

Interactive comment on “Altitude profiles of CCN characteristics across the Indo-Gangetic Plain prior to the onset of the Indian summer monsoon” by Venugopalan Nair Jayachandran et al.

Anonymous Referee #2

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General comments: The manuscript presents the altitude variations of CN and CCN characteristics in the troposphere below 3 km based on systematic aircraft based observations carried out over the western, central and eastern IGP during June 2016, just before the onset of Indian summer monsoon. Altitude variations of CCN activation efficiency, CCN spectra and their similarities and differences over the three regions are investigated, in the light of the potentially different aerosol sources. One of the most striking features observed is the high CCN activation efficiency over the dust-dominated western IGP. The topic of research is highly relevant and current and the results presented here are of very high importance for a wide range of scientific community (including aerosols, aerosol-cloud interaction and climate modelling studies).

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The manuscript is well written and the conclusions are well supported by observations.

I have a few minor comments/suggestions; addition/modification of a few sentences will be sufficient to address all these comments. Considering the very high scientific importance of the results presented, which are of interest to a wide scientific community, I recommend that the manuscript may be accepted for publication in ACP after minor revision.

Page-22, Paragraph-2 & Fig.8(b): This information is redundant as it can be inferred from Figs. 6, 7, and 8(a) and the discussions on them. However, if the authors want to still keep it, please spell out the following: Lines 18-19: what is the range of 'low CCN efficiency' and 'low k values' referred here? I think this result is not very evident in Fig.8(b).

Page-23, Lines 17-18: "The airmass traversing through the polluted-continental region is responsible for the lowering of CCN activation efficiency at the free troposphere heights over the east IGP". Note that, among the three regions considered here, the CCN efficiency is highest at all altitudes over BBR (e.g., Fig.8a). The above statement can be true if the CCN activation efficiency is found to be higher when the tropospheric airmass transport over BBR is from the east compared to those from the west. You may clarify how this conclusion was arrived at? Please delete the sentence if it cannot be explained unambiguously .

Page-24, second paragraph: This is a very interesting and, perhaps, the most important finding from this study. It has major implications in ACI.

Page-25, Line 18: "... while the air is deprived of moisture;...". Note that 'k' is related to the property of aerosols (size distribution and water affinity, as stated in the manuscript) and is measured by systematically changing the supersaturation inside the instrument. Then, how "depriving of moisture" in the atmosphere will result in high value of 'k'?

Page-26, Lines 8-9: "... and at VNS a rainfall of 20 mm occurred on the evening of

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7th June”. What is relevance of this statement here? Dependence of any aerosol/CCN parameter on rainfall at VNS is not presented in this manuscript.

Page-26, Line-15: “After the rainfall, a reduction (<10%) is seen in the CCN efficiency over BBR, ...”. This is true for the height range below 2000 m, while the opposite is the case for 2500-3000 m (Fig.10). Is it because of the difference between in-cloud and below-cloud processes that remove/shift the size distribution? Also see the comment below. If it cannot be explained based on the present set of observations, please include a line on the differences (CCN efficiency) observed in the altitude range of 2500-3000 m.

Page-27, Lines 14-17: How this process (more efficient removal of CCN by in-cloud scavenging) can enhance the CCN efficiency after rainfall (height range of 2500-3000 m; Fig.10)?

Page-28: Lines 8-12: Modify this sentence (it is not very clear; contains ‘because’ twice).

Page-28, Lines 11-12: “... implying that the total scattering coefficient would have to be of comparable magnitude”. Why this guess? You already have the scattering coefficient measurements available (used for estimating AI). Did I miss something?

Page-30 (Conclusions), Lines 17-18: “High CCN activation efficiency ... dust dominated western IGP”. This is a very interesting and important result. A statement on its implication will be highly useful.

Other suggestions:

Page-4 Line 20: Keep proper reference format Page-5 Line 14: Change : “Synoptic wind ...” as “Monthly mean synoptic wind ...” Page-11, Line 1: expand “ss” (first time usage of ss for supersaturation) Figure 4: If you have sufficient ancillary data required, it would be interesting to know why there are major deviations from the general trend on (i) Day-1 at BBR and (ii) Day-4 at VNS. Is this the effect of rain or change in airmass

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trajectory?

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