(1) Page 4, Line 5-6

Please show the table number in SI.

Response: We revised “SI” to “Table S4”. (Page 4, Line 5-6)

(2) Page 4, Line 17-

This part is still confusing. Iron and steel production are mentioned as an example in the line 18. However, it seems that the explanation of the symbols in the equation (2) is for cement production. Please reconsider rephrasing.

In addition, these sentences have been added.

“The production processes represented by the first and second terms of equation (2) are frequently performed in different enterprises. For example, for cement production, clinker may be produced in one enterprise and subsequently processed in another enterprise, which is very common.”

I agree that. However, the equation (2) is for the enterprise j, isn’t it? If processes are divided to multiple enterprises, equation should be also divided.

It is not clear that how to apply information of stacks and locations in the equation (2). Are individual information of stacks and locations applied to each m process in the first term and the second term?

Response:

(1) We rephrased the description of the equation. It is revised as follows:

Some industrial sources involve multiple production process, such as iron and steel production and cement production. Taking cement production for example, emissions are calculated by using the following equation:

$$\boldsymbol{E_{i,j}} = \sum_{\boldsymbol{m}} \left(\boldsymbol{AK_{j,m}} \times \boldsymbol{EF_{i,m}} \times (\mathbf{1} - \boldsymbol{\eta}_{\boldsymbol{i},\mathrm{j},\boldsymbol{m}}) \right) + \left(\boldsymbol{AC_j} \times \boldsymbol{ef_i} \times (\mathbf{1} - \boldsymbol{\eta_{i,j}}) \right) \quad (2)$$

(Page 4, Line 18-21)

(2) Equation (2) is for enterprise j. For each enterprise, we calculate the emission of each production process. Specifically, the total emission of enterprise j is the sum of the emissions of all production processes in that enterprise. If processes are divided to multiple enterprises, the emission will be considered in the calculation of the emission of each individual enterprise. (Page 5, Line 7-9) Therefore, it is not necessary to divide equation (2).

(3) Individual information of stacks is applied to each m process in the first term and the second term. The locations of different processes in the same enterprise are usually assumed to be the same. (Page 6, Line 9-11)

(3) Page 5, Line 20-

How to interpret emission standards and permits for stack parameters?

Response:

We take the emission standard of air pollutants for cement industry (Ministry of Environmental Protection of China, 2013) as an example. As shown in Table R1 (Translation of part of the emission standard), there are specific requirement for the height of the chimney of different facilities with different production capacities. We assume that the factories are built following the standard. Therefore, we can calculate the minimum stack height with the production capacity of each plant.

Table R1 Emission standard of air pollutants for cement industry. (Translation of part of the standard)

Facility name	Cement kiln				Drying and grinding mill, coal mill and cooler			Other facilities
Production capacity, t/d	<240	240~700	700~1200	>1200	<500	500~1000	>1000	3 m higher than the building
Minimum acceptable height	30	45	60	80	20	25	30	

We can also get the detailed stack information from the national information platform of pollutant discharge permit (http://114.251.10.126/permitExt/outside/default.jsp). We choose a random coal-fired power plant (ID of the permit: 9137018135347640XF001P) from the website of the platform as an example, as shown in Table R2 (Translation of part of the permit). We can see that the permit includes most of the stack information of the plant.

Table R2 Basic condition of the chimney of a coal-fired power plant. (Translation of part of the permit)

No.	Chimney Number	LON	LAT	Chimney height (m)	Chimney diameter (m)	Flue gas temperature (℃)
1	DA001	117°27′	36°38′	100	3	50
2	DA004	117°27′	36°38′	80	3	50
3	DA005	117°27′	36°38′	80	3.4	50

(4) Page 8, Line 2-

Was plume-in-grid utilized?

Response: No. The focus of this research is to study the influence of horizontal and vertical distribution of emissions from industrial point sources on simulated air quality. The difference between the hypo unit-based inventory and unit-based inventory represents the influence of vertical distribution. If plume-in-grid was utilized, it would be more difficult to isolate the impact of emission distribution because of the chemical reactions in sub-grid scale.

Nonetheless, we recognize that using plume-in-grid might help to further improve the model performance, which merits further in-depth study. (Page 15, Line 1-2)

(5) Page 10, Line 4-

Do the authors think uncertainties in these factors are dominant? Are there no remaining problems in emission inventory for industries? SO2 is overestimated by 100 ug/m3 in winter. If they are converted to PM through chemical processes listed here, overestimation of PM2.5 would become even much larger.

SO2 emission factors are determined by sulfur contents. They should be relatively reliable. I suppose it may not be so easy to obtain accurate removal efficiencies from each enterprise. Do the authors expect little uncertainties in them?

Response: We agree with the reviewer that the overestimation of SO_2 concentration may also be due to uncertainty in emission inventory, especially the uncertainty in the removal efficiencies of SO_2 control facilities. We have mentioned this possible reason in the revised manuscript. (Page 10, Line 15-17)

In fact, our SO_2 emission estimates are already lower than most previous studies. Fig. R1 (Fig.S3 (a) in the manuscript) compares the SO_2 emission of BTH region with those calculated in other studies. The SO_2 emission in Beijing and Tianjin in this study is much lower than other studies. As for the SO_2 emission in Hebei province, the emission in this study is close to other studies. Further studies are needed to determine the reasons for the discrepancy and improve the simulation results.

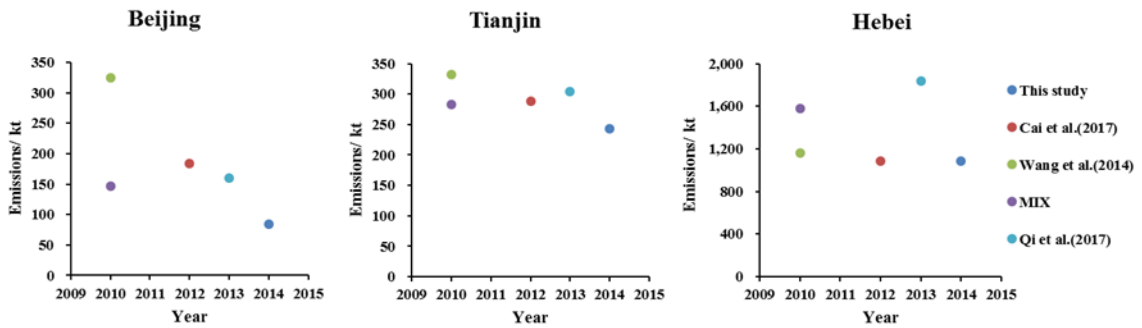

Fig. R1 Emissions of SO_2 compared with other studies.

(6) Page 12, Line 26

Page 13, Line 4

Table 2 -> Table 3

Response: The manuscript is revised accordingly.

(7) SI Page 4, Figure S2

Abbreviations of sectors are not known.

Response: The full names of the sectors are added to the manuscript. (SI Page 4, Figure S2)

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