RI of 2.26 – 1.26i looks higher than usually used value for the RI of BC. Page8 line 9: As mentioned earlier, be consistent in picking unit for a given quantity. Here for flow rate, you used cm³/min while in line 21 you used liters/minute. Page 8 line 15: For the 40-100 nm range, mention clearly that the size is 'aerodynamic diameter'. Page 8 line 26: The sub-heading 3.1 can be made more specific. By 'Mass and number concentration' only it is not clear what is being measured. Pages 8-9 section 3.1: As mentioned earlier, use as least numeral values as possible in the discussion. All the numerals can be summarized in the table. Also, use the same units for particle concentration. In some cases, ng/m³ is used in some instance, $\mu\text{g}/\text{m}^3$ is used for particle concentration. Page 10 line 27: I am not clear about this '...reported for reported from...'. Please clarify this sentence. Page 11 line 2: Is 'Figure S1' the same labeled as 'Figure A1' in the appendix? Add label for each season in the map. In fig. A1 (a) and (b), it will be useful to mention the location of the distinct data points below south India as a note. Page 11 line 10: It is mentioned that the BC mass loading was lowest during PMS, but fire events were maximum during PMS throughout the Indian region as shown in Fig. A (d). Is not it reasonable to expect a high concentration of BC? Page 14 lines7-9: The sentence "The figure reveals..." is not clear to me. Please rewrite the sentence Page 14 line11, line 13: Do you mean to say that the RCT of BC is contributed by the day-night temperature difference in different seasons? I am not clear. Page 15 lines6-9: The sentence 'Interestingly...occurring' is a long sentence. Page 15 lines 13-16: The sentence 'Not...role' is again a long sentence and is not clear. Simplify your statement. Page 16 line 28: Chlorine is shown to be present in very low concentration even when air mass arrived from marine region to the sampling site during PMS. Is this concentration normal during the PMS as well? Page 17 lines10-13: The sentence 'Further... mixed' is not clear. In "absorption condensable species", do you mean 'absorption of condensable species' and the part "which already more internally mixed" is not clear.

Technical comments: Page4 line 16: Correct the year for 'China et al., 2012' to make it '2013'. Page4 line 27: A sentence starts with a pronoun at the beginning of a para-

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graph. It makes it difficult to know what you are referring to using a pronoun in the very beginning of a paragraph. Page 10 line3: What is represented by 'A' in equation (1)? Mention it. Page 11 line1: add 'of' before 'larger-sized BC particles. . .'. Page 20 line 2: Stronger is already a comparative adjective. Remove 'more' before stronger.

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