

## Supplemental Information

The potential for organic compounds to partition from the gas phase to the condensed phase via aqueous phase processes is dominant for the Eastern part of the U.S. due to the spatial patterns in particle phase liquid water ( $H_2O_{ptcl}$ ). This conclusion arises whether the potential index described in this work is employed or if models use a simplified Henry's Law approach or reactive uptake. As an example, we calculate July 2003 averages for aqueous partitioned organic aerosol concentrations that arise when a simplified Henry's Law approach is used.

$$C_J(aq) = H_J RTLC_J(g) \quad \text{Equation S1}$$

Where:

$C_J(aq)$  is the concentration of organic species "J" in air that is present in the aerosol liquid water with units of:  $\left[ \frac{\mu g_J}{m^3_{air}} \right]$

$H_J$  is the Henry's Law constant for organic species J with units of:  $\left[ \frac{mol_J / L_{water}}{atm} \right]$

R is the Ideal Gas Law Constant:  $0.08205 \left[ \frac{atm \cdot L}{mol \cdot K} \right]$

T is temperature in [K]

L is the aerosol liquid water concentration in air  $\left[ \frac{\mu g_{aerosolH_2O}}{m^3_{air}} \right]$

$C_J(g)$  is the mass concentration of organic species J in the gas phase (converted from CMAQ-predicted mixing ratios using the ideal gas law), with units of  $\left[ \frac{\mu g_J}{m^3_{air}} \right]$

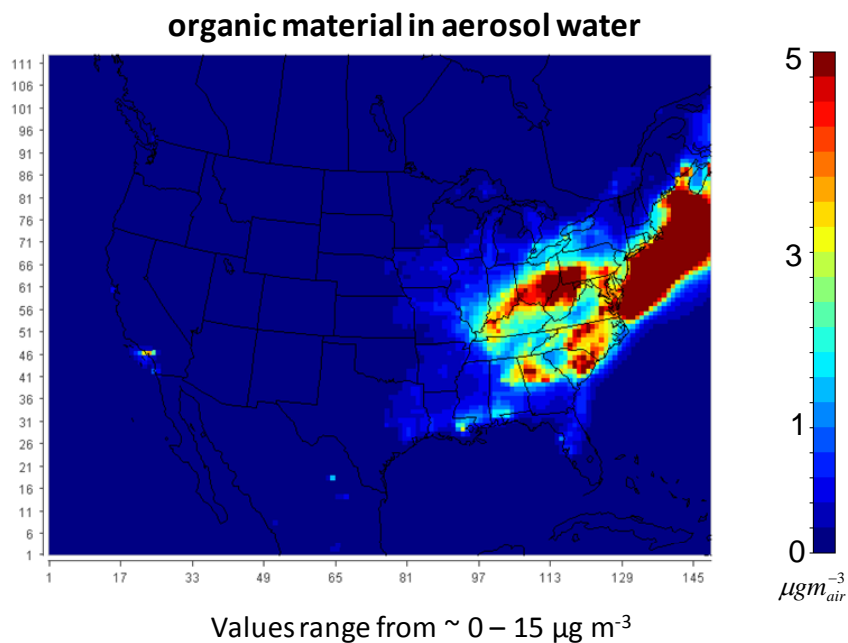


Figure S1. Organic material in the particle phase due to gas-to-aqueous partitioning by Henry's Law. The predominance of  $\text{SOA}_{\text{AQ}}$  in the eastern U.S. is a consequence of  $\text{H}_2\text{O}_{\text{ptcl}}$  spatial patterns.