

# ***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 #1**

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### General comments:

The authors presented an analysis of the regional transport flux of pollutants between Beijing and North China Plain (NCP) based on two years measurements at a single ground site (Yufa) located between the two regions. They also discussed a range of factors that contributed to the pollutant transport. The manuscript is concise and clear. However, the paper has major structure problems. While only four figures are included, the main text has extensive discussions on figures from the supplementary materials. Supplements are meant to provide information to readers, which is not key component to complete the paper. The authors need to reconsider what figures to include in the main text and avoid long discussions on supplements.

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The paper lacks in-depth discussions and fails to present sufficient evidence to back their interpretations of the results (see details below). The transport flux calculation method comes with assumptions, and is subject to uncertainties and errors, which should be made clear to readers. The authors did not discuss at all how these assumptions and errors would affect the interpretation of results. I believe that the paper needs substantial revisions in order to be considered suitable for publication at ACP. Thus, I recommend rejecting the paper at this stage. The authors may consider a resubmission.

The authors use measurements at a certain height from a single ground station to infer the transport flux between two vast regions – Beijing and NAP. The flux calculation method has many assumptions, which are not mentioned at all. Hourly winds are used in Eq. 3. Is it hourly mean and is the wind assumed to be constant? Note that winds can be highly variable within an hour. Are there any changes in wind speeds along the transport route between Beijing and NAP but not recorded at Yufa site? What are the conditions of the atmospheric boundary layer (stable, well mixed?) during the different years and seasons? The ABL condition strongly affects the pollutant mixing and vertical profile, and is expected to change a lot during different seasons (e.g., summer vs. winter). How are the seasonal PBL conditions accounted for in calculating the flux? Since the Yufa site is built on the top of a building, does the building or nearby structure affect the boundary layer and consequently, the wind and gas measurements? In addition, the extrapolation from Yufa site to the entire region is not backed by any analysis (e.g., trajectory analysis in HYSPLIT or STILT). How do the authors know that data collected at Yufa are representative for the entire region?

Detailed comments:

L53 and other places: avoid putting citations in the middle of a sentence. Put them at the end.

L67: need to define the abbreviations (SO<sub>2</sub>, CO. . .) (write their full names). Only need

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to define abbre. at their first occurrence. On L119, SO<sub>2</sub> is defined, but at the wrong place.

Figure 1: The authors need to make the best use of figures. Fig. 1 is too simple and does not convey much information. I recommend placing marks or better, using color coding, to show where exactly NAP is located at. I suggest using terrain height as the background in Fig.1, since topography is a big factor in affecting the air quality in Beijing.

Sect. 1.1: what are the instrument accuracies for the gas species?

Eq. 2: what does the smooth function do?

L159: citation for White et al is missing. Doublecheck that the reference is complete.

L169: haven't you already described the angle at L165?

Eq. 3: how is the cross section area calculated?

L191: define WS, RH, TF and BP. Consider moving Fig. S2 to main text because you talk about it a lot! Sect. 3.2, L226-234, move the description on bivariate polar plots to the methods section.

L278-322: I suggest splitting the discussions on local emissions vs transport by different seasons for different species, because on the one hand the emission source has a seasonal cycle and on the other hand, the seasonal meteorological conditions affect the chemical reaction rate, species lifetime and transport. I feel that this part of discussions is not backed by any solid analysis at all, but it is key to understand why different species behave differently on the bivariate polar plot.

L307: SO<sub>2</sub> lifetime in the atmosphere is typically a couple of hours to 1-2 days.

Sect. 3.3: the fact that the flux values in Table 1 do not come with standard deviations points to the lack of uncertainty analysis in the flux calculations. Table 1 is subject to various errors which should be discussed and addressed.

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Technical comments:

L54: 'important factors' should be 'an important factor'.

L61: 'stationary' should be 'station'.

L64: remove "have been employed".

L64-69: rewrite this sentence. "found that" should have an appropriate subject (e.g., study, human).

L80-84: rewrite this sentence. It is confusing. Do the authors want to say that, when switching from off to on in CMAQ, SO<sub>2</sub> and PM<sub>2.5</sub> increase by 26% and 15%?

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Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-476, 2016.

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