

## ***Interactive comment on “Evaluation of hygroscopic cloud seeding in liquid-water clouds: a feasibility study” by Fei Wang et al.***

**Anonymous Referee #2**

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General comments: Assessment remains elusive of the hygroscopic cloud seeding, given the buffering effect induced by the co-variability of meteorology, aerosol particles (agents) and clouds. The authors comprehensively evaluated the effect of hygroscopic cloud seeding used a combination of aircraft measurements, ground-based radar and gauge observations, along with radiosonde and geostationary data. The topic is of interest and the data obtained here are valuable to the weather modification community. However, the paper is not well organized and should be substantially revised before it can be acceptable for publication. Also, the writing should be polished to improve the readership given a lot of grammar errors. Below listed are the major comments and minor comments returned to the authors for consideration.

Major comments: 1. Major findings are derived from ground-based radar data and

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aircraft-based CDP measurements, which is valuable to the scientific community. Given that Himawari is new-generation geostationary satellite which provides cloud observations at 10-min intervals, Figure 1b-c is a good case in point. I am wondering whether the authors can show any images of post-seeding, in order to provide circumstantial evidence for the argument of “The echo top height dropped to  $\sim 3.5$  km”. Are there any changes in the cloud top height as observed from Himawari? I think this addition and related discussion will make this paper more convincing. 2. The organization of this manuscript needs to be substantially changed. It is customary to put “methods” together with “data” rather than with “results”. Therefore, sections 3.1 and 3.3 are advised to be moved to section 2. On top of it, the title of section 3 can be revised to “Results and discussion”. As such, more discussion is required in analyzing the observational results to enhance its readership. 3. Sections 3.4, and 3.5: In the domain with cloud seeding, it seems to me that the precipitation peaked at 0300-0400 UTC from the perspective of life cycle of the stratocumulus clouds analyzed here. This will undoubtedly result in the expected results shown here. It is therefore supposed to add some discussion in this regard.

Minor comments: 1. Page 1 Line 26: Several grammar errors in “This probably because the hygroscopic growth by agent particles and collision-coalescence by small cloud..” 2. Page 1 Line 26: There is a typo here. “is” is missing in “which probably” 3. Page 1 Line 1: something is missing after “ground-based” 4. Page 2 Line 30: the author may consider to add “ending up with delayed onset of precipitation (Rosenfeld et al., 2014; Guo et al., 2016; Lee et al., 2016)” following “precipitation (Rosenfeld et al., 2008).” 5. Page 3 Lines 7-8: It is advised to mention several most recent assessment studies conducted in China used ground-based radar and aircraft measurements, including Wang et al., 2019. J. Meteor. Res., doi: 10.1007/s13351-019-8122-1. 6. Page 3 Lines 14-16: The three radiosonde sites are part of radiosonde observational network operated by CMA, which is supposed to be mentioned here. Also, the uncertainties of humidity and temperature are needed to be discussed, given they have been used to derive the vertical structures of clouds. 7. Page 5 Line 11: “which pending”-> “depending” 8. Page

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5 Line 31: 0600 UTC ? 9. Page 7 Line 10: “as”->”at” 10. Page 8 Lines 19-20: “Radiosonde soundings, real-time satellite images, and airborne CDP observations were all acquired to help identify cloud conditions suitable for cloud seeding.” is misleading, especially for the purpose of radiosonde. I noticed in the supplementary materials, the authors used 0600 UTC, which was 2-3 hrs after cloud seeding. 11. Page 9 Line 12: “not”-> “rather than” or “instead” 12. The authors may consider to revise the x-axis title from “Time series” in Figures 4 and 8 to “Hours (UTC)” 13. The caption in Figure 9: “consider” is advised to be changed to “corresponds to” ; “right graph” is advised to be changed to “rightmost panel”

References:

Rosenfeld D, et al., 2014. Climate effects of aerosol-cloud interactions. *Science*. 343(6169):379-80. Guo, J. et al. 2016, Delaying precipitation and lightning by air pollution over the Pearl River Delta. Part I: Observational analyses, *J. Geophys. Res. Atmos.*, 121, 6472–6488, doi:10.1002/2015JD023257. Lee, S.-S., et al., 2016. Delaying precipitation by air pollution over Pearl River Delta. Part 2: model simulations, *J. Geophys. Res. Atmos.*, 121, 11,739–11,760, doi: 10.1002/2015JD024362 Wang, W., et al. 2019. Extra-area effect in operational cloud seeding during winter in Jiangxi province, East China. *J. Meteor. Res.*, 33(3), doi: 10.1007/s13351-019-8122-1.

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