

Interactive comment on “Observation of regional air pollutant transport between the megacity Beijing and the North China Plain” by Yingruo Li et al.

Anonymous Referee #4

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This work presents an interesting study on the regional-flux calculation based on two-year valuable ground-based measurement at a cross-boundary site between Beijing and its neighbor province. Generally speaking, the overall scientific topic of this paper, i.e. the cross-boundary transport, is very important for air quality management. The authors tried to apply a method to estimate the pollution flux based on ground-based measurement following the idea proposed 40 years ago by White et al. (1976).

In White's work, aircraft and balloon measurements in different locations in and downwind a city were used for the flux estimation, here this study was mainly based ground based measurements. In air quality management, the flux around surface is meaningless but a flux in the entire boundary layer is the main concern. However, because

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the cross-boundary PBL transport flux at a certain place will be strongly related to the distribution of vertical profiles of air pollutants and wind. Primary pollutants like SO₂, CO, NO_x generally have a different vertical profile with secondary species like O₃, especially at nighttime. So the flux calculation based on ground-based data will have very large uncertainty at different time of a day.

This paper focuses more on method application/developing but not results discussion, which maybe the reason that they only put several key figures in the main text but others in the supplementary. For this reason, although the authors already mentioned that they didn't consider the possible influence from high altitude and boundary layer (Line 402-404), I would like to encourage them pay more efforts to improve the methods of PBL flux calculation based on ground-based station measurement. Below I suggest some possible methods for this kind of calculation.

First, because nowadays numerical models, such as the CMAQ or WRF-Chem, could give a relatively good estimation in the transport flux at surface and also the entire PBL, I would like suggest the authors to make a comparison of their calculated flux with these modeling results. This kind of modeling study and comparison don't have to cover very long period but may be okay for several days in different seasons. This comparison will provide valuable information on how to use the ground-based data to estimate the PBL flux. One interesting point could be that if the proposed method only works for the early afternoon (12:00-16:00 for example), when the boundary layer is well-developed and the vertical profiles of air pollutants and wind are relatively unified in the entire boundary layer. If it is true, maybe the authors can only use the afternoon data to discuss the seasonal pattern of flux.

If the authors would like to further apply this method for other time of a day except the early afternoon, they could use historical averaged profiles of air pollutants and wind to give an estimation of the PBL flux. In fact, in Beijing and other regions in the North China Plain some studies already showed vertical profiles of air pollutants based on aircraft or balloon studies and also there are routine radiosonde measurements of wind

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in some meteorological station. It will be better to include those averaged profiles in the estimation of PBL flux based on surface measurement. Of course, these modeling studies for cases in different seasons will be useful for evaluating these calculations and for improving the methodology.

Minor comments:

- 1) Figure 1, it will be better to include terrain and also the emission data in the figure.
- 2) White et al. (1976), one of the most important references, was missed in the reference list.

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