Supplementary Material for the ACP manuscript "Predicting Secondary Organic Aerosol Phase State and Viscosity and its Effect on Multiphase Chemistry in a Regional Scale Air Quality Model"

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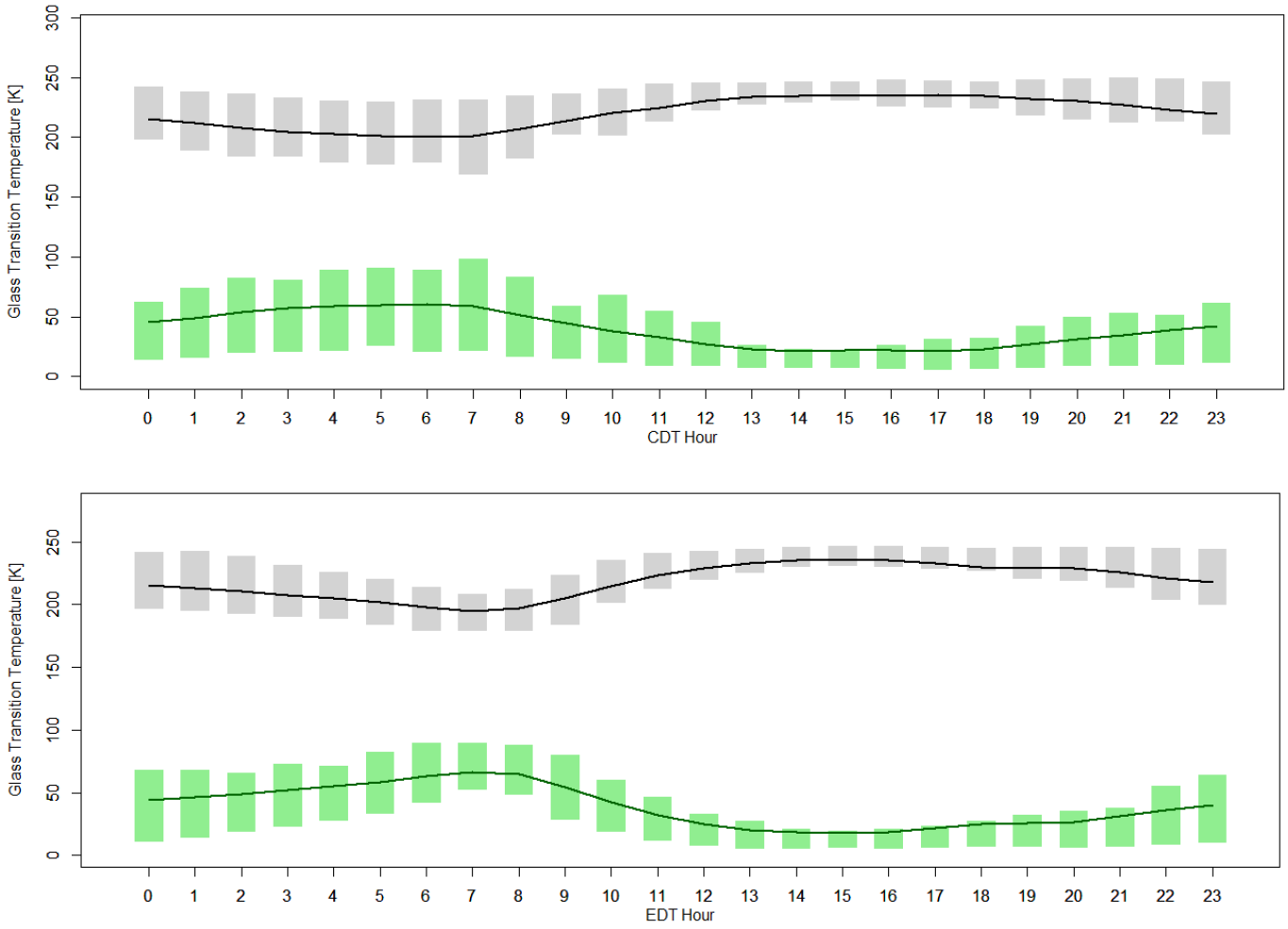


Figure S1 – Diurnal pattern for SOAS (June 1- July 15) 2013 of the contributions of aerosol liquid water (green) to Organic glass transition temperature (T_{org}) (gray) at the **(A)** Centreville, AL site and the **(B)** Jefferson Street, Atlanta site. Bars/shading indicate 25th to 75th percentiles. Lines indicate means.

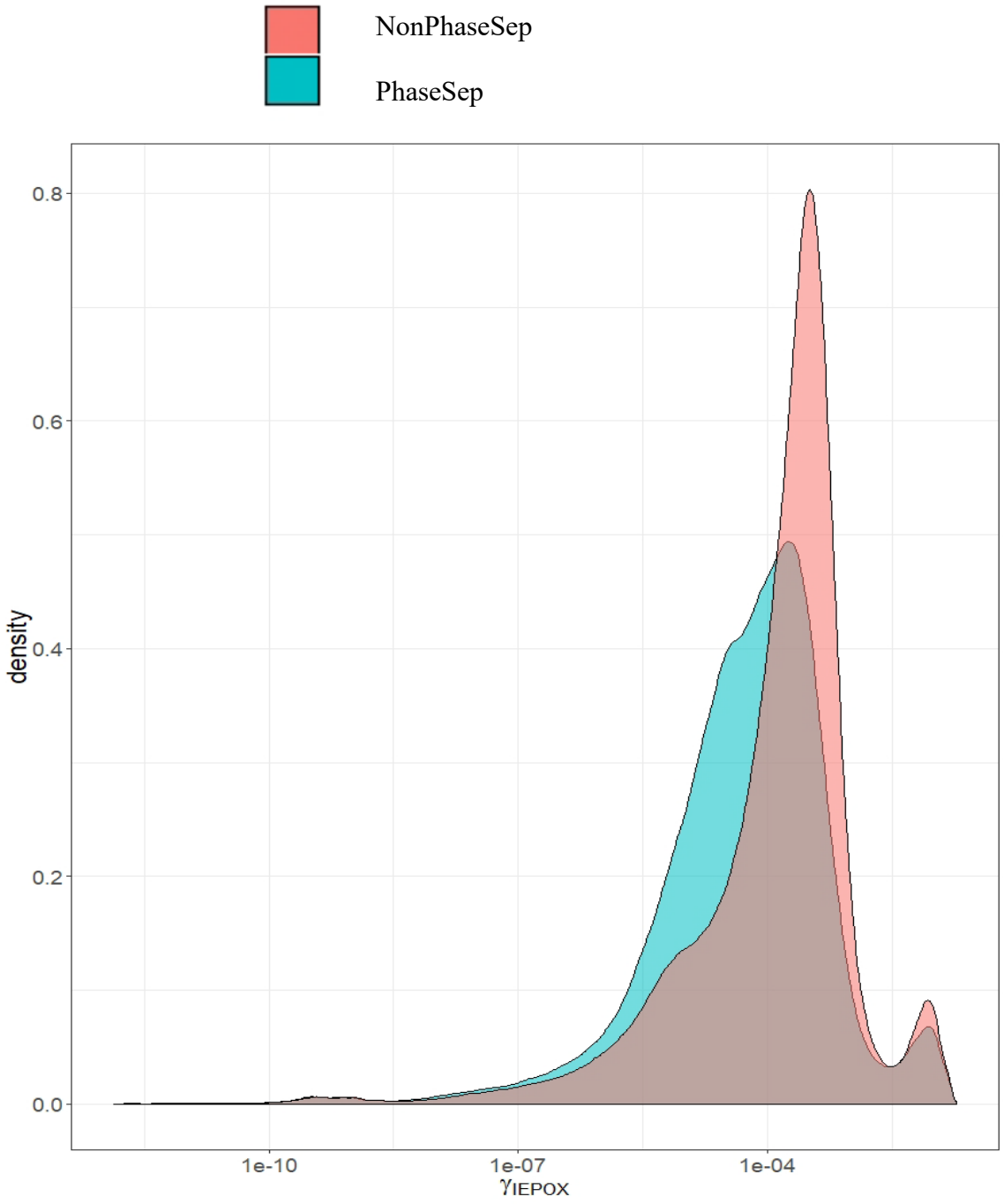


Figure S2 – For Southeastern United States, Probability distribution of γ_{IEPOX} at the surface level for the *NonPhaseSep* (red), *PhaseSep* (green) for SOAS 2013 simulation period.

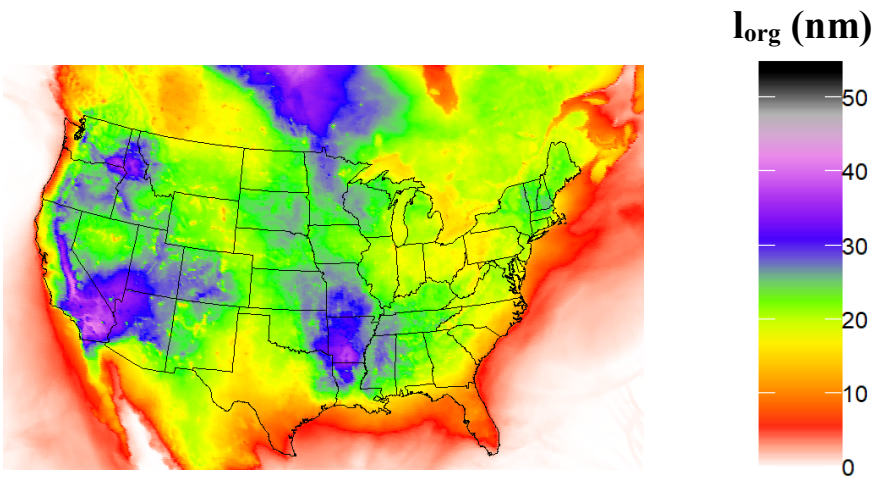


Figure S3 – Average organic coating thickness (l_{org} in nm) at the surface level for *PhaseSep* case for SOAS 2013 simulation period.

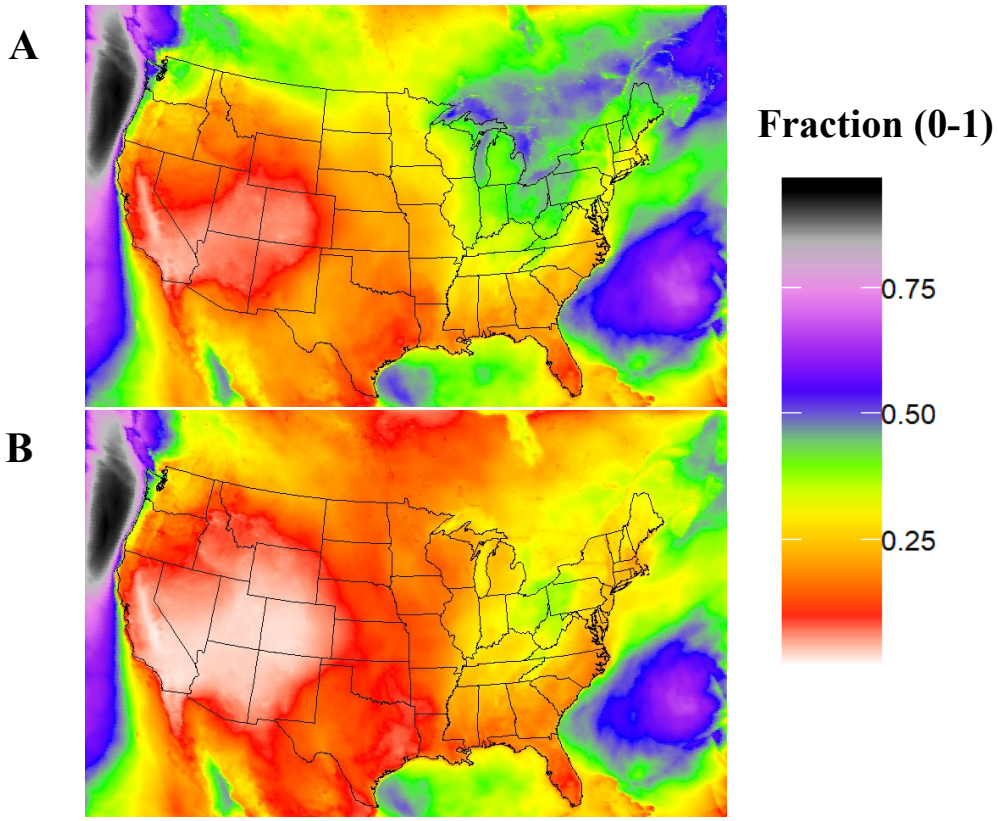


Figure S4 – Average fraction of IEPOX-derived SOA in biogenic SOA mass at the surface level for: **(A)** *NonPhaseSep and* **(B)** *PhaseSep* case for SOAS 2013 simulation period.

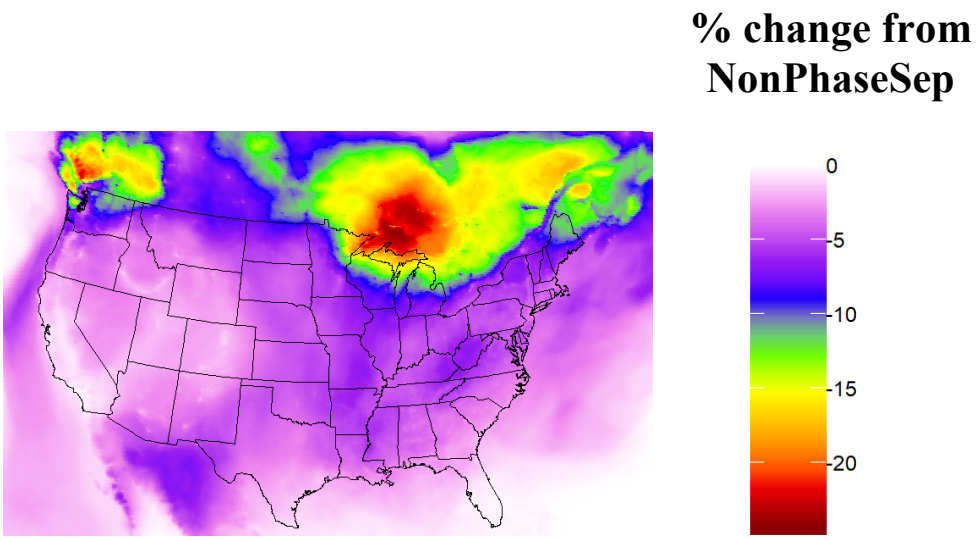
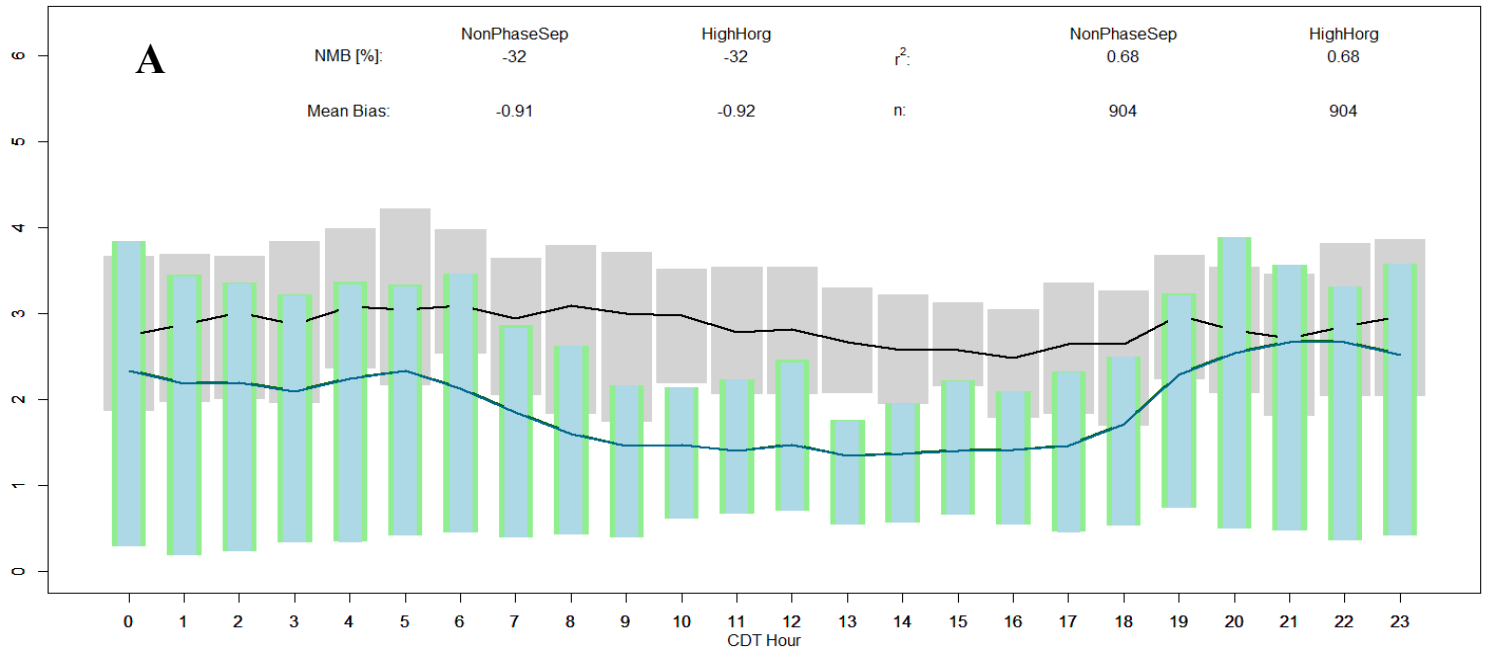
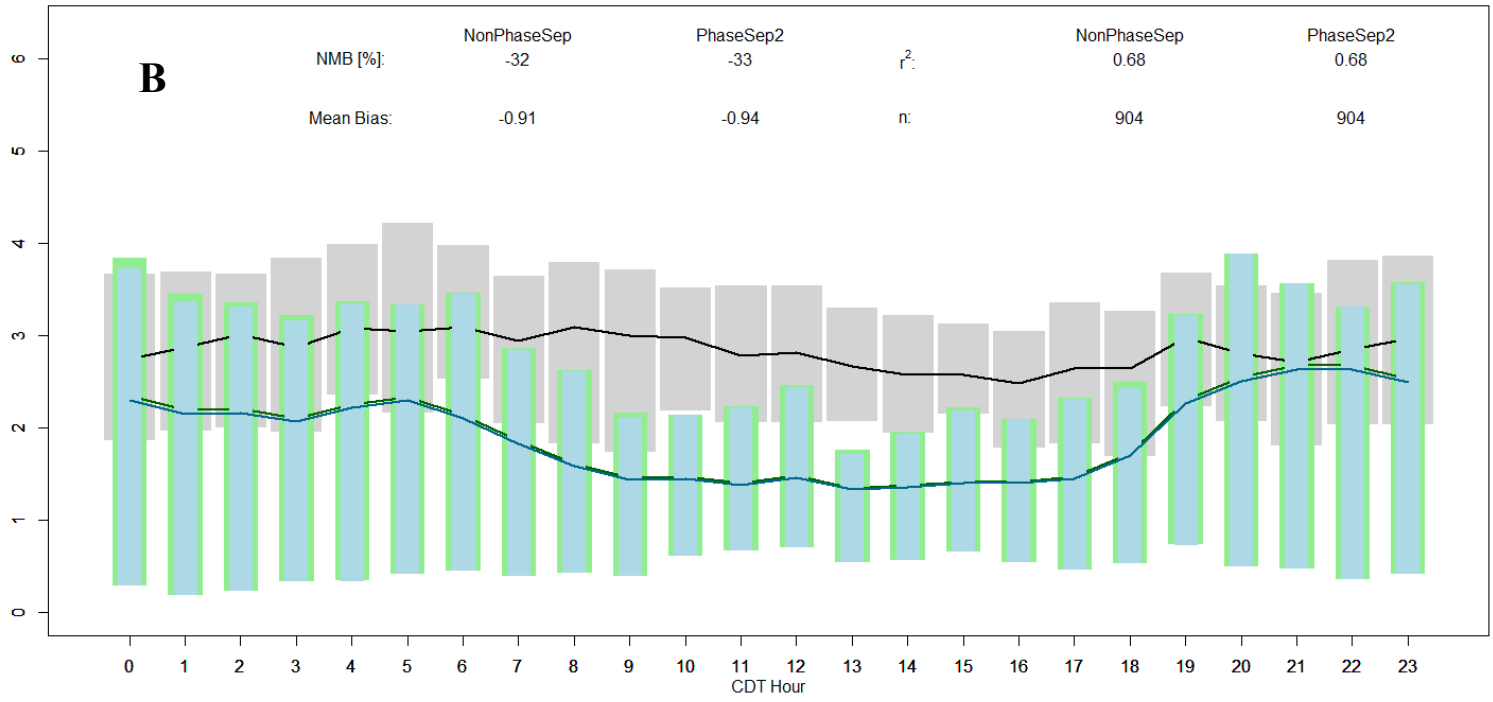


Figure S5 – Spatial map of the mean percent relative change of $PM_{2.5}$ organic carbon (OC) mass in *PhaseSep* case relative to the *NonPhaseSep* Simulation.


A
NonPhaseSep
HighHorg
NonPhaseSep
HighHorg
NMB [%]:
-32
-32
r2:
0.68
0.68
Mean Bias:
-0.91
-0.92
n:
904
904
0 1 2 3 4 5 6
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
CDT Hour


B
NonPhaseSep
PhaseSep2
NonPhaseSep
PhaseSep2
NMB [%]:
-32
-33
r2:
0.68
0.68
Mean Bias:
-0.91
-0.94
n:
904
904
0 1 2 3 4 5 6
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
CDT Hour

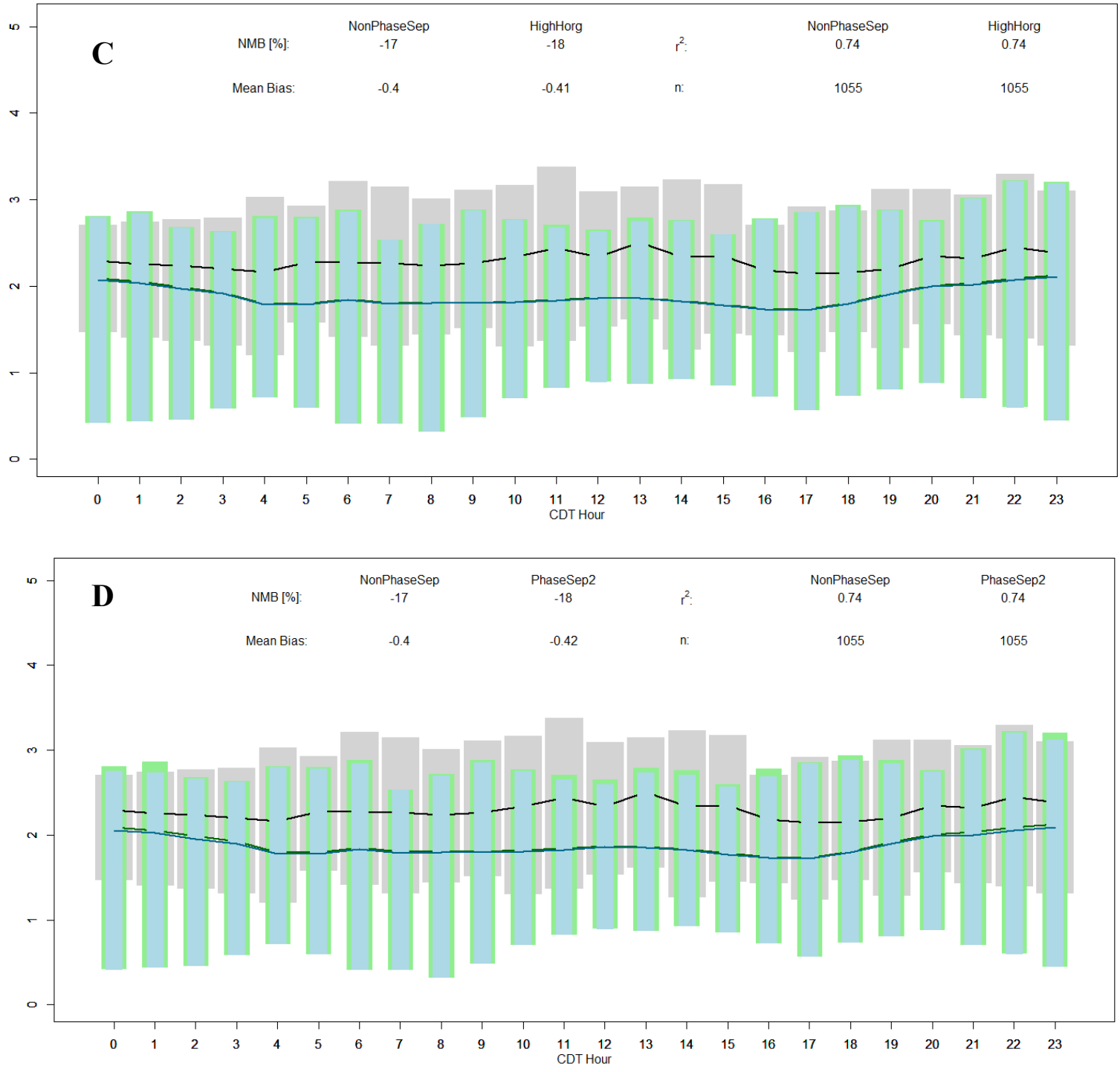


Figure S6 – $PM_{2.5}$ organic carbon (OC) mass ($\mu g/m^3$) as a function of hour of the day. Non-aggregated performance statistics- Mean Bias ($\mu g/m^3$), % Normalized Mean Bias (NMB) and Spearman's Correlation coefficient (r^2) of *NonPhaseSep* (green) and *HighHorg* (blue) relative to

observed (grey) $PM_{2.5}$ OC mass: **A-** for Rural Centreville, Alabama site and, **C-** for Urban Jefferson Street, Atlanta, Georgia site. Non-aggregated performance statistics *NonPhaseSep* (green) and *PhaseSep2* (blue) cases relative to observed (grey) $PM_{2.5}$ OC mass: **B-** for Rural Centreville, Alabama site and, **D-** for Urban Jefferson Street, Atlanta, Georgia site). Bars/shading indicate 25th to 75th percentiles. Lines indicate means. n= number of observation points.

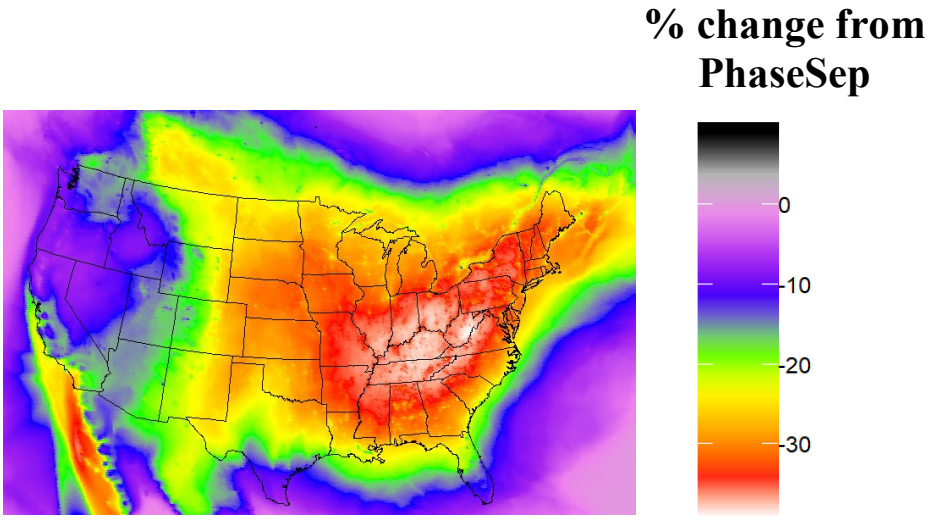


Figure S7 – Spatial map of the mean percent relative change of $PM_{2.5}$ sulfate mass in *Emission Reduction* sensitivity case relative to the *PhaseSep* Simulation.