

# Supplementary Material: Fine Aerosol Acidity and Water during Summer in the Eastern North Atlantic

Theodora Nah<sup>1,2,\*</sup>, Junwei Yang<sup>1</sup>, Jian Wang<sup>3</sup>, Amy P. Sullivan<sup>4</sup> and Rodney J. Weber<sup>5</sup>

<sup>1</sup> School of Energy and Environment, City University of Hong Kong, Hong Kong, China; jwyang6-c@my.cityu.edu.hk

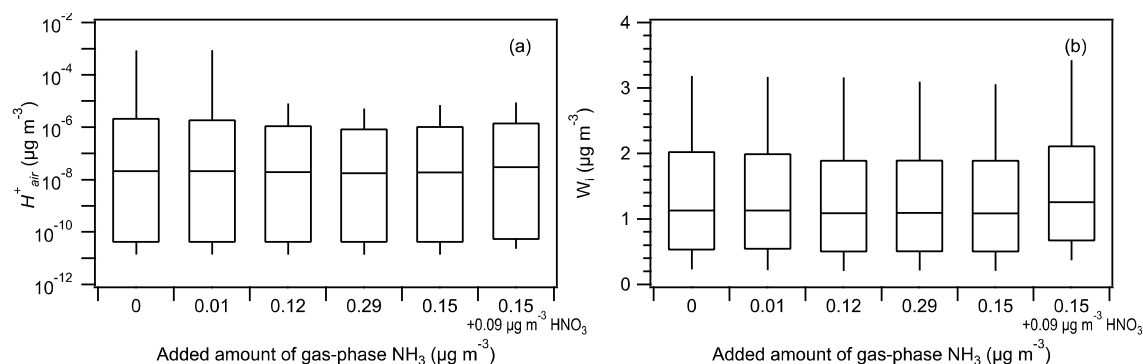
<sup>2</sup> State Key Laboratory of Marine Pollution, City University of Hong Kong, Hong Kong, China

<sup>3</sup> Department of Energy, Environmental and Chemical Engineering, Washington University in St. Louis, Saint Louis, MO 63130, USA; jian@wustl.edu

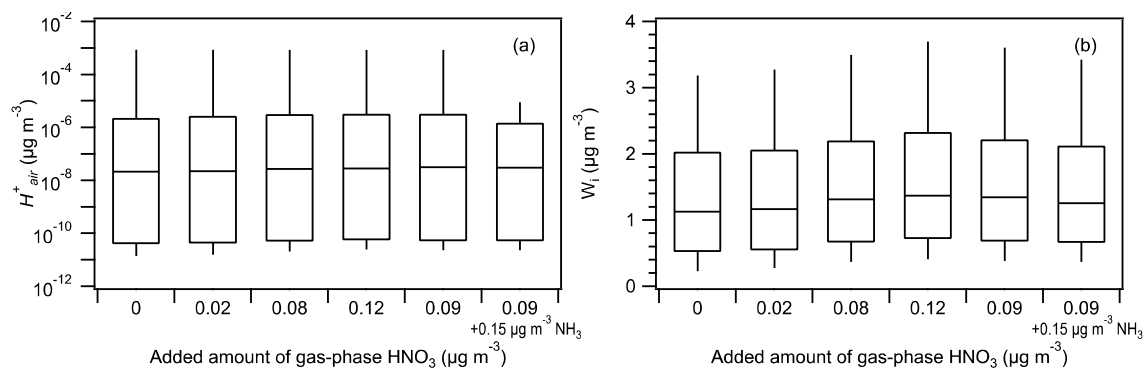
<sup>4</sup> Department of Atmospheric Science, Colorado State University, Fort Collins, CO 80523, USA; amy.sullivan@colostate.edu

<sup>5</sup> School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Atlanta, GA 30332, USA; rweber@eas.gatech.edu

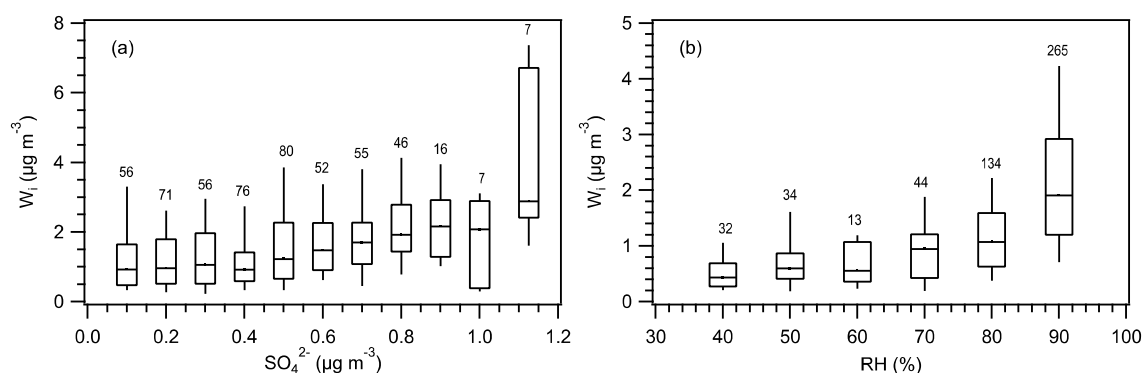
\* Correspondence: theodora.nah@cityu.edu.hk; Tel.: +852-3442-5578



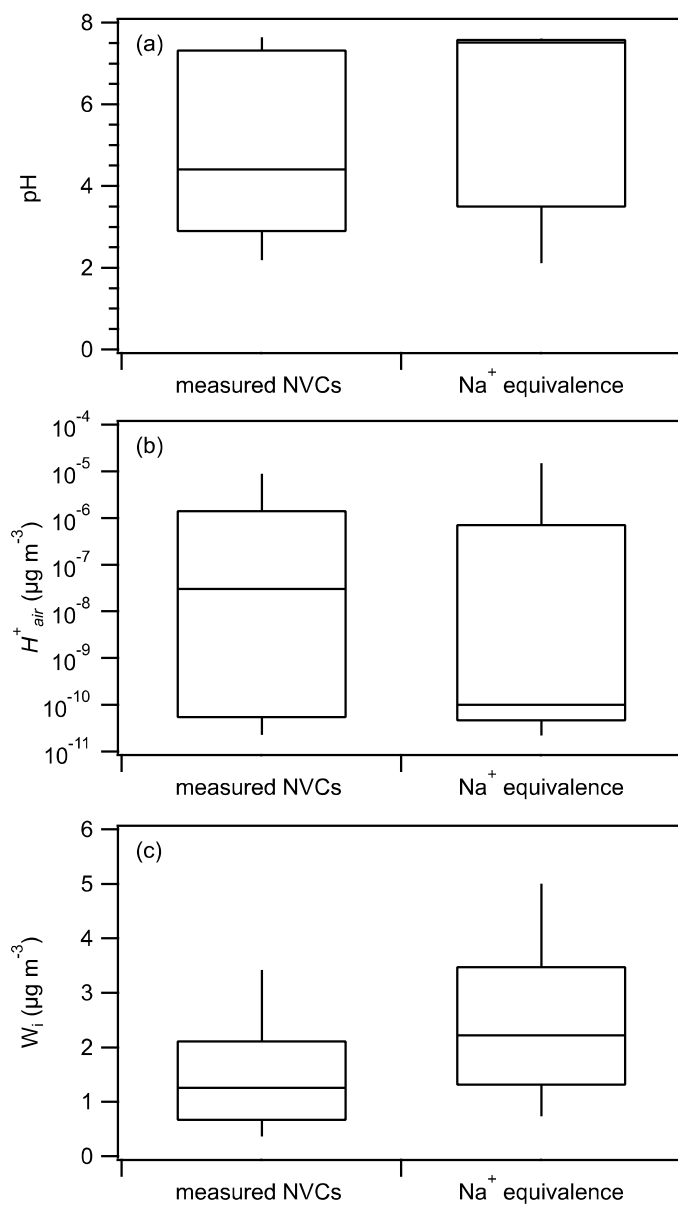
**Figure S1.** Box plots depicting the median (a)  $H^+_{\text{air}}$ , and (b)  $W_i$  values calculated by ISORROPIA-II for the different concentrations of gas-phase  $\text{NH}_3$  added into the system. Standard box-whisker plots are shown, with the 90<sup>th</sup> and 10<sup>th</sup> percentile data indicated by black error bars. The top and bottom of the box are the interquartile ranges (75<sup>th</sup> and 25<sup>th</sup> percentile) centered around the median value (50<sup>th</sup> percentile).



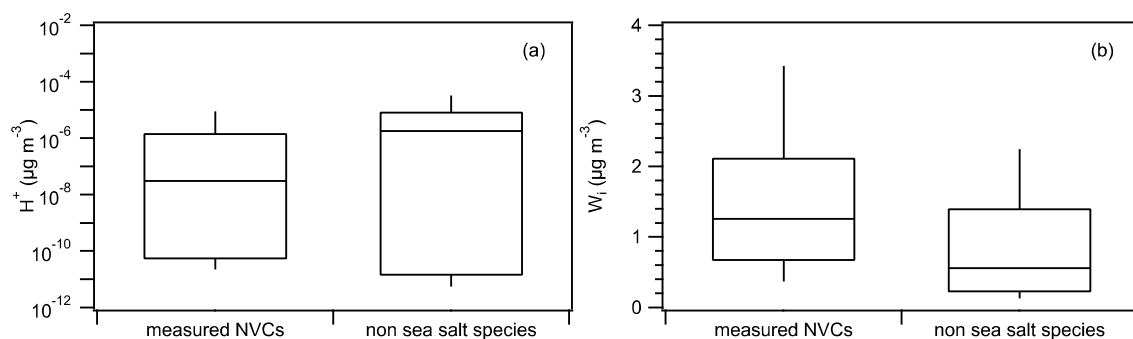
**Figure S2:** Box plots depicting the median (a)  $H_{air}^+$  and (b)  $W_i$  values calculated by ISORROPIA-II for the different concentrations of gas-phase  $\text{HNO}_3$  added into the system. Standard box-whisker plots are shown, with the 90<sup>th</sup> and 10<sup>th</sup> percentile data indicated by black error bars. The top and bottom of the box are the interquartile ranges (75<sup>th</sup> and 25<sup>th</sup> percentile) centered around the median value (50<sup>th</sup> percentile).



**Figure S3:** Box plots of  $W_i$  vs. (a)  $\text{SO}_4^{2-}$ , and (b) RH. The box plot was generated by segregating the data into eleven equally-spaced  $\text{SO}_4^{2-}$  mass concentration bins in (a), and into six equally-spaced RH bins in (b). Standard box-whisker plots are shown, with the 90<sup>th</sup> and 10<sup>th</sup> percentile data indicated by black error bars. The top and bottom of the box are the interquartile ranges (75<sup>th</sup> and 25<sup>th</sup> percentile) centered around the median value (50<sup>th</sup> percentile). The number of points considered for each bin are also shown.



**Figure S4:** Box plots depicting the median (a) pH, (b)  $H^+_{air}$ , and (c)  $W_i$  values calculated by ISORROPIA-II where crustals were treated explicitly vs. as mole-equivalent Na<sup>+</sup>. Standard box-whisker plots are shown, with the 90<sup>th</sup> and 10<sup>th</sup> percentile data indicated by black error bars. The top and bottom of the box are the interquartile ranges (75<sup>th</sup> and 25<sup>th</sup> percentile) centered around the median value (50<sup>th</sup> percentile).



**Figure S5:** Box plots depicting the median (a)  $H_{air}^+$ , and (b)  $W_i$  values calculated by ISORROPIA-II for internally mixed aerosols vs. the aerosol mode containing only non-sea salt species. Standard box-whisker plots are shown, with the 90<sup>th</sup> and 10<sup>th</sup> percentile data indicated by black error bars. The top and bottom of the box are the interquartile ranges (75<sup>th</sup> and 25<sup>th</sup> percentile) centered around the median value (50<sup>th</sup> percentile).

**Table S1.** Average mass concentrations of water-soluble inorganic species measured by the PILS-fraction collector system.

Species	Mass concentration ( $\mu\text{g m}^{-3}$ )
$\text{SO}_4^{2-}$	$0.43 \pm 0.27$
$\text{NO}_3^-$	$0.03 \pm 0.03$
$\text{Cl}^-$	$0.19 \pm 0.23$
$\text{NH}_4^+$	$0.09 \pm 0.07$
$\text{Na}^+$	$0.10 \pm 0.13$
$\text{Ca}^{2+}$	$0.20 \pm 0.20$
$\text{K}^+$	$0.03 \pm 0.05$
$\text{Mg}^{2+}$	$0.18 \pm 0.18$

**Table S2:** Sensitivity of  $H_{air}^+$  and  $W_i$  to  $\text{SO}_4^{2-}$ , TA ( $\text{NH}_3 + \text{NH}_4^+$ ),  $\text{Na}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{K}^+$ ,  $\text{Mg}^{2+}$ , RH, and temperature. The larger the relative standard deviation (RSD) was, the greater the impact the variable had on  $H_{air}^+$  or  $W_i$ .

Impact factor	$\text{SO}_4^{2-}$	TA	$\text{Na}^+$	$\text{Ca}^{2+}$	$\text{K}^+$	$\text{Mg}^{2+}$	RH	Temp
$H_{air}^+$ -RSD (%)	242.0	0.40	289.0	127.0	295.7	50.5	65.2	10.7
$W_i$ -RSD (%)	29.7	0.28	9.5	36.9	14.9	31.0	51.1	0.0