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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A study of the impact of synoptic weather conditions and water vapor on aerosol-cloud relationships over major urban clusters of China" *by* K. Kourtidis et al.

Anonymous Referee #2

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General comments:

In an attempt to decouple the aerosol-cloud-meteorology conundrum, this manuscript investigates the impact of water vapor (WV), sea low pressure (SLP) and aerosol on cloud cover (CC) and cloud top pressure (CTP) over three ubran clusters in China, where is continuously plagued by heavy aerosol pollutions.

Overall the work by Kourtidis et al is valuable to the cloud physics and aerosol-cloud interaction communities. Although there are some issues in the discussion and explanation of some of the figures, the authors do figure out the WV and CTP effect on

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CC, except for aerosol optical depth (AOD). They provide interesting results in their figures for the co-variation in CTP, CC, WV, AOD and LSP, albeit they cannot give compelling evidence concerning meteorological factor or aerosol will dominate the changes in cloud properties. This work is novel in the way in which it uses SLP from reanalysis data to stratify the dataset into three subsets. The work is a very interesting contribution, but i believe it deserves more discussion and several clarifications as follows:

Concerns: This paper investigated the meteorological effect on cloud using MODIS AOD for the whole year. Actually, availability of MODIS AOD largely depend on season (desperate scant AOD available in Winter), so does the AOD-Cloud Interactions (e.g. Wang et al. 2015). This likely leads to not pronounced effect of aerosol on cloud cover. The authors should elucidate or make a case for such samples selection for aerosol-cloud interaction analysis.

Specific comments:

1 P14013 lines 13-14: I am looking forward to the possible reasons (except for WV) for the statements “In fact, over PRD the impact of AOD on CC for constant WV seems negligible (Fig. 4a, b, e and f).” They may discuss it as least from the following two aspects: 1, aerosol types is complicated in China, because different aerosol types have totally different effect on clouds; 2, The vertical aerosol-cloud laying pattern: mixing or separated? Which exert great influence on the results. you can cite the paper by Huang et al., 2015 and Wang et al. 2015. 2 “Sea Level Pressure (SLP) and Water Vapor (WV) regimes daily Sea Level Pressure (SLP) data from the NCEP/NCAR Reanalysis for the same . . .” you may clarify why not use the hourly (or 6 hourly) that is close to AQUA or TERRA overpass time. 3 P14011 line 09: we used daily Sea Level Pressure (SLP) data from the NCEP/NCAR Reanalysis for the same. 4 P14011-lines 12-15: Given this paper is largely based on the stratification of meteorological parameters, the authors should give more details concerning how the stratification of WV, CTP, AOD has been made, except for SLP. 5 From Figures 2-4, it seems for each bin of meteorological factor and AOD does not have equal sample size. In such case, there will mostly likely

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be large bias in the conclusions you. You'd better clarify why not choose this method of equal-sample bin, which is thought to be more robust in the statistical analysis and widely used in previous studies. 6 P14012, second paragraph should be removed to Section 2. 7 P14016, I am not convinced of "It is also found that there is no large systematic AOD retrieval bias due to aerosol swelling at high WV. ", which can typically be concluded from validation or simulation work. Suggest delete it or clarify it with supporting materials.

References: Costantino, L., and F. M. Bréon (2013), Aerosol indirect effect on warm clouds over South-East Atlantic, from co-located MODIS and CALIPSO observations, Atmospheric Chemistry and Physics, 13, 69-88. Huang, J., J. Guo, F. Wang, Z. Liu, M. -J. Jeong, H. Yu and Z. Zhang, 2015. CALIPSO Inferred Most Probable Heights of Global Dust and Smoke Layers, Journal of Geophysical Research-Atmosphere, 120(10): 5085–5100, doi: 10.1002/2014JD022898. Wang F., J. Guo, J. Zhang, J. Huang, M. Min, T. Chen, H. Liu, M. Deng, and X. Li, 2015. Multi-sensor quantification of aerosol-induced variability in warm cloud properties over eastern China, Atmospheric Environment, 113, 1-9.doi:10.1016/j.atmosenv.2015.04.063.

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