Supplement of

Significant contrasts in aerosol acidity between China and the United States

Bingqing Zhang et al.

Correspondence to: Huizhong Shen (shenz@sustech.edu.cn)

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Supplementary Information

Text. S1 Effects of ammonium on aerosol pH

The result of MTSM indicates that the difference in TNH\textsubscript{3} is one of the predominant reasons causing the pH difference. In order to study the effect of TNH\textsubscript{3}, we conduct sensitivity tests for China and the US separately to investigate the responses of aerosol pH to changing TNH\textsubscript{3}. We change the TNH\textsubscript{3} concentrations from 0.1 to 1000 µg m\textsuperscript{-3} while keep all other components constant at their annual average levels based on observation data (Table 2). We also use simulation data with population as the weight to study the effects, which consider other areas in China where TNH\textsubscript{3} concentration is not as high as in NCP. The results are shown in Fig. S10. It is clearly illustrated that, over a large range of TNH\textsubscript{3} concentrations, aerosol pH increases with the increase in TNH\textsubscript{3} because the production process of NH\textsubscript{4}\textsuperscript{+} from NH\textsubscript{3} consumes aqueous H\textsuperscript{+}. The local sensitivity of pH to TNH\textsubscript{3}, expressed as the pH increase per tenfold increase in TNH\textsubscript{3} at current TNH\textsubscript{3} level, is higher in the US (3.0 based on observational data and 1.6 based on simulation data) than in China (0.4 based on observational data and 1.2 based on simulation data), indicated a higher sensitivity of aerosol pH to TNH\textsubscript{3} in the US than in China. Besides, we find that the responses of pH to TNH\textsubscript{3} are nonlinear and anisotropic. With all others equal, pH in the US could be closer to the level in China if the TNH\textsubscript{3} increases to the level in China if the TNH\textsubscript{3} increases to the level in China. On the other hand, the pH in China would be lower than the US if the TNH\textsubscript{3} decreases to the US level because of the relative higher abundances of acidic components (SO\textsubscript{4}, TNO\textsubscript{3}, TCl) than basic ions (TNH\textsubscript{3}, NVCs) (Fig. S10a). In both countries, the sensitivities would quickly diverge from the original values toward higher values as TNH\textsubscript{3} decreases, with the sensitivities in China changing at a faster pace. As TNH\textsubscript{3} increases, however, the sensitivities in these two countries would gradually become constant, stabilizing at comparable levels (0.002 pH unit per TNH\textsubscript{3} increase in both two countries). Results based on simulation data are similar with results based on observational data, especially the sensitivity of aerosol pH at high level of TNH\textsubscript{3} (represented by similar slope). Higher pH values in China based on simulation data at low TNH\textsubscript{3} level (1-10 µg m\textsuperscript{-3}) could be caused by lower SO\textsubscript{4}\textsuperscript{2-} concentrations. However, lower value of aerosol pH at high level of TNH\textsubscript{3} (> 50 µg m\textsuperscript{-3}) based on simulation data even with lower SO\textsubscript{4}\textsuperscript{2-} concentrations indicates the limit effect of TNH\textsubscript{3} at this level and potential effect of other components.

The effects of TNH\textsubscript{3} on the gas-particle partitioning of NH\textsubscript{3}-NH\textsubscript{4}\textsuperscript{+} and HNO\textsubscript{3}-NO\textsubscript{3} are illustrated in Fig. S10b and S10c, showing a decreasing trend of ε(NH\textsubscript{4}\textsuperscript{+}) and an increasing trend of ε(NO\textsubscript{3}-) as TNH\textsubscript{3} increases. In the range of observation cases the value of ε(NH\textsubscript{4}\textsuperscript{+}) in China is smaller than in the US, suggesting excess presence of TNH\textsubscript{3} compared to other aerosol components (e.g., TNO\textsubscript{3} and SO\textsubscript{4}\textsuperscript{2-}). The gas to particle partitioning of NH\textsubscript{3} produces inorganic ammonium salt of ammonium bisulfate (NH\textsubscript{4}HSO\textsubscript{4}) and ammonium sulfate ((NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4}) first because the affinity of sulfuric acid for NH\textsubscript{3} is much larger than that of nitric and hydrochloric acid for NH\textsubscript{3}, especially when TNH\textsubscript{3} concentration is relatively low (Behera et al., 2013); The excess TNH\textsubscript{3} may also react with nitric acid and hydrochloric acid to form salt of NH\textsubscript{4}NO\textsubscript{3} and NH\textsubscript{4}Cl which will dissolve in the aerosol liquid water (Zhao et al., 2016). That is why the increase of ε(NO\textsubscript{3}-) is small at the beginning and gradually become faster later. At the same level of TNH\textsubscript{3}, ε(NH\textsubscript{4}\textsuperscript{+}) in China is higher than ε(NH\textsubscript{4}\textsuperscript{+}) in the US,
causing by formation of $\text{NH}_4\text{NO}_3$ due to higher level of TNO$_3$. Both the lower $\varepsilon(\text{NH}_4^+)$ and higher $\varepsilon(\text{NO}_3^-)$ in China estimated by the sensitivity curves are consistent with observations.

Therefore, the ratio of $[\text{NH}_4^+]$ to different acid ions ($[\text{SO}_4^{2-}]$, $[\text{NO}_3^-]$, $[\text{Cl}^-]$) can be used to indicate the relative abundance of ammonia. To further investigate the different levels of abundance of ammonia, we tend to look at groups of real cases, instead of the average values only. We divide the observation data into three groups based on neutralization condition of particle phase NH$_4^+$. Group A contains the observations when $[\text{NH}_4^+] < 2\times[\text{SO}_4^{2-}]$, when available NH$_4^+$ cannot completely balance aerosol SO$_4$. Group B consists of the data points when $2\times[\text{SO}_4^{2-}] < [\text{NH}_4^+] < 2\times[\text{SO}_4^{2-}]+[\text{NO}_3^-]+[\text{Cl}^-]$ when most of the aerosol SO$_4$ is in the form of SO$_4^{2-}$ and excess [NH$_4^+$] is available to stabilize nitrate and chloride driving the gas phase to shift to the particle phase. Group C contains the data points when $[\text{NH}_4^+] > 2\times[\text{SO}_4^{2-}]+[\text{NO}_3^-]+[\text{Cl}^-]$, where available NH$_4^+$ is enough to balance particle phase anions. The distribution of pH values in three groups in two countries is shown in Figure S1 by boxplots. Note that no data in the US fall in Group C, making up only two groups in Figure S1 (b). Overall, cases in groups B and C with higher relative abundance of ammonia are more likely to have higher aerosol pH than in group A, though the relationship is not linear and does not happen in all the cases. Note that although the relative abundance of NH$_4^+$ in group B is smaller than in group C, the transition from group B to group C due to TNH$_3$ increase does not always happen. Because if TNH$_3$ increase in an aerosol system with $2\times[\text{SO}_4^{2-}] < [\text{NH}_4^+] < 2\times[\text{SO}_4^{2-}]+[\text{NO}_3^-]+[\text{Cl}^-]$, [NH$_4^+$] would increase, and more TNO$_3$ and TCl would shift into the particle phase, leading to the increase of WSI concentration. However, the average WSI concentration in group B is 55.03±46.79 µg m$^{-3}$ in China, significantly higher than that in group C in China (31.60±20.29 µg m$^{-3}$). LWC in group B (22.90±7.38 µg m$^{-3}$) is also higher than that in group C (14.37±16.85 µg m$^{-3}$). We find that most of the cases in group B could be identified as highly polluted cases where large amount of NH$_4$NO$_3$ is formed and dissolves in the aerosol water.

Throughout the observed cases, 85% in China are in Group C (i.e., aerosol systems with excess NH$_4^+$), and 55% in the US are in Group A (i.e., aerosol systems with insufficient NH$_4^+$). Overall, the positive sensitivity of pH to TNH$_3$ and the different dominant groups in these two countries (Group C in China, Group A in the US) suggest that the high abundance of TNH$_3$ in China increases the aerosol pH and is one of the major reasons for the pH difference between the two countries.

Text. S2 The relationship between sulfate/nitrate and aerosol pH

Besides the effect of TNH$_3$ discussed in Text. S1, other species, especially the acidic species which mainly include SO$_4$ and TNO$_3$, could also affect aerosol pH because of their effects on H$^+$ air concentration as well as on LWC (Ding et al., 2019). This effect is investigated in a sensitivity test by changing TNO$_3$ or SO$_4$ concentration while keeping other inputs constant as
the average levels (Fig. S12). Similar to the MSTM results as shown in Fig. 6, elevated SO$_4^{2-}$ significantly increases aerosol acidity by increasing H$_{\text{air}}^+$. On the other hand, elevated TNO$_3$ only slightly increases H$_{\text{air}}^+$, indicating a weaker acidity than that of SO$_4^{2-}$, in line with the result in a previous study (Guo et al., 2017b). This is partially due to the semi-volatile property of TNO$_3$ (Ding et al., 2019). Notably, even in China where $\varepsilon$(NO$_3^-$) are mostly close to 1, the variation of aerosol pH with TNO$_3$ (roughly equals to NO$_3^-$ in this case) is also subtle. Therefore, for two systems with different moles of SO$_4^{2-}$ and NO$_3^-$ neutralized by same moles of NH$_4^+$, the system with more SO$_4^{2-}$ will likely have a lower pH. This result indicates that higher aerosol acidity is associated with higher availability of SO$_4^{2-}$ rather than TNO$_3$, which can be confirmed by observed data in Fig. S13.

Based on observation data, 74.5% of the cases in China have NO$_3^-$/SO$_4^{2-}$ molar ratio larger than one, while only 22.3% in the United States. The different NO$_3^-$/SO$_4^{2-}$ ratios, could subsequently affect other aerosol properties, such as aerosol water uptake ability, which is one of the important reasons causing haze events in China during wintertime (Xie et al., 2019; Wang et al., 2020). Although nitrate aerosol and sulfate aerosol absorb similar amounts of water per mass, heavy haze events in China are usually associated with increased LWC with enhanced RH levels under nitrate-dominate condition (Wang et al., 2020).

In order to study this effect, we categorize the observation data into a nitrate-rich group (Group N, where [NO$_3^-$]/[SO$_4^{2-}$] > 3) and a sulfate-rich group (Group S, where [NO$_3^-$]/[SO$_4^{2-}$] < 1) and compare these two groups under different RH conditions. The ratio 3 in group N is mentioned in lab studies and is a more typical value of nitrate-rich conditions in field observations (Ge et al., 1998; Xie et al., 2020).

The results in Fig. S14 show that aerosol pH values in the same groups in China and the US have similar responses to the changes in RH. In both countries, as RH increases, the pH in group N decreases, and the pH in group S increases (Fig. S14a). Both the values and the increasing rate of LWC in group N is larger than in group S, suggesting a higher water uptake ability in nitrate-rich condition, which is likely due to higher aerosol mass compared with group S as shown in Fig. S14f. The nearly two times aerosol mass in group N as in group S indicates the co-condensation effect of nitrate aerosol and LWC (Guo et al., 2017a), which suggests that NO$_3^-$ formed in aerosol leads to a higher LWC due to the increase in aerosol mass, while higher LWC dilutes H$_{\text{air}}^+$ and increases pH, which is favorable for more HNO$_3$ shifting from gas phase to particle phase and thus continually increases particle NO$_3^-$ concentration. This effect will reach a balance when most of the gas phase HNO$_3$ is in the particle phase with enough NH$_4^+$, and, therefore, $\varepsilon$(NO$_3^-$) is close to 100% in group N in the two countries (Fig. S14e). Besides, water uptake by hygroscopic aerosols increases the aerosol surface area and volume, enhancing the hydrolysis of N$_2$O$_5$ across particles and forming NO$_3^-$ (Tian et al., 2018; Wang et al., 2020).

The condition in group N usually has a higher LWC and aerosol mass, due to the mutual promotion between LWC and particle nitrate. And such a condition in group N occurs more often in China than in the United States, which is probably one of the reasons leading to high particle concentrations on hazy days in China.
The nitrate/sulfate ratio depends on the emission ratio of NO\textsubscript{x}/SO\textsubscript{2}, the availability of cations due to the dependency of ε(NO\textsubscript{3}\textsuperscript{-}) on TNH\textsubscript{3} (Fig. S10c), and other factors such as the atmospheric oxidizing capacity. Further investigation into the total emissions shows that the emission molar ratios of [NO\textsubscript{x}]/[SO\textsubscript{2}] are close to 3:1 in both countries (2.92 in China in 2017 and 3.12 in the US in 2011 when assuming the emission NOX is in the form of NO\textsubscript{2}), indicating that the emission difference is not the major factor leading to the nitrate/sulfate ratio difference. On the other hand, the emission molar ratio of [NH\textsubscript{3}]/([NO\textsubscript{x}]+2×[SO\textsubscript{2}]) in China (0.75) is 1.6 times higher than that in the US (0.46), which is consistent with the measured high relative abundance of TNH\textsubscript{3} in China and confirms that high availability of cations (mainly NH\textsubscript{4}\textsuperscript{+} caused by high NH\textsubscript{3} emission) is one of the causes for the high nitrate/sulfate ratio in China.
Fig. S1 Comparison of results in pH calculation when using different methods to estimate HCl concentration in the United States. Group “Cl only” means using particle Cl\textsuperscript{-} concentration as total Cl and ignore gas phase HCl; group “5Cl” means assuming total Cl equals to 5 times particle Cl\textsuperscript{-} concentration therefore HCl concentration equals to 4 times particle Cl\textsuperscript{-} concentration; group “Cl ratio” means using measured particle Cl\textsuperscript{-} concentration divided by CMAQ simulation partitioning ratio to estimate the amount of total Cl. The result showed the three methods will lead to essentially the same pH at most of the monitoring sites.

Fig. S2 Location of monitoring sites used in this study in the United States(a) and China(b), with a close-up North China Plain (c). The world shapefiles were obtained from Esri (ArcGIS Hub, Countries WGS84. June 21, 2019. http://www.arcgis.com/home/item.html?id=30e5fe3149c34df1ba922e6f5bbf808f)
Fig. S3 Observed $\varepsilon$(NH$_4^+$) (left column) and $\varepsilon$(NO$_3^-$) (right column) in China (top row) and the United States (bottom row) versus simulated by ISORROPIA-II. The regression line (red), 1:1 line (blue), and the regression equation and correlation coefficient $r$ are shown on each panel.
Fig. S4 Annual mean concentrations of PM$_{2.5}$ components SO$_4^{2-}$, NO$_3^-$, NH$_4^+$, gaseous components HNO$_3$ and NH$_3$ and the partitioning including ε(NO$_3^-$) and ε(NH$_4^+$) based on CMAQ simulations (colored map) and observations (colored dots) in China (panels a-g) and in the United States (panels i-vii). Normalized mean bias (NMB) and normalized root mean square error (NRMSE) are shown on each panel. The world shapefiles were obtained from Esri (ArcGIS Hub, Countries WGS84. June 21, 2019. http://www.arcgis.com/home/item.html?id=30e5fe3149c34df1ba922e6f5bbf808f)
Fig. S5 Comparison of daily observed and CMAQ simulated aerosol component concentrations of SO$_4^{2-}$, NO$_3^-$, NH$_4^+$, gaseous concentrations of HNO$_3$ and NH$_3$ and the partitioning $\varepsilon$(NO$_3^-$) and $\varepsilon$(NH$_4^+$) in China (panels a-g) and in the United States (panels i-vii). The regression line (red), 1:1 line (blue), regression equation and correlation coefficient $r$ are shown in each panel.
Fig. S6 Monthly average concentrations of SO$_4^{2-}$, NO$_3^-$, HNO$_3^-$, NH$_4^+$, NH$_3$: observed versus CMAQ simulated data in China (panels a, c, e, g, i) and in the United States (panels b, d, f, h, j). The error bars represent the standard deviation of all the cases in each month.

Fig. S7 Step-specific contributions of individual factors to the pH difference between China and the US. (a), (b), and (c) show the contributions of individual components and meteorological factors to (a) total difference of aerosol pH ($\Delta pH$), (b) through the pathway of LWC ($\Delta pH_{LWC}$), (c) through the pathway of H$^+_{air}$ ($\Delta pH_{H^+_{air}}$) between the US case and an intervening case with the concentrations of all components in the US case multiplied by a constant factor of 8.4. The former is chosen as the starting point, and the latter is chosen as the ending point. (d), (e), and (f) show the contributions of individual components and meteorological factors to (d) total difference of aerosol pH ($\Delta pH$), (e) through the pathway of LWC ($\Delta pH_{LWC}$), (f) through the pathway of H$^+_{air}$ ($\Delta pH_{H^+_{air}}$) between the intervening case and the China case. The former is chosen as the starting point, and the latter is chosen as the ending point. The inputs are shown in Table S4, sensitivity test.
**Fig. S8** Sensitivity tests showing the pH changes in response to different levels of \( \text{SO}_4 \) and \( \text{TNO}_3 \) in an \( \text{NH}_4^+\text{SO}_4^2-\text{NO}_3^-\text{H}_2\text{O} \) system. (a) The pH of an aerosol with fixed \( \text{TNH}_3 \) (2 \( \mu g \) m\(^{-3} \)) and varied \( \text{SO}_4 \) and \( \text{TNO}_3 \) (from 0.5 \( \mu g \) m\(^{-3} \) to 5 \( \mu g \) m\(^{-3} \)) (b) The pH after multiplying all the inputs in (a) by a factor of 8.4. Note that the \( \text{SO}_4 \) and \( \text{TNO}_3 \) levels shown along the axes are the initial levels before multiplication. (c) pH differences between (b) and (a) (b minus a).

**Fig. S9** Contributions of individual components and meteorological factors to (a) total difference of aerosol pH (\( \Delta \text{pH} \)), (b) through the pathway of LWC (\( \Delta \text{pH}_{\text{LWC}} \)), (c) through the pathway of \( \text{H}_+^\text{air} \) (\( \Delta \text{pH}_{\text{H}_+^\text{air}} \)) calculated by Multivariable Taylor Series Method (MTSM) between the NCP scenario and the US-SE scenario in Zheng’s study (Zheng et al., 2020). For individual factors, the sum of the contributions through the two pathways yields the net contribution of this factor to aerosol pH. The case in the United States is chosen as the starting point, and China as the ending point.

**Fig. S10** Responses of pH, \( \varepsilon(\text{NH}_4^+) \) and \( \varepsilon(\text{NO}_3^-) \) to the change of \( \text{TNH}_3 \) from 0.1 to 1000 \( \mu g \) m\(^{-3} \) while keep all other components constant at their annual average levels. The shaded areas show the \( \text{TNH}_3 \) concentration ranges that covers 75% of the observed cases in the countries, the dashed lines show the 5\(^{th} \) and 95\(^{th} \) percentiles of the observed cases, the black square and the red diamond mark the average \( \text{TNH}_3 \) levels in China and the United States, respectively.
Fig. S11 Distribution of aerosol pH in three groups with different relative abundance of ammonia in two countries. Outliers recognized by data out of the range of three times median absolute deviations from the median are removed.

Fig. S12 Values of pH, liquid water content and H⁺air to the change of TSO₄ and TNO₃ concentration in China and the United States.

Fig. S13 Relation between aerosol pH and TSO₄/TNO₃ molar ratio in China (left) and the United States (right) based on observational data.
Fig. S14 Values of pH, LWC, H_\text{air}, \varepsilon(\text{NH}_4^+), \varepsilon(\text{NO}_3^-) and dissolved mass in group N and group S under different RH conditions in China and the United States. China: group N, n=410; group S, n=470; US: group N, n=72; group S, n=1119.
| No. | Site name                                      | Latitude | Longitude |
|-----|-----------------------------------------------|----------|-----------|
| 1   | Chinese Research Academy of Environmental Science (CRAES) | 40.04    | 116.42    |
| 2   | Anyang                                        | 36.09    | 114.39    |
| 3   | Baoding                                       | 38.87    | 115.52    |
| 4   | Dezhou                                        | 37.45    | 116.32    |
| 5   | Hohhot                                        | 40.80    | 111.64    |
| 6   | Jinan                                         | 36.66    | 117.05    |
| 7   | Liulihe                                       | 39.58    | 116.00    |
| 8   | Qinhuangdao                                   | 39.91    | 119.56    |
| 9   | Shijiazhuang                                  | 38.03    | 114.54    |
| 10  | Taiyuan                                       | 37.82    | 112.57    |
| 11  | Tangshang                                     | 39.90    | 118.60    |
| 12  | Tianjin                                       | 39.10    | 117.17    |
| 13  | Xianghe                                      | 39.78    | 116.96    |
| 14  | Yizhuang                                      | 39.80    | 116.51    |
| 15  | Yufa                                          | 39.52    | 116.31    |
| 16  | Zhengzhou                                     | 34.28    | 113.68    |
Table S2. List of the 34 monitoring sites in the United States.

| No. | Site name                      | Latitude | Longitude |
|-----|--------------------------------|----------|----------|
| 1   | Parsons                        | 39.09    | -79.66   |
| 2   | Prince Edward                  | 37.17    | -78.31   |
| 3   | Perkinstown                    | 45.21    | -90.60   |
| 4   | Rocky Mtn NP Collocated        | 40.28    | -105.55  |
| 5   | Sand Mountain                  | 34.29    | -85.97   |
| 6   | Stockton                       | 42.29    | -90.00   |
| 7   | Sequoia NP - Ash Mountain      | 36.49    | -118.83  |
| 8   | Wash. Crossing                 | 40.31    | -74.87   |
| 9   | Yosemite NP - Turtleback Dome  | 37.71    | -119.71  |
| 10  | Abington                       | 41.84    | -72.01   |
| 11  | Alhambra                       | 38.87    | -89.62   |
| 12  | Arendtsville                   | 39.92    | -77.31   |
| 13  | Beaufort                       | 34.88    | -76.62   |
| 14  | Caddo Valley                   | 34.18    | -93.10   |
| 15  | Cadiz                          | 36.78    | -87.85   |
| 16  | Chiricahua NM                  | 32.01    | -109.39  |
| 17  | Cherokee Nation                | 35.75    | -94.67   |
| 18  | Candor                         | 35.26    | -79.84   |
| 19  | Coweeta                        | 35.06    | -83.43   |
| 20  | Connecticut Hill               | 42.40    | -76.65   |
| 21  | Deer Creek                     | 39.64    | -83.26   |
| 22  | Georgia Station                | 33.18    | -84.41   |
| 23  | Palo Duro                      | 34.88    | -101.67  |
| 24  | Joshua Tree NP                 | 34.07    | -116.39  |
| 25  | Bondville                      | 40.05    | -88.37   |
| 26  | Great Smoky NP - Look Rock     | 35.63    | -83.94   |
| 27  | Indian River Lagoon            | 27.85    | -80.46   |
| 28  | Santee Sioux                   | 42.83    | -97.85   |
| 29  | Beltsville                     | 39.03    | -76.82   |
| 30  | Everglades NP                  | 25.39    | -80.68   |
| 31  | Mount Rainier NP               | 46.76    | -122.12  |
| 32  | Kane Exp. Forest               | 41.60    | -78.77   |
| 33  | Konza Prairie                  | 39.10    | -96.61   |
| 34  | Mackville                      | 37.70    | -85.05   |
Table S3. Distribution of observational cases in China in each month (with outliers removed)

| Month | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|-------|------|------|------|------|-----|------|------|------|------|------|------|------|
| Number of cases | 104  | 144  | 176  | 157  | 268 | 184  | 182  | 111  | 30   | 45   | 134  | 231  |

Table S4. Summary of the inputs of Multivariable Taylor Series Method (MTSM) calculation. The unit of concentrations is $\mu g \text{ m}^3$, the RH is a relative number with no unit, and the unite of temperature is K. The values in “observation” group are the average values based on observation data, the values in “simulation group” are the average values based on CMAQ simulation data and the “Simulation, population-weighted” group is the population-weighted values based on CMAQ simulation data.

| Observation          | Na$^+$ | SO$_4$ | TNH$_3$ | TNO$_3$ | TCl | Ca$^{2+}$ | K$^+$ | Mg$^{2+}$ | RH   | Temp |
|----------------------|--------|--------|---------|---------|-----|-----------|-------|-----------|------|------|
| US                   | 0.16   | 2.16   | 1.87    | 1.75    | 0.39| 0.03      | 0.07  | 0.05      | 0.71 | 284.75|
| China                | 0.69   | 9.19   | 26.53   | 13.11   | 4.1 | 0.03      | 0.72  | 0.15      | 0.45 | 287.39|

| Simulation           | Na$^+$ | SO$_4$ | TNH$_3$ | TNO$_3$ | TCl | Ca$^{2+}$ | K$^+$ | Mg$^{2+}$ | RH   | Temp |
|----------------------|--------|--------|---------|---------|-----|-----------|-------|-----------|------|------|
| US                   | 0.03   | 0.85   | 0.56    | 0.75    | 0.11| 0.02      | 0.02  | 0.01      | 0.72 | 285.96|
| China                | 0.08   | 1.95   | 3.05    | 2.82    | 0.11| 0.05      | 0.11  | 0.02      | 0.72 | 280.98|

| Simulation, population-weighted | Na$^+$ | SO$_4$ | TNH$_3$ | TNO$_3$ | TCl | Ca$^{2+}$ | K$^+$ | Mg$^{2+}$ | RH   | Temp |
|---------------------------------|--------|--------|---------|---------|-----|-----------|-------|-----------|------|------|
| US                              | 0.03   | 1.42   | 1.79    | 2.41    | 0.13| 0.03      | 0.08  | 0.01      | 0.66 | 287.86|
| China                           | 0.18   | 3.96   | 8.41    | 7.21    | 0.23| 0.09      | 0.29  | 0.04      | 0.7  | 289.26|

| Sensitivity test, increasing concentrations with a constant factor and then changing the composition | Na$^+$ | SO$_4$ | TNH$_3$ | TNO$_3$ | TCl | Ca$^{2+}$ | K$^+$ | Mg$^{2+}$ | RH   | Temp |
|----------------------------------------------------------|--------|--------|---------|---------|-----|-----------|-------|-----------|------|------|
| US, original                                             | 0.16   | 2.16   | 1.87    | 1.75    | 0.39| 0.03      | 0.07  | 0.05      | 0.71 | 284.75|
| US composition, Chinese level                            | 1.33   | 18.19  | 15.74   | 17.42   | 3.28| 0.22      | 0.62  | 0.43      | 0.71 | 284.75|
| China                                                    | 0.69   | 9.19   | 26.53   | 13.11   | 4.1 | 0.03      | 0.72  | 0.15      | 0.71 | 284.75|
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