

Supplementary information for “Evaluation of PM_{2.5} acidity sensitivity to meteorological parameters and chemical composition changes: results from 10-year records of six Canadian monitoring sites”

Ye Tao¹, Jennifer G. Murphy²

¹Department of Physical and Environmental Sciences, University of Toronto Scarborough, Toronto, ON, M1C 1A4, Canada

²Department of Chemistry, University of Toronto, Toronto, ON, M5S 3H6, Canada

Corresponding to: Jennifer G. Murphy (jmurphy@chem.utoronto.ca)

Table S1. Detail information of the chosen six monitoring sites.

NAPS site	Locations	NAPS station code	Year
Toronto*	43.658°N, 79.397°W	60427	2007-2013
	43.659°N, 79.395°W	60439	2014-2016
Simcoe	42.857°N, 80.270°W	62601	2007-2016
Windsor	42.293°N, 83.073°W	60211	2007-2010, 2012-2016
Ottawa	45.434°N, 75.676°W	60104	2007-2016
Montreal	45.652°N, 73.574°W	50129	2009-2016
St Anicet	45.121°N, 74.288°W	54401	2007-2016

*The two sites in Toronto were located in the same region and were only 400 meters apart. During 2014-Jan-20 and 2014-May-26, simultaneous sampling was performed in both sites. The comparisons of NH₃ and SNA concentrations in PM_{2.5} were made in Figure S1. The observation results of these two sites are highly consistent with each other, so it is safe to merge the data from these two sites to get ten-year trends of aerosol chemistry in Toronto.

Table S2. Monthly average \pm standard deviation values of ambient temperature and relative humidity in each site from year 2007-2016.

	Ottawa		Montreal		Windsor		Simcoe		St Anicet	
Month	T (°C)	RH(%)	T(°C)	RH(%)	T(°C)	RH(%)	T(°C)	RH(%)	T(°C)	RH(%)
1	-8.7 \pm 5.8	80 \pm 9	-7.6 \pm 6.5	74 \pm 11	-4.3 \pm 5.2	74 \pm 11	-4.8 \pm 6.5	79 \pm 9	-8.6 \pm 6.5	81 \pm 9
2	-7.2 \pm 5.9	74 \pm 11	-6.1 \pm 6.5	70 \pm 13	-5.0 \pm 5.5	73 \pm 11	-5.5 \pm 6.3	78 \pm 8	-7.2 \pm 6.1	76 \pm 10
3	-1.4 \pm 6.3	66 \pm 16	-0.5 \pm 5.9	62 \pm 16	1.2 \pm 5.3	71 \pm 13	-0.3 \pm 5.1	76 \pm 11	-1.1 \pm 6.8	71 \pm 13
4	6.9 \pm 4.7	60 \pm 18	7.4 \pm 4.6	56 \pm 18	9.0 \pm 4.5	62 \pm 12	7.1 \pm 4.4	69 \pm 14	6.5 \pm 4.7	67 \pm 16
5	15.2 \pm 4.5	64 \pm 15	16.0 \pm 5.0	58 \pm 17	16.6 \pm 4.6	64 \pm 12	15.2 \pm 4.7	65 \pm 12	14.9 \pm 4.4	67 \pm 16
6	19.1 \pm 3.2	71 \pm 12	19.0 \pm 3.5	65 \pm 14	21.8 \pm 3.5	65 \pm 10	19.0 \pm 3.6	67 \pm 10	18.4 \pm 3.1	75 \pm 11
7	20.9 \pm 2.9	71 \pm 12	22.1 \pm 3.0	66 \pm 9	22.4 \pm 3.0	69 \pm 9	20.7 \pm 3.1	71 \pm 9	21.2 \pm 2.9	75 \pm 9
8	20.0 \pm 2.9	74 \pm 10	21.2 \pm 2.6	69 \pm 10	22.4 \pm 2.8	73 \pm 10	20.2 \pm 2.8	75 \pm 8	20.0 \pm 3.1	79 \pm 7
9	15.6 \pm 4.1	76 \pm 9	17.1 \pm 4.2	69 \pm 9	18.0 \pm 3.9	73 \pm 8	16.4 \pm 4.0	76 \pm 7	15.8 \pm 4.3	81 \pm 7
10	9.4 \pm 4.4	78 \pm 11	10.4 \pm 4.4	71 \pm 11	12.5 \pm 4.8	72 \pm 11	10.8 \pm 4.8	78 \pm 9	9.9 \pm 4.5	79 \pm 10
11	2.5 \pm 5.2	78 \pm 10	4.0 \pm 4.6	71 \pm 12	4.9 \pm 4.8	72 \pm 11	4.1 \pm 5.5	78 \pm 10	2.9 \pm 5.2	78 \pm 10
12	-5.4 \pm 6.3	82 \pm 9	-3.0 \pm 6.1	77 \pm 12	0.0 \pm 4.5	79 \pm 11	-0.7 \pm 4.6	81 \pm 9	-4.2 \pm 6.3	82 \pm 9

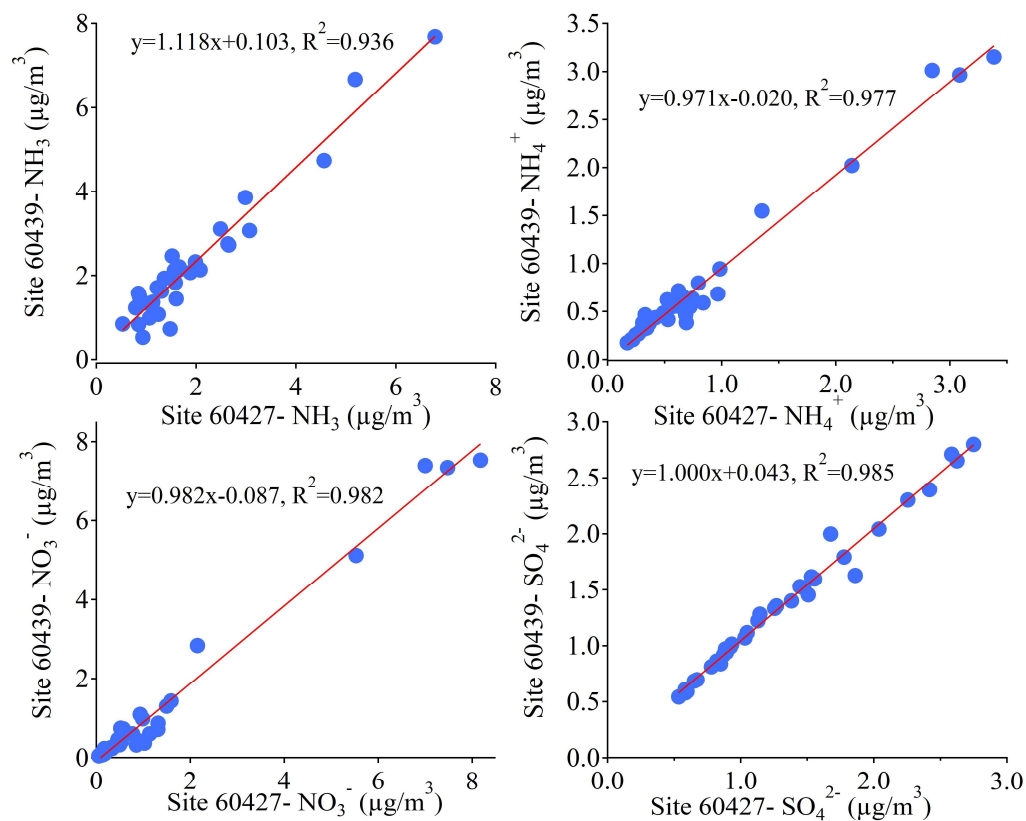


Figure S1. Linear regression results of NH_3 , $\text{PM}_{2.5}$ ammonium, sulfate and nitrate concentrations measured in Toronto site 60439 and site 60427. High correlations and near utility slopes were found for all four linear regressions.

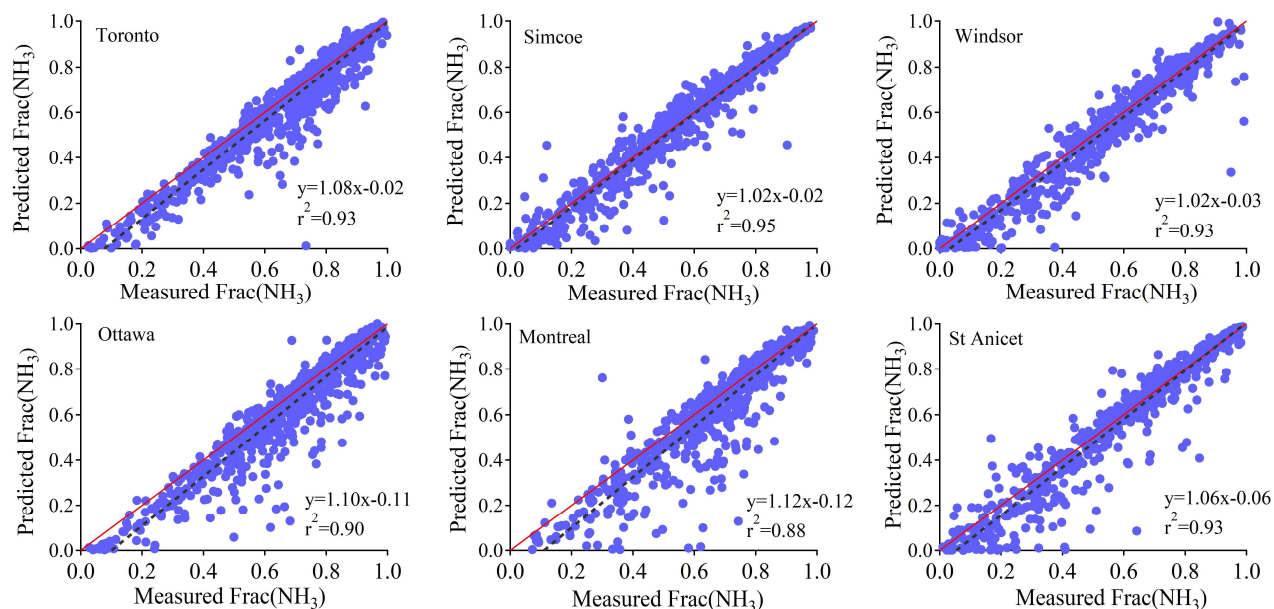


Figure S2. Comparison of measured and predicted gas fraction of NH_x in six sites. The red line in each graph represents 1:1 line. Linear regression results (dashed grey line) are also shown in each graph.

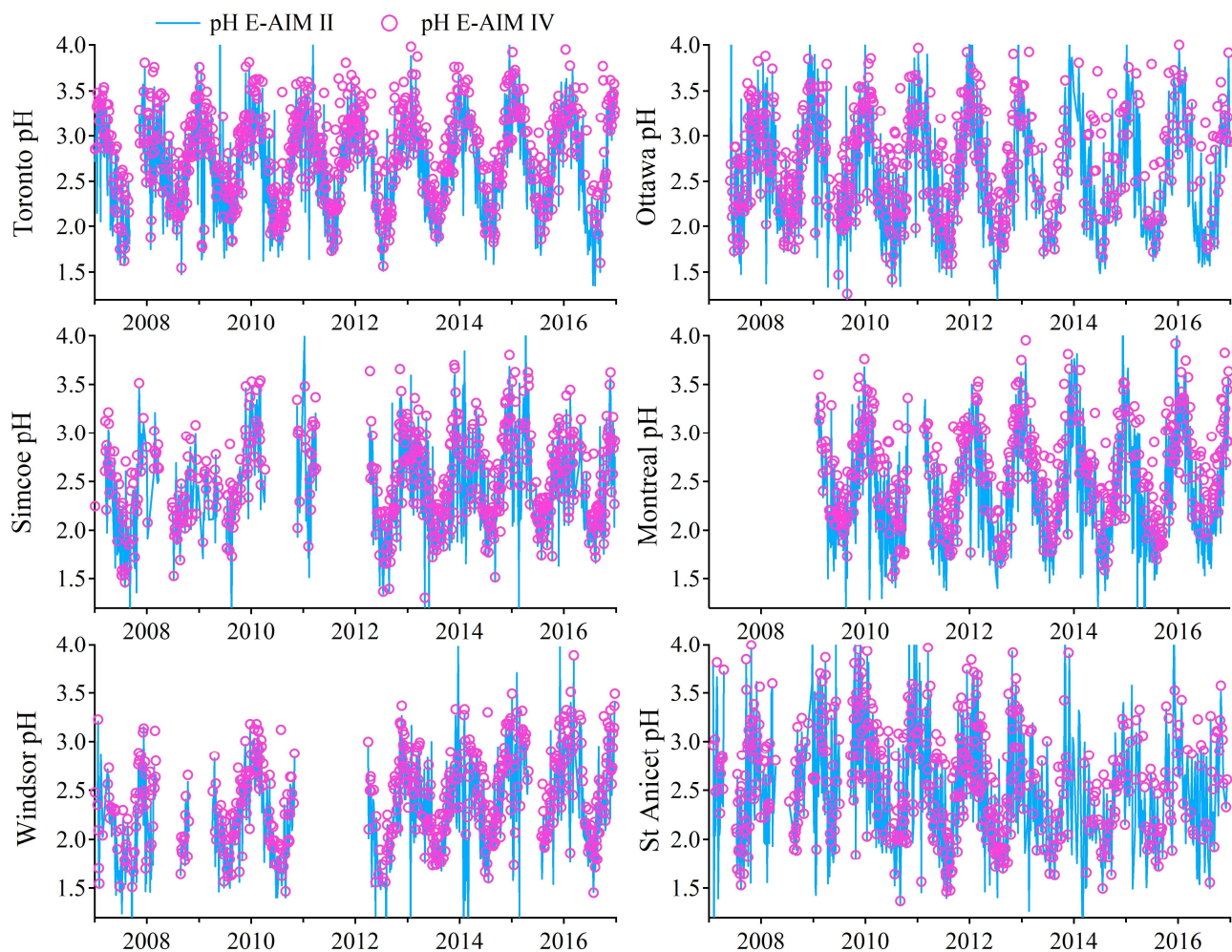


Figure S3. The comparison of aerosol pH calculated in E-AIM II model (blue solid line) and E-AIM IV model (purple open circle), showing that they both exhibit similar seasonal variation pattern.

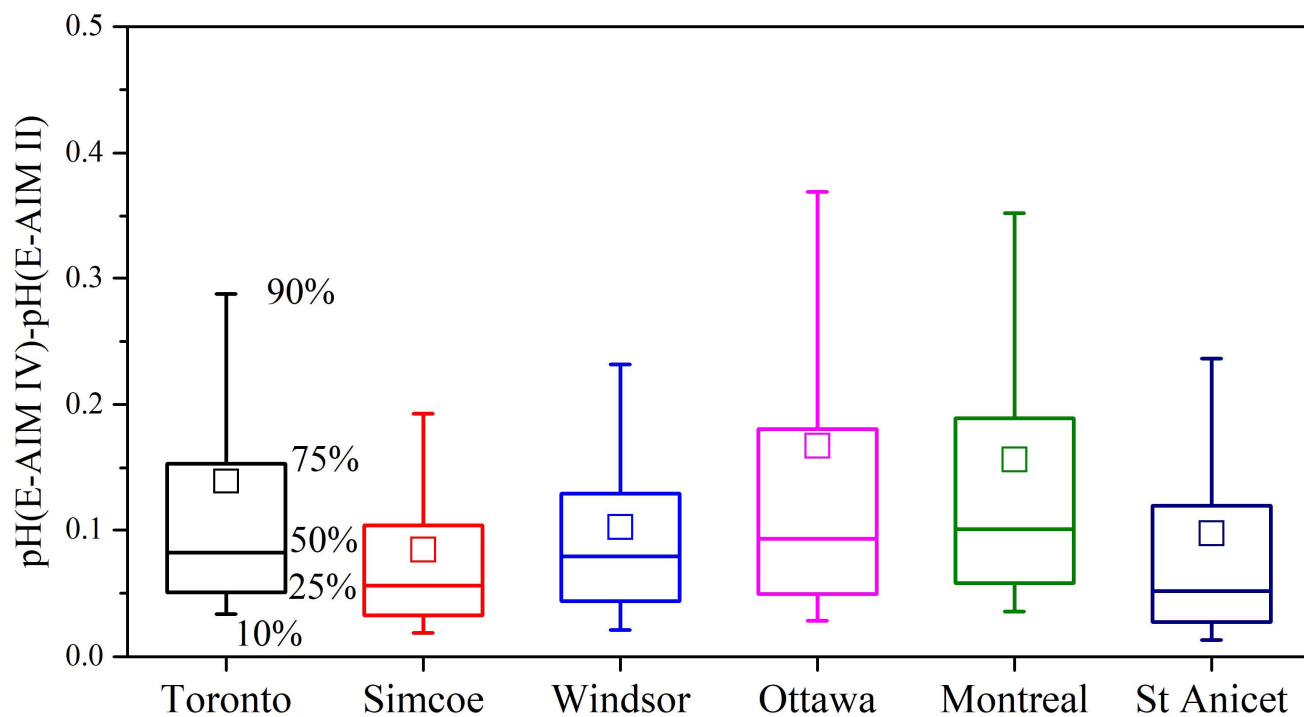


Figure S4. The box and whisker plot of aerosol pH different calculated in E-AIM IV model and E-AIM II model in six sites. In each box, the top, middle and bottom lines represent 75th, 50th and 25th percentile of statistical data, the upper and lower whiskers represent 90th and 10th percentile, and the square mark represent the mean value.

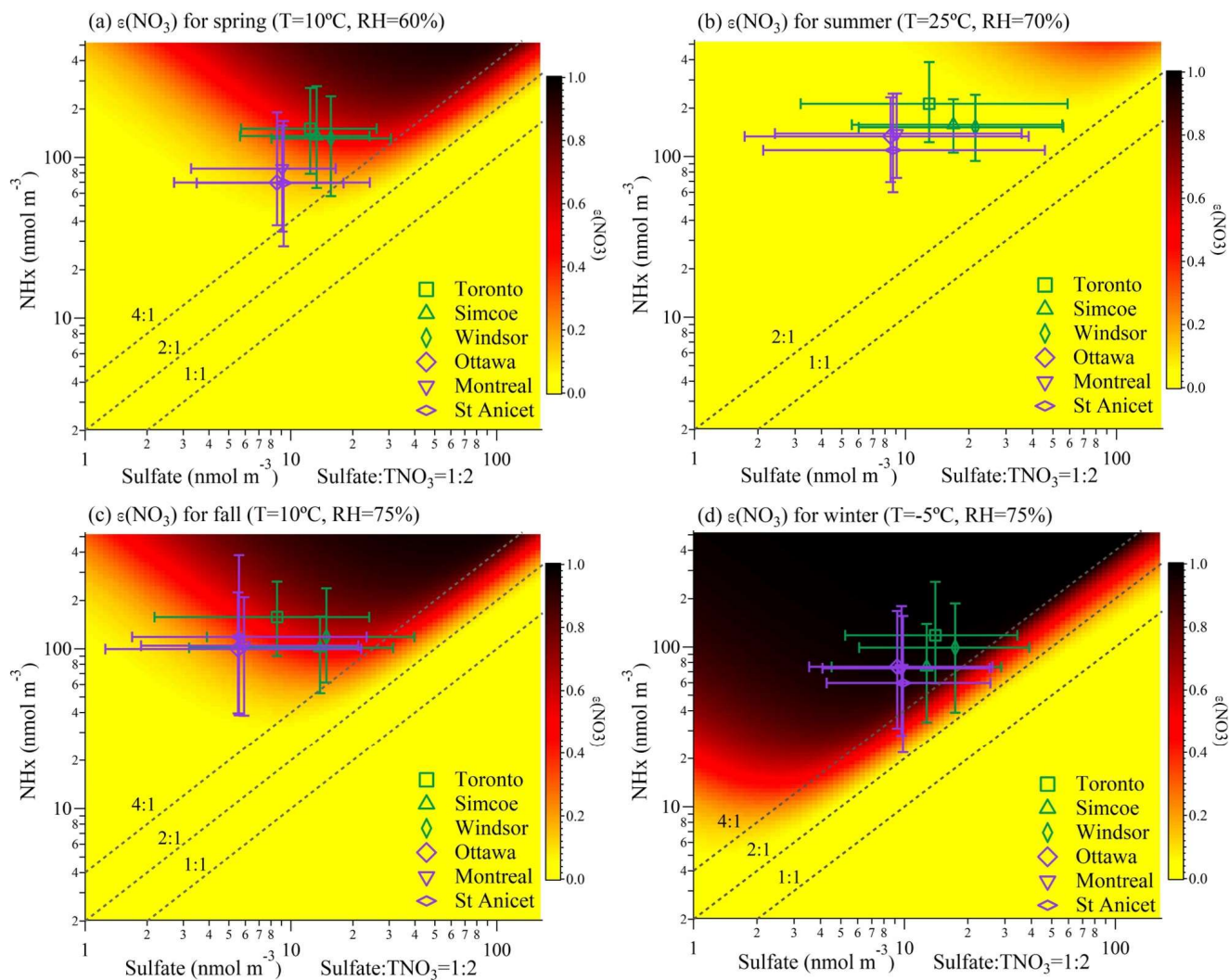


Figure S5. E-AIM modelling results of particle phase fraction of total nitrate, $\epsilon(\text{NO}_3)=[\text{NO}_3^-]/([\text{HNO}_3(\text{g})]+[\text{NO}_3^-])$ in four seasons. All parameters are the same for the calculations shown in Figure 5.

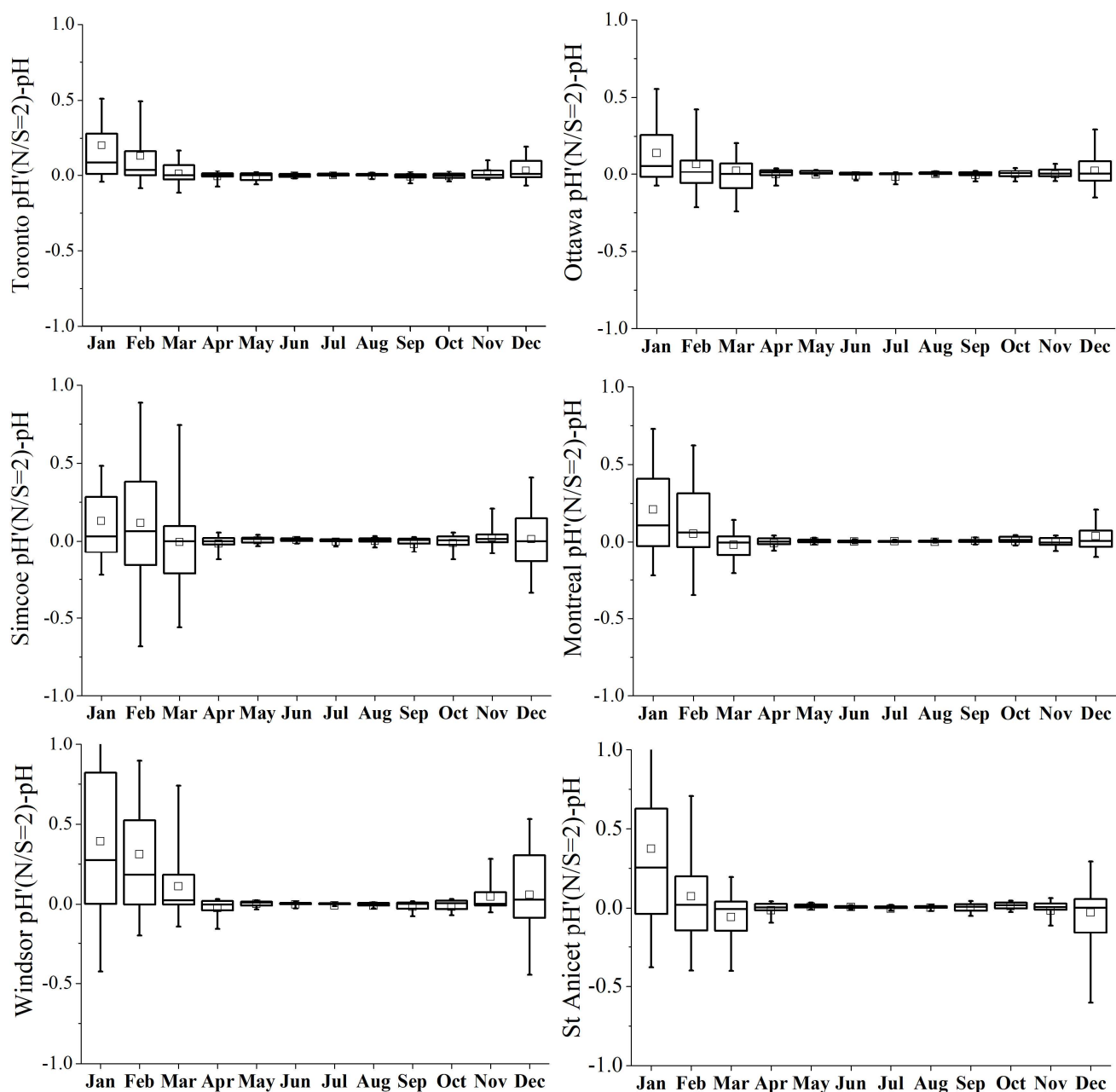


Figure S6. Box and whisker plots of the pH difference between the values calculated forcing TNO_3 to sulfate molar ratio to be 2 and calculated using measured total nitrate concentration in each month in each sampling site. The boxes represent 25th, 50th and 75th percentile, the whiskers represent 10th and 90th percentile, and the square markers represent the mean values.

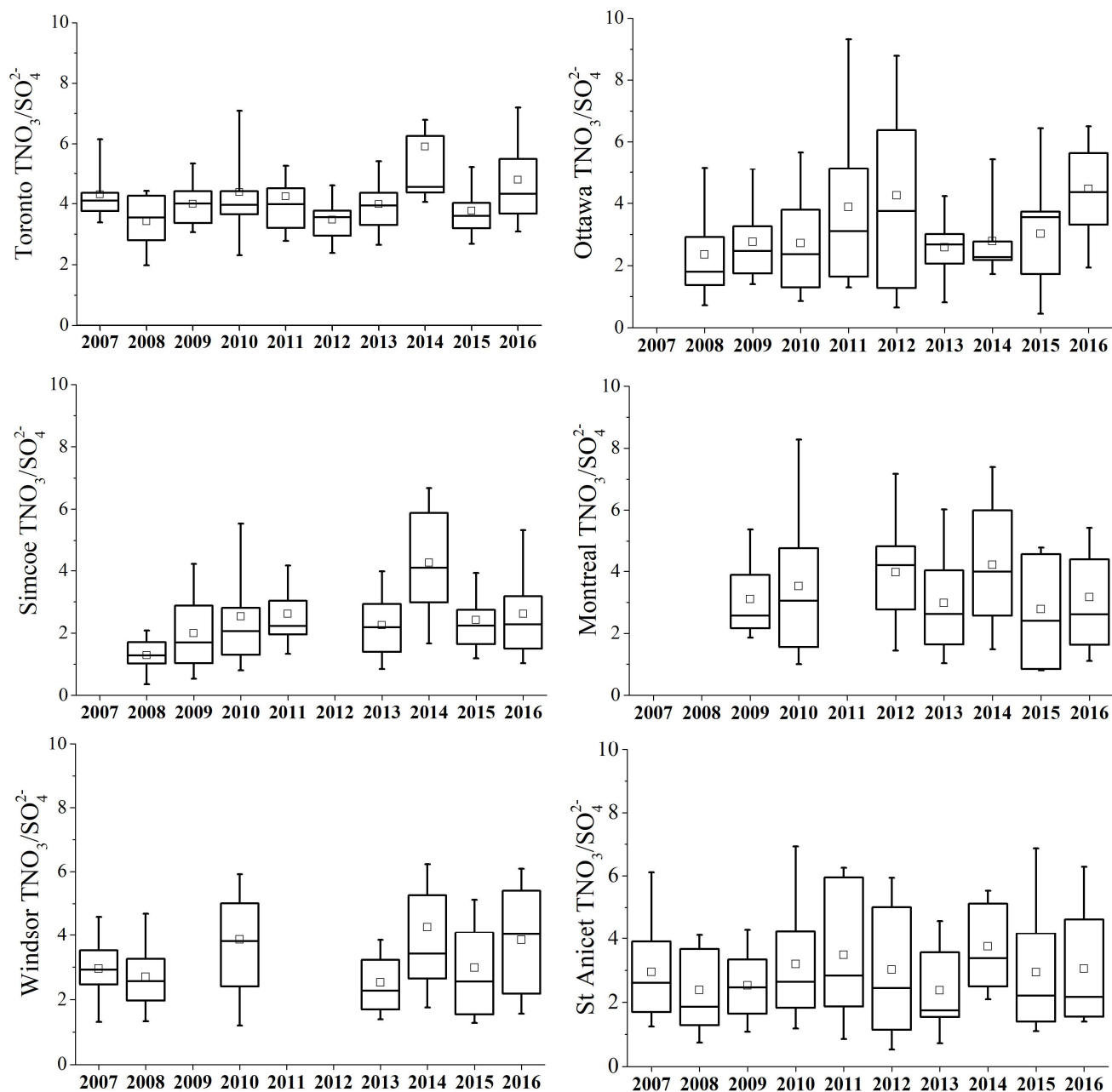


Figure S7. Box and whisker plots of TNO_3 to sulfate molar ratio in each year in each sampling site. The boxes represent 25th, 50th and 75th percentile, the whiskers represent 10th and 90th percentile, and the square markers represent the mean values.