

Interactive comment on “Cloud Condensation Nuclei properties of South Asian outflow over the northern Indian Ocean during winter” by Vijayakumar S. Nair et al.

Review of "Cloud Condensation Nuclei properties of South Asian outflow over the northern Indian Ocean during winter" by Vijayakumar S Nair et al., (ACP-2019-828)

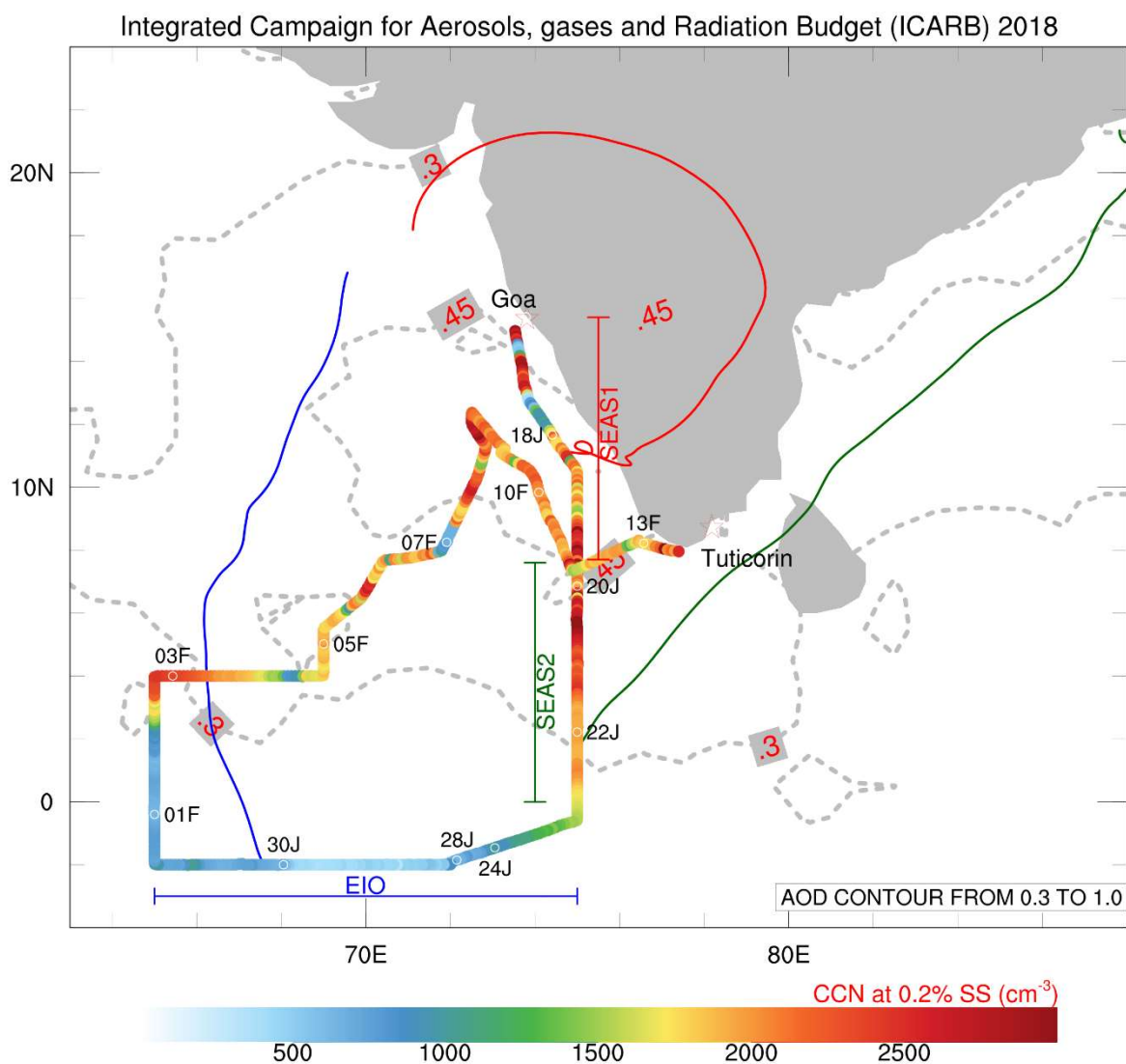
This paper presents some interesting results on cloud condensation nuclei (CCN) and condensation nuclei (CN) concentrations obtained over north Indian ocean as a part of ICARB-2018 conducted during winter 2018. Sophisticated data collected within the ship cruise campaign (16 Jan. 2018 to 13 Feb.2018) has been wisely used to investigate the latitudinal and longitudinal variations. Major conclusions drawn from this detailed investigations includes findings of high CCN over southeastern Arabian sea compared to equatorial Indian ocean, high CCN efficiency over south Asian outflow compared to equatorial Indian ocean, contribution of accumulation mode to high activation fraction over north Indian ocean. Further, strong association between CCN efficiency and geometrical mean diameter of aerosol number size distribution is being reported. In general, paper is concise and well written with substantial new information and apt for Atmospheric Chemistry and Physics Journal. However, few clarifications are required before accepting for its publication. Below are the some of the issues which authors need to take care. Authors are strongly encouraged to revise this manuscript.

We thank the reviewer for the encouraging comments and fruitful suggestions.

Comments/Suggestions:

Page 3, Lines 28-31, Figure 1: The spatial extend of the aerosol transport to the Indian Ocean is qualitatively depicted by the climatological (2002-2017) mean aerosol optical depth (AOD) derived from MODIS observations over the northern Indian Ocean (contours in Figure 1). These contours are hard to see from the figure. I suggest including color contour of the same.

Complied with. The figure is redrawn in the revised version for better clarity. Instead of multiple colorbars, we have increased the thickness of the contour and AOD values are embedded in the each contour line.



Page 4, Lines 5-7: The first phase of the cruise over southeastern Arabian Sea (SEAS) is divided into 'SEAS1' and 'SEAS2' regions where the former is influenced by the air masses from peninsular India, and the latter is from the Bay of Bengal. I wonder how the lines are drawn that differentiates SEAS1 and SEAS2.

We have computed the air mass back trajectories for all the days using HYSPLIT model. Three typical cases are shown in the manuscript (Figure 01). The air mass trajectories reaching at ship location above 8°N have direct influence of peninsular India while below 8°N air masses are arriving from the Bay of Bengal. Moreover, regions above 8°N has proximity to landmass and below 8°N represent the open ocean under the influence of pollution transport from Bay of Bengal.

Page 4, Lines 11-12: Indian sub-continent during this period due to the. This is an incomplete sentence.

We are sorry for the inadvertent error. The sentence is corrected in the revised version of the manuscript. "These wide spread rainfall events associated with the

western disturbances are also observed over the peninsular and western part of the Indian sub-continent during this period.”

Page 17, Figure 8: I am unable to see much difference between Type 3 and Type 4. Did it qualify the followed analysis procedure?

As mentioned in the manuscript, we have followed stringent conditions ($R^2 > 0.9$) to group the similar NSDs. Though they look same in activation efficiency, there are differences in the size distributions of Type 3 and 4 especially at 10-20 nm range and 150-300 nm range. So, we have $R^2 < 0.9$ for the regression of Type 3 and Type 4. However, the difference in GMD between Type 3 and Type 4 is ~10 nm and thus activation efficiencies are comparable.

Page 20, Line 3: Reported ‘bi-modal’ size distributions should be reported ‘bi-model’ size distributions.

We have verified this in several text books (eg: Seinfeld and Pandis, Atmospheric Chemistry and Physics, 2006). Aerosol NSD with 2 modes is called as ‘bimodal’.

There are few grammatical mistakes and typos. I suggest authors to go through the manuscript carefully again before submitting revised draft.

Complied with.