Dear Referees,

Thanks for giving us an opportunity to revise our manuscript (acp-2019-1045). We appreciate your positive and constructive comments. We have studied these comments carefully and make revisions on the manuscript. These comments and the corresponding replies are listed below.

The referee's comments are highlighted by gray, and followed by the comments are our responses. The symbol "≫" is the original texts in the manuscript. The modified sentences are marked by underlines. The added/replaced texts are colored by red.

With regards,

Shuqi Yan, Bin Zhu*, and all co-authors.

Replies to Referee#3

1. The focus of this study is on the radiative fog. However, there are different fog formation in atmosphere. For example, the advection fog formation is often occurred in the coast of eastern China. The Authors should highlight that under different fog conditions (i.e., radiative fog or advection fog, etc.) what is the effects of the urbanization and aerosol particles on the fog formation.

Thank you for this valuable suggestion. We agree that radiation fog and advection fog are two major fog types in China. They can occur in both inland and coastal areas. Gu et al. (2019) revealed the occurring frequencies of different fog types in Shanghai, a coastal city, during the past three decades. The major fog type is radiation fog (38.3%), followed by advection fog (27.7%) and advection-radiation fog (23.4%). Therefore, we infer that the dominant fog type in inland areas and coastal areas is radiation fog, which should be attracted more attention.

Compared with radiation fog which usually occurs under stagnant weather conditions, advection fog is associated with synoptic forcing, i.e., advection of a moist air mass with contrasting temperature properties with respect to the underlying surface (Gultepe et al., 2007). The role of synoptic forcing should be considered when studying the effects of urbanization and aerosols on advection fog, which is more complex than radiation fog. Zhong et al. (2017) indicated that urbanization and aerosols have nonsignificant effects on convective precipitation when the synoptic forcing is strong. Therefore, this study focuses on radiation fog to study the effects of urbanization and aerosols.

References

Gu, Y., Kusaka, H., van Doan, Q., and Tan, J.: Impacts of urban expansion on fog types in Shanghai, China: Numerical experiments by WRF model, Atmos. Res., 220, 57–74, https://doi.org/10.1016/j.atmosres.2018.12.026, 2019.

Zhong, S., Qian, Y., Zhao, C., Leung, R., Wang, H., Yang, B., Fan, J., Yan, H., Yang, X., and Liu, D.: Urbanization-induced urban heat island and aerosol effects on climate extremes in the Yangtze River Delta region of China, Atmos. Chem. Phys., 17, 5439–5457, https://doi.org/10.5194/acp-17-5439-2017, 2017.

2. Is this study suitable for the most of large cities in eastern China?

Thank you for this valuable suggestion. In the reply to comment1, we infer that the dominant fog type in inland areas and coastal areas of eastern China is radiation fog. Under the unified leadership of national government, most of the cities in eastern China experience the similar development pattern, i.e., the expansion of urban areas is commonly accompanied by increasing aerosol pollution. So we believe our results of radiation fog are suitable for most of the cities in eastern China.

3. Some important references are missing. For example, Tie et al (2017) studied the important feedback of atmospheric moister on the aerosol pollution in eastern China, which should state in the instruction.

Thank you for this valuable suggestion. We have added the two references in Line 54-55: " Aerosols attenuate shortwave radiation, influencing PBL structure and the vertical profile of moisture and aerosols (Tie et al., 2017, 2019), which can alter the formation and dissipation condition of fog".

References

Tie, X., R.J. Huang, J.J. Cao, Q. Zhang, Y.F. Cheng, H. Su, D. Chang, U. Pöschl, T. Hoffmann, U. Dusek, G. H. Li, D. R. Worsnop, C. D. O'Dowd, Severe Pollution in China Amplified by Atmospheric Moisture, Sci. Rep. 7: 15760 DOI:10.1038/s41598-017-15909-1, 2017.

Tie, XX, X. Long, GH Li, SY Zhao, JJ Cao, JM Xu, Ozone enhancement due to photo-dissociation of nitrous acid in eastern China, Atmos. Chem. Phys., 19,11267–11278, 2019.