Review of 'Measurement Report: Cloud condensation nuclei (CCN) activity in the South China Sea from shipborne observations during summer and winter of 2021: seasonal variation and anthropogenic influence'

This manuscript presents a comprehensive aerosol and CCN properties over the South China Sea (SCS) during summer and winter from two ship-based measurements. The aerosol size distribution, chemical composition of PM1, hygroscopicity, and the CCN (with closure study) are examined and briefly analyzed, and the seasonal variations in the aerosol species and activation ratio is evident. This study provides extra data sources for future studies over the SCS. I think this manuscript holds the potential of publication, after considering and addressing the concerns and questions I have listed below.

Measurements

Please specify the instruments (CCN counter, SMPS, and DMA), measurable size range (and bin size if applicable), frequency, and instrumental uncertainty on the size-resolved number concentrations.

What is the supersaturation ramping time scale for the CCN column A?

Also, the error or precision of the ACSM measured mass concentration should be specified after the composition-dependent collection efficiency correction.

The uncertainties for the meteorological quantities need to be reported.

More details on the aethalometer are also encouraged (size ranges, uncertainty, etc.).

In the CCN closure section, can you report representative D50 values for four species (as in S7) under the External scheme, during summer and winter seasons in the study domain?

I believe those are crucial for a measurement report.

Specific Comments:

Line 117: Can you elaborate on how the seasonal variation of the fraction of high cloud is relevant here in terms of the ship-observed CCN near the sea surface and the aerosol-high cloud interaction? Intuitively, would the lower boundary layer aerosol/CCN have greater impacts on the MBL clouds, or is there any particular dynamical mechanism the author is referring to?

L153. 'The … SMCA… was initially…'. And do you want to say you utilize this sampling strategy to get the size-resolved CCN?

L159. Have both sensors in the counter column B on two ships malfunctioned during the two sampling periods?

L206. You have introduced D50 as 'particle size at which 50% of the particles are activated at a specific SS' before. Your statement here is flawed.

L275. The results in S8 and S9 are well-justified, though, you should consider putting a few words about it in the main text.

L307. Winter period shows two peaks with more organic (less sulfate) and with both high organic and sulfate. Elaborate on how the impact of Northeast Monsoon 'persist'.

L311. Define clearly how the Nucleation, Aikten, and Accumulation are defined, in terms of size cut and rationale, in this study (should have been done in the Data section).

L330. Explanation is needed on the flipped hygroscopicity-supersuration relations between summer and winter.

L388. Which figure or table are you referring to wrt. 'smaller sizes'. And yes, sulfate fraction is reduced in winter 'Marine' period, but the increased ammonium may compensate for this effect (Fig. 5f). You may also consider attributing this to the increases in organic aerosol contribution due to factors like reduced photochemical oxidation.

Technical Comments

L56. '…partially attributed…'. And considering adding more recent and relevant references to these statements.

L71. Please be more specific on what particles (compositions, sizes, etc.) were examined in Ajith et al. (2022)

L90. This paper (Zheng et al., 2020) is not on the reference list. And I presume you refer to 'Eastern North Atlantic'.

L153. 'The … SMCA… was initially…'.

L153. '(Fig. 1c2)'

L377. Here, the statement, though reasonable, has not been supported by the results, use 'potentially led' instead.

Figures. Please put the figure caption directly beneath the figure.

Fig. 3. Same y-axis range is needed for (a) and (b). And please state the seasons for (e) and (f).

Fig. S9. Panel (c) and (f), consider using something like 'Marine-Win'? I was confused with Marine-(South) and Marine-(West) at first glance.

Fig. S14. Use more distinguishable colors between 14.6 and 41.4 nm. And the subpanel labels do not match the captions for winter.

Reference. The reference list is hard to distinguish between entries, so please correct the format.