

SUPPLEMENTARY INFORMATION

An inter-laboratory comparison of aerosol inorganic ion measurements by Ion Chromatography: implications for estimation of aerosol pH

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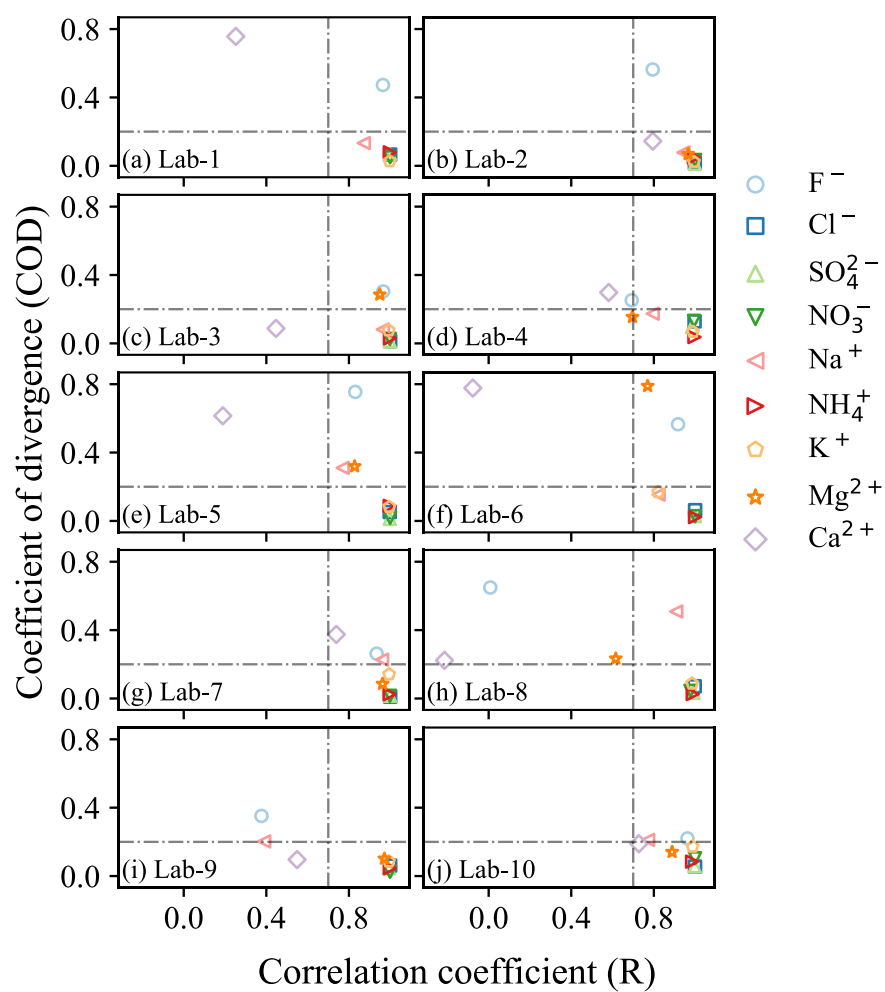


Fig. S1 Coefficient of divergence (COD) plotted against correlation coefficient (R) for all ions in each lab with the mean ionic concentrations of 10 labs. (Note: vertical line indicates an R value of 0.8, and horizontal lines indicate COD values of 0.2.)

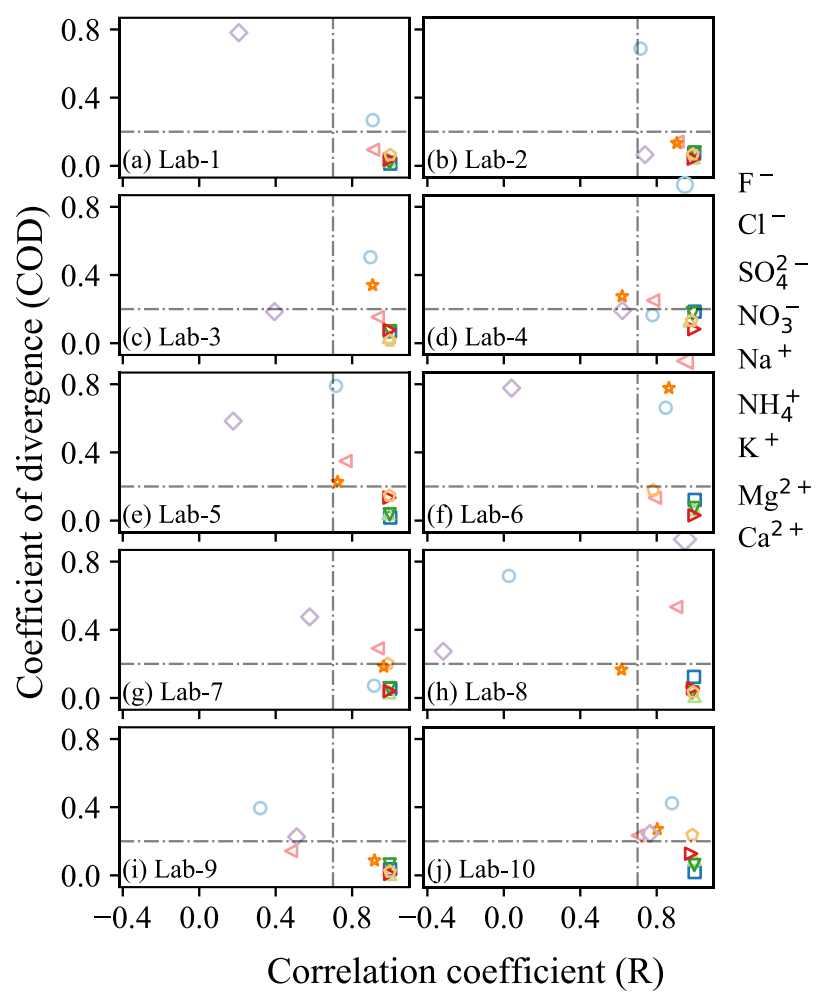


Fig. S2 Coefficient of divergence (COD) plotted against correlation coefficient (R) for all ions in each lab with the upper values (84% percentile) of ionic concentrations of 10 labs. (Note: vertical line indicates an R value of 0.8, and horizontal lines indicate COD values of 0.2.)

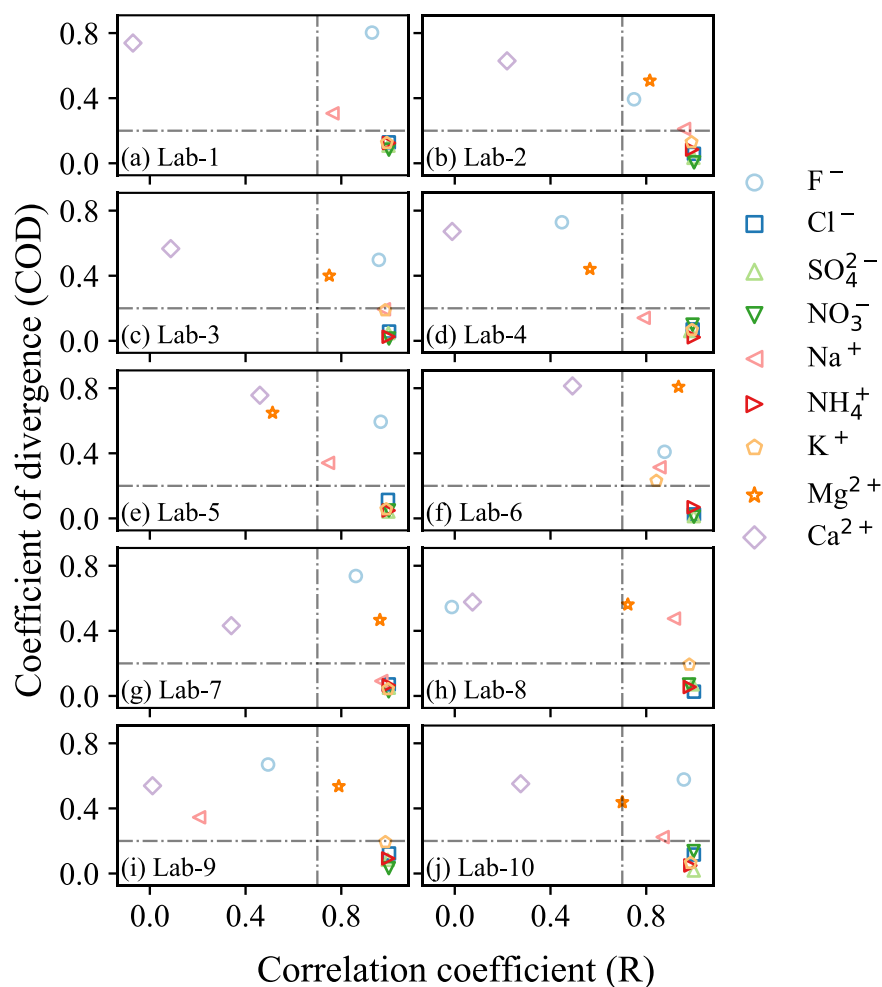


Fig. S3 Coefficient of divergence (COD) plotted against correlation coefficient (R) for all ions in each lab with the lower values (16% percentile) of 10 labs. (Note: vertical line indicates an R value of 0.8, and horizontal lines indicate COD values of 0.2.)

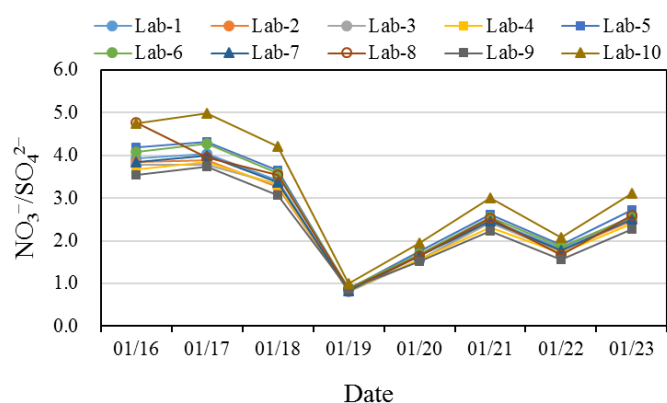


Fig. S4 Mass ratio of $\text{NO}_3^-/\text{SO}_4^{2-}$ during the study period in 10 labs.

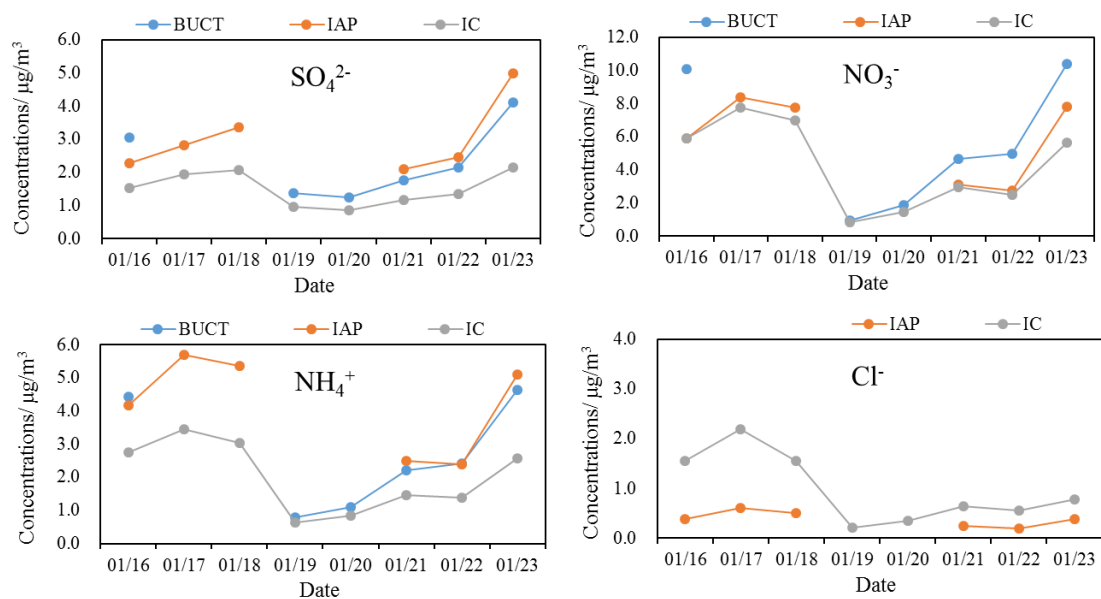


Fig. S5 Time series of ion species measured by IC (median values measured by 10 labs) in this study and ACSM at IAP and BUCT

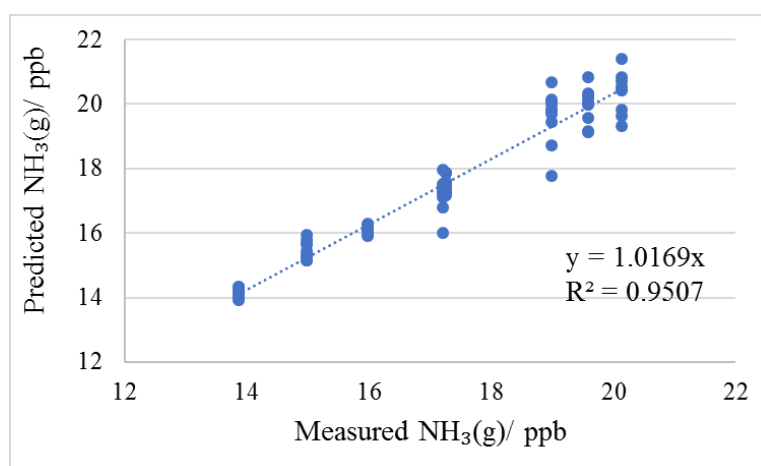


Fig. S6 The correlation between predicted and measured gas-phase NH_3

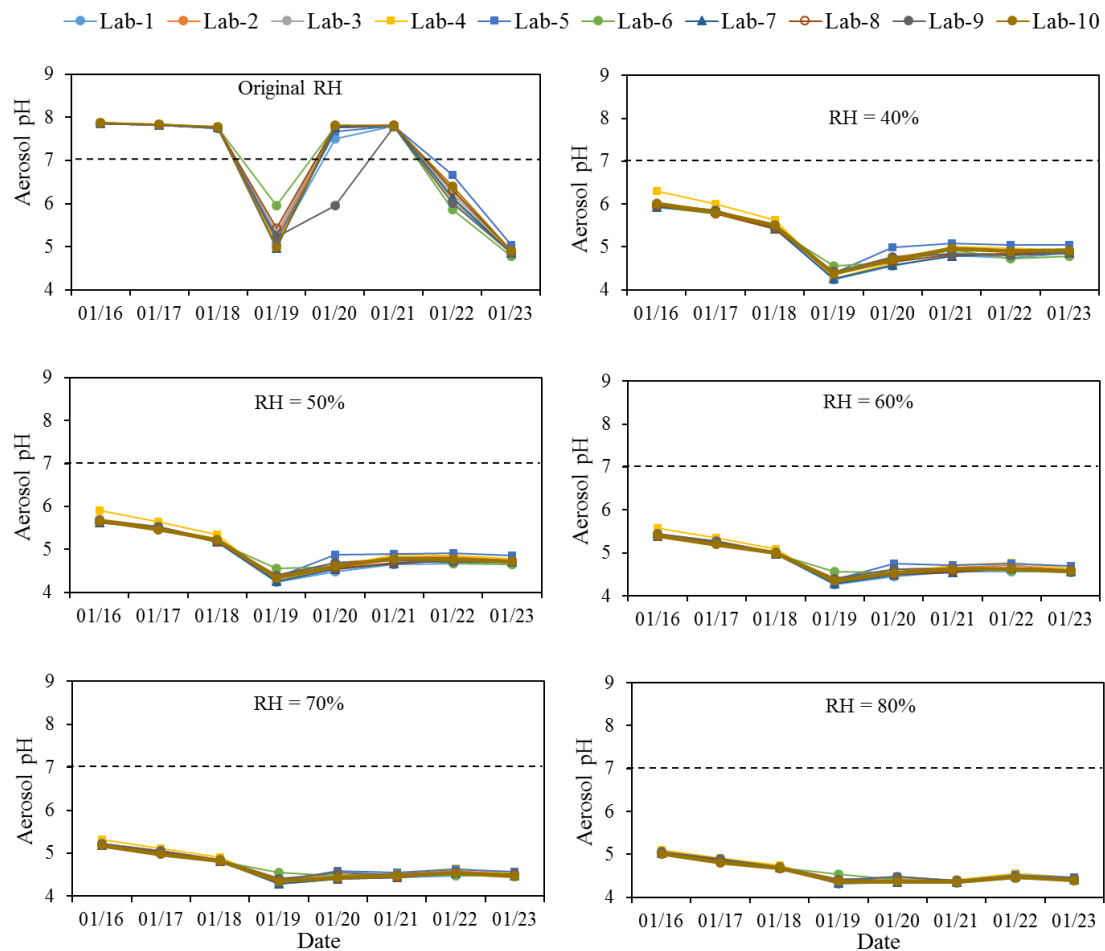


Fig. S7 Aerosol pH estimated by ISORROPIA-II at different RH for all samples

Table S1 Summary of extraction details in 10 laboratories.

Lab NO.	Extraction vial type	Ultrapure water purity & generator model	Ultrasonicator model & power	Syringe type	Syringe filter type	Vial type (used for cation & anion analysis)
1	Nalgene high density polyethylene bottle	18.2 MΩ cm & Millipore, USA	KQ5200DE & 600 W	Disposable polypropylene syringe	0.22 μm PTFE	Dionex 5 ml PolyVials
2	Nalgene Wide-Mouth Straight-Sided PPCO Jars with Closure, 250mL	18.2 M Ω .cm & UNIQUE-R20	KQ-300B & 300W	10mL disposable polypropylene syringe	Acrodisc® 25 mm syringe filter, 0.45 μm supor® Membrane, Pall corporation	15mL conical centrifuge tubes, Watson®
3	-	18.2 MΩ .cm & Elix Essential	-	-	-	5mL Thermo PolyVials
4	50ml centrifuge tube (Jiang su, Haimen)	18.2 MΩ cm & Millipore, USA.	KQ5200DE & 200W	Disposable polypropylene syringe (Shanghai, Yuzhi)	0.45 μm syringe filter (Tianjin, Jinteng)	10ml centrifuge tube
5	Centrifuge tube 50mL	18.2 MΩ cm & Model: DURA FV	KQ-100DB & 100W	Disposable sterile syringe 1mL	0.22 μ m, 13 mm Agela technologies	PP-11ml (Model: 6.2743.050)
6	CNW Technologies GmbH	18.2 MΩ cm & Elix Essential 15	GT SONIC-D27 & 500W	5ml disposable polypropylene syringe	0.2 μm PTFE	PP-11ml
7	50 mL Centrifuge Tube	18.2 MΩ cm & A3S-10-10-BE	KQ-500E & 500W	20 mL disposable sterile syringe	Labfic 13 mm PES Syringe Filter 0.45 μm with Outer Ring	25 mL glass vial
8	Glass Vials	18.2 MΩ cm & ELGA PURELAB Option / ELGA Classic	Bandelin Sonorex super RK 100H & 35 kHz, 80 W	Disposable medical polypropylene syringe (Romed Holland Van Oostveen Medical B.V.)	0.2 μm Agilent Nylon syringe filter	Dionex PolyVials supplied with 20 μm filter caps
9	15 ml Sarstedt Vials	18.2 MΩ cm & SUEZ	Fisher Scientific model FB 15051 & 37 kHz, 80 W	5ml disposable polypropylene syringe	Milex Syringe Filter 0.22 μm Pore Size	Thermo Scientific 0.5ml PolyVials
10	15 mL Centrifuge Tube	18.2 MΩ cm & Millipore, USA	MRC DCF-120H & 65 kHz, 100 W	Disposable polypropylene syringe (10 ml)	ACRODISC Syringe Filter 0.22 μm Pore Size	Chromatography Direct 1.5ml PolyVials (cations); Dionex 5 ml PolyVials (anions)

Table S2 Summary of calibration (calibration range: mg/L (R²)) and QA/QC details in 10 laboratories.

Lab NO.	F ⁻	Cl ⁻	SO ₄ ²⁻	NO ₃ ⁻	Na ⁺	NH ₄ ⁺	K ⁺	Mg ²⁺	Ca ²⁺	QA/QC
1	0.05~5 (>0.999)	0.05~5 (>0.999)	0.3~30 (>0.999)	0.3~30 (>0.999)	0.05~10 (>0.999)	0.05~10 (>0.999)	0.05~10 (>0.999)	0.05~10 (>0.999)	0.05~10 (>0.999)	3 water blanks were run before analysis; Quality control (QC) samples were run every 10 samples;
2	0.048~2.4 (0.999)	0.072~3.6 (>0.999)	0.36~36 (0.999)	0.24~24 (>0.999)	0.04~8 (0.998)	0.08~16 (0.997; non-linear)	0.04~2 (>0.999)	0.04~2 (0.997)	0.2~10 (0.995)	3 water blanks were run before analysis;
3	0.002~5 (>0.999)	0.04~100 (0.999)	0.04~100 (0.999)	0.02~50 (0.999)	0.05~20 (0.999)	0.05~20 (>0.999; non-linear)	0.05~20 (0.999)	0.05~20 (0.999)	0.05~20 (0.998)	3 water blanks were run before analysis;
4	0.1~10 (>0.999)	0.4~40 (>0.999)	0.4~40 (>0.999)	0.3~30 (>0.999)	0.1~5 (>0.999)	0.5~25 (>0.999)	0.1~5 (>0.999)	0.1~5 (>0.999)	0.1~5 (>0.999)	3 water blanks were run before analysis;
5	0.05~0.8 (0.997)	0.3~2.4 (>0.999)	1.5~12 (>0.999)	1~8 (>0.999)	0.2~3.2 (0.999)	0.4~6.4 (0.997)	0.2~3.2 (0.998)	0.2~3.2 (0.997)	1~16 (0.998)	3 water blanks were run before analysis;
6	0.1~2 (>0.999)	1~20 (>0.999)	2~40 (>0.999)	1~20 (>0.999)	0.5~10 (>0.999)	0.1~2 (>0.999)	0.5~10 (>0.999)	0.5~10 (>0.999)	2~40 (>0.999)	3 water blanks were run before analysis; Quality control (QC) samples were run every 10 samples;
7	0.005~0.2 (0.998)	0.02~0.8 (>0.999)	0.2~8 (0.999)	0.1~4 (>0.999)	0.5~2 (>0.999)	0.2~8 (0.999)	0.02~0.8 (>0.999)	0.01~0.4 (>0.999)	0.05~2 (0.999)	3 water blanks were run before analysis; Standards were prepared from dilution of certified standard solutions;
8	0.0032~0.125 (0.999)	0.08~4 (>0.999)	0.16~8 (>0.999)	0.16~8 (>0.999)	0.04~1.6 (0.997)	0.2~8 (>0.999; non-linear)	0.04~1.6 (0.998)	0.016~0.8 (>0.999)	0.08~4 (>0.999)	3 water blanks were run before analysis; Standards were prepared from dilution of certified standard solutions; Quality control (QC) samples were run at the beginning and end of analysis;
9	0.01~25 (>0.999)	0.01~25 (0.999)	0.01~25 (>0.999)	0.01~25 (0.998)	0.01~25 (>0.999)	0.01~25 (>0.999)	0.01~25 (>0.999)	0.01~25 (>0.999)	0.01~25 (>0.999)	3 water blanks were run before analysis; Standards were prepared from single standard with purity considered for correction; Quality control (QC) samples were run after every 4 samples;
10	0.05~5 (>0.999)	0.05~5 (>0.999)	0.05~5 (>0.999)	0.05~5 (>0.999)	0.01~5 (>0.999)	0.01~5 (0.996)	0.01~5 (>0.999)	0.01~5 (>0.999)	0.01~5 (0.998)	3 water blanks were run before analysis; Standards were prepared from single standard with purity considered; Quality control (QC) samples were run at the beginning and end of analysis;

Table S3 Temperature (T), relative humidity (RH) and gas-phase NH₃ concentrations during the study period

Date	T/°C	RH/%	NH ₃ /ppb
2019/1/16	-4.4	23.8	20.1
2019/1/17	-1.8	21.9	19.0
2019/1/18	0.6	21.0	19.6
2019/1/19	1.2	21.7	16.0
2019/1/20	2.5	14.3	13.9
2019/1/21	4.3	13.8	15.0
2019/1/22	2.8	22.7	17.3
2019/1/23	2.9	40.1	17.2

Table S4 Uncorrected and CRM-corrected ion concentrations (µg/m³) and their corresponding coefficient of variations (CV/ %)

	Uncorrected		Corrected		Uncorrected		Corrected	
	Mean (min-max)	CV/%	Mean (min-max)	CV/%	Mean (min-max)	CV/%	Mean (min-max)	CV/%
	Chloride				Sulfate			
2019/1/16	1.5 (1.2-1.8)	11.0	1.5 (1.2-1.7)	10.5	1.5 (1.1-1.7)	10.7	1.5 (1.2-1.7)	11.7
2019/1/17	2.2 (1.8-2.6)	11.7	2.2 (1.7-2.6)	11.1	2.0 (1.6-2.3)	9.1	2.0 (1.5-2.2)	10.6
2019/1/18	1.5 (1.2-1.8)	11.3	1.5 (1.2-1.8)	11.2	2.0 (1.6-2.4)	9.6	2.0 (1.6-2.3)	11.0
2019/1/19	0.2 (0.1-0.3)	18.2	0.2 (0.2-0.2)	16.1	1.0 (0.9-1.1)	7.5	1.0 (0.8-1.1)	9.0
2019/1/20	0.3 (0.2-0.4)	18.0	0.3 (0.3-0.4)	16.8	0.9 (0.8-1.1)	10.1	0.9 (0.7-1.0)	10.8
2019/1/21	0.6 (0.5-0.8)	11.9	0.6 (0.5-0.7)	11.0	1.2 (1.1-1.4)	8.3	1.2 (0.9-1.3)	8.9
2019/1/22	0.5 (0.4-0.7)	12.6	0.5 (0.4-0.6)	11.2	1.4 (1.0-1.6)	11.8	1.4 (1.0-1.6)	12.2
2019/1/23	0.8 (0.5-0.9)	13.1	0.7 (0.6-0.8)	11.7	2.2 (1.7-2.5)	11.0	2.2 (1.6-2.4)	12.6
Average		13.5		12.4		9.8		10.9
	Ammonium							
2019/1/16	2.7 (2.1-3.2)	12.0	2.6 (2.0-3.2)	15.2				
2019/1/17	3.6 (2.6-4.5)	14.3	3.5 (2.5-4.2)	15.6				
2019/1/18	3.1 (2.7-3.8)	10.3	3.1 (2.2-3.8)	13.8				
2019/1/19	0.6 (0.5-0.8)	11.5	0.6 (0.5-0.7)	10.6				
2019/1/20	0.9 (0.6-1.0)	13.5	0.8 (0.7-1.1)	13.4				
2019/1/21	1.5 (1.1-1.8)	13.5	1.5 (1.3-1.7)	9.6				
2019/1/22	1.3 (1.0-1.5)	12.2	1.3 (1.1-1.6)	12.5				
2019/1/23	2.5 (2.0-3.0)	12.9	2.5 (1.8-3.0)	15.2				
Average		12.5		13.2				

Table S5 Aerosol water content (AWC, $\mu\text{g}/\text{m}^3$) estimated by ISORROPIA II model using temperature, RH and aerosol-phase ion concentrations

Lab NO.	1	2	3	4	5	6	7	8	9	10
2019/1/16	0.93	0.78	0.80	0.40	0.92	0.80	0.85	0.96	0.83	0.89
2019/1/17	1.04	0.83	0.87	0.60	1.13	1.04	0.95	0.89	0.92	1.00
2019/1/18	0.93	0.81	0.82	0.55	0.99	0.79	0.86	0.83	0.86	0.88
2019/1/19	0.31	0.24	0.24	0.23	0.27	0.19	0.28	0.24	0.30	0.31
2019/1/20	0.22	0.15	0.14	0.12	0.18	0.15	0.15	0.15	0.31	0.14
2019/1/21	0.26	0.25	0.24	0.19	0.24	0.23	0.24	0.22	0.27	0.25
2019/1/22	0.61	0.46	0.49	0.38	0.46	0.53	0.52	0.50	0.58	0.54
2019/1/23	3.13	2.51	2.55	1.85	2.53	2.55	2.75	2.75	2.86	2.92