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Interactive comment on "Observational Analyses of Dramatic Developments of A Severe Air Pollution Event in the Beijing Area" *by* Ju Li et al.

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We would like to thank Reviewer 1 for spending his/her valuable time on reviewing the paper. Obvious, we disagree with Reviewer 1 on values of detailed process studies vs. climatology studies. Hopefully through our detailed replies below (in red), Reviewer 1 can see the unique values of our contribution to understanding developments of pollution events at Beijing.

This study investigates the meteorological reasons for haze formation in Beijing that occurred at the end of November 2015. The authors presented one-week surface stable layer and wind data collected at Beijing sampling site that of interest to the readers to solidify their findings. The paper is valuable to the audiences and scientists

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Discussion paper

who want to understand the reasons for Beijing haze formations in winter and also well organized for being published on ACPD.

We have detailed data analyses on the severe air pollution event, which indeed lasted about a week. However, the boundary layer was not stable during the entire week-long time period and the dramatic increase of PM2.5 actually occurred during a daytime convective period. We clearly identified the role of the nighttime stable boundary layer in helping transferring air pollutants above Beijing and the dramatic increase of PM2.5 as a result of development of convective turbulent mixing in transporting pollutants down to Beijing in the morning. In other words, we found that the role of the stable boundary layer is beyond trapping pollutants within the stable boundary layer as frequently discussed in the literature. In addition, our observation coverage, which includes remotely sensed aerosol measurements at three locations across Beijing, vertical measurements of meteorological variables from remote sensing instruments and soundings, and turbulence measurements up to 280 m, is unprecedented in the area because of the special field campaign of SURF-15. Because the pollutant transfer mechanism described in the manuscript (not haze formation as the reviewer described) can occur at other places not just unique for the Beijing area, understanding this unique pollutant transfer mechanism can help improving pollution forecasts.

However, this study is unable to provide a long-term meteorological dataset of haze event at the sampling site in Beijing, where âĹij30

Climatological investigation of haze events is not the goal of this study. Detailed analyses with unprecedented observations in the Beijing area are lacking in the area in the literature, that is what we aim at.

In addition, the air pollution in Northern China exhibited a spatiotemporal variations, even in one city. Please see Environment Pollution 2017, 227, 334-347. In other words, the results from one sampling site in Beijing is unable to represent the whole one to illustrate the reasons of haze formation in Beijing.

Please check out section 2 on instrumentation and observations across Beijing. It is definitely not at one observation site.

Also, a large number of papers have already looked at this topic from the meteorological angle. 1. Characteristics of chemical composition and role of meteorological factors during heavy aerosol pollution episodes in northern Beijing area in autumn and winter of 2015 Author: Zhang, Zhouxiang; Zhang, Xiaoye; Zhang, Yangmei;et al. TELLUS SERIES B-CHEMICAL AND PHYSICAL METEOROLOGY, 69: 1347484, JUL 26 2017 2.

Their focuses are the composition of pollutants and the feedback effect of meteorological conditions after the formation of a pollution event. Our analyses focused on the meteorological condition that led to the rapid growth of PM2.5.

2. Attributions of meteorological and emission factors to the 2015 winter severe haze pol- lution episodes in China's Jing-Jin-Ji area Author: Liu, Tingting; Gong, Sunling; He, Jianjun; et al ATMOSPHERIC CHEMISTRY AND PHYSICS, 17: 2971-2980 , FEB 27 2017 3.

The observational analyses presented in the paper were mainly on correlations between the meteorological parameters such as air temperature and relative humidity at 2 m above the surface and wind speed at 10 m above the surface. Our analyses focused on what kind of physical transporting mechanisms were responsible for the dramatic increase of PM2.5, which is significantly different from this paper.

3. Characteristics and classification of PM2.5 pollution episodes in Beijing from 2013 to 2015 Author: Wang, Xiaoqi; Wei, Wei; Cheng, Shuiyuan; et al. SCIENCE OF THE TOTAL ENVIRONMENT , 612 : 170-179, JAN 15 2018 4.

The paper focused on model trajectory investigations of pollution episodes, while we used the unprecedented data coverage including in-site observations over a tall tower and remotely sensed measurements and found detailed horizontal and vertical trans-

porting mechanisms for the dramatic increase of PM2.5 at Beijing.

4. Relative Contributions of Boundary-Layer Meteorological Factors to the Explosive Growth of PM2.5 during the Red-Alert Heavy Pollution Episodes in Beijing in December 2016 Author: Zhong, Junting; Zhang, Xiaoye; Wang, Yaqiang; et al. JOURNAL OF METEOROLOGICAL RESEARCH, 31 : 809-819 , OCT 2017 5.

5. Climatology of the Meteorological Factors Associated with Haze Events over Northern China and Their Potential Response to the Quasi-Biannual Oscillation Author: Liang, Ju; Tang, Yaoguo JOURNAL OF METE- OROLOGICAL RESEARCH , 31 , 5: 852-864 , OCT 2017 6.

As indicated from the title of the paper, it focused on climatology of meteorological variables with haze events, while we focused on detailed transporting mechanisms for our severe pollution event.

6. Cause and predictability for the severe haze pollution in downtown Beijing in November-December 2015 Au- thor: Zhang, Ziyin; Gong, Daoyi; Mao, Rui; et al. SCIENCE OF THE TOTAL ENVI- RONMENT, 592 : 627-638 , AUG 15 2017 7.

They explored possible influences of meteorological conditions on the severe pollution at Beijing. Again, we have different focuses.

7. Characteristics of chemical composition and role of meteorological factors during heavy aerosol pollution episodes in northern Beijing area in autumn and winter of 2015 Author: Zhang, Zhouxiang; Zhang, Xiaoye; Zhang, Yangmei; et al. TELLUS SERIES B-CHEMICAL AND PHYSICAL METEOROL- OGY, 69 : 1347484, JUL 26 2017 8.

This is the same paper as the first one.

8. Local and regional contributions to fine particulate matter in Beijing during heavy haze episodes Author: Wang, Yangjun; Bao, Shengwei; Wang, Shuxiao; et al. SCIENCE OF THE TOTAL ENVIRONMENT, 580 : 283-296, FEB 15 2017

This is a statistical study, which is very different from our focuses.

Thus, this paper could not show a more complete picture of illustrating the meteorological reasons for Beijing haze formation and lacks the comprehensiveness for the audiences in ACP . I recommend this paper could not be accepted by ACP.

We demonstrated how pollutants were transported horizontally and vertically to Beijing through detailed observational analyses across the Beijing area, which none of the suggested papers have shown. We focused on the dramatic development of a severe pollution event with the unprecedented vertical observations of aerosols at three locations across Beijing as well as turbulence data up to 280 m above the surface. Climatology studies are different from process analyses. Without process analyses to reveal detailed formation of some pollution events especially in vertical, we would not be able to understand what happens during the development of pollution events.

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