Eight fog events are observed and analyzed in this manuscript, with a focus on the characterization of fog microphysics and their relationships with visibility. This is a meaningful study that will likely attract the attention of ACP readers. However, I struggled with the manuscript for the following reasons:

Major comments

1. Analysis of Pre-Fog Aerosols

In Section 3.2, the authors explore the relationship between pre-fog aerosols and fog droplets. Under stable conditions, this relationship is logically sound due to weak wind speed. However, the article reports that wind speed during observation is relatively high (4 to 8 m/s), which suggests that advection plays a significant role in these fog events. The authors also state that "the pre-fog aerosols measured at the observation site may not fully represent the particles that actually activated into fog droplets." This raises the question: Can pre-fog aerosols be reliably replaced by aerosols observed during fog? The rationale behind this needs further explanation. Additionally, how does Section 3.2 lay the foundation for the subsequent content? The logic in Section 3.2 should be clarified.

In Section 3.3, pre-fog aerosols are used in the estimation by the κ-Köhler equation. How can the authors be certain that the pre-fog aerosols and those that activated into fog droplets share similar physical and chemical properties? For instance, fog event E3 had a long lifetime. Are the changes in aerosol physicochemical properties negligible? Observing supersaturation in fog is challenging, and bias is inevitable. The authors should discuss the sources of errors in this algorithm and provide references to support this approach. Wang et al. (2021) can be referenced.

2. Mechanism in Fog Event E3

The authors note that "the main wind speeds ranged from 4 to 8 m/s" in lines 157-158, indicating that advection influences the observations. In lines 256-258, they state, "The enhanced supersaturation facilitated the further activation of smaller particles that

were un-activated during the SS_{Q1} stage, resulting in a secondary activation-dominated process during E3." Does this imply that un-activated aerosols from the SS_{Q1} stage remained stationary without being affected by advection? This statement is confusing and potentially misleading.

The authors also mention "excess water vapor" in line 258. However, Figure 4 shows an increase in supersaturation from the SS_{Q1} stage to the SS_{Q2} stage during E3. Does lower supersaturation correspond to excess water vapor during the SS_{Q1} stage? Please clarify this analysis.

In line 261, the authors discuss the "evaporation of liquid water from previously formed large fog droplets." Both large and small droplets are affected by evaporation, but small droplets are more susceptible to dry air because of a larger surface area concentration. The authors only mention large droplets in this context. Moreover, under the influence of advection, even if previous large droplets evaporate, they may not affect current observations. Is this correct? I suggest revising the analysis to clarify the mechanism.

Minor Comments

1. There is a formatting issue. When there is no space before a paragraph, a blank line should be inserted between consecutive paragraphs (e.g., a blank line is needed between lines 42 and 43). Alternatively, please refer to the formatting style of articles already published in ACP.
2. In line 37, the article focuses on mountain fog; there is no need to mention maritime fog in the introduction.
3. Distinction Between Clean and Polluted Backgrounds

In lines 159-163, the authors differentiate between clean and polluted backgrounds based on fog microphysical properties. However, the distinction between clean and polluted backgrounds should be based on aerosol concentration, as fog microphysics are also influenced by meteorological conditions. The concentration of cloud

condensation nuclei (CCN) at the same supersaturation level would be more appropriate for this distinction. Numerous studies, such as Figure 2 in Wang et al. (2024), provide CCN concentration data under different background conditions.

4. In Section 2.1, the authors mention that the observation site is far from Hangzhou but claim that the site is generally near the top of the planetary boundary layer (PBL) around midday based on the PBL height of Hangzhou. This is unreliable because the boundary layer height varies by location.

5. The installation of instruments is important for observation results. Could you provide photos of the observation setup in the supplement? This would help readers better understand the instrument installation.

6. In line 145, the threshold involved in the definition of fog requires a reference for support.

7. The information in the figures should be clearly explained. For instance, there is a lack of explanation for Dp in Figure 1; Q1 and Q2 are not explained in the title of Figure 6. Please check other figures.

8. In line 158, there is an "s" at the end of "speeds." Is speed a countable noun?

9. Water Vapor Consumption in Line 218

The hygroscopic growth of aerosols affects the water vapor mixing ratio, but temperature directly influences the saturated water vapor mixing ratio, not water vapor itself. The authors mention only water vapor consumption in line 218. Please reorganize the explanation to clarify the mechanism behind the relatively high supersaturation.

10. Definition of Activation Ratio in Line 243

The authors define the Activation Ratio (AR) as "the CCN number concentration at a supersaturation setting of 0.2% relative to the total particle concentration." Why was 0.2% chosen? Please provide a reference to justify this choice.

11. In line 270, why was 880 nm used in this study? Please provide a reference or explanation.

12. In lines 296-299, the “≤” symbol is not in Times New Roman font.

13. Introduction

In line 68, the authors focus on polluted regions. The criterion for distinguishing between polluted and clean backgrounds is aerosol mass concentration, but the authors do not use this threshold to determine whether the observation site is polluted or clean. Describing the background as having high or low aerosol loading would be more accurate. If the authors wish to continue using the terms "polluted" and "clean," they should provide criteria to support these distinctions.

In lines 67-68, The authors emphasize the impact of interactions between aerosols and fog microphysics on visibility (“their impacts on visibility degradation”). However, only the effect of aerosols on visibility is highlighted. What about the influence of interactions between aerosols and fog on visibility? Additionally, while the effect of aerosols on fog microphysics is analyzed in the manuscript, the effect of fog on aerosols is not addressed (Qian et al., 2023). The interactions between aerosol and fog should be more prominently discussed.

14. There are large uncertainties in the aerosol–cloud interactions (ACIs) (Fan et al., 2016). If the conclusion provides novel insights into ACIs based on the findings related to interactions between aerosols and fog, it could significantly enhance the manuscript's appeal and attract more attention.

References

Fan, J., Wang, Y., Rosenfeld, D., and Liu, X.: Review of Aerosol–Cloud Interactions: Mechanisms, Significance, and Challenges, J. Atmos. Sci., 73, 4221-4252, https://doi.org/10.1175/jas-d-16-0037.1, 2016.

Qian, J., Liu, D., Yan, S., Cheng, M., Liao, R., Niu, S., Yan, W., Zha, S., Wang, L., and Chen, X.: Fog scavenging of particulate matters in air pollution events: Observation and simulation in the Yangtze River Delta, China, Sci. Total Environ., 876, 162728, https://doi.org/10.1016/j.scitotenv.2023.162728, 2023.

Wang, Y., Niu, S., Lu, C., Lv, J., Zhang, J., Zhang, H., Zhang, S., Shao, N., Sun, W., Jin, Y., and Song, Q.: Observational study of the physical and chemical

characteristics of the winter radiation fog in the tropical rainforest in Xishuangbanna, China, Sci. China, Ser. D Earth Sci., 64, 1982-1995, https://doi.org/10.1007/s11430-020-9766-4, 2021.

Wang, Y., Li, J., Fang, F., Zhang, P., He, J., Pöhlker, M. L., Henning, S., Tang, C., Jia, H., Wang, Y., Jian, B., Shi, J., and Huang, J.: In-situ observations reveal weak hygroscopicity in the Southern Tibetan Plateau: implications for aerosol activation and indirect effects, npj Clim. Atmos. Sci., 7, https://doi.org/10.1038/s41612-024-00629-x, 2024.