Atmospheric
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Supplement of

Long-term observational constraints of organic aerosol dependence on inorganic species in the southeast US

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Supplementary Information

Table S1. Multivariate linear regression analysis of modeled IEPOX-SOA. β_1, β_2 and β_3 are standardized partial regression coefficients associated with sulfate, aerosol H^+ activity and isoprene emission. R^2 represent the square of correlation between IEPOX-SOA and the linear-fitted function. The r_1^2, r_2^2 and r_3^2 within parentheses are square of direct correlation between IEPOX-SOA and each variable.

	Sulfate β_1 (r_1^2)	H^+ activity β_2 (r_2^2)	ISOP emission β_3 (r_3^2)	R^2
2000-2013	0.39 (0.64)	0.50 (0.71)	0.34 (0.18)	0.88
2000-2004	0.46 (0.76)	0.43 (0.64)	0.25 (0.55)	0.93
2005-2008	0.34 (0.62)	0.57 (0.82)	0.31 (0.24)	0.94
2009-2013	0.45 (0.55)	0.27 (0.56)	0.42 (0.53)	0.84

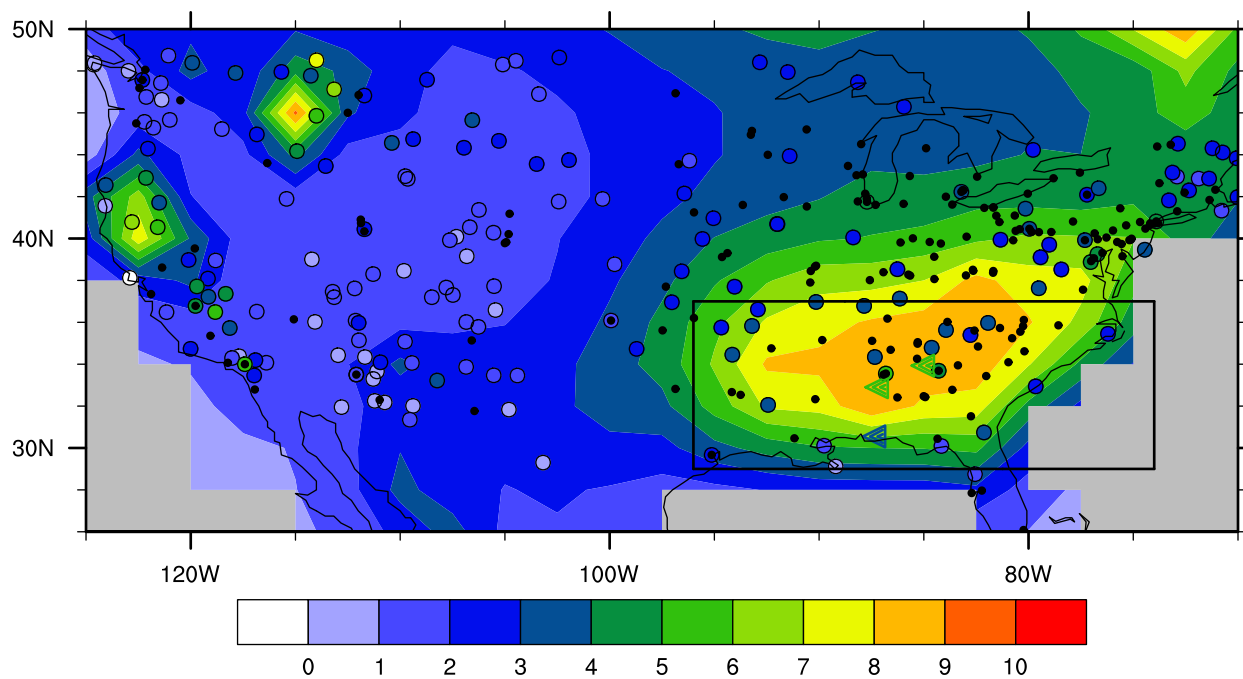**Figure S1.** OA concentration (μg/m³) averaged in JJA 2000-2013 from the default model and the IMPROVE and SEARCH networks. Rectangle defines the SEUS region. Circles and triangles represent sites from IMPROVE and SEARCH, respectively. Black dots represent the location of CSN sites, but due to the discontinuity of CSN organic carbon measurements, the 2000-2013 OA concentrations are not shown for CSN sites.
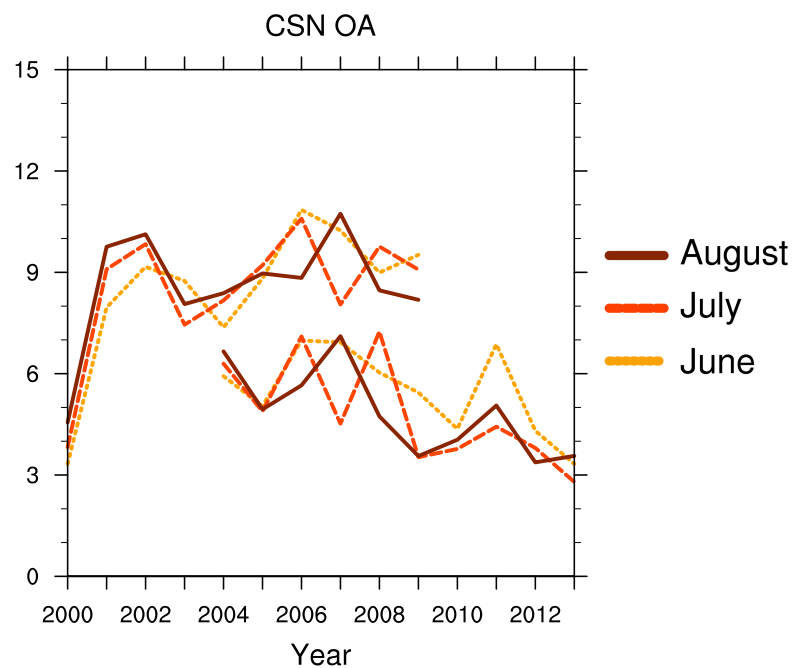
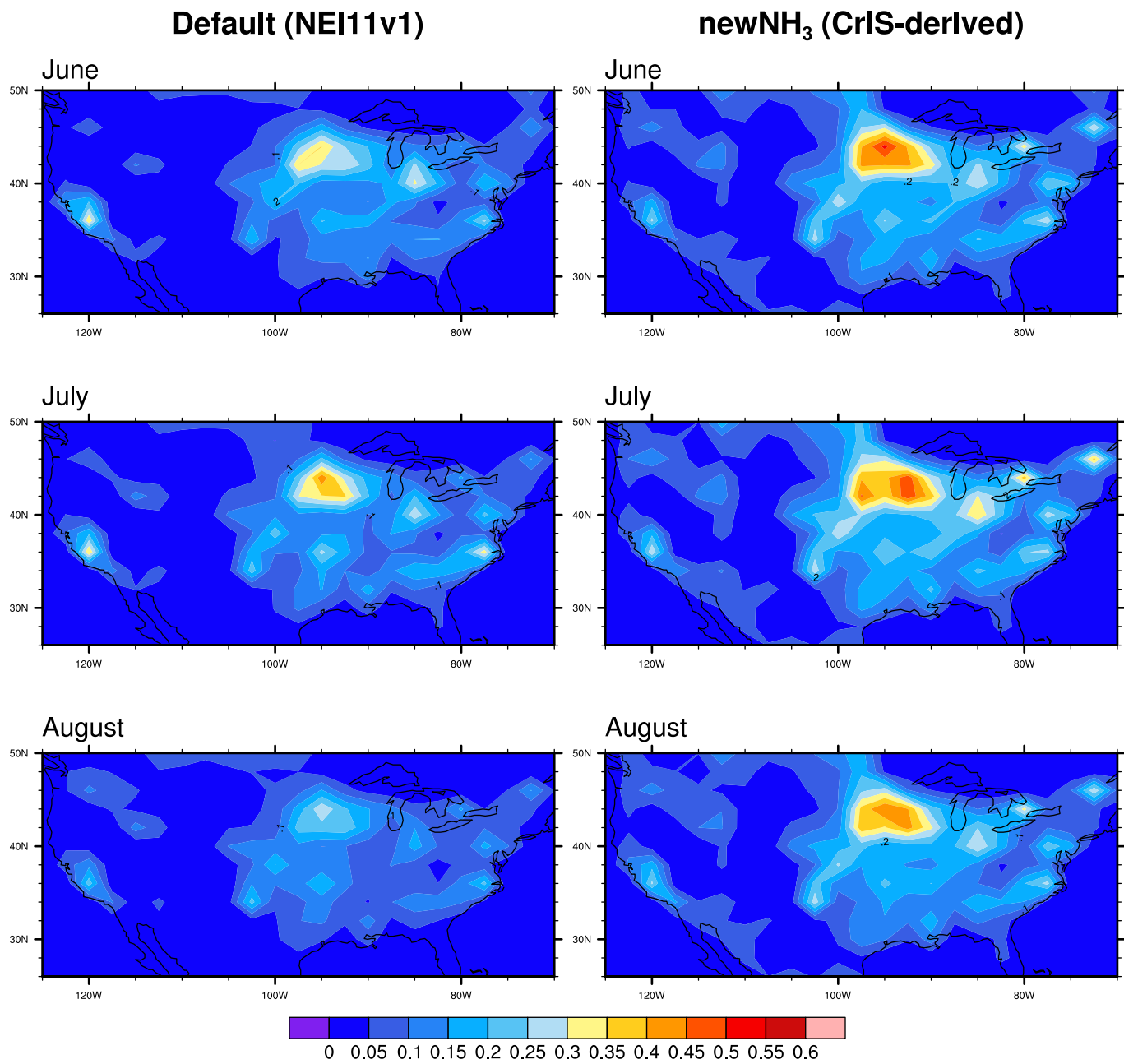**Figure S2.** Monthly observed OA from the CSN networks. Units are μg/m^3.

Figure S3. Monthly NH₃ emissions from the default NEI11v1 emission inventory and the CrIS-derived emission inventory used in the 'CT_NH₃' sensitivity simulation. Emissions are averaged in 2000-2013.
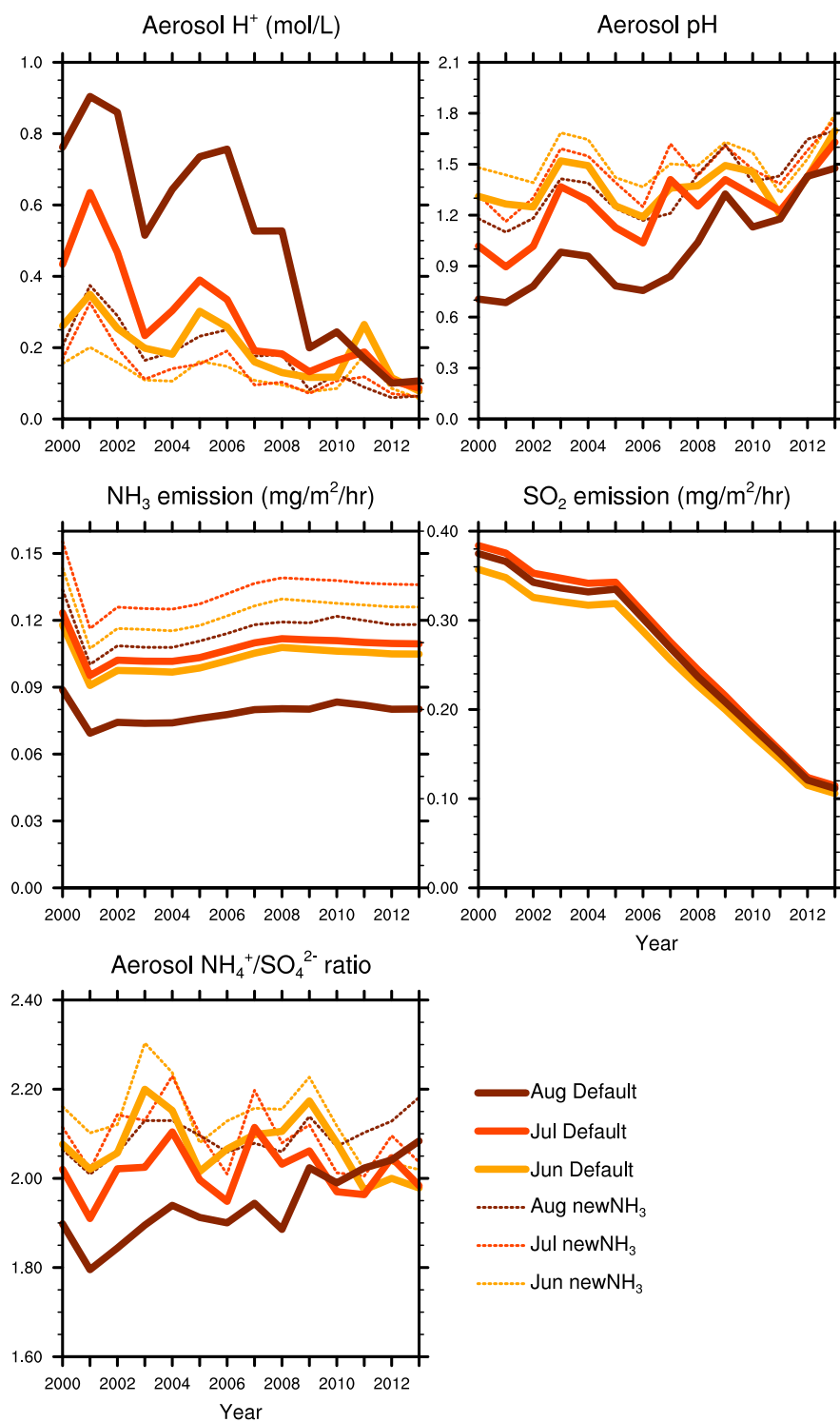
Figure S4. Monthly surface aerosol H^+ activity (mol/L), NH_3 emission, SO_2 emission (mg/m^2/hr) and aerosol NH_4^+/SO_4^{2-} ratio from the default and 'CT_newNH$_3$' simulations.

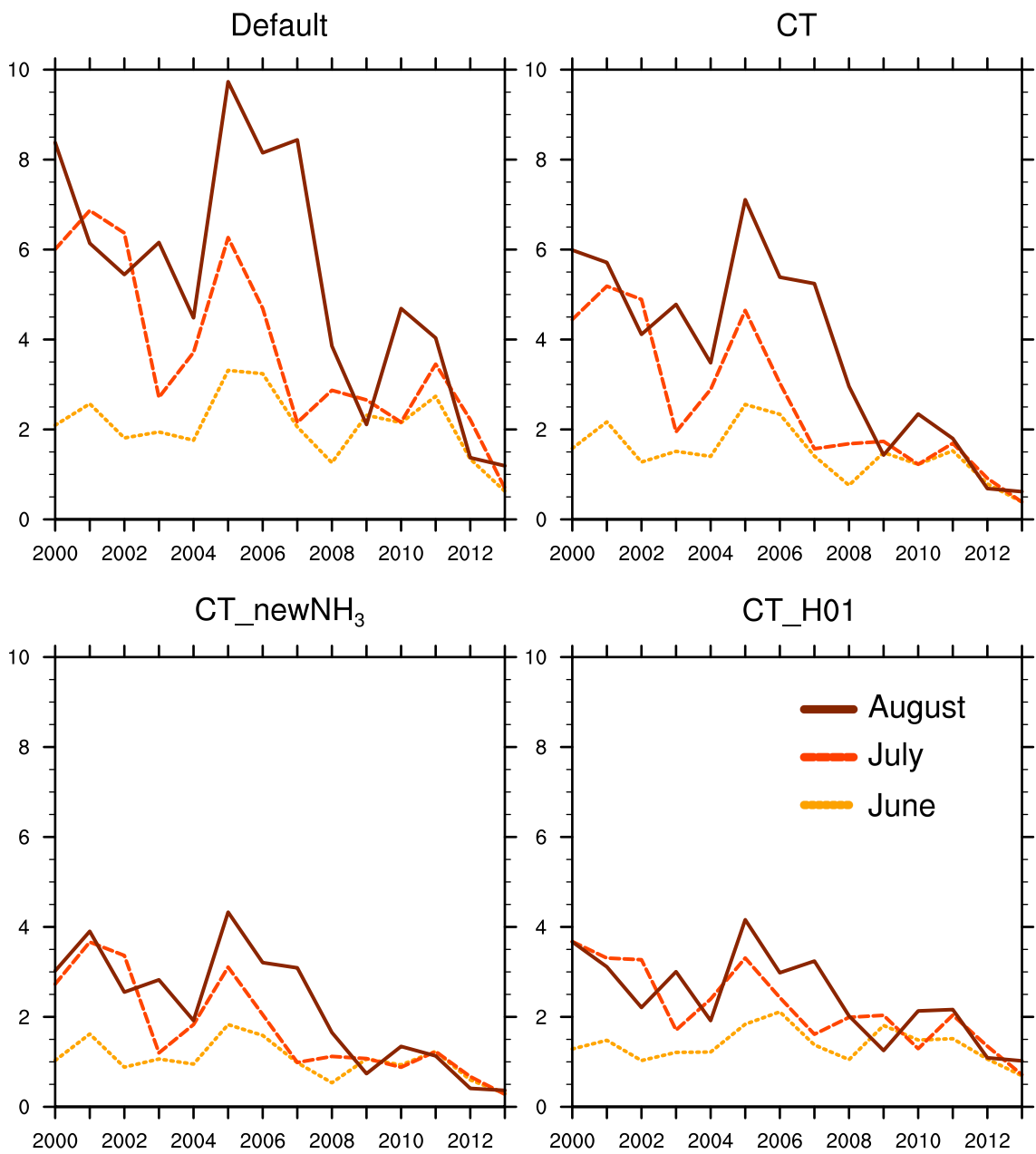**Figure S5.** The monthly surface IEPOX-SOA concentration ($\mu g/m^3$) over the SEUS from all simulations.
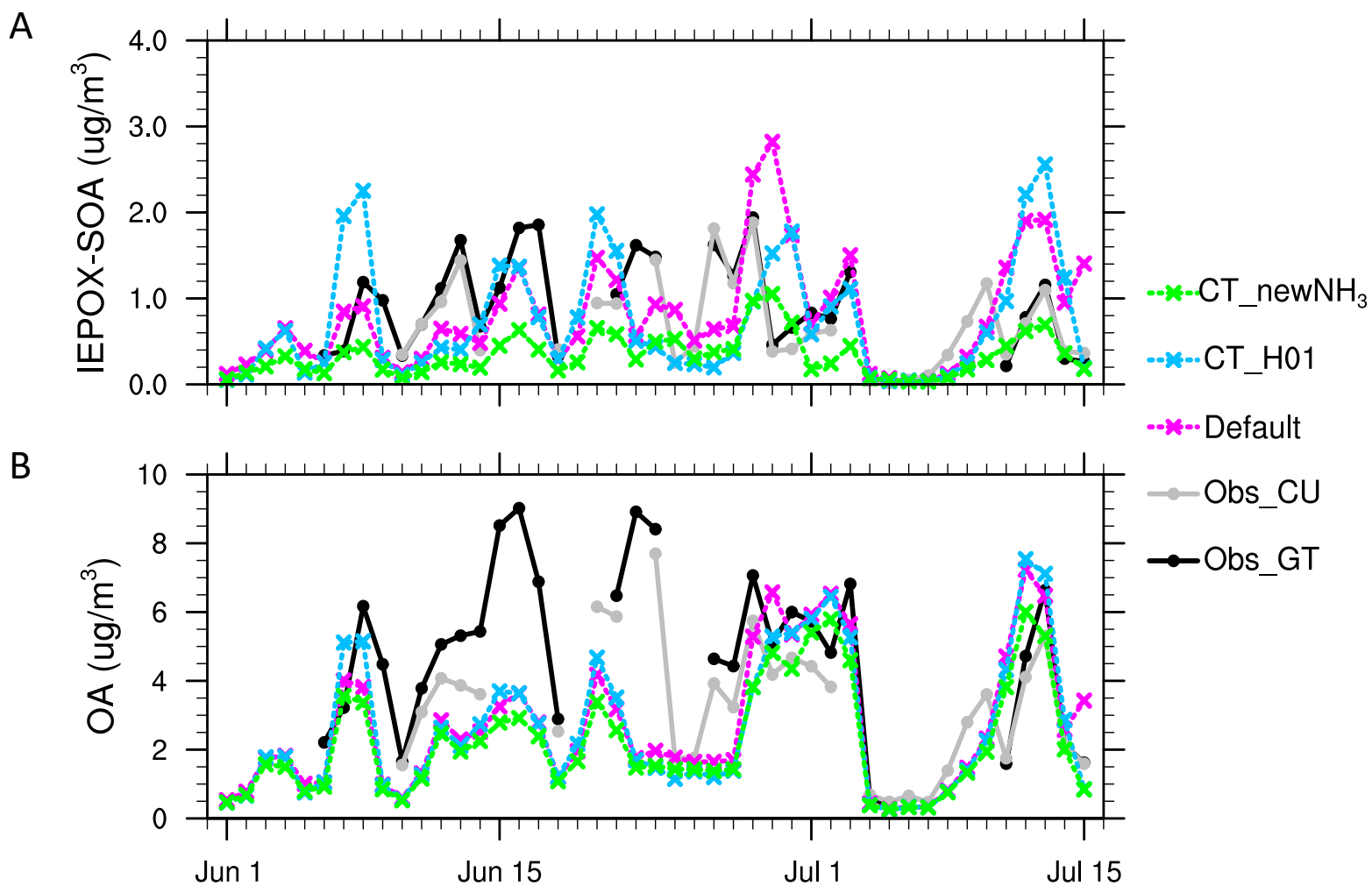
Figure S6. Comparison of **(A)** IEPOX-SOA, **(B)** OA between AMS measurement and the default and CT_H01 simulations in the SOAS campaign from June 01 to July 15, 2013. In (A), IEPOX-SOA is obtained by a Positive Matrix Factorization (PMF) analysis of the AMS-measured OA. Units are $\mu g/m^3$.