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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurement report: Altitudinal variation of CCN activation across the Indo-Gangetic Plains prior to monsoon onset and during peak monsoon periods: Results from the SWAAMI field campaign" *by* Mohanan R. Manoj et al.

Anonymous Referee #1

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General Comments This study investigates the vertical distributions (altitude profiles) of the condensation nuclei (CN) and cloud condensation nuclei (CCN), based on airborne measurements during the SWAAMI field campaign (June to July, 2016) over the Indo-Gangetic Plains (IGP). The paper examines the vertical distributions of CN, CCN and the activation ratio (AR=CCN/CN) and compares the changes on them between locations in east and west Indo-Gangetic Plains (IGP) as well as between the pre-monsoon and monsoon season in order to assess the role of different aerosol types

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Discussion paper

and chemical composition on CCN activation just prior and during the Indian summer monsoon. It's an interesting work, well within the scope of the journal and useful for scientists of the atmospheric aerosol community. This paper comes as a continuation of previous ones (by the same team) regarding aerosol properties, radiative effects and compositions during the SWAAMI campaign. The paper is well organized and the narrative flows well, however, some more discussions and references at specific parts that will enhance the importance of the current results and will provide physical explanations and comparisons with previous studies are needed. Specific Comments In the Introduction section, authors should insist more on previous works in India dealing with CCN, since they practically refer only to CAIPEEX campaign (airborne measurements). Looking the literature, I can see several other works with ground instrumentation as well, some of them also cited later in the manuscript like Dumka et al. (2015), Jayachandran et al. (20020a, 2020b), etc.. You may also see Jayachandran, et al., 2018 (Atm.Res.), Dipu et al. (2013, AtmEnv), Bhattu et al. (2014, AtmEnv)... Line 83: BBR is not located in the eastern IGP, but at the eastern Indian coast. This should be mentioned here, since reader has a wrong thought about the geographical distribution of the sites. Also, you should clarify that JPR is at the arid zone and is not also considered as a standard IGP site. Line 114: The reference Dee et al. (2011) should accompany the meteo dataset used i.e. ERA-Interim or ERA-5 reanalysis. So, this should be referred here. Lines 145-147: I would expect a more detailed discussion here related with aerosol hygroscopicity and types over the IGP region. Obviously, aerosol chemical properties play the major role in aerosol hygroscopicity and CCN activation. These chemical properties, as well as aerosol types should be discussed here, in view of changes in CCN and hygroscopicity. Literature, global and Indian, are rich in this issue and should be used here. Line 150: Correct as CN and CCN Line 159: There is only marginal differences in the AR compared to Lucknow. I think that there is no important difference between these AR values deserving further explanation from the view of the physical and chemical aerosol point of view. So, authors should refer to marginal or slight differences between these sites, at least for the AR values near

the surface, indicating low aerosol hygroscopicity. Lines 169-170: This difference in aerosol types also exists in the vertical between west and east IGP and this should be further discussed in the manuscript, along with dominant aerosol types and chemical compositions between the regions. Line 221: The role of the water-soluble organics should be highlighted here. Lines 127-248: References are needed here. Lines 249-251: A recent work at the Indian Himalayas (Nainital site, 1958 m; Dumka et al., 2021, STOTEN), which classified the aerosol types based on in situ surface observations showed that the fresh BC aerosols of local origin (BC-dominated type) was much less hygroscopic than the coated and aged "large-BC type", which was mostly transported by the IGP. This finding supports the current results and should be an advance in the discussions about different hygroscopicity levels from various aerosol types in India. Lines 255-257: This statement is true and also supported by previous studies that show an increase in water-vapor content (from AERONET) during pre-monsoon dust events over the IGP (Prasad and Singh, 2007, JGR; Sarvan Kumar et al., 2015, Aeolian Research, etc), indicating a mixing of marine-dust air masses. In addition, more recently, Dumka et al. (2019, JGR) showed that the dust emissions and dust-storm propagation over the Thar desert in pre-monsoon is highly controlled by the SW monsoon density currents over the land area, which may increase the WVC, and therefore, the aerosol hygroscopicity. Lines 340-367: In the major findings discussed here, you may increase the literature overview about aerosol size and chemical properties. Line 345: Delete “IGP”. Line 366: Delete "of". Figure 1: The experimental sites should be clearly visible in Fig. 1. Increase the fonts, make the sites clearly visible. Figure 6 Caption. Correct the figure numbers there.

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