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Supplement of

A model-based analysis of foliar NO_x deposition

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Supporting information

Table S1: Advection concentrations for the UMBS and BEARPEX-2009 scenarios

Species[a]	UMBS (ppb)	BEARPEX-2009 (ppb)
NO_2	0.6	0.1-0.35[b]
O_3	30	50
CH_2O	1	1
CH_3CHO	0.5	0.5

a. Species not shown have advection concentrations of zero

b. For the BEARPEX-2009 case this was the maximum daily advection concentration reached around 17 hrs, based on field observations of higher NO_x plumes from near-by Sacramento in the afternoon.

Table S2: Reactions and rate constants used in the 1D multibox model

Reaction	Rate constant
$NO+O_3 \longrightarrow NO_2+O_2$	$3.0 \times 10^{-12}\exp(-1500/T)$
$NO_2+h\nu \xrightarrow{O_2} NO+O_3$	See Text
$O_3+h\nu \xrightarrow{H_2O} O_2+2OH$	See Text
$OH+O_3 \longrightarrow HO_2+O_2$	$1.7 \times 10^{-12}\exp(-940/T)$
$HO_2+O_3 \longrightarrow OH+2O_2$	$1.0 \times 10^{-14}\exp(-490/T)$
$OH+OH \xrightarrow{M} H_2O_2$	$k_0 = 6.9 \times 10^{-31}(T/300)^{-1}$ $k_\infty = 2.6 \times 10^{-11}$
$OH+HO_2 \longrightarrow H_2O+O_2$	$4.8 \times 10^{-11}\exp(250/T)$
$HO_2+HO_2 \xrightarrow{M} H_2O_2+O_2$	$3.5 \times 10^{-13}\exp(430/T) + 1.7\times 10^{33} \times (M-[H_2O]) \times \exp(1000/T) \times (1 + 1.4 \times 10^{-21} \times [H_2O] \times \exp(2200/T)$
$H_2O_2 + OH \longrightarrow HO_2 + H_2O$	1.8×10^{-12}
$H_2O_2 + h\nu \longrightarrow 2OH$	See Text
$NO_2 + OH \xrightarrow{M} HNO_3$	$k_0 = 1.49 \times 10^{-30}(T/300)^{-1.8}$ $k_\infty = 2.58 \times 10^{-11}$
$HO_2 + NO \longrightarrow OH + NO_2$	$3.5 \times 10^{-12}\exp(250/T)$
$NO_2 + O_3 \longrightarrow NO_3 + O_2$	$1.2 \times 10^{-13}\exp(-2450/T)$
$NO_3 + NO_2 \xrightarrow{M} N_2O_5$	$k_0 = 2.0 \times 10^{-30}$ $(T/300)^{-4.4}$ $k_\infty = 1.4 \times 10^{-12}(T/300)^{-0.7}$
$N_2O_5 + H_2O \longrightarrow 2HNO_3$	2.0×10^{-21}
$NO + NO_3 \longrightarrow 2NO_2$	$1.5 \times 10^{-11}\exp(170/T)$
$N_2O_5 \longrightarrow NO_2 + NO_3$	$K_{eq} = 2.7 \times 10^{-27}$ $\exp(1100/T)$
$NO_3 + h\nu \longrightarrow NO + O_2$	See Text
$NO_3 + h\nu \xrightarrow{2O_2} NO_2 + O_3$	See Text
$CO + OH \xrightarrow{M,O_2} CO_2 + HO_2$	$k_0 = 5.9 \times 10^{-33}$ $(T/300)^{-1.4}$ $k_\infty = 1.1 \times 10^{-12}(T/300)^{1.3}$
$CH_4 + OH \longrightarrow CH_3O_2 + H_2O$	$2.45 \times 10^{-12}\exp(-1775/T)$
$CH_3O_2 + HO_2 \longrightarrow CH_3OOH + O_2$	$4.1 \times 10^{-13}\exp(750/T)$
$CH_3O_2 + NO \xrightarrow{O_2} CH_2O + HO_2 + NO_2$	$2.8 \times 10^{-12}\exp(300/T)$
$CH_3OOH + OH \longrightarrow CH_2O + OH + H_2O$	$0.3 \times 3.8 \times 10^{-12}\exp(200/T)$
$CH_3OOH + OH \longrightarrow CH_3O_2 + H_2O$	$0.7 \times 3.8 \times 10^{-12}\exp(200/T)$
$CH_3OOH + h\nu \xrightarrow{O_2} CH_2O + H_2O + OH$	See Text
$CH_2O + OH \longrightarrow CO + HO_2 + H_2O$	$5.5 \times 10^{-12}\exp(125/T)$
$CH_2O + h\nu \xrightarrow{O_2} CO + 2HO_2$	See Text
$CH_3CHO + OH \xrightarrow{O_2} CH_3C(O)O_2 + H_2O$	$5.4 \times 10^{-12}\exp(135/T)$
$CH_3C(O)O_2 + NO_2 \longrightarrow PAN$	$k_0 = 9.7 \times 10^{-29}$ $(T/300)^{-5.6}$ $k_\infty = 9.3 \times 10^{-12}(T/300)^{-1.5}$
$CH_3C(O)O_2 + NO \xrightarrow{O_2} NO_2 + CO_2 + CH_3O_2$	$8.1 \times 10^{-12}\exp(270/T)$
$CH_3C(O)O_2 + CH_3O_2 \longrightarrow CH_2O + O_2 + CH_3OOH$	$1.3 \times 10^{-12}\exp(640/T)$
$CH_3C(O)O_2 + HO_2 \longrightarrow O_3 + CH_3COOH$	$4.3 \times 10^{-13}\exp(1040/T)$

$CH_3C(O)O_2 + CH_3C(O)O_2 \longrightarrow O_2 + 2CO_2 + 2CH_3$	$2.9 \times 10^{-12}\exp(500/T)$
$CH_3CHO + NO_3 \longrightarrow HNO_3 + CH_3COO_2$	$1.4 \times 10^{-12}\exp(-1900/T)$
$PAN \longrightarrow CH_3COO_2 + NO_2$	$K_{eq}=(9.0 \times 10^{-29}\exp(14000/T))^{-1}$
$VOC + OH \longrightarrow RO_2$	kOH
$RO_2 + NO \longrightarrow (1-\alpha)\, HO_2 + (1-\alpha)\, NO_2 + \alpha\, RONO_2$	$2.7 \times 10^{-12}\exp(360/T)$
$RO_2 + HO_2 \longrightarrow 0.5\, ROOH + 0.5\, O_2 + 0.5\, HO_2 + 0.5\, OH$	$2.06 \times 10^{-13}\exp(1300/T)$
$RO_2 + RO_2 \xrightarrow{O_2} 1.2\, CH_3O_2 + \text{products}$	9×10^{-14}
$RO_2 + CH_3O_2 \xrightarrow{O_2} 0.6\, CH_3O_2 + 0.6\, HO_2 + \text{products}$	9×10^{-14}
$VOC + NO_3 \longrightarrow \beta\, RONO_2 + (1-\beta)\, NO_2 + \text{products}$	kNO_3

Table S3: Reactions and rate constants used in the simplified single box model

Reaction	Rate constant
$HO_2 + HO_2 \xrightarrow{M} H_2O_2 + O_2$	2.74×10^{-12}
$NO_2 + OH \xrightarrow{M} HNO_3$	9.2×10^{-12}
$RO_2 + NO \longrightarrow (1-\alpha)\,HO_2 + (1-\alpha)\,NO_2 + \alpha\,RONO_2$	9.0×10^{-12}
$RO_2 + HO_2 \longrightarrow ROOH + O_2$	8.0×10^{-12}
$RO_2 + RO_2 \xrightarrow{O_2} 1.2\,CH_3O_2$ + products	6.8×10^{-14}

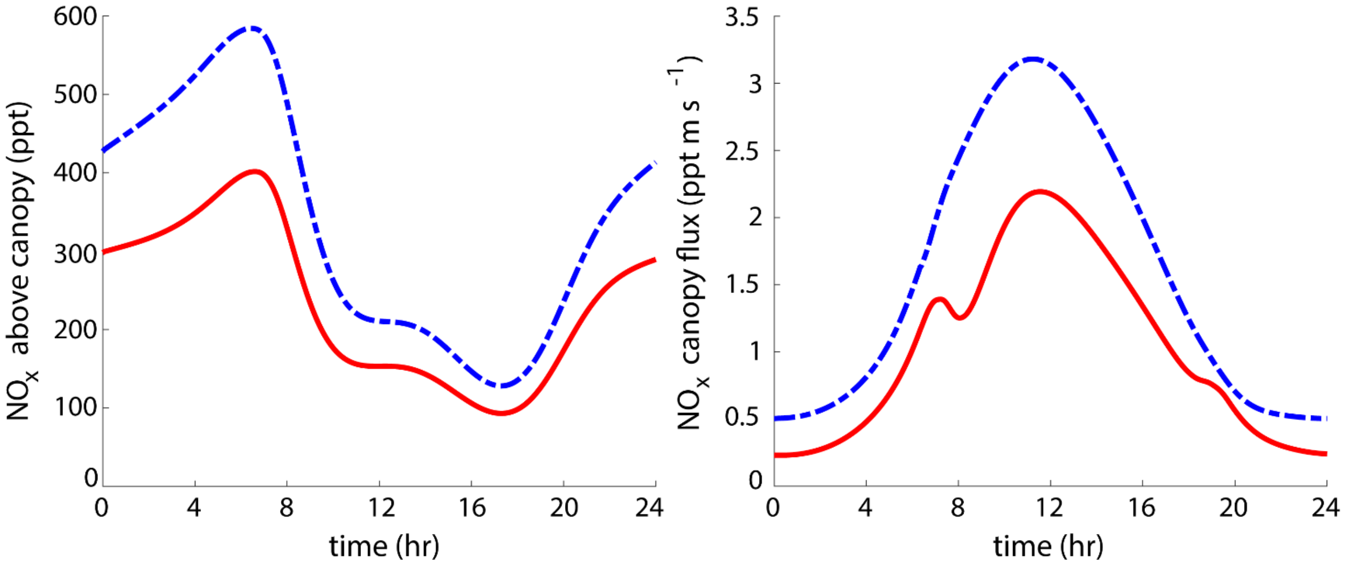

Figure S1: Model predictions for the above canopy NO_x mixing ratios (a) and fluxes (b) for a LAI scaling factor of 0.25 (blue dash) and 1.5 (red solid).

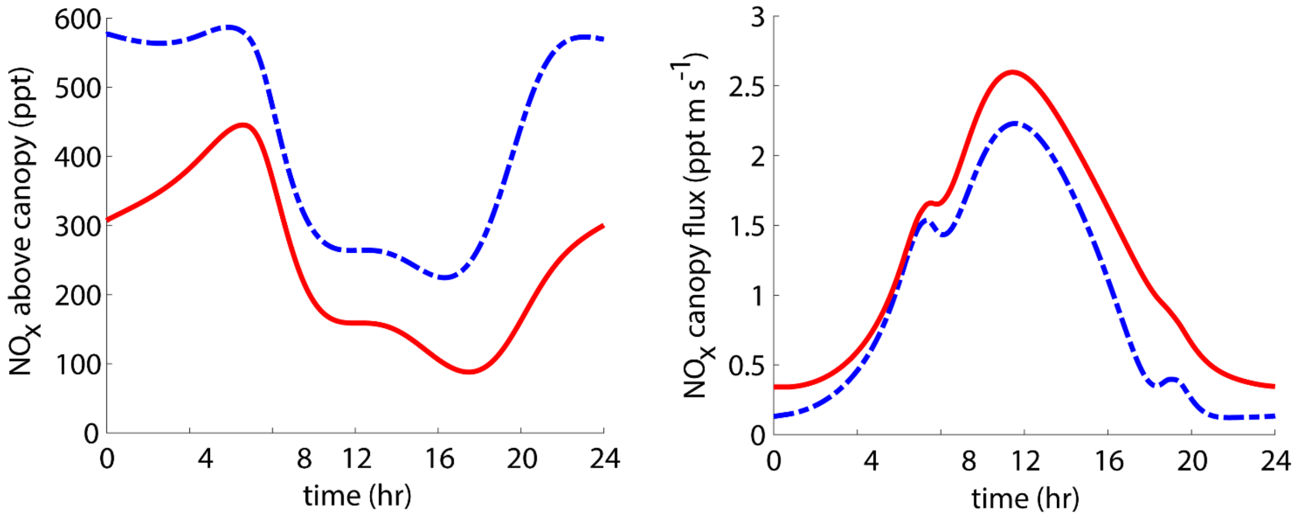

Figure S2: Model predictions for the above canopy NO_x mixing ratios (a) and fluxes (b) for $\alpha = 0.01$ (blue dash) and $\alpha = 0.1$ (red solid).

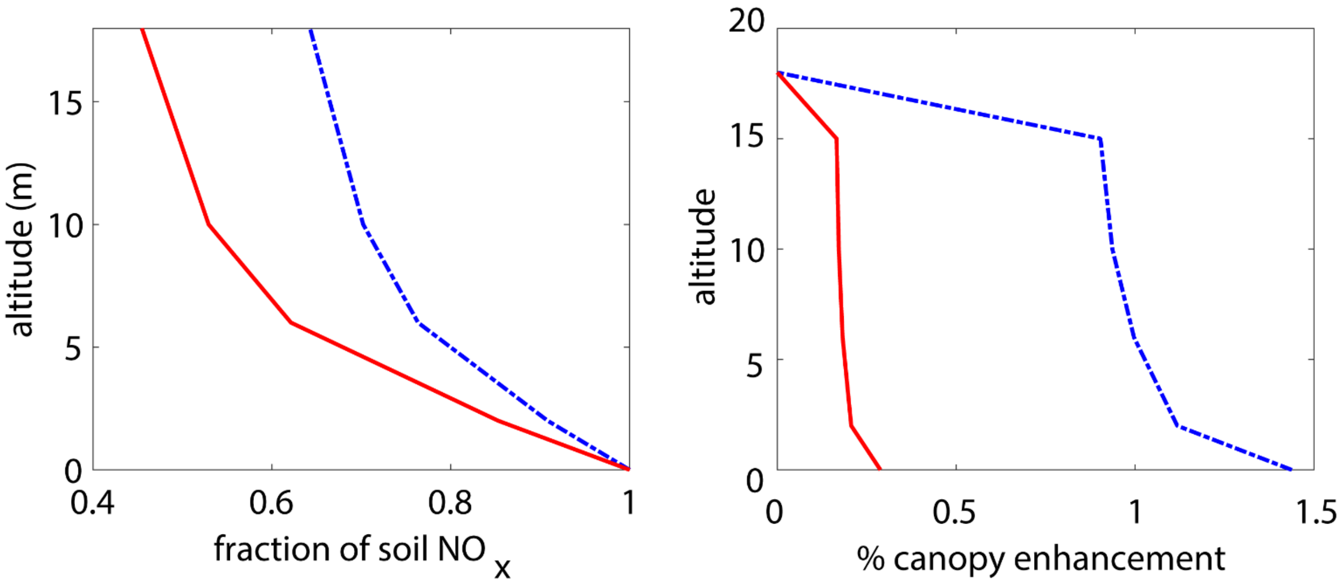

Figure S3: Model predictions for the fraction of soil NO_x ventilated vertically (a) percent of NO_x within the canopy relative to above-canopy concentrations (b) for an NO emission rate of 10 ppt m s^{-1} (blue dash) and 1 ppt m s^{-1} (red solid).

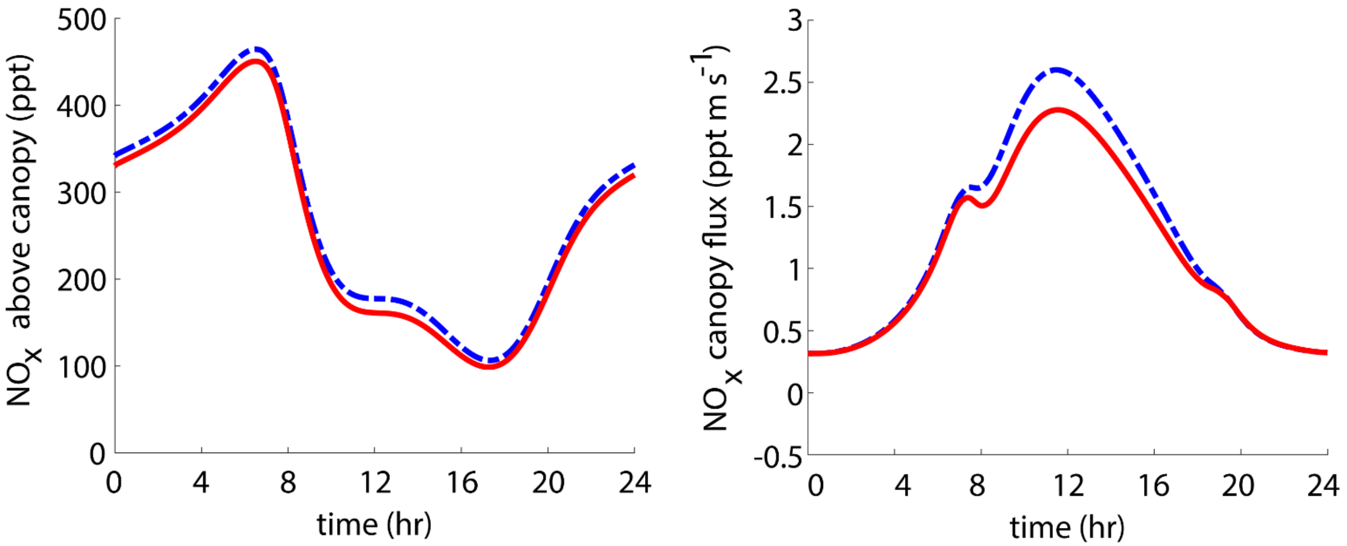

Figure S4: Model predictions for the above canopy NO_x mixing ratios (a) and fluxes (b) for $\tau/T_L = 8$ (blue dash) and $\tau/T_L = 1.2$ (red solid).

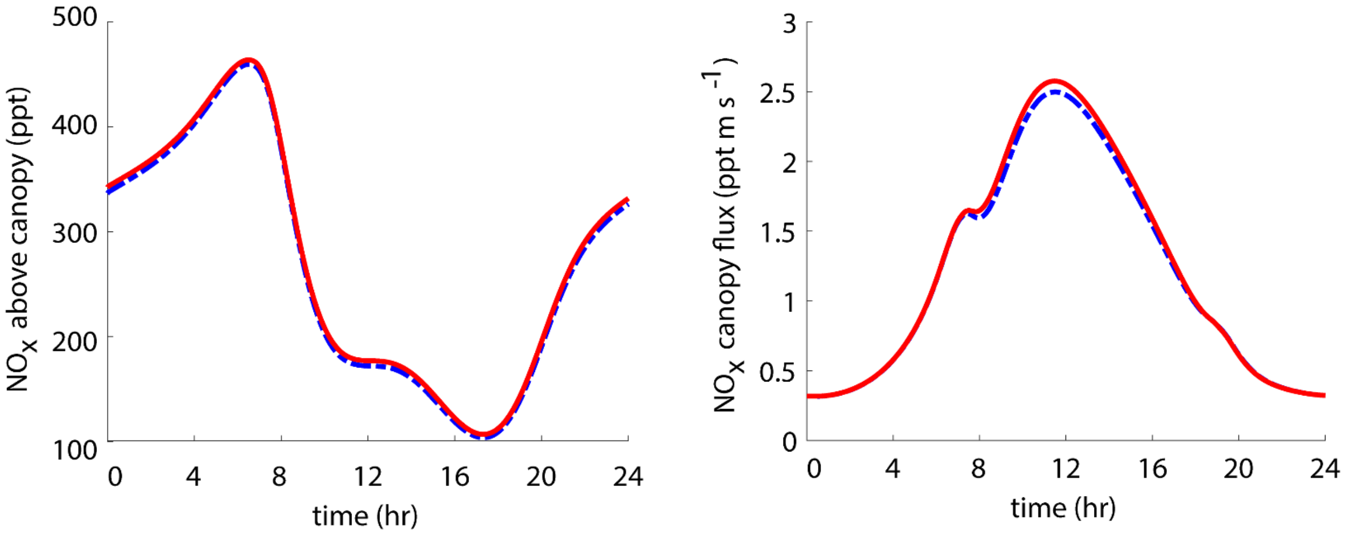

Figure S5: Model predictions for the above canopy NO$_x$ mixing ratios (a) and fluxes (b) for an l$_w$ scaling factor of 0.1 (blue dash) and 2 (red solid).

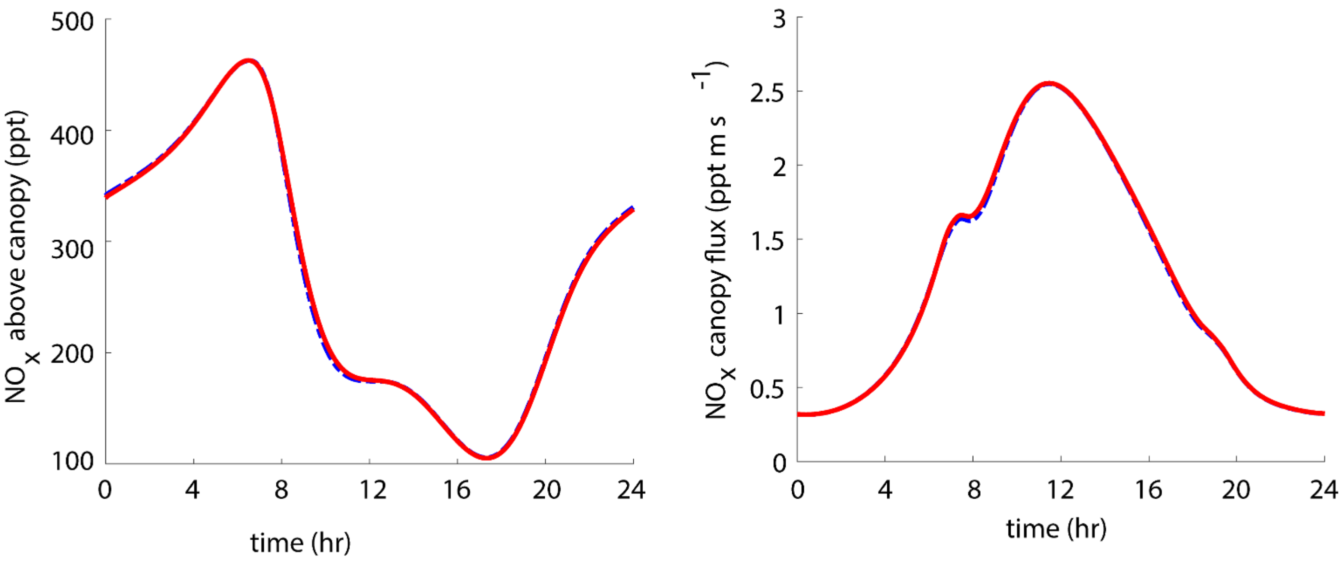

Figure S6: Model predictions for the above canopy NO$_x$ mixing ratios (a) and fluxes (b) for k_{rad} = 0.6 (blue dash) and k_{rad} = 0 (red solid).

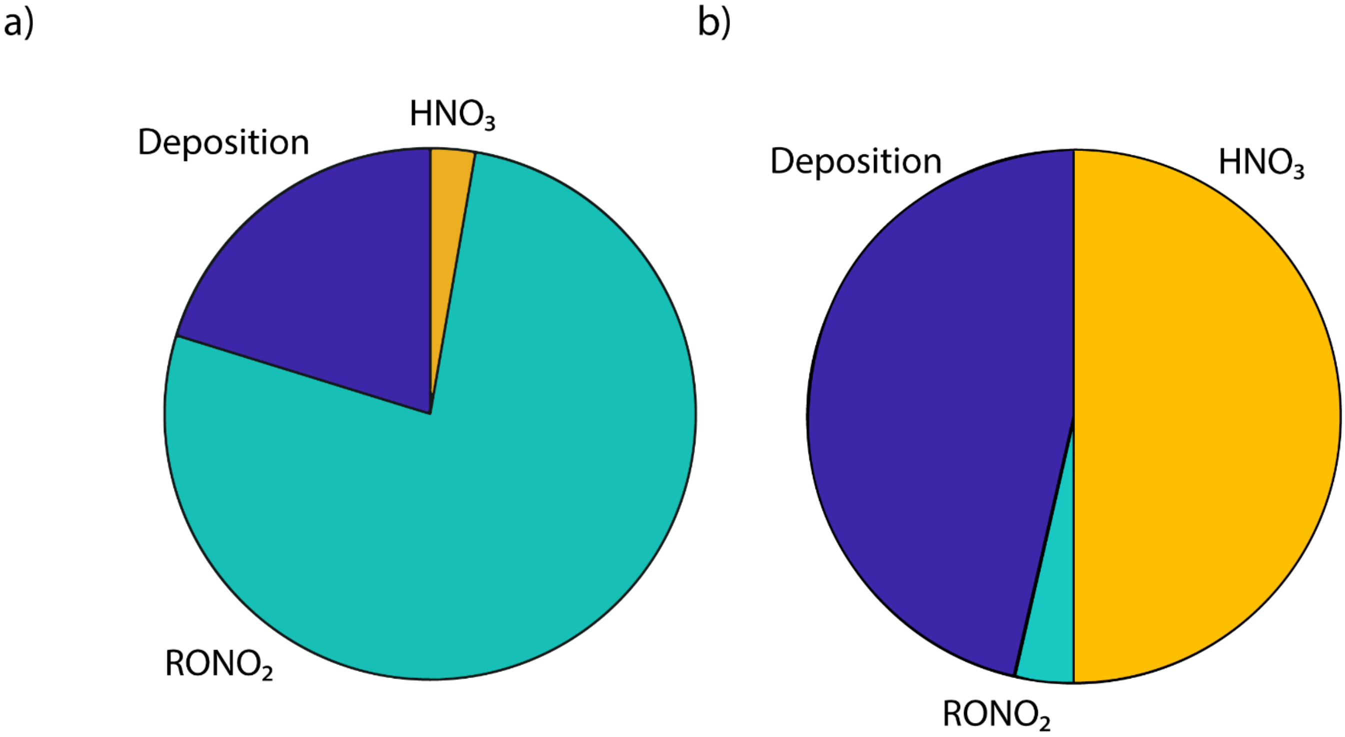

Figure S7: Multi-box model prediction of the average daily fraction of NO_x lost to nitric acid formation, alkyl nitrate formation, and deposition in an environment with 0.1-0.2 ppb NO_x (a) and 20-30 ppb NO_x (b).

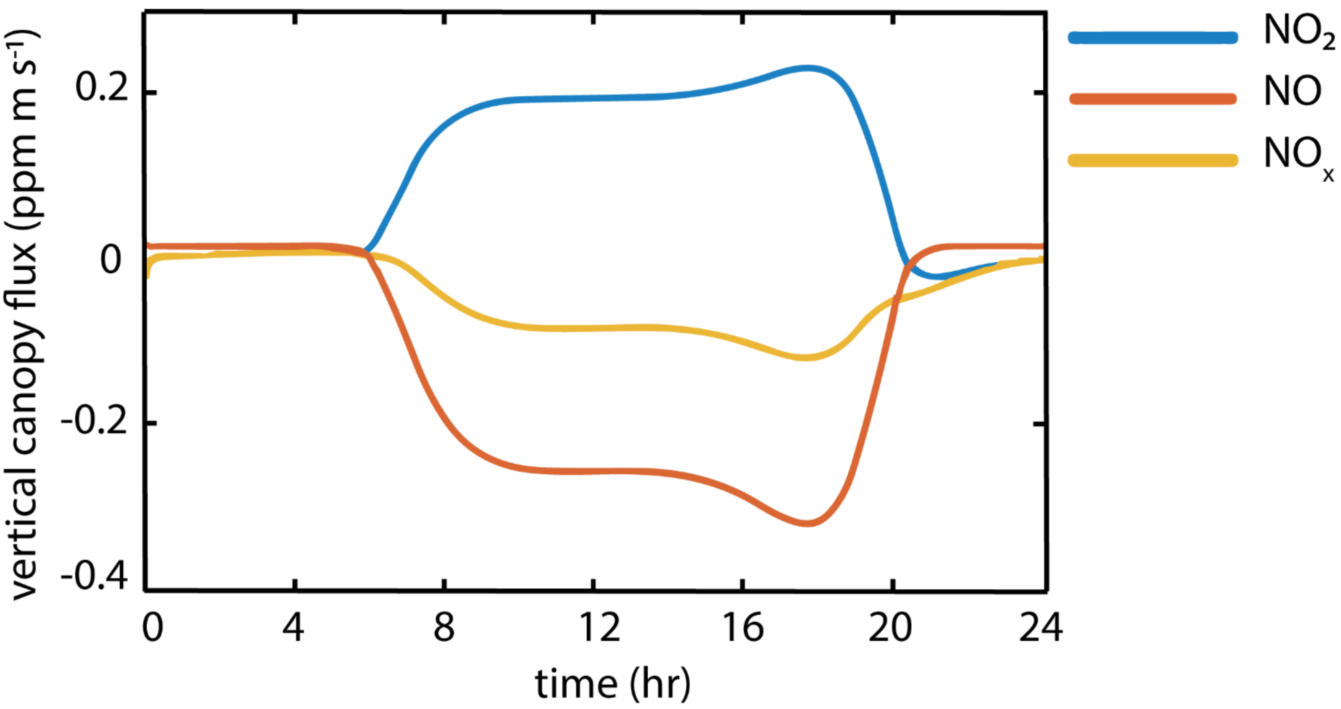

Figure S8: Multi-box model prediction of the diurnal canopy flux in an environment with daily minimum NO$_x$ concentrations of 20 ppb during the day and maximum concentrations of 50 ppb at night. Model was run using parameters for Blogett Forest.

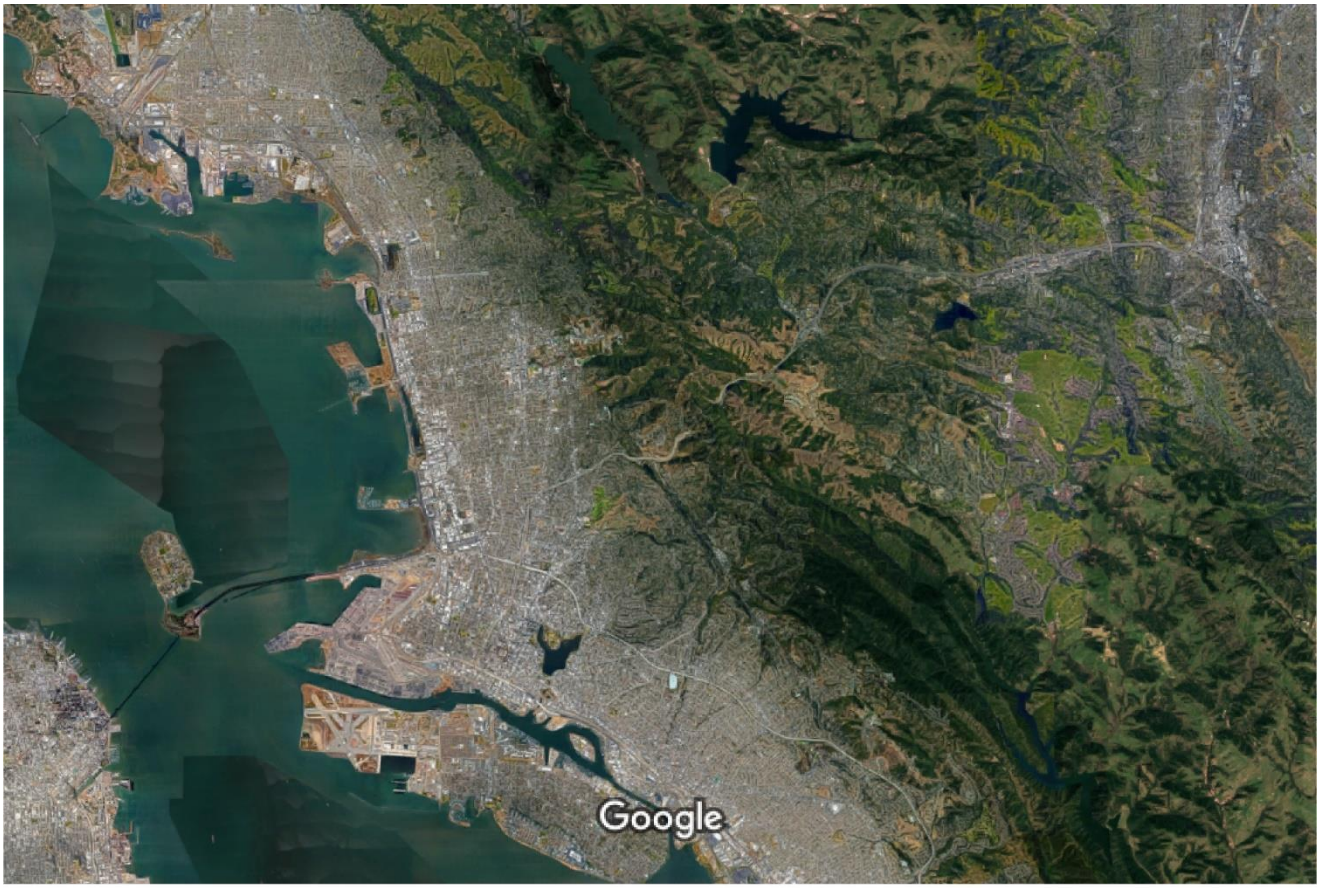

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Figure S9: Satellite image of east San Francisco Bay Area