

Supporting information for

How will SOA change in the future?

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Table S1. Global anthropogenic and biomass burning emissions and biogenic emissions

Species	Present day (year 2000)	Future (year 2100)
Anthropogenic and biomass burning emissions (Tg/yr)		
SO ₂	129.2	49.5
NO	88.6	65.5
CO	956.7	711.0
MEK(>C3 ketones)	5.8	5.2
C ₂ H ₆	9.9	4.2
C ₃ H ₈	8.6	2.8
NH ₃	64.8	92.1
ALK4(>=C4 alkanes)	35.2	15.1
Acetaldehyde	6.9	2.7
HCHO	3.2	5.5
ALK7(C6-C8 alkanes)	38.5	16.5
Aromatics	31.7	37.4
Trans-2-butene	8.1	3.6
HCOOH	7.0	8.7
Acetic acid	8.2	11.4
Acetone	2.5	4.2
Methanol	7.1	5.7
C ₂ H ₄	11.4	9.2
PRPE(>=C4 alkenes)	4.3	4.8
POA	49.8	33.2
Biogenic emissions (Tg/yr)		
Isoprene	440	534
C ₁₀ H ₁₆	131.9	246.5
PRPE(>=C4 alkenes)	14.0	24.3
Methanol	85.0	159.4
Acetone	38.6	67.2
C ₂ H ₄	23.4	46.0
CO	64.8	127.4
HCHO	4.1	8.7

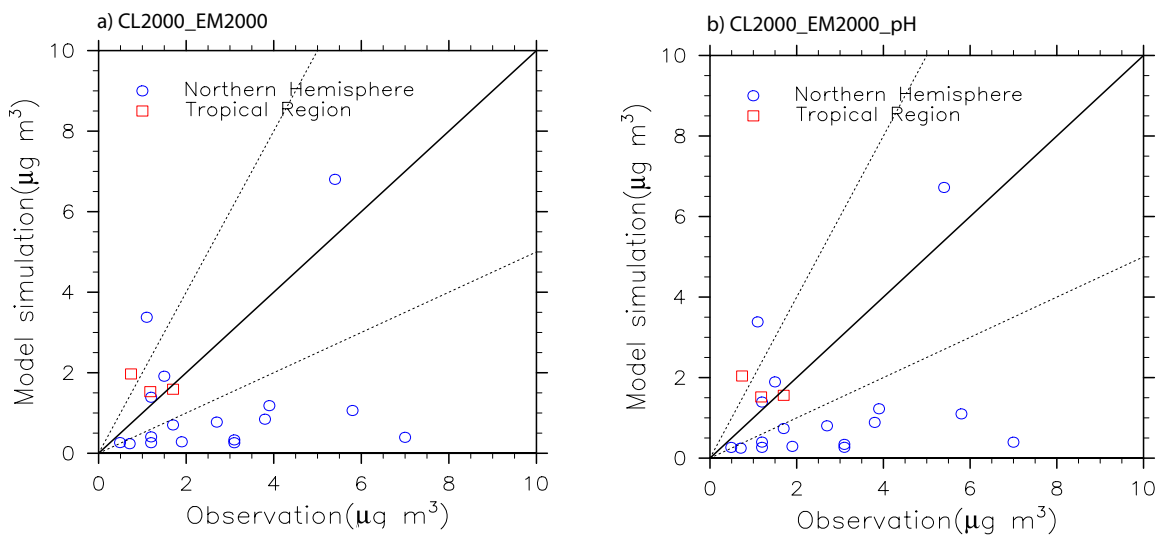


Figure S1. Comparison of modeled SOA with observed OOA measured by AMS. Panel (a) shows the model results from the simulation CL2000_EM2000 that does not include the effect of aerosol acidity on the reactive uptake of IEPOX, while the panel (b) shows those from the simulation CL2000_EM2000_pH that includes the effect of aerosol acidity on the reactive uptake of IEPOX. AMS measurements in Northern Hemisphere were reported in *Zhang et al.* [2007], and in tropical regions were reported in *Capes et al.* [2009], *Gilardoni et al.* [2011], and *Robinson et al.* [2011].

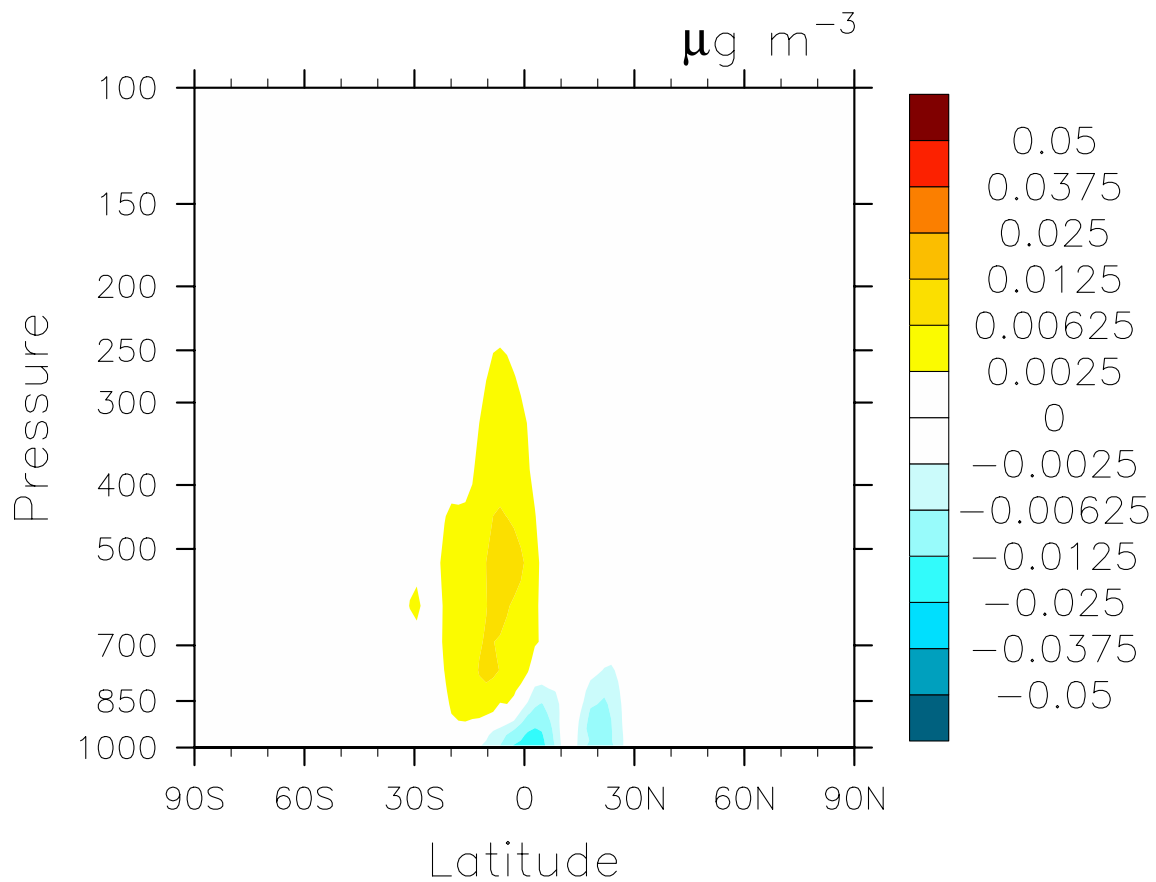


Figure S2. Zonal mean present-day SOA concentration difference between the simulations with and without considering the effect of aerosol acidity on reactive uptake of IEPOX (CL2000_EM2000_pH - CL2000_EM2000). Units are in $\mu\text{g/m}^3$.

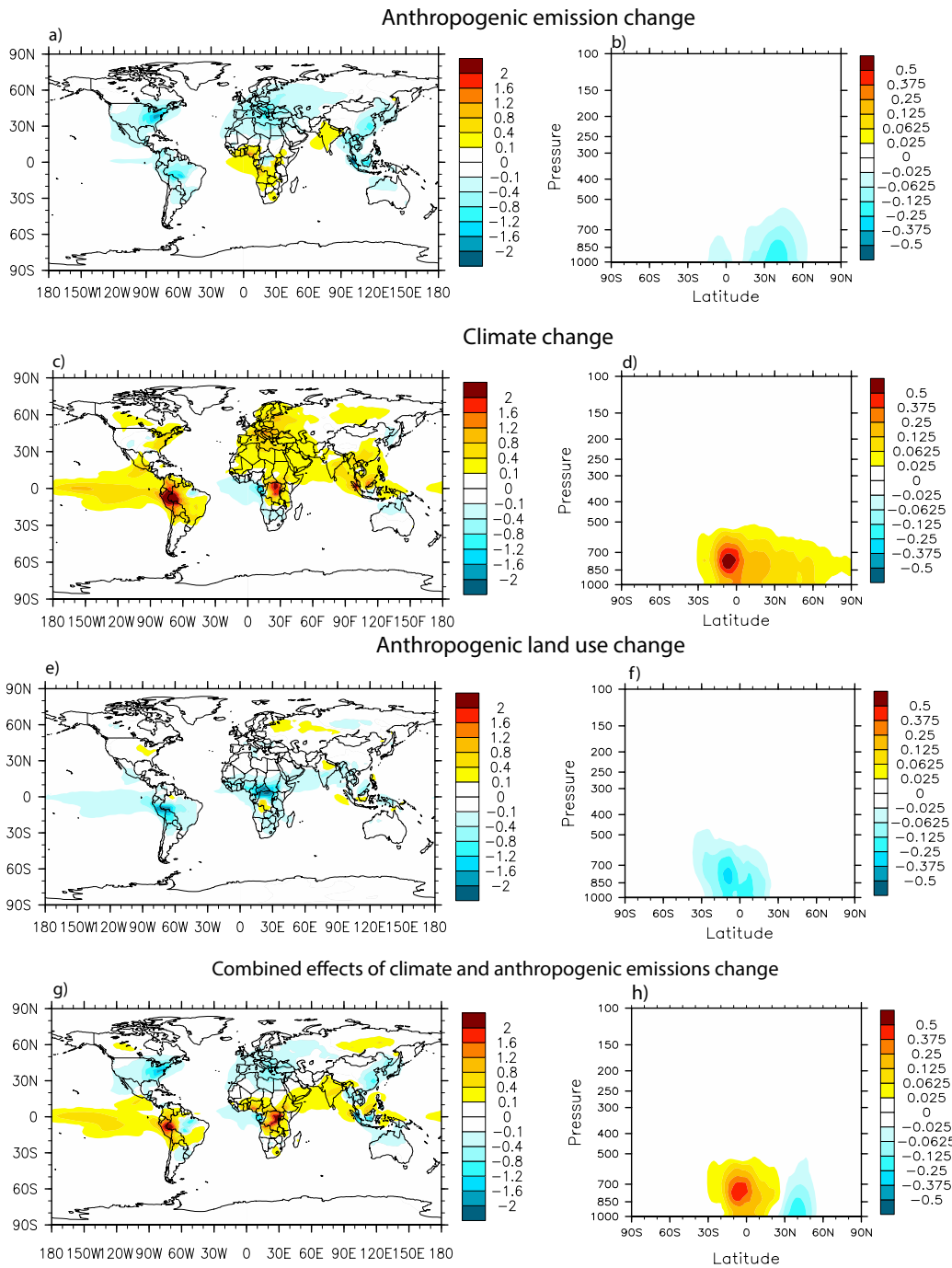


Figure S3. Projected year 2000 to year 2100 change in surface SOA concentration and vertical SOA concentrations in response to anthropogenic emission change (a and b), climate change (c and d), anthropogenic land use change (e and f), combined effect of anthropogenic emission change and climate change (g and h). All units are in $\mu\text{g}/\text{m}^3$.

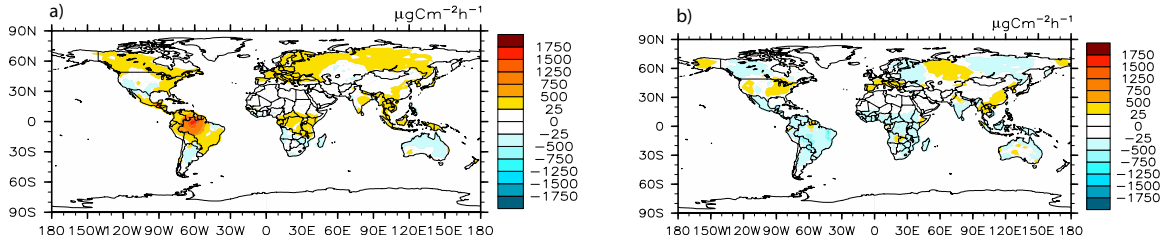


Figure S4. Projected year 2000 to year 2100 change in isoprene emission in response to climate change (a) and to anthropogenic land use change (b). All units are in $\mu\text{g C m}^{-2} \text{h}^{-1}$.

The treatment of reactive uptake of IEPOX with aerosol acidity dependence

The parameterization of reactive uptake of IEPOX on sulfate aerosols follows the treatment described in *Pye et al.* [2013]. This parameterization uses a simple uptake parameter called reactive uptake coefficient γ . It is calculated as follows:

$$\gamma = \left(\frac{1}{\alpha} + \frac{v}{4HRT\sqrt{D_a k_{particle}}} \frac{1}{f(q)} \right)^{-1}$$

$$f(q) = \coth(q) - \frac{1}{q}$$

$$q = r_p \sqrt{\frac{k_{particle}}{D_a}}$$

where α is the mass accommodation coefficient, v is the mean molecular speed, H is the Henry's Law coefficient ($2.7 \times 10^6 \text{ M atm}^{-1}$), R is the gas constant, T is the temperature, D_a is diffusivity in the aerosol phase ($1 \times 10^{-9} \text{ m}^2 \text{ s}^{-1}$), $k_{particle}$ is the pseudo-first-order rate constant for reaction of the parent hydrocarbon in the aerosol phase, q is the diffuso-reactive parameter, and r_p is the effective particle radius. $k_{particle}$ is calculated as follows:

$$k_{particle} = \sum_{i=1}^N \sum_{j=1}^M k_{i,j} [nuc_i] [acid_j]$$

for N nucleophiles and M acids. $[nuc_i]$ and $[acid_j]$ are concentrations of nucleophiles and acids in units of mol/L . $k_{i,j}$ are third-order rate constants for the particle-phase reactions, the values of which were adopted from Tables 1, S1, and S2 in *Pye et al.* [2013]. The concentrations of nucleophiles and acids are calculated explicitly in the model [*Lin et al.*, 2014]. The method to calculate aqueous phase species concentrations is described in detail in *Lin et al.* [2014].

References

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