

Reviewer comments to authors of “Microphysics of radiation fog and estimation of fog deposition velocity for atmospheric dispersion applications”

In this paper, the authors have undertaken the task of characterizing radiation fog in around Barakah nuclear power plant in the United Arab Emirates. They have observed twelve fog events and conducted an analysis of microphysical and dynamical properties, and thermodynamics. Furthermore, they simulated a specific fog event (15 Feb. 2021) using various PBL schemes. The authors also delved into analyzing a particle dispersion model to comprehend the impact of fog deposition. Overall, this paper encompasses a wide range of analyses lack a thorough and cohesive understanding, making it challenging to arrive at a solid conclusion.

One notable concern is that fog events differ in each section and figure. For instance, section 3.1 focuses on the fog event of Feb 25, 2021 (Figure 5), while section 3.2 deals with fog events on Jan 27, Feb 4, and Feb 24, 2021 (Figures 6c and 6d). Similarly, section 4 concentrates on the Feb 16, 2021 fog event (Figure 7), whereas section 4 involves Jan 27, Feb 4, and Feb 24 (Figures 8 and 9). Section 5 centers around Feb 15. The reviewer is perplexed as to why different fog events are chosen for each section, leading to confusion regarding the author's primary focus. Furthermore, the connection between the WRF simulations and the preceding analyses (such as fog microphysical characteristics and the thermodynamic environment) is not well established. The instruments used to observe the fog events also appear to yield differing results.

In light of these issues, the reviewer strongly recommends that the authors narrow down their research topic and engage in more in-depth analyses. Addressing these concerns is crucial for enhancing the manuscript's coherence and overall quality. Given the current state of the manuscript, it is the opinion of the reviewer that it may not be suitable for publication in ACP.

Minor comments:

1. Line 76: Remove the semicolon (;)
2. Line 90-91: I am not clear what the sentence means. Also, it might need to consider a referent to support author's argument.
3. Line 101: If the author would like to emphasize this (first observation-derived fog deposition velocity for the UAE), it would be great if the author presents a distinct feature about the first study by comparing the previous studies with different regions.
4. Figure 1: It could be very helpful the author can mark the observational sites on the map, because the instruments installed the different sites. Also, please change the color for the ocean, because it looks land since the lowest elevation over land also shaded blue color.
5. Table 1: It could be very helpful if the author can add the measurement bias at each instrument.
6. Table 1: There were two analysis period in one box. Please modify the box correctly. The period was not same among the instruments. How the author analyzes the data? Does them use the same period of case?
7. Line 221: Why the author uses the WSM3 rather than WSM6 as microphysics scheme? The WSM6 provides the 6 class hydrometeor types including ice, snow, and graupel.

8. Line 289-290: Form what?
9. Figure 2: at Barakkah? Does this mean at BNPP?
10. Line 509-511: Need result/figure or reference to support the argument.
11. Figure 6a,b: Hard to see the lines
12. Line 623-624: How can see this result? The reviewer can not find the result correctly in Figure 9a. The background map showed wide ranges. Please explain more about this.
13. Line 677-678: What the author refers to? FLEXPART?
14. Figure 10: Why the author shows only two simulations (ACM2 and MYJ)? The simulations were performed five (Table 2), so please add more figures for all simulations.