

Review on “Contributions of Trans-boundary Transport to the Summertime Air Quality in Beijing, China” by Wu et al.

General comments

This manuscript presents a WRF-CHEM modeling study using to evaluate the contribution of regional emissions to the air quality in Beijing during a summertime pollution episode using the FSA analysis. This study comes timely as there have been debates over whether local emissions play the major contribution to the air pollution in Beijing. The methodology is sound, and the results are well presented and organized. I would recommend it for publishing with a few minor revisions.

Specific comments

1. P1 lines 27-28 and P21 lines 462-463, it is a big jump to extrapolate the results from an episode to the whole summer season. You need to prove that the episode studied is representative of the summertime situation in Beijing. In addition, air quality “primarily determined by the trans-boundary transport” may only be applied to PM_{2.5}, not O₃, since background O₃ accounts for 46% of the afternoon O₃ (line 338). Maybe I have a misunderstanding in here, which is related to the comment below.
2. Confusions on some concepts. To my understanding, the “trans-boundary transport” term refers to the transport of regional anthropogenic emissions (i.e., f_s), and it does not include “background” (f_0). Am I right? In addition, in the FSA analysis, which term include the biogenic emissions? Are the interactions between anthropogenic and biogenic emissions accounted? Does the trans-boundary transport include the impacts of biogenic emissions?
3. In both the abstract and summary sections, besides considering the uncertainties in emissions and meteorology, simulations for more pollution episodes should be addressed to “evaluate trans-boundary transport contributions to the air quality in Beijing for supporting the design and implementation of emission control strategies”.
4. P2-3, lines 55-56, “daily average of up to 110...”, daily average or daytime average?
5. P5 lines 111-113, more descriptions of the episode are needed, including meteorological conditions, which may help to add information whether or not the episode is representative of the summertime air pollution in Beijing. Also, what does the “mean daily” mean here? episode average?
6. P9 line 191-193, the differences in CO, SO₂, NO_x and PM_{2.5} between 2013 and 2015 are attributed solely to the emission change. Are the meteorological conditions similar between these two periods?
7. P10-11 Section 3.2, NO₃⁻ and NH₄⁺ are shown in Figure 3, but there are no discussions or descriptions of these two components. Point comparisons may also contribute to the biases.

8. Figures 10 and 11, regarding the contributions from total emissions, emissions from Beijing, and emissions outside Beijing. As I understand, the last two terms are calculated as $f'_B + f'_{BS}$ (or $f_{BS} - f_S$) and $f'_S + f'_{BS}$ (or $f_{BS} - f_B$), but how is the first term (contribution from total emissions) calculated? $f_{BS} - f_0$? or sum of the last two terms? Captions in Fig. 10 and 11 are a bit of confusing: f_B , f_S , and f_{BS} represent simulation results, not contributions.
9. P15 line 337, 45.6%, but in table 2, the number is 46.1%.
10. Table 3 is shown and is not discussed.

Technical corrections

1. Line 25, change “more” to “higher”
2. Line 32, change “reasonably” to “better”
3. Line 134, Stein et al. (1993) should be Stein and Alpert (1993)
4. Line 189, delete “hourly”
5. Line 227, change “the failure of” to “biased”
6. Lines 533-538, the two references do not show in the text.