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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The evaluating study of the momentum and heat exchange process of two surface layer schemes during the severe haze pollution in east China" *by* Yue Peng et al.

Anonymous Referee #2

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This work evaluated the performance of a new surface layer scheme (Li) and a widely applied scheme (MM5) in simulating the momentum and sensible heat fluxes. Using the observational data in Gucheng station located in the southwest of Beijing from Dec 1, 2016, to Jan. 9, 2017, The authors found the Li scheme generally performed better than MM5 in calculating SL fluxes during the heavy pollution process. The study fits within the scope of the journal, and the manuscript is generally well written. The result presented is interesting as it shows the SL scheme performance in a polluted case. However, I found that some key details on the introductions are lacking and some of the discussions are not very well grounded.

Major comments:

1. The author should explicitly explain the scientific meaning of the paper. Since Li scheme has been published and evaluated in Li et al. (2014; 2015), why do we need additional evaluation using the observation during a severe haze episode from Gucheng station? I believe this evaluation may be necessary, but the authors need to illustrate clearly the specialty of this case. Also, the word "east China" appears several times in the paper. How did the author conclude Li generally performed better than MM5 in winter in east China since they only did one case in Beijing?

2. The role of surface layer (SL) scheme in air quality modeling needs to be further discussed in the introduction. The authors made sufficient introduction to the current status of SL. However, a detailed introduction of the importance of SL schemes in simulating pollution episode is somewhat lacking. In other words, the interactions between pollutant transportation, momentum and sensible heat (and how current SL schemes perform in momentum and sensible heat modeling) should be well established in the introduction part.

3. In the third conclusion (Line 342-343): The authors argued that "During the heavy pollution process, the calculated momentum and sensible heat fluxes by the Li scheme were better than those by the MM5 scheme generally". If the authors only compared simulated momentum and sensible heat to the observation, why this work emphasized the "heavily polluted conditions"? Future work may consider coupling SL scheme with atmospheric chemistry models to compare the modeled pollutant concentration with observation directly.

Minor comments:

1. Line 65-66: Why is the pollution episode important? The author may need to specify and add more discussion instead of arguing "few studies discussed it based on a pollution episode corresponding various atmospheric states."

2. Line 172-180: The observation and method should be introduced in further details. What is the spatial representativeness of the station? Can it represent the whole east China? If not, should add more cases in other parts of China or considering changing this word. What is the measuring height for the fluxes? (Could refer to Liu et al. 2016 as an example for the introduction)

3. Line 182-189: The data processing should be explained in further details and add more reference in data processing methods (Line 182-Line 189). For example, how was the quality control conducted? The reference for quality control may be included if they have been applied in the study (e.g., frequency response correction (Moore, 1986) and WPL correction (Webb et al., 1980), or quality control (Foken et al., 2004)).

4. Please explain why z = 10 m has been used (line 218)?

5. What variables have been used in Li and MM5 schemes? In the third part (Observational data and methods), the paper only introduced the data acquired from the Gucheng station, without specifying what variables would be used in the two schemes.

6. Straight from 5. Line 247, the authors mentioned: “Given the observational data, a dataset of Z0m (Z0h) then is generated”. What variables were used in calculating Z0m and Z0h? This may be clarified in the third part (observational data and methods).

7. Line 250 to Lint 264: The author may consider comparing their conclusion with analysis from other papers (Chen et al. 2009; Chen et al. 2011). The reference used here is somewhat out of date.

8. In the Fig. 4, the authors showed the effect of the roughness length on flux calculation by choosing different z0m values. Since the z0m and Z0h has already been determined in the crop field, I feel it may not be necessary to discuss the influence of roughness length on the calculation of turbulent flux

9. Line 315-316: In the previous results and discussion, the authors only analyzed the superiority of Li scheme in modeling sensible heat and momentum flux. More analysis

is needed discussing the SL flux influence the air pollution process should be illustrated before concluding “the superiority of Li scheme in the air pollution modeling.”

The reference listed here could be helpful:

Chen, Fei, and Ying Zhang. "On the coupling strength between the land surface and the atmosphere: From viewpoint of surface exchange coefficients." Geophysical Research Letters 36.10 (2009).

Chen, Yingying, et al. "Improving land surface temperature modeling for dry land of China." Journal of Geophysical Research: Atmospheres 116.D20 (2011).

Zheng, Donghai, et al. "Assessment of roughness length schemes implemented within the Noah land surface model for high-altitude regions." Journal of hydrometeorology 15.3 (2014): 921-937.

Liu, Ye, WeiDong Guo, and YaoMing Song. "Estimation of key surface parameters in semi-arid region and their impacts on improvement of surface fluxes simulation." Science China Earth Sciences 59.2 (2016): 307-319.

Moore C J. Frequency response corrections for eddy correlation systems[J]. Boundary-Layer Meteorology, 1986, 37(1-2): 17-35.

Webb E K, Pearman G I, Leuning R. Correction of flux measurements for density effects due to heat and water vapour transfer[J]. Quarterly Journal of the Royal Meteorological Society, 1980, 106(447): 85-100.

Foken T, Göockede M, Mauder M, et al. Post-field data quality control[M]//Handbook of micrometeorology. Springer, Dordrecht, 2004: 181-208.

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