

Review of ‘Using Aircraft Measurements to Characterize Subgrid-Scale Variability of Aerosol Properties Near the ARM Southern Great Plains Site’

This study uses the aircraft in-situ measurements from the HI-SCALE campaign to characterize the sub-grid variability of aerosols over the ARM-SGP site, by applying the methodology of comparing the averaged aerosol properties in the scales of 81, 27, 9, and 3 km. Results show substantial variabilities in aerosol composition, concentration, size distribution, as well as CCN over the SGP. Hence, the model misrepresentation of the sub-grid variabilities might induce uncertainties in simulating the aerosol direct and indirect forcings. The authors present robust and statistically sound analysis within one field campaign, and also express the expectation of further application of the methodology. I recommend publication after a few minor comments of mine are considered and addressed.

Minor Comments:

Line 157. The TSI 3010 was designed for measured particle concentration up to 10000/cm³ with very little coincidence. However, in Table S1 there are 4 cases that have averaged CPC > 10000/cm³. How would you reconcile those results, whether they are comprised of real signals or noises (e.g., instrument glitch, cloud water splash...)? Please give a discussion on it.

TSI, Model 3010 Condensation Particle Counter Instruction Manual, https://ethz.ch/content/dam/ethz/special-interest/usys/iac/iac_dam/documents/edu/courses/atmospheric_physics_lab_work/TSI-3010.pdf, 2022.

Line 236. ‘excluded from...’?

Line 261. Readers might also be interested in seeing the relationships between those departure values versus the relative position of the targeted cell within that 81 km grid box (e.g., departures at southeast grid box versus northwest grid box), under different background wind conditions. Perhaps some empirical functions can be deduced from those relationships, if any.

Line 282. Is there any potential explanation for the relatively larger spatial variabilities in NO₃ and NH₄?

Line 291. What about NH₄?

Line 293. Is the bi-modal distribution of IOP2 SO₄ a reflection of any cloud processing signals (e.g., in-cloud sulfate production), or purely due to the local emission variabilities?

Line 389. ‘81, 27, 9, and 3 km...’

Line 390. Is there a redundant preposition here?

Line 402. Could you explain why the CPC 3025/3010/FIMS ranges (5-95) for 27 km are generally higher than the 9km and 3km in IOP2? Seems counter-intuitive compared to previous figures.

Line 404. Please define NPF before using it.

Line 696. ‘prepared the manuscript...’

Section 4.4. Since you have the simultaneous measurements of aerosol and CCN at two supersaturation levels, it would be interesting to see if the spatial variabilities of the aerosol hygroscopicity (or activation capacity) share similar relationships to either aerosol or CCN.

Figure 5. Can you also define the meaning of the box edges and whisker in the caption? And please add the mean values, maybe as short lines?