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Supplement of

Can atmospheric chemistry deposition schemes reliably simulate stomatal ozone flux across global land covers and climates?

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S1. Total dry deposition velocity calculation

The total dry deposition velocity of O3 (v_d) is calculated by the standard formula including the aerodynamic resistance (R_a), quasi-laminar boundary layer resistance (R_b), and surface resistance (R_c).

$$v_d = \frac{1}{\left(R_a + R_b + R_c\right)} \quad (1)$$

The formula for R_a and R_b are essentially the same among different models that follow earlier literature (e.g., Padro, 1996; Wesely et al., 2002). R_c is calculated as follows.

$$R_c = \frac{1}{\left(\frac{1}{R_s + R_m} + \frac{1}{R_{ext}} + \frac{1}{R_{inc} + R_{soil}}\right)} \quad (2)$$

Where $R_s, R_m, R_{ext}, R_{inc}, R_{soil}$ are resistances due to stomata, mesophyll, cuticle, in-canopy (aerodynamic), and soil resistance to deposition. R_m= 0 for O_3 in all models used in this study. Equations for R_{ext} , R_{inc}, and R_{soil} can be found in the respective literature of each of the models. Equations for R_s is different for each model and are discussed in section S3.

S2. Effective conductance calculation

The effective conductance of O_3 through a given pathway indicates the relative importance of the pathway to the total deposition (Clifton et al., 2023; Galmarini et al., 2021). There are three deposition branches for the models used in the current study, i.e., the effective conductance through ground ($G_{ground,eff}$), Cuticle ($G_{cut,eff}$), and Stomata ($G_{st,eff}$), and their formulae are as follows.

$$G_{ground,eff} = \frac{\frac{1}{R_{inc} + R_{soil}}}{\frac{1}{R_s} + \frac{1}{R_{ext}} + \frac{1}{R_{inc} + R_{soil}}} * V_d \quad (3)$$

$$G_{cut,eff}=\frac{\frac{1}{R_{ext}}}{\frac{1}{R_s}+\frac{1}{R_{ext}}+\frac{1}{R_{inc}+R_{soil}}}*V_d \quad (4)$$

$$G_{st,eff}=\frac{\frac{1}{R_s}}{\frac{1}{R_s}+\frac{1}{R_{ext}}+\frac{1}{R_{inc}+R_{soil}}}*V_d \quad (5)$$

Where $R_s, R_{ext}, R_{inc}, \wedge R_{soil}$ are resistances due to stomata, cuticle, in-canopy aerodynamic resistance, and soil resistance to deposition. V_d is the deposition velocity of O3.

S3. Stomatal Ozone Flux (F_{st}) calculation using the Stomatal resistance $\left(R_s\right)$

The canopy level stomatal ozone flux (F_{st}) was calculated from the canopy level total stomatal resistance by the following equation:

$$F_{st}=\frac{C_0}{R_s+R_m} \quad (6)$$

Where, C_0 is the ozone concentration at the top of the canopy. As the O3 concentrations at the top of the canopy are typically not available and the O3 measurement heights across our study sites were mostly below 10 m (Table 1), C_0 were assumed to be the same as the O3 concentrations above the canopy and such assumptions are very reasonable (Zhang et al., 2006). R_s and R_m are the stomatal and mesophyll resistance, respectively; the latter of which is assumed to be 0 for O_3. Calculations of R_s are described in the following sections.

S3.1. R_s calculation by the Zhang et al. (2003) model

The stomatal resistance (R_s) calculation by Zhang et al. (2003) uses the Jarvis-style approach, where the R_s is calculated from minimum stomatal resistance (maximum stomatal conductance) and a series of empirical functions as stress functions. The equation for R_s:

$$R_s = 1/G_s(PAR) \quad (7)$$

where $G_s(PAR)$ is the unstressed leaf stomatal conductance, which is a function of photosynthetically active radiation (PAR). The dimensionless stress functions *f(T)*, *f(D)*, and *f(ψ)* represent the conductance-reducing effects of air temperature *T*, water vapour pressure deficit *D*, and water stress (leaf water potential) ψ, respectively, on leaf stomatal conductance. D_v and D_i are the molecular diffusivities for water vapour and ozone, respectively. The sunlit/shade stomatal conductance model (two-big leaf model) is used for calculating $G_s(PAR)$:

$$G_s(PAR) = \frac{L_{sun}}{r_s(PAR_{sun})} + \frac{L_{shade}}{r_s(PAR_{shade})} \quad (8)$$

$$r_s(PAR) = r_{s,min}(1 + b_{rs}/PAR) \quad (9)$$

where L_{sun} and L_{shade} are the total sunlit and shaded leaf area indexes, respectively. $r_s$is the unstressed leaf stomatal resistance calculated for PAR_{sun} and PAR_{shade} (PAR received by sunlit and shaded leaves, respectively). $r_{s,min}$ is the minimum leaf stomatal resistance and b_{rs} is an empirical constant. Details of the calculations of these parameters as well as those for *f(T)*, *f(D)*, and *f(ψ)* can be found in Zhang et al. (2002).

S3.2. R_s calculation in the Noah-GEM model

The Noah-GEM model uses the semi-empirical Ball-Berry type approach where the stomatal resistance is calculated from the plant photosynthesis rates (Niyogi et al., 2009; Wu et al., 2011):

$$R_s = 1 / \left[LAI \left(m\, A_n h_s P / C_s + b \right) \right] (10)$$

Where LAI, A_n, h_s, P, C_s are leaf area index, net photosynthesis rate, relative humidity at leaf surface, atmospheric pressure, and CO_2 partial pressure at the leaf surface, respectively. m and b are linear coefficients obtained through gas exchange experiments. The Noah-GEM model for $R_s$calculation requires several submodels for calculating the $A_n$and are described in Wu et al. (2011) and Niyogi et al. (2009).

S3.3. R_s calculation in the CMAQ model

The CMAQ model has the options of both Jarvis-style and Ball-Berry type approaches to calculate the stomatal resistance. Current study used both approaches of the model. In the Jarvis-style approach, the canopy is treated as a single leaf (one-big leaf model) and the stomatal resistance is calculated as follows (Pleim and Ran, 2011; Pleim and Xiu, 2003; Xiu and Pleim, 2001):

$$R_s = r_{s,min} LAI / \left(f \left| PAR f \right| T\, f_{vpd} f_w \right) (11)$$

Where $r_{s,min}$ is the minimum stomatal resistance (maximum conductance of a leaf under unstressed conditions), which is specified according to the vegetation type (Xiu and Pleim, 2001). LAI is the leaf area index of the canopy. f_{PAR}, f_T, f_{vpd}, and f_w are the dimensionless stress functions, which represent the fractions of stomatal closure (0 to 1) associated with the photosynthetically active radiation PAR, air temperature in the canopy, relative humidity at the leaf surface, and root-depth soil moisture, respectively. Equations of the four stress functions are given in Xiu and Pleim (2001).

Ran et al. (2017) implemented the Ball-Berry type stomatal resistance calculations in the CMAQ model:

$$R_s = 1 / \left(m_g A_{net} e_s P_a / C_s e_i + g_0 \right) (12)$$

Where A_{net} is the net photosynthesis rate, C_s is the CO_2 partial pressure at leaf surface, e_s is the water vapor partial pressures at leaf surface, e_i is the saturation vapor pressure inside the leaf, and P_a is the atmospheric pressure. g_0 is set to

0.01 mol/m^{-2}s^{-1} for C_3 plants and 0.04 mol/m^{-2}s^{-1} for C_4 plants, m_g is a plant-type parameter which is 9 for C_3 plants and 4 for C_4 plants. Detailed discussion on A_{net} calculations can be found in Ran et al. (2017).

S3.4. R_s calculation in the TEMIR model

The Terrestrial Ecosystem Model in R (TEMIR) (Sun et al., 2022; Tai et al., 2023) has two Jarvis-style stomatal conductance schemes adopted from the Wesley scheme (Wesely, 1989) and the Zhang et al. (2003) scheme, as well as two photosynthesis-based schemes: Farquhar–Ball–Berry (Ball et al., 1987; Farquhar et al., 1980) and Medlyn (Medlyn et al., 2011) schemes. In the current study, the FBB scheme was used. The equation for the stomatal resistance is as follows:

$$R_s = 1/\left[\left(\frac{L_{sun}}{r_b + r_{sun}} + \frac{L_{shade}}{r_b + r_{shade}}\right)\frac{D_i}{D_v}\right] \quad (13)$$

Where L_{sun} and L_{shade} are the sunlit and shaded LAI respectively, r_b is the leaf boundary resistance, r_{sun} and $r_{shade}$are the leaf level sunlit and shaded stomatal resistances for water vapor, respectively, and D_v and $D_i$are the molecular diffusivities for water vapour and ozone, respectively. r_{sun} and r_{shade}in the FBB scheme are calculated from the stomatal conductance (g_s) according to the following equation.

$$r_s = 1/g_s = 1/\left[\alpha\left(\frac{m A_n\left(\frac{e_s}{e_{sat}}\right)}{\left(\frac{C_s}{P_{atm}}\right)} + b\right)\right] \quad (14)$$

Where α is the unit conversion factor (μmol H_2O m^{-2} s^{-1} to m s^{-1}) that is dependent on atmospheric temperature and pressure, m and b are linear coefficients, which are dependent on the plant types, and the values are given in Oleson et al. (2013), A_n is the photosynthesis rate calculated separately for sunlit and shaded leaves. C_s is the CO_2 partial pressure at leaf surface, $P_{atm}$is the atmospheric pressure e_s is the water vapor partial pressure at the leaf surface, and e_{sat} is the saturation vapor pressure inside the leaf.

S3.5. R_s calculation in the ECHAM-MESSy model

The ECHAM-MESSy model uses Jarvis-style approach for the stomatal resistance calculations (Emmerichs et al., 2021) and the formula is very similar to that in Zhang et al. (2003):

$$R_s = \left[r_s(PAR, LAI) \middle| f_T f_{vpd} f_w \right] \times D_v / D_i \quad (15)$$

$$r_s(PAR, LAI) = \frac{kc}{\left[\frac{b}{dPAR} \ln\left(\frac{exp(kLAI)+1}{d+1} \right) - \ln\left(\frac{exp(-kLAI)}{d+1} \right) \right]} \quad (16)$$

Where $r_s(PAR, LAI)$ is the optimal stomatal resistance which depends on the photosynthetically active radiation (PAR) and the leaf area index (LAI). $f_{T,} f_{vpd}$, and f_w are the dimensionless stress functions associated with air temperature in the canopy, relative humidity at the leaf surface, and root-depth soil moisture, respectively. D_v and D_i are the molecular diffusivities of water vapour and ozone, respectively. k is the extinction coefficient (= 0.9), c is the minimum stomatal resistance (= 100 sm^{-1}), and a = 5000 J m^{-3}, b = 10 W m^{-2} and d = $\frac{a+bc}{cPAR}$ are fitting parameters. Stress function equations are given in Emmerichs et al. (2021).

S3.6. R_s calculation in the DO₃SE model

The DO3SE model calculates the Rs from the by stomatal conductance that is obtained by the following formulas (Emberson et al., 2000):

$$R_s = r_s / LAI \qquad (17)$$

$$r_s = g_{max} max \qquad (18)$$

Where LAI is the leaf area index, g_{max} is the maximum stomatal conductance (prescribed) that is modified by several stress functions to account for the conductance change by the variations of leaf/needle age over the growing period (f_{phen}), solar radiation (f_{light}), temperature (f_{temp}), vapor pressure deposit (f_{VPD}), and soil water (f_{SWC}). $f_{m\in}$ is the minimum daytime stomatal conductance under field conditions (expressed as the fraction of g_{max})

S4. Supplementary figures

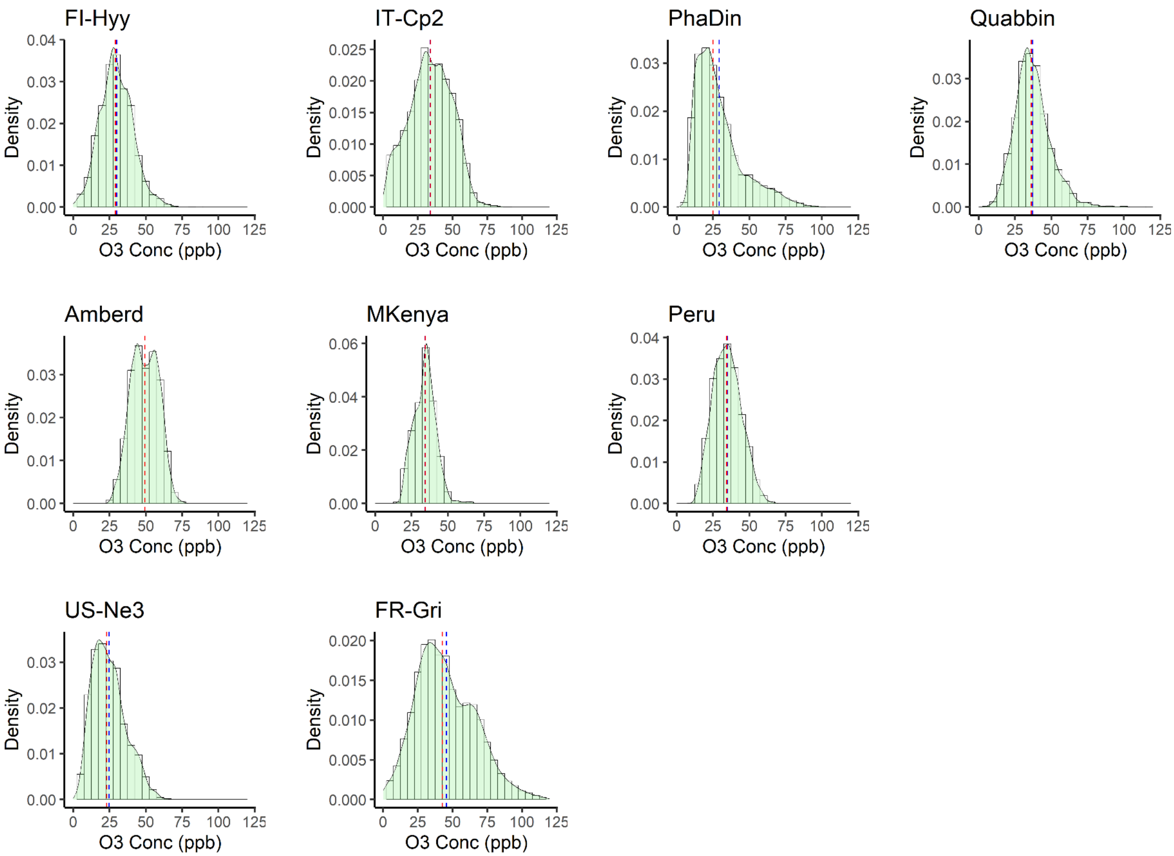


Fig S1. Density distribution of the O_3 concentration over the entire study period at the 9 sites. Blue and red vertical lines are the mean and median values of the distribution. The smoothed green curve represents the kernel density estimate (based on the Gaussian kernel function) of the histogram.

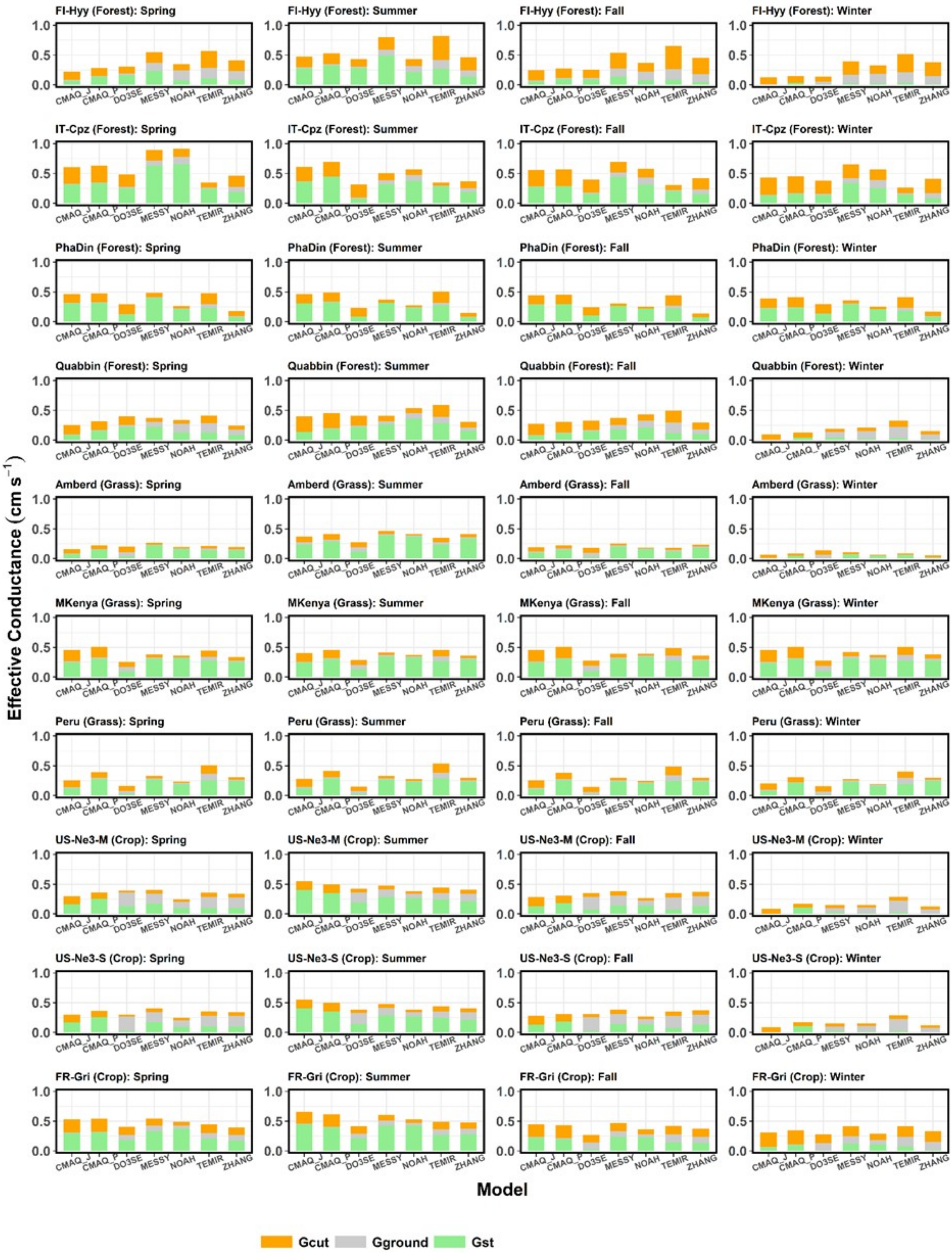


Fig S2. Seasonal mean effective conductance of the cuticular (Gcut), ground (Gground), and stomatal (Gst) deposition pathways of O3 across various models and sites (Exp#1).

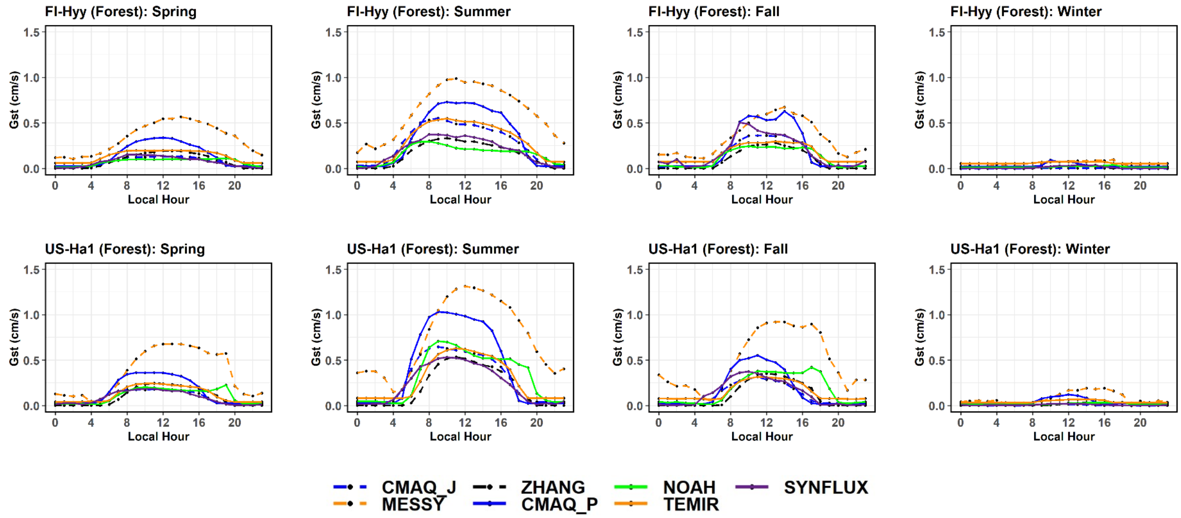


Fig S3. Comparison of model simulated (driven by the FLUXNET input data) diurnal variations of total stomatal conductance (Gst) with the SynFlux observations.

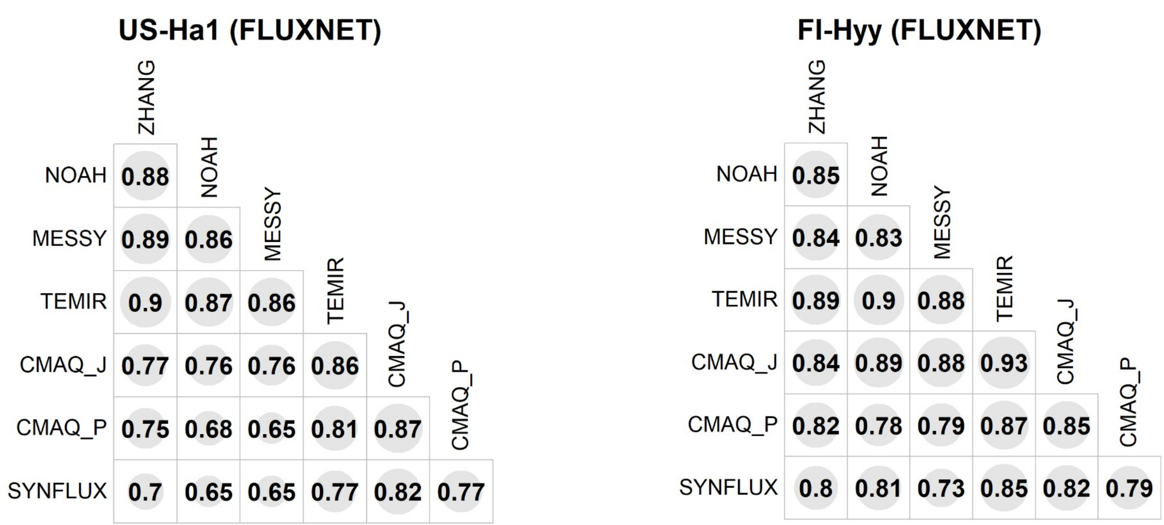


Fig S4. Spearman correlation coefficients ($p<0.05$) between the hourly canopy-level modelled Gst using all available data (including SynFlux). Models were run from the FLUXNET input data.

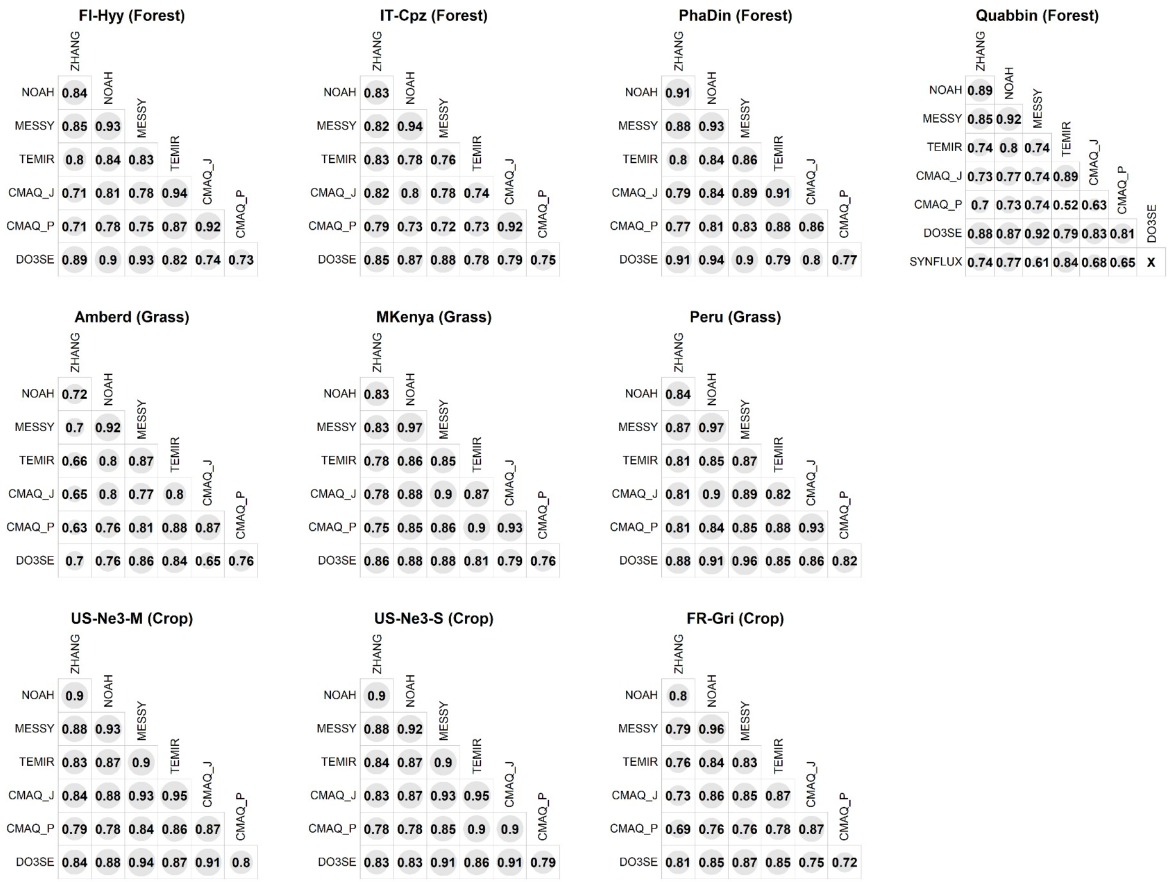
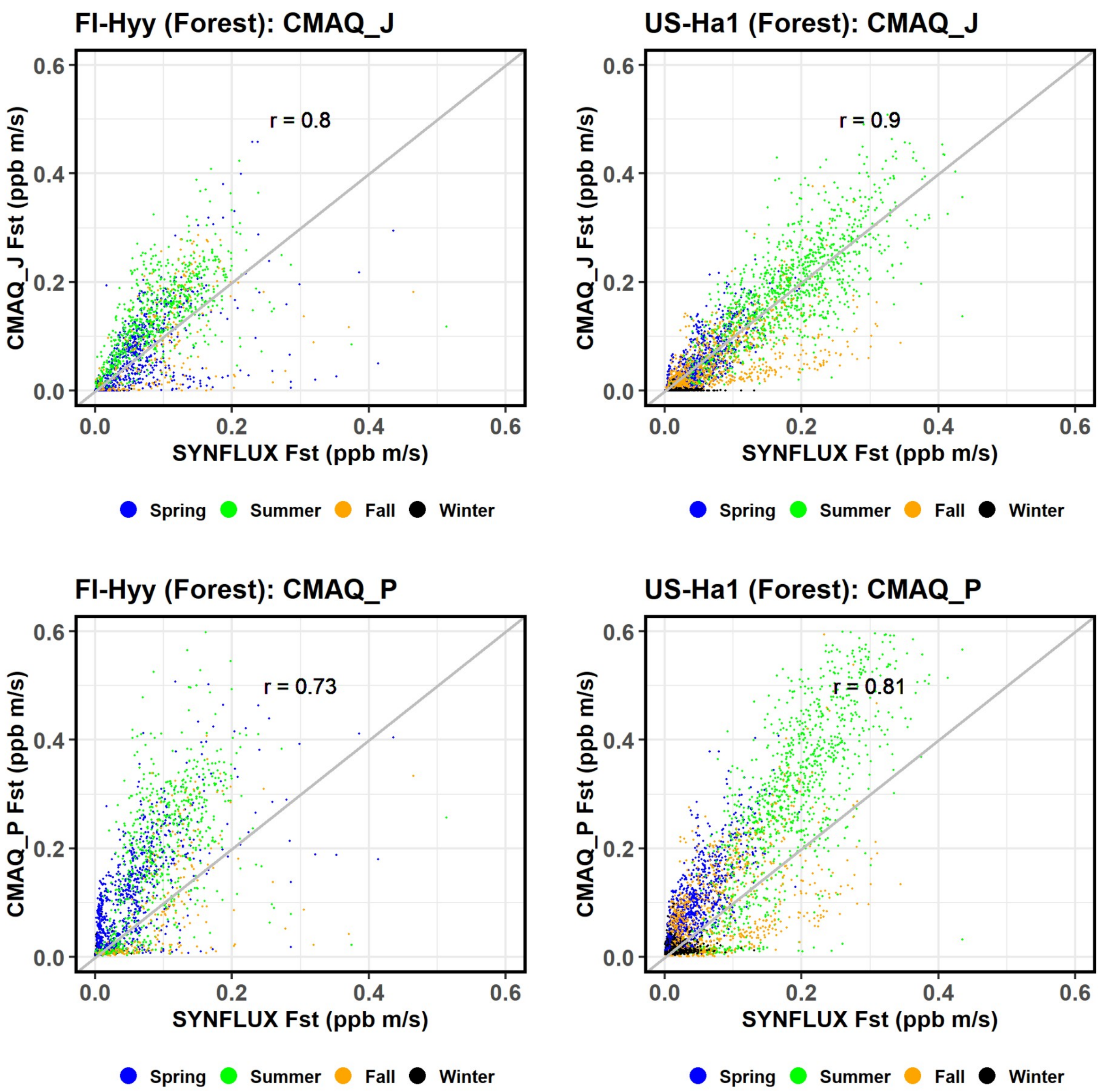
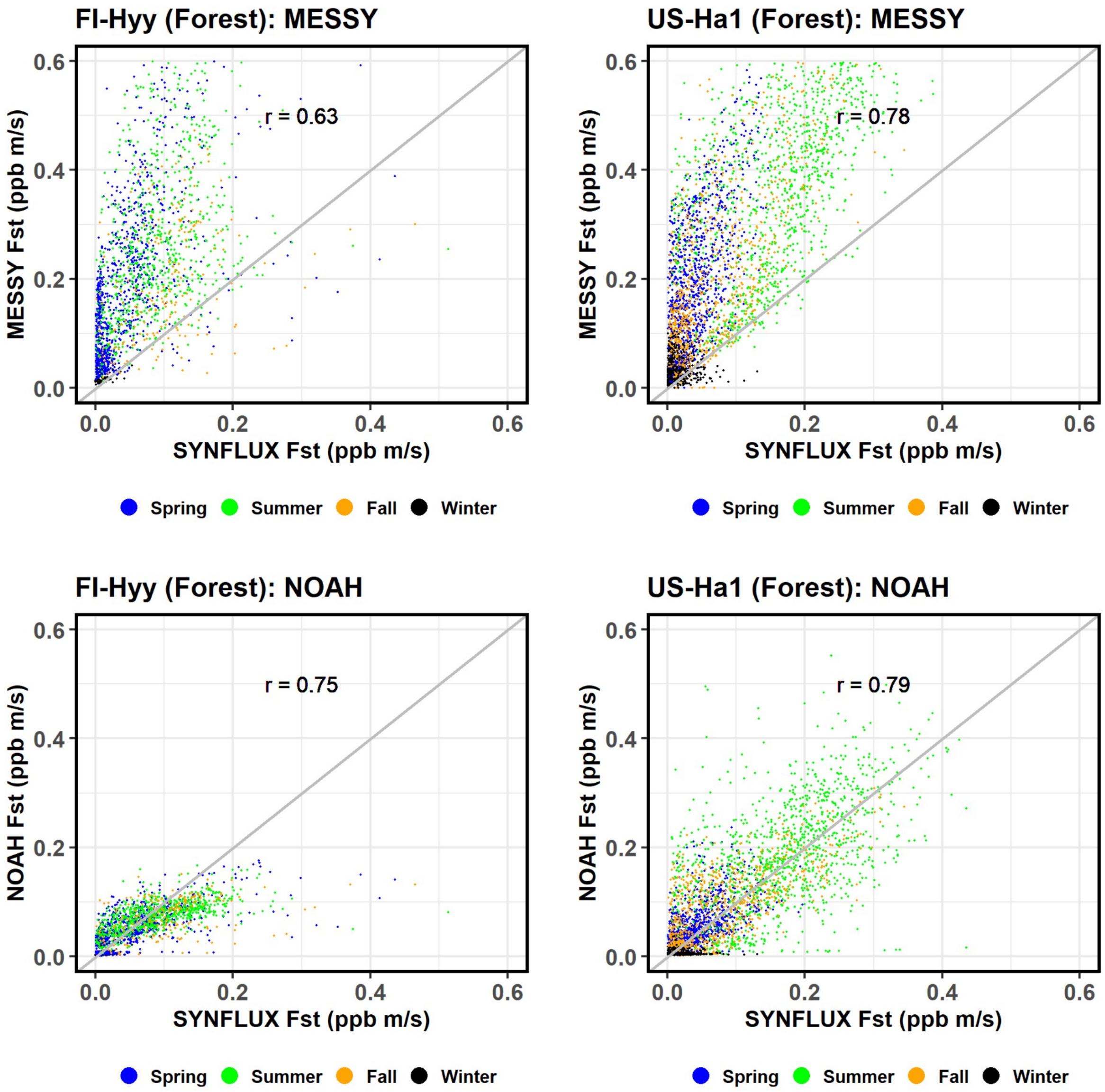


Fig S5. Spearman correlation coefficients ($p<0.05$) between the hourly canopy-level modelled Gst using all available data (including SynFlux). Models were run from the TOAR input data.


FI-Hyy (Forest): CMAQ_J
r = 0.8
CMAQ_J Fst (ppb m/s)
SYNFLUX Fst (ppb m/s)
US-Ha1 (Forest): CMAQ_J
r = 0.9
CMAQ_J Fst (ppb m/s)
SYNFLUX Fst (ppb m/s)
FI-Hyy (Forest): CMAQ_P
r = 0.73
CMAQ_P Fst (ppb m/s)
SYNFLUX Fst (ppb m/s)
US-Ha1 (Forest): CMAQ_P
r = 0.81
CMAQ_P Fst (ppb m/s)
SYNFLUX Fst (ppb m/s)
0.0
0.2
0.4
0.6
Spring
Summer
Fall
Winter



FI-Hyy (Forest): MESSY
r = 0.63
MESSY Fst (ppb m/s)
SYNFLUX Fst (ppb m/s)
US-Ha1 (Forest): MESSY
r = 0.78
FI-Hyy (Forest): NOAH
r = 0.75
NOAH Fst (ppb m/s)
US-Ha1 (Forest): NOAH
r = 0.79
Spring
Summer
Fall
Winter
0.0
0.2
0.4
0.6

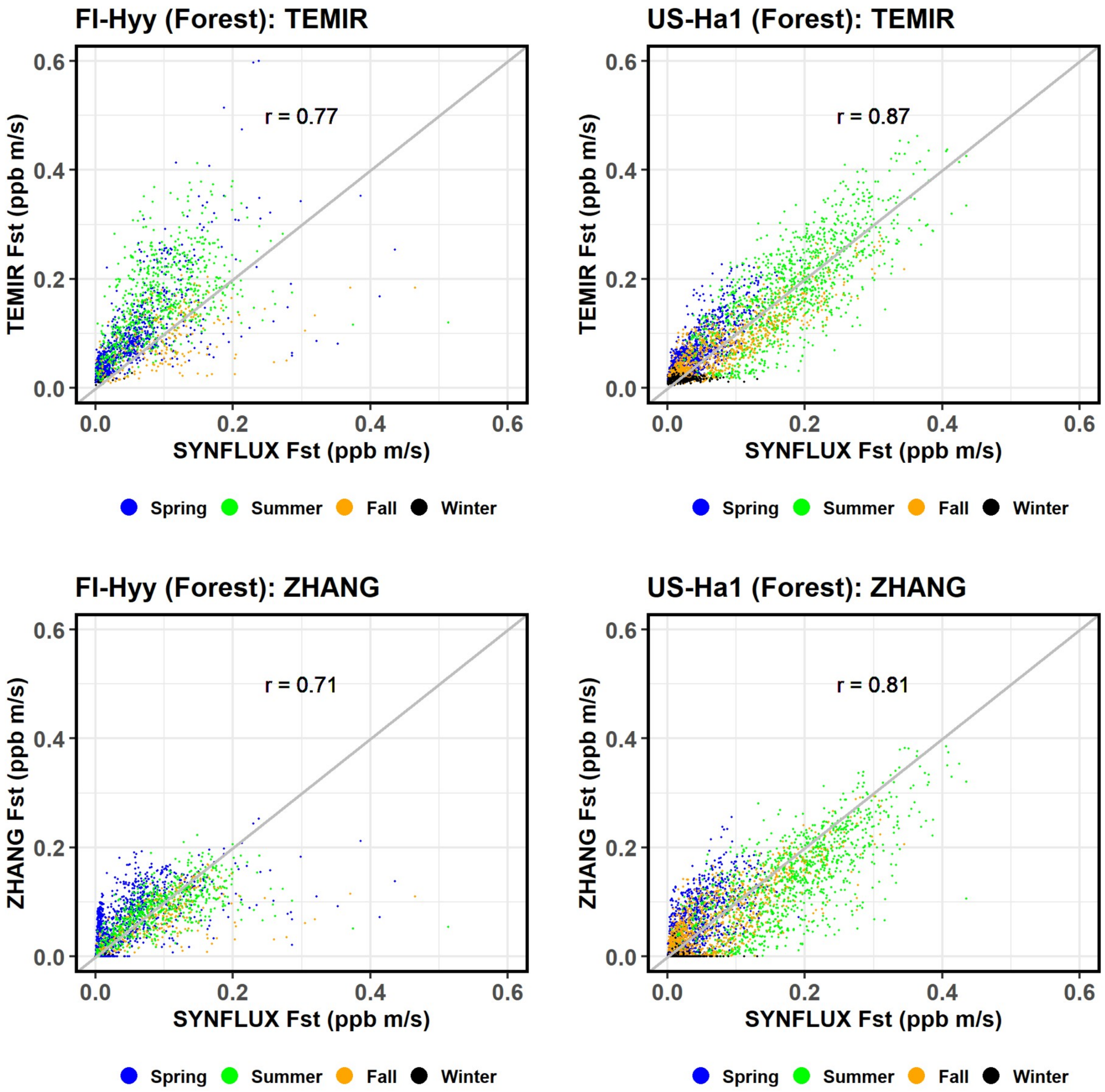


Figure S6. Scatter plots of hourly modeled stomatal flux and the respective SynFlux stomatal flux. 'r' represents Spearman correlations between the hourly fluxes throughout the entire year ($p < 0.05$).

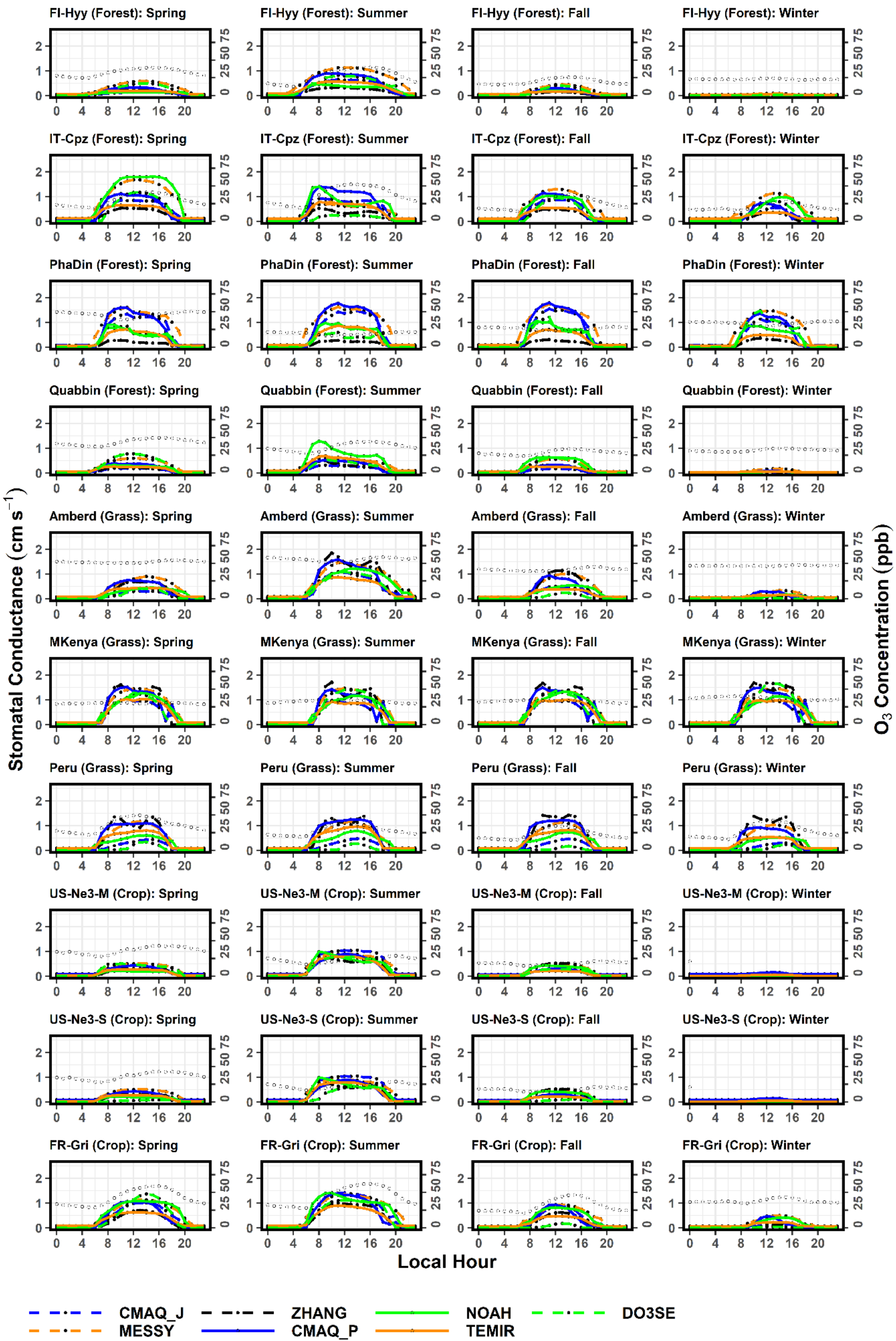


Fig. S7. Multi-year diurnal cycle of growing season G_{st} from models at 9 different sites. Four topmost panels are the forest sites, three panels in the middle are grass sites, and three lowermost panels are crop sites. Open circles indicate diurnal O_3 variations.

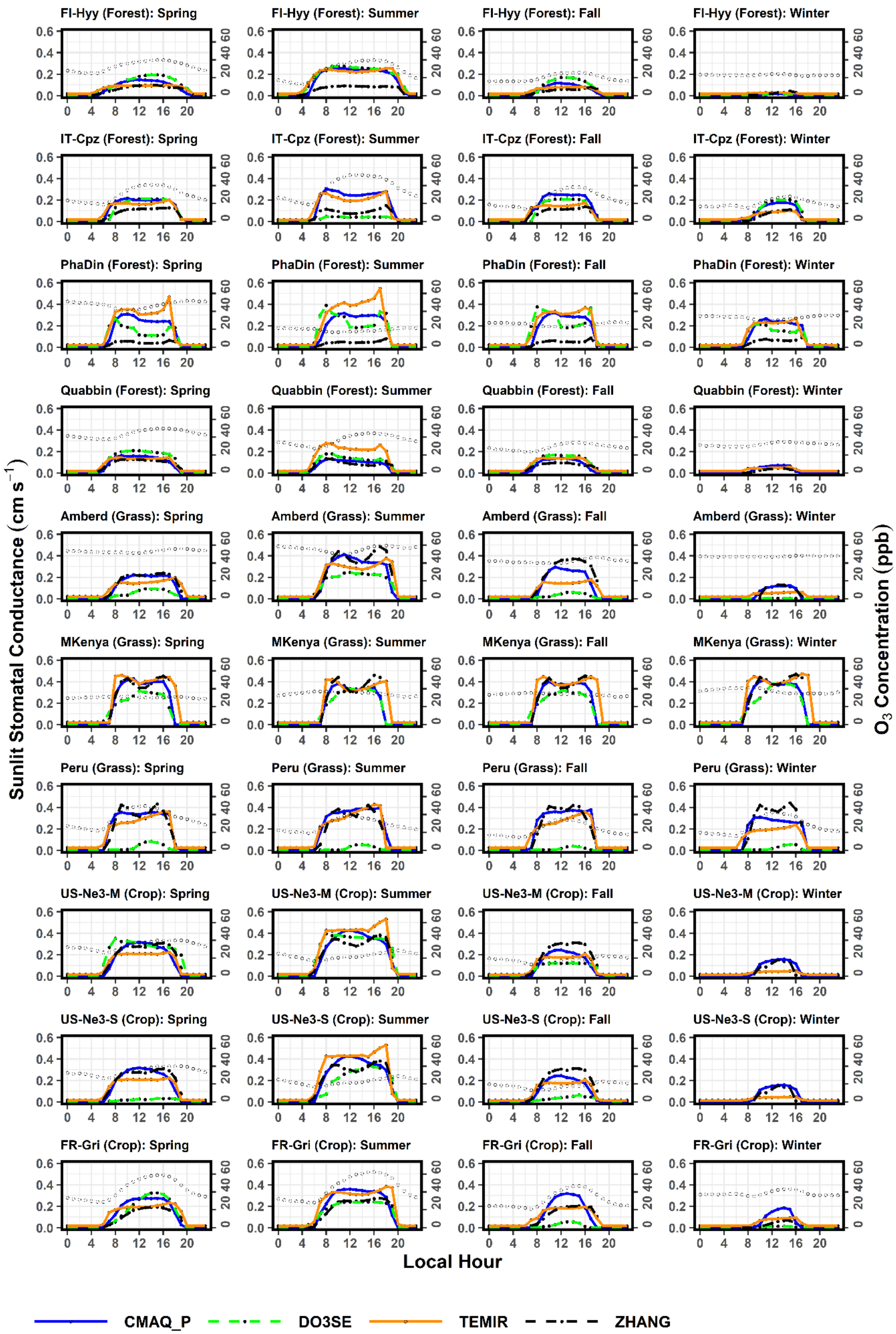


Fig S8. Leaf level sunlit stomatal conductance (G_{sun}) from the 3 two-leaf models (CMAQ_P, TEMIR, and ZHANG) at 9 different sites. Four topmost panels are the forest sites, three panels in the middle are grass sites, and two lowermost panels are crop sites (US-Ne3-S=soybeans, US-Ne3-M=maize). Open circles indicate diurnal O_3 variations.

S5. Supplementary tables

Table S1. Seasonal mean values of the key input data used for the model runs.										
Site	Season	Ssrd (Wm^{-2})	O3 (ppb)	LAI	Wspeed (ms^{-1})	TSkin (K)	T2m (K)	Tsoil1 (K)	SM1 (m3m-3)	RH (%)
Amberd (Grass)	Fall	157.6	42.2	3.7	1.3	281.0	281.8	282.6	0.3	67.6
	Spring	233.6	53.3	3.8	1.4	277.0	277.7	278.1	0.4	71.4
	Summer	280.7	55.8	4.6	1.6	291.7	290.2	291.8	0.3	64.9
	Winter	112.8	47.4	3.3	1.1	267.6	270.2	273.4	0.3	74.8
FI-Hyy (Forest)	Fall	43.6	19.9	2.9	3.1	278.8	278.7	278.1	0.4	89.1
	Spring	148.0	32.8	2.7	3.4	277.5	278.0	277.3	0.3	70.8
	Summer	195.1	28.2	4.1	2.7	288.9	289.0	288.2	0.4	77.7
	Winter	11.1	23.1	2.0	3.4	269.5	269.0	269.9	0.4	92.3
FR-Gri (Crop)	Fall	96.3	30.1	3.9	3.5	285.6	285.7	286.2	0.3	83.6
	Spring	172.7	42.5	4.8	3.6	282.5	282.8	283.0	0.3	75.4
	Summer	222.4	44.1	4.6	3.3	291.6	291.3	291.6	0.3	73.7
	Winter	45.2	37.4	3.8	4.2	276.9	277.5	277.7	0.4	87.2
IT-Cpz (Forest)	Fall	139.1	25.5	6.7	2.7	290.6	291.1	291.2	0.3	78.2
	Spring	220.5	29.8	7.2	2.8	286.7	287.4	287.4	0.3	75.1
	Summer	282.4	37.1	6.9	2.3	297.3	296.7	297.2	0.2	70.5
	Winter	84.7	20.3	6.6	3.0	281.0	282.2	282.0	0.4	79.2
MKenya (Grass)	Fall	242.2	30.5	4.0	1.6	289.5	288.6	289.9	0.4	78.6
	Spring	242.4	33.8	4.2	1.7	289.9	289.0	290.2	0.3	78.0
	Summer	232.8	37.6	4.1	1.9	288.9	287.7	289.0	0.3	77.8
	Winter	267.1	34.8	4.3	1.5	289.5	288.3	289.4	0.3	71.9
Peru (Grass)	Fall	265.7	35.8	3.5	1.0	284.1	280.9	285.1	0.3	76.5
	Spring	212.4	23.4	3.8	0.9	282.8	280.4	283.9	0.4	81.0
	Summer	233.4	27.7	3.5	1.0	281.4	279.6	282.3	0.3	68.6
	Winter	248.4	28.4	3.6	0.9	283.7	280.9	284.9	0.4	81.0
PhaDin (Forest)	Fall	157.2	25.7	7.5	0.8	294.3	296.0	295.3	0.4	85.0
	Spring	217.6	47.6	6.5	1.0	295.4	296.2	295.4	0.4	78.5
	Summer	182.6	19.5	6.7	0.8	297.3	298.6	298.2	0.5	86.3
	Winter	132.8	33.3	6.7	1.0	287.6	289.2	288.4	0.4	82.8
Quabbin (Forest)	Fall	122.3	29.0	3.0	3.4	284.0	284.7	284.3	0.2	70.3
	Spring	205.6	44.0	2.5	3.3	282.9	283.9	283.1	0.2	61.3

	Summer	233.7	36.9	5.0	2.8	294.7	295.3	294.7	0.2	67.3
	Winter	91.8	32.1	1.5	3.6	269.3	270.6	270.9	0.3	68.9
US-Ne3 (Crop)	Fall	147.8	18.1	1.5	4.3	285.3	285.2	286.2	0.3	65.2
	Spring	207.9	34.5	1.5	4.4	284.5	284.8	284.6	0.3	66.4
	Summer	263.6	22.8	2.6	3.5	297.5	297.7	297.7	0.3	75.3
	Winter	99.4	NA	1.2	4.8	265.6	266.6	272.0	0.3	78.9

Table S2. Conductance contributions from different deposition branches.

Site	Season	Model	Vd (cm s^{-1})	Effective Conductance (cm s^{-1})			Effective Conductance Contributions (%)		
				Gcut	Gground	Gst	Gcut	Gground	Gst
Amberd (Grass)	Fall	CMAQ_J	0.188	0.065	0.024	0.099	34.5	12.9	52.5
		CMAQ_P	0.224	0.058	0.022	0.144	26	9.8	64.2
		DO3SE	0.182	0.088	0.07	0.024	48.2	38.7	13.1
		MESSY	0.253	0.03	0.018	0.205	11.9	7.2	80.8
		NOAH	0.185	0.017	0.014	0.154	9.3	7.4	83.3
		TEMIR	0.183	0.039	0.026	0.118	21.1	14.4	64.5
		ZHANG	0.233	0.033	0.019	0.181	14	8.2	77.8
	Spring	CMAQ_J	0.159	0.075	0.014	0.07	47.1	9	43.9
		CMAQ_P	0.221	0.06	0.012	0.149	27.3	5.2	67.4
		DO3SE	0.202	0.091	0.075	0.036	45.1	37.2	17.7
		MESSY	0.266	0.034	0.013	0.219	12.9	4.9	82.2
		NOAH	0.197	0.022	0.018	0.157	11	9.3	79.6
		TEMIR	0.214	0.045	0.029	0.14	21.2	13.7	65.1
		ZHANG	0.196	0.04	0.016	0.14	20.5	8	71.5
	Summer	CMAQ_J	0.368	0.095	0.037	0.236	25.7	10.1	64.2
		CMAQ_P	0.412	0.093	0.036	0.283	22.6	8.8	68.6
		DO3SE	0.275	0.086	0.076	0.113	31.1	27.7	41.2
		MESSY	0.468	0.052	0.025	0.391	11.1	5.4	83.6
		NOAH	0.413	0.024	0.019	0.37	5.8	4.5	89.6
		TEMIR	0.348	0.074	0.041	0.233	21.3	11.8	66.9
		ZHANG	0.414	0.052	0.026	0.336	12.5	6.2	81.3
	Winter	CMAQ_J	0.063	0.052	0.005	0.006	82.7	8.1	9.2
		CMAQ_P	0.09	0.04	0.004	0.046	44.5	4.3	51.2
		DO3SE	0.142	0.078	0.061	0.003	54.8	42.8	2.4
		MESSY	0.102	0.026	0.009	0.067	25.6	8.9	65.4

		NOAH	0.064	0.013	0.01	0.041	20.3	15.6	64.1
		TEMIR	0.085	0.016	0.015	0.054	18.8	17.6	63.7
		ZHANG	0.051	0.027	0.014	0.01	53.5	26.7	19.8
FI-Hyy (Forest)	Fall	CMAQ_J	0.247	0.168	0.022	0.057	68.2	8.8	23.1
		CMAQ_P	0.275	0.163	0.021	0.091	59.3	7.6	33.1
		DO3SE	0.25	0.133	0.029	0.088	53.1	11.8	35.2
		MESSY	0.539	0.268	0.13	0.141	49.7	24.1	26.2
		NOAH	0.37	0.155	0.145	0.07	41.9	39.1	19
		TEMIR	0.656	0.397	0.176	0.083	60.5	26.8	12.7
		ZHANG	0.448	0.272	0.132	0.044	60.8	29.5	9.8
	Spring	CMAQ_J	0.225	0.138	0.022	0.065	61.5	9.7	28.9
		CMAQ_P	0.28	0.128	0.02	0.132	45.7	7.1	47.2
		DO3SE	0.302	0.108	0.039	0.155	35.8	12.8	51.4
		MESSY	0.549	0.176	0.14	0.233	32	25.6	42.4
		NOAH	0.345	0.106	0.162	0.077	30.7	47.1	22.3
		TEMIR	0.567	0.286	0.172	0.109	50.5	30.3	19.3
		ZHANG	0.409	0.179	0.144	0.086	43.8	35.2	21
	Summer	CMAQ_J	0.474	0.182	0.018	0.274	38.4	3.8	57.8
		CMAQ_P	0.531	0.183	0.018	0.33	34.4	3.4	62.2
		DO3SE	0.431	0.129	0.023	0.279	29.9	5.4	64.7
		MESSY	0.797	0.211	0.096	0.49	26.4	12	61.5
		NOAH	0.433	0.117	0.107	0.209	27	24.7	48.3
		TEMIR	0.818	0.401	0.148	0.269	49.1	18.1	32.9
		ZHANG	0.465	0.223	0.103	0.139	47.9	22.2	29.9
	Winter	CMAQ_J	0.124	0.117	0.006	0.001	94.2	5	0.8
		CMAQ_P	0.143	0.11	0.006	0.027	76.8	4.1	19.1
		DO3SE	0.133	0.085	0.043	0.005	63.8	32.5	3.7
		MESSY	0.394	0.229	0.143	0.022	58.1	36.2	5.6
		NOAH	0.328	0.145	0.166	0.017	44.1	50.6	5.2
		TEMIR	0.513	0.301	0.177	0.035	58.6	34.5	6.9
		ZHANG	0.378	0.23	0.143	0.005	60.8	37.9	1.4
FR-Gri (Crop)	Fall	CMAQ_J	0.448	0.211	0.017	0.22	47	3.8	49.2
		CMAQ_P	0.432	0.217	0.018	0.197	50.3	4.1	45.6
		DO3SE	0.266	0.125	0.119	0.022	47	44.6	8.3
		MESSY	0.468	0.134	0.099	0.235	28.6	21.2	50.2
		NOAH	0.361	0.079	0.056	0.226	21.9	15.6	62.4
		TEMIR	0.42	0.142	0.137	0.141	33.8	32.6	33.6
		ZHANG	0.374	0.141	0.105	0.128	37.7	28.1	34.2

	Spring	CMAQ_J	0.53	0.22	0.015	0.295	41.5	2.8	55.7
		CMAQ_P	0.541	0.22	0.015	0.306	40.6	2.8	56.6
		DO3SE	0.4	0.131	0.084	0.185	32.8	21.1	46.2
		MESSY	0.546	0.123	0.089	0.334	22.5	16.3	61.2
		NOAH	0.492	0.068	0.051	0.373	13.8	10.4	75.8
		TEMIR	0.444	0.144	0.097	0.203	32.4	21.8	45.8
		ZHANG	0.398	0.131	0.097	0.17	33	24.3	42.7
	Summer	CMAQ_J	0.653	0.193	0.014	0.446	29.5	2.2	68.3
		CMAQ_P	0.61	0.204	0.015	0.391	33.4	2.5	64.1
		DO3SE	0.411	0.121	0.079	0.211	29.5	19.2	51.3
		MESSY	0.606	0.098	0.08	0.428	16.2	13.2	70.6
		NOAH	0.531	0.058	0.045	0.428	10.9	8.4	80.7
		TEMIR	0.485	0.12	0.096	0.269	24.7	19.7	55.6
		ZHANG	0.475	0.105	0.087	0.283	22.2	18.3	59.5
	Winter	CMAQ_J	0.315	0.243	0.017	0.055	77.3	5.4	17.4
		CMAQ_P	0.347	0.236	0.016	0.095	67.9	4.7	27.3
		DO3SE	0.274	0.142	0.124	0.008	51.8	45.3	2.9
		MESSY	0.414	0.172	0.126	0.116	41.6	30.4	28.1
		NOAH	0.285	0.102	0.076	0.107	35.7	26.7	37.6
		TEMIR	0.415	0.176	0.16	0.079	42.4	38.6	19.1
		ZHANG	0.328	0.179	0.131	0.018	54.5	39.9	5.5
IT-Cpz (Forest)	Fall	CMAQ_J	0.557	0.272	0.009	0.276	48.9	1.6	49.5
		CMAQ_P	0.567	0.278	0.009	0.28	49	1.6	49.3
		DO3SE	0.396	0.215	0.02	0.161	54.3	5	40.7
		MESSY	0.694	0.179	0.075	0.44	25.8	10.8	63.4
		NOAH	0.579	0.15	0.117	0.312	25.9	20.2	53.9
		TEMIR	0.306	0.087	0.016	0.203	28.4	5.3	66.3
		ZHANG	0.419	0.186	0.079	0.154	44.5	18.8	36.7
	Spring	CMAQ_J	0.605	0.282	0.009	0.314	46.7	1.5	51.9
		CMAQ_P	0.635	0.286	0.009	0.34	45	1.4	53.6
		DO3SE	0.482	0.213	0.021	0.248	44.2	4.4	51.5
		MESSY	0.894	0.182	0.079	0.633	20.3	8.9	70.8
		NOAH	0.919	0.144	0.118	0.657	15.7	12.9	71.5
		TEMIR	0.345	0.083	0.017	0.245	24.1	4.8	71.1
		ZHANG	0.466	0.191	0.085	0.19	41.1	18.2	40.7
	Summer	CMAQ_J	0.613	0.245	0.009	0.359	40	1.4	58.6
		CMAQ_P	0.693	0.245	0.008	0.44	35.4	1.2	63.4
		DO3SE	0.313	0.221	0.018	0.074	70.7	5.6	23.6

		MESSY	0.503	0.118	0.067	0.318	23.4	13.4	63.2
		NOAH	0.572	0.096	0.102	0.374	16.8	17.8	65.4
		TEMIR	0.348	0.055	0.013	0.28	15.7	3.8	80.5
		ZHANG	0.371	0.119	0.068	0.184	31.9	18.4	49.7
	Winter	CMAQ_J	0.428	0.286	0.01	0.132	66.9	2.3	30.9
		CMAQ_P	0.452	0.286	0.01	0.156	63.4	2.1	34.4
		DO3SE	0.378	0.221	0.024	0.133	58.4	6.5	35.1
		MESSY	0.654	0.229	0.089	0.336	35	13.5	51.4
		NOAH	0.567	0.18	0.135	0.252	31.8	23.8	44.5
		TEMIR	0.265	0.097	0.02	0.148	36.6	7.5	55.9
		ZHANG	0.41	0.237	0.092	0.081	57.9	22.5	19.7
MKenya (Grass)	Fall	CMAQ_J	0.456	0.196	0.015	0.245	43	3.4	53.7
		CMAQ_P	0.511	0.189	0.015	0.307	37	2.9	60.1
		DO3SE	0.28	0.088	0.094	0.098	31.4	33.5	35.2
		MESSY	0.396	0.063	0.029	0.304	15.9	7.4	76.7
		NOAH	0.395	0.036	0.022	0.337	9.1	5.5	85.3
		TEMIR	0.484	0.124	0.084	0.276	25.6	17.4	57
		ZHANG	0.363	0.062	0.029	0.272	17.1	8	74.9
	Spring	CMAQ_J	0.458	0.196	0.016	0.246	42.8	3.5	53.7
		CMAQ_P	0.512	0.187	0.015	0.31	36.6	3	60.4
		DO3SE	0.258	0.083	0.084	0.091	32.2	32.5	35.2
		MESSY	0.384	0.055	0.025	0.304	14.4	6.5	79.1
		NOAH	0.364	0.032	0.018	0.314	8.7	5	86.3
		TEMIR	0.447	0.103	0.068	0.276	23.1	15.1	61.8
		ZHANG	0.334	0.054	0.025	0.255	16.3	7.4	76.3
	Summer	CMAQ_J	0.401	0.144	0.012	0.245	35.9	2.9	61.2
		CMAQ_P	0.452	0.138	0.011	0.303	30.6	2.5	66.9
		DO3SE	0.283	0.079	0.077	0.127	28	27.1	44.9
		MESSY	0.411	0.041	0.027	0.343	10	6.6	83.4
		NOAH	0.37	0.024	0.021	0.325	6.6	5.6	87.8
		TEMIR	0.456	0.108	0.082	0.266	23.7	18	58.3
		ZHANG	0.362	0.041	0.028	0.293	11.4	7.7	80.8
	Winter	CMAQ_J	0.453	0.198	0.017	0.238	43.7	3.7	52.6
		CMAQ_P	0.51	0.189	0.016	0.305	37.1	3.1	59.8
		DO3SE	0.273	0.086	0.09	0.097	31.3	33	35.7
		MESSY	0.419	0.069	0.036	0.314	16.5	8.6	74.9
		NOAH	0.37	0.043	0.026	0.301	11.5	7	81.5
		TEMIR	0.504	0.135	0.092	0.277	26.7	18.2	55.1

		ZHANG	0.382	0.069	0.036	0.277	18.1	9.5	72.4
Peru (Grass)	Fall	CMAQ_J	0.26	0.129	0.022	0.109	49.5	8.6	41.9
		CMAQ_P	0.379	0.105	0.018	0.256	27.7	4.7	67.7
		DO3SE	0.146	0.085	0.048	0.013	58.3	33	8.7
		MESSY	0.301	0.046	0.017	0.238	15.2	5.8	79
		NOAH	0.247	0.026	0.013	0.208	10.4	5.4	84.2
		TEMIR	0.489	0.146	0.096	0.247	29.9	19.6	50.6
		ZHANG	0.294	0.043	0.015	0.236	14.5	5.3	80.2
	Spring	CMAQ_J	0.259	0.118	0.024	0.117	45.6	9.2	45.2
		CMAQ_P	0.389	0.094	0.018	0.277	24.1	4.7	71.2
		DO3SE	0.163	0.083	0.053	0.027	50.8	32.8	16.4
		MESSY	0.334	0.044	0.024	0.266	13.3	7.1	79.7
		NOAH	0.234	0.023	0.018	0.193	9.7	7.6	82.7
		TEMIR	0.511	0.145	0.107	0.259	28.4	21	50.6
		ZHANG	0.309	0.041	0.022	0.246	13.1	7	79.8
	Summer	CMAQ_J	0.281	0.136	0.024	0.121	48.3	8.7	43
		CMAQ_P	0.417	0.109	0.019	0.289	26.1	4.6	69.3
		DO3SE	0.153	0.079	0.054	0.02	51.6	35.2	13.2
		MESSY	0.333	0.05	0.02	0.263	15	6.1	78.9
		NOAH	0.272	0.027	0.015	0.23	9.9	5.7	84.4
		TEMIR	0.536	0.151	0.101	0.284	28.2	18.9	52.9
		ZHANG	0.3	0.046	0.018	0.236	15.3	6.1	78.6
	Winter	CMAQ_J	0.201	0.101	0.021	0.079	50.2	10.5	39.3
		CMAQ_P	0.305	0.079	0.016	0.21	25.9	5.3	68.8
		DO3SE	0.155	0.086	0.051	0.018	55.4	32.8	11.8
		MESSY	0.278	0.027	0.022	0.229	9.6	7.9	82.5
		NOAH	0.196	0.015	0.016	0.165	7.6	8.2	84.2
		TEMIR	0.398	0.105	0.104	0.189	26.4	26.1	47.5
		ZHANG	0.295	0.026	0.02	0.249	8.8	6.9	84.3
PhaDin (Forest)	Fall	CMAQ_J	0.442	0.152	0.003	0.287	34.4	0.7	64.9
		CMAQ_P	0.456	0.158	0.003	0.295	34.7	0.7	64.6
		DO3SE	0.244	0.137	0.005	0.102	56.2	2	41.8
		MESSY	0.307	0.04	0.004	0.263	12.9	1.5	85.7
		NOAH	0.254	0.028	0.007	0.219	10.9	2.6	86.6
		TEMIR	0.441	0.172	0.045	0.224	38.9	10.3	50.8
		ZHANG	0.136	0.059	0.007	0.07	43.2	5.4	51.4
	Spring	CMAQ_J	0.46	0.148	0.005	0.307	32.2	1	66.8
		CMAQ_P	0.476	0.153	0.005	0.318	32.2	1	66.8

		DO3SE	0.29	0.161	0.008	0.121	55.5	2.8	41.8
		MESSY	0.481	0.066	0.014	0.401	13.7	2.9	83.4
		NOAH	0.26	0.036	0.016	0.208	14	6	80
		TEMIR	0.479	0.181	0.063	0.235	37.8	13.2	49
		ZHANG	0.177	0.083	0.018	0.076	46.9	10.3	42.8
	Summer	CMAQ_J	0.465	0.154	0.004	0.307	33.1	0.8	66.2
		CMAQ_P	0.489	0.156	0.003	0.33	31.9	0.7	67.4
		DO3SE	0.234	0.145	0.005	0.084	61.8	2.2	36
		MESSY	0.369	0.049	0.006	0.314	13.3	1.6	85.1
		NOAH	0.276	0.031	0.008	0.237	11.2	3	85.7
		TEMIR	0.51	0.193	0.047	0.27	37.8	9.2	53
		ZHANG	0.153	0.072	0.009	0.072	47.2	5.8	47
	Winter	CMAQ_J	0.392	0.162	0.004	0.226	41.2	1.1	57.7
		CMAQ_P	0.408	0.166	0.004	0.238	40.7	1.1	58.2
		DO3SE	0.295	0.155	0.007	0.133	52.4	2.4	45.1
		MESSY	0.359	0.056	0.009	0.294	15.7	2.5	81.8
		NOAH	0.25	0.034	0.011	0.205	13.7	4.2	82.1
		TEMIR	0.41	0.174	0.06	0.176	42.4	14.7	42.9
		ZHANG	0.166	0.072	0.012	0.082	43.3	7.4	49.3
Quabbin (Forest)	Fall	CMAQ_J	0.271	0.189	0.01	0.072	69.8	3.8	26.5
		CMAQ_P	0.309	0.184	0.01	0.115	59.5	3.2	37.4
		DO3SE	0.329	0.158	0.025	0.146	48	7.6	44.3
		MESSY	0.376	0.117	0.075	0.184	31.1	19.9	48.9
		NOAH	0.43	0.099	0.12	0.211	23.2	27.8	49
		TEMIR	0.495	0.197	0.177	0.121	39.8	35.7	24.5
		ZHANG	0.295	0.118	0.076	0.101	40.1	25.7	34.2
	Spring	CMAQ_J	0.251	0.152	0.01	0.089	60.5	4	35.5
		CMAQ_P	0.314	0.144	0.009	0.161	45.8	3	51.2
		DO3SE	0.398	0.147	0.028	0.223	37	7	56
		MESSY	0.375	0.064	0.086	0.225	17	23	60
		NOAH	0.337	0.063	0.145	0.129	18.8	43.1	38.1
		TEMIR	0.41	0.128	0.157	0.125	31.1	38.4	30.5
		ZHANG	0.24	0.065	0.089	0.086	27.2	37.1	35.7
	Summer	CMAQ_J	0.402	0.261	0.008	0.133	64.9	2	33.1
		CMAQ_P	0.456	0.258	0.008	0.19	56.5	1.8	41.7
		DO3SE	0.407	0.163	0.018	0.226	40	4.4	55.7
		MESSY	0.407	0.091	0.054	0.262	22.4	13.3	64.2
		NOAH	0.539	0.083	0.101	0.355	15.4	18.8	65.8

		TEMIR	0.59	0.203	0.102	0.285	34.4	17.3	48.3
		ZHANG	0.305	0.093	0.055	0.157	30.4	18.2	51.4
	Winter	CMAQ_J	0.099	0.094	0.002	0.003	94.3	2.4	3.4
		CMAQ_P	0.129	0.087	0.002	0.04	67.4	1.6	31
		MESSY	0.192	0.055	0.089	0.048	28.5	46.5	25
		NOAH	0.211	0.056	0.134	0.021	26.8	63.4	9.8
		TEMIR	0.324	0.102	0.188	0.034	31.6	58	10.4
		ZHANG	0.152	0.055	0.09	0.007	36.2	58.9	4.9
US-Ne3-M (Crop)	Fall	CMAQ_J	0.283	0.156	0	0.127	55.2	0	44.8
		CMAQ_P	0.311	0.129	0	0.182	41.5	0	58.5
		DO3SE	0.347	0.059	0.215	0.073	17	61.9	21.1
		MESSY	0.38	0.075	0.167	0.138	19.6	44	36.4
		NOAH	0.27	0.045	0.089	0.136	16.8	32.8	50.4
		TEMIR	0.35	0.076	0.2	0.074	21.7	57.2	21.1
		ZHANG	0.371	0.075	0.168	0.128	20.3	45.2	34.5
	Spring	CMAQ_J	0.303	0.136	0	0.167	44.9	0	55.1
		CMAQ_P	0.359	0.106	0	0.253	29.5	0	70.5
		DO3SE	0.398	0.037	0.231	0.13	9.2	58.1	32.7
		MESSY	0.405	0.063	0.172	0.17	15.5	42.5	42
		NOAH	0.244	0.044	0.106	0.094	18	43.5	38.5
		TEMIR	0.357	0.074	0.183	0.1	20.8	51.2	28
		ZHANG	0.345	0.065	0.179	0.101	18.8	51.9	29.3
	Summer	CMAQ_J	0.552	0.151	0	0.401	27.3	0	72.7
		CMAQ_P	0.498	0.148	0	0.35	29.8	0	70.2
		DO3SE	0.423	0.059	0.17	0.194	14	40.2	45.8
		MESSY	0.479	0.069	0.118	0.292	14.4	24.6	61
		NOAH	0.385	0.048	0.066	0.271	12.5	17.2	70.4
		TEMIR	0.441	0.093	0.103	0.245	21.1	23.3	55.6
		ZHANG	0.409	0.072	0.124	0.213	17.7	30.3	52
	Winter	CMAQ_J	0.087	0.082	0	0.005	94.5	0	5.5
		CMAQ_P	0.172	0.067	0	0.105	39	0	61
		MESSY	0.147	0.048	0.073	0.026	32.5	49.8	17.7
		NOAH	0.153	0.043	0.094	0.016	28.3	61.5	10.2
		TEMIR	0.287	0.062	0.204	0.021	21.6	71.1	7.3
		ZHANG	0.126	0.049	0.075	0.002	38.9	59.7	1.4
US-Ne3-S (Crop)	Fall	CMAQ_J	0.283	0.156	0	0.127	55.2	0	44.8
		CMAQ_P	0.311	0.129	0	0.182	41.5	0	58.5
		DO3SE	0.308	0.052	0.234	0.022	16.8	76.2	7

	MESSY	0.38	0.075	0.167	0.138	19.6	44	36.4
	NOAH	0.27	0.045	0.089	0.136	16.8	32.8	50.4
	TEMIR	0.35	0.076	0.2	0.074	21.7	57.2	21.1
	ZHANG	0.371	0.075	0.168	0.128	20.3	45.2	34.5
Spring	CMAQ_J	0.303	0.136	0	0.167	44.9	0	55.1
	CMAQ_P	0.359	0.106	0	0.253	29.5	0	70.5
	DO3SE	0.298	0.031	0.246	0.021	10.3	82.8	6.9
	MESSY	0.405	0.063	0.172	0.17	15.5	42.5	42
	NOAH	0.244	0.044	0.106	0.094	18	43.5	38.5
	TEMIR	0.357	0.074	0.183	0.1	20.8	51.2	28
	ZHANG	0.345	0.065	0.179	0.101	18.8	51.9	29.3
Summer	CMAQ_J	0.552	0.151	0	0.401	27.3	0	72.7
	CMAQ_P	0.498	0.148	0	0.35	29.8	0	70.2
	DO3SE	0.383	0.057	0.183	0.143	14.8	47.7	37.5
	MESSY	0.479	0.069	0.118	0.292	14.4	24.6	61
	NOAH	0.385	0.048	0.066	0.271	12.5	17.2	70.4
	TEMIR	0.441	0.093	0.103	0.245	21.1	23.3	55.6
	ZHANG	0.409	0.072	0.124	0.213	17.7	30.3	52
Winter	CMAQ_J	0.087	0.082	0	0.005	94.5	0	5.5
	CMAQ_P	0.172	0.067	0	0.105	39	0	61
	MESSY	0.147	0.048	0.073	0.026	32.5	49.8	17.7
	NOAH	0.153	0.043	0.094	0.016	28.3	61.5	10.2
	TEMIR	0.287	0.062	0.204	0.021	21.6	71.1	7.3
	ZHANG	0.126	0.049	0.075	0.002	38.9	59.7	1.4

Table S3. Normalized mean bias (NMB; %) and Spearman correlation coefficient (r) of the model-predicted F_{st} against SynFlux F_{st}. Data for the entire year was used for the calculation.

Site	Model	NMB (%)	r
US-Ha1 (Forest)	CMAQ_J	-7	0.9
	CMAQ_P	54	0.81
	MESSY	180	0.78
	NOAH	10	0.79
	TEMIR	9	0.87
	ZHANG	-12	0.81

FI-Hyy (Forest)	CMAQ_J	23	0.8
	CMAQ_P	84	0.73
	MESSY	222	0.63
	NOAH	-14	0.75
	TEMIR	60	0.77
	ZHANG	4	0.71

Table S4. Yearly mean model input and output data (unitless) for different models. Data were normalized with respect to the corresponding minimum values across all sites.

Site	Amberd (Grass)	FI-Hyy (Forest)	FR-Gri (Crop)	IT-Cpz (Forest)	MKenya (Grass)	Peru (Grass)	PhaDin (Forest)	Quabbin (Forest)	US-Ne3-M (Crop)	US-Ne3-S (Crop)
Inputs										
Wind Speed	1.48	3.47	3.98	2.97	1.85	1.03	1.00	3.59	4.69	4.69
2 m Temperature	1.00	1.00	1.02	1.04	1.03	1.01	1.06	1.02	1.02	1.02
Surface Temperature	1.00	1.00	1.02	1.04	1.04	1.02	1.05	1.01	1.02	1.02
30 m Temperature	1.00	1.00	1.02	1.04	1.03	1.00	1.06	1.02	1.02	1.02
Solar radiation	1.97	1.00	1.35	1.82	2.46	2.40	1.73	1.64	1.80	1.80
Relative Humidity	1.04	1.23	1.19	1.13	1.14	1.15	1.24	1.00	1.07	1.07
Cloud fraction	1.16	1.64	1.45	1.00	1.37	1.65	1.48	1.22	1.15	1.15
Precipitation	1.98	1.00	1.24	1.80	5.70	2.50	3.64	1.77	1.59	1.59
Surface Pressure	1.26	1.57	1.57	1.57	1.21	1.00	1.45	1.55	1.53	1.53
O3 Concentration	2.01	1.06	1.57	1.15	1.37	1.17	1.25	1.44	1.00	1.00
LAI	2.29	1.74	2.55	4.08	2.48	2.13	4.09	1.80	1.00	1.00
Soil Moisture (Level 1)	1.32	1.52	1.44	1.20	1.42	1.46	1.87	1.00	1.36	1.36
Soil Moisture (Level 2)	1.32	1.57	1.46	1.31	1.53	1.50	1.94	1.00	1.39	1.39
Soil Moisture (Level 3)	1.27	1.70	1.54	1.47	1.76	1.68	2.11	1.00	1.50	1.50
Soil Temperature (Level 1)	1.01	1.00	1.02	1.04	1.04	1.02	1.06	1.02	1.02	1.02
Soil Temperature (Level 3)	1.01	1.00	1.02	1.04	1.04	1.02	1.05	1.01	1.02	1.02
Soil Temperature (Level 3)	1.01	1.00	1.02	1.04	1.04	1.02	1.05	1.01	1.02	1.02
GsMax	2.00	1.14	2.86	1.67	2.00	2.00	1.14	1.00	2.86	2.86

(CMAQ_J)										
VcMax (CMAQ_P)	1.53	1.17	1.97	1.00	1.53	1.53	1.17	1.13	1.97	1.97
Gst_px_cms	2.49	1.59	4.64	4.61	4.86	1.73	7.28	1.00	2.51	2.51
Gst_psn_cms	2.48	1.35	2.52	3.04	4.06	3.39	4.35	1.00	1.60	1.60
GsMax (CMAQ_J).1	2.00	1.14	2.86	1.67	2.00	2.00	1.14	1.00	2.86	2.86
VcMax (CMAQ_P).1	1.53	1.17	1.97	1.00	1.53	1.53	1.17	1.13	1.97	1.97
GsMax (DO3SE)	1.50	1.00	2.50	1.11	1.50	1.50	1.00	1.25	1.68	1.66
GsMax (MESSY)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
VcMax (NOAH)	1.00	2.00	2.67	3.33	1.00	1.00	2.00	3.33	2.67	2.67
VcMax (TEMIR)	1.36	1.08	1.75	1.07	1.36	1.36	1.08	1.00	1.75	1.75
GsMax (ZHANG)	2.50	1.00	2.08	1.67	2.50	2.50	1.00	1.67	2.08	2.08
Gst Outputs										
Gst (CMAQ_J)	2.49	1.59	4.64	4.61	4.86	1.73	7.28	1.00	2.51	2.51
Gst (CMAQ_P)	2.48	1.35	2.52	3.04	4.06	3.39	4.35	1.00	1.60	1.60
Gst (DO3SE)	2.91	3.81	4.51	5.21	9.16	1.00	6.52	4.79	5.97	4.52
Gst (MESSY)	1.89	1.37	2.07	2.50	2.82	1.96	3.31	1.00	1.10	1.10
Gst (NOAH)	2.46	1.00	3.75	4.84	4.47	2.43	3.13	2.11	1.56	1.56
Gst (TEMIR)	1.58	1.00	1.80	2.04	2.96	2.34	1.97	1.08	1.06	1.06
Gst (ZHANG)	4.08	1.00	2.73	2.16	7.20	5.90	1.32	1.25	1.98	1.98

Table S5. Statistics of the Model simulated canopy-level stomatal conductance (cm s^{-1}) at the 9 sites.

Site	Season	Model	Min	Max	Mean	Median
Amberd (Grass)	Fall	CMAQ_J	0	1.086	0.17	0.033
		CMAQ_P	0.029	1.654	0.291	0.031
		DO3SE	0.001	1.977	0.059	0.001
		MESSY	0.001	1.493	0.372	0.041
		NOAH	0.013	1.097	0.215	0.013
		TEMIR	0.052	0.813	0.189	0.079
		ZHANG	0	1.82	0.334	0.001
	Spring	CMAQ_J	0	1.35	0.119	0.016
		CMAQ_P	0.024	1.517	0.297	0.031
		DO3SE	0.001	2.245	0.124	0.006

		MESSY	0.001	1.613	0.373	0.233
		NOAH	0.013	1.315	0.207	0.013
		TEMIR	0.062	1.058	0.235	0.099
		ZHANG	0	1.877	0.243	0.001
	Summer	CMAQ_J	0.011	1.549	0.444	0.261
		CMAQ_P	0.03	2.272	0.613	0.118
		DO3SE	0.001	2.614	0.433	0.039
		MESSY	0.001	1.724	0.716	0.746
		NOAH	0.013	2.096	0.582	0.566
		TEMIR	0.07	1.126	0.409	0.308
		ZHANG	0.001	2.039	0.676	0.334
	Winter	CMAQ_J	0	0.405	0.008	0.001
		CMAQ_P	0.015	0.959	0.096	0.029
		DO3SE	0.001	0.025	0.007	0.001
		MESSY	0.001	0.87	0.098	0.001
		NOAH	0.013	0.336	0.051	0.013
		TEMIR	0.046	0.273	0.089	0.066
		ZHANG	0.001	1.002	0.014	0.001
FI-Hyy (Forest)	Fall	CMAQ_J	0	0.666	0.062	0.01
		CMAQ_P	0.023	0.948	0.103	0.024
		DO3SE	0.001	1.379	0.121	0.001
		MESSY	0.001	1.235	0.172	0.001
		NOAH	0.013	0.482	0.08	0.013
		TEMIR	0.04	0.441	0.094	0.058
		ZHANG	0	0.36	0.049	0.001
	Spring	CMAQ_J	0	0.766	0.069	0.011
		CMAQ_P	0.023	0.95	0.147	0.025
		DO3SE	0.001	1.201	0.196	0.05
		MESSY	0.001	1.316	0.28	0.183
		NOAH	0.013	0.434	0.084	0.06
		TEMIR	0.036	0.615	0.123	0.073
		ZHANG	0	0.421	0.096	0.036
	Summer	CMAQ_J	0.005	1.085	0.339	0.299
		CMAQ_P	0.013	1.335	0.429	0.182
		DO3SE	0.001	1.4	0.393	0.293
		MESSY	0.001	1.538	0.652	0.704
		NOAH	0.013	0.677	0.246	0.266
		TEMIR	0.064	0.876	0.325	0.333

		ZHANG	0	0.457	0.16	0.153
	Winter	CMAQ_J	0	0.034	0.001	0
		CMAQ_P	0.012	0.296	0.027	0.024
		DO3SE	0.001	0.149	0.006	0.001
		MESSY	0.001	0.239	0.024	0.001
		NOAH	0.013	0.107	0.018	0.013
		TEMIR	0.032	0.087	0.039	0.036
		ZHANG	0	0.141	0.006	0.001
FR-Gri (Crop)	Fall	CMAQ_J	0.001	1.78	0.286	0.047
		CMAQ_P	0.002	1.626	0.253	0.025
		DO3SE	0.001	1.497	0.032	0.001
		MESSY	0.001	1.351	0.355	0.252
		NOAH	0.013	1.581	0.311	0.013
		TEMIR	0.057	0.839	0.205	0.072
		ZHANG	0	1.144	0.179	0.001
	Spring	CMAQ_J	0	2.117	0.399	0.072
		CMAQ_P	0.023	2.016	0.407	0.025
		DO3SE	0.001	3.989	0.427	0.006
		MESSY	0.001	1.695	0.512	0.448
		NOAH	0.013	2.267	0.523	0.266
		TEMIR	0.066	1.227	0.31	0.14
		ZHANG	0	1.242	0.234	0.001
	Summer	CMAQ_J	0.011	2.496	0.64	0.421
		CMAQ_P	0.006	2.475	0.551	0.122
		DO3SE	0.001	4.552	0.5	0.037
		MESSY	0.001	1.786	0.686	0.769
		NOAH	0.013	2.641	0.648	0.546
		TEMIR	0.06	1.421	0.42	0.314
		ZHANG	0	1.287	0.412	0.256
	Winter	CMAQ_J	0	0.95	0.052	0.011
		CMAQ_P	0.023	0.985	0.104	0.024
		DO3SE	0.001	1.367	0.01	0.001
		MESSY	0.001	1.075	0.156	0.001
		NOAH	0.013	1.002	0.127	0.013
		TEMIR	0.063	0.396	0.112	0.071
		ZHANG	0	0.632	0.022	0.001
IT-Cpz (Forest)	Fall	CMAQ_J	0.002	1.259	0.354	0.089
		CMAQ_P	0.023	1.758	0.369	0.026

		DO3SE	0.001	2.196	0.276	0.001
		MESSY	0.001	1.818	0.532	0.515
		NOAH	0.013	2.683	0.404	0.103
		TEMIR	0.092	0.828	0.269	0.127
		ZHANG	0.001	0.726	0.17	0.001
	Spring	CMAQ_J	0.003	1.504	0.398	0.184
		CMAQ_P	0.014	1.703	0.439	0.025
		DO3SE	0.001	2.417	0.407	0.019
		MESSY	0.001	2.041	0.781	0.8
		NOAH	0.013	3.04	0.863	0.571
		TEMIR	0.102	0.987	0.344	0.146
		ZHANG	0	0.754	0.211	0.05
	Summer	CMAQ_J	0.041	1.358	0.459	0.405
		CMAQ_P	0.013	1.888	0.585	0.17
		DO3SE	0.001	2.08	0.106	0.036
		MESSY	0.001	1.205	0.36	0.297
		NOAH	0.013	2.566	0.509	0.212
		TEMIR	0.094	1.18	0.391	0.311
		ZHANG	0.001	0.782	0.204	0.104
	Winter	CMAQ_J	0.001	1.026	0.161	0.055
		CMAQ_P	0.023	1.21	0.194	0.025
		DO3SE	0.001	2.1	0.204	0.001
		MESSY	0.001	1.695	0.404	0.001
		NOAH	0.013	2.508	0.302	0.013
		TEMIR	0.104	0.569	0.186	0.123
		ZHANG	0.001	0.549	0.088	0.001
MKenya (Grass)	Fall	CMAQ_J	0.02	1.428	0.367	0.051
		CMAQ_P	0.029	2.456	0.539	0.032
		DO3SE	0.001	2.646	0.423	0.001
		MESSY	0.001	1.639	0.563	0.423
		NOAH	0.013	2.279	0.516	0.345
		TEMIR	0.064	1.368	0.44	0.094
		ZHANG	0.001	1.877	0.569	0.001
	Spring	CMAQ_J	0.018	1.302	0.369	0.044
		CMAQ_P	0.032	1.9	0.548	0.032
		DO3SE	0.001	2.569	0.394	0.001
		MESSY	0.001	1.613	0.591	0.42
		NOAH	0.013	2.086	0.488	0.333

		TEMIR	0.065	1.31	0.447	0.087
		ZHANG	0.001	1.843	0.565	0.001
	Summer	CMAQ_J	0.021	1.231	0.36	0.054
		CMAQ_P	0.031	1.85	0.51	0.033
		DO3SE	0.001	2.487	0.471	0.001
		MESSY	0.001	1.667	0.604	0.436
		NOAH	0.013	1.761	0.471	0.366
		TEMIR	0.066	1.422	0.405	0.092
		ZHANG	0.001	1.876	0.542	0.001
	Winter	CMAQ_J	0.011	1.273	0.354	0.046
		CMAQ_P	0.032	1.878	0.533	0.032
		DO3SE	0.001	2.475	0.482	0.001
		MESSY	0.001	1.587	0.582	0.404
		NOAH	0.013	1.772	0.448	0.343
		TEMIR	0.064	1.321	0.435	0.091
		ZHANG	0.001	1.883	0.572	0.001
Peru (Grass)	Fall	CMAQ_J	0	0.833	0.138	0.016
		CMAQ_P	0.037	1.669	0.463	0.038
		DO3SE	0.001	0.769	0.03	0.001
		MESSY	0.001	1.282	0.4	0.227
		NOAH	0.013	0.997	0.277	0.345
		TEMIR	0.091	1.124	0.352	0.098
		ZHANG	0	1.676	0.474	0.001
	Spring	CMAQ_J	0.001	0.718	0.14	0.02
		CMAQ_P	0.037	1.625	0.468	0.038
		DO3SE	0.001	1.479	0.068	0.001
		MESSY	0.001	1.389	0.432	0.247
		NOAH	0.013	0.799	0.251	0.323
		TEMIR	0.084	1.113	0.36	0.091
		ZHANG	0	1.581	0.461	0.001
	Summer	CMAQ_J	0.001	0.705	0.15	0.02
		CMAQ_P	0.037	1.564	0.516	0.038
		DO3SE	0.001	1.547	0.052	0.003
		MESSY	0.001	1.389	0.439	0.274
		NOAH	0.013	0.985	0.307	0.348
		TEMIR	0.088	1.211	0.411	0.095
		ZHANG	0	1.625	0.47	0.006
	Winter	CMAQ_J	0	0.541	0.088	0.012

		CMAQ_P	0.035	1.269	0.335	0.038
		DO3SE	0.001	1.154	0.042	0.001
		MESSY	0.001	1.19	0.358	0.023
		NOAH	0.013	0.718	0.21	0.013
		TEMIR	0.063	0.803	0.246	0.091
		ZHANG	0.001	1.652	0.436	0.001
PhaDin (Forest)	Fall	CMAQ_J	0.055	2.022	0.59	0.1
		CMAQ_P	0.011	2.228	0.6	0.028
		DO3SE	0.001	2.592	0.335	0.001
		MESSY	0.001	2	0.706	0.787
		NOAH	0.013	1.47	0.36	0.013
		TEMIR	0.067	0.943	0.287	0.078
		ZHANG	0	0.472	0.102	0.001
	Spring	CMAQ_J	0.043	1.776	0.561	0.088
		CMAQ_P	0.014	2.074	0.579	0.028
		DO3SE	0.001	2.783	0.296	0.049
		MESSY	0.001	1.961	0.703	0.735
		NOAH	0.013	1.364	0.3	0.111
		TEMIR	0.063	0.997	0.297	0.07
		ZHANG	0	0.539	0.096	0.009
	Summer	CMAQ_J	0.074	1.96	0.614	0.182
		CMAQ_P	0.014	2.194	0.681	0.028
		DO3SE	0.001	1.285	0.218	0.052
		MESSY	0.001	2	0.752	0.813
		NOAH	0.013	1.567	0.38	0.116
		TEMIR	0.071	1.038	0.361	0.076
		ZHANG	0	0.426	0.106	0.024
	Winter	CMAQ_J	0.004	1.702	0.404	0.086
		CMAQ_P	0.013	1.855	0.418	0.027
		DO3SE	0.001	2.675	0.415	0.001
		MESSY	0.001	1.887	0.582	0.481
		NOAH	0.013	1.303	0.306	0.013
		TEMIR	0.064	0.694	0.205	0.068
		ZHANG	0	0.538	0.107	0.001
Quabbin (Forest)	Fall	CMAQ_J	0	0.48	0.067	0.021
		CMAQ_P	0.007	0.854	0.112	0.025
		DO3SE	0.001	1.781	0.201	0.001
		MESSY	0.001	1.282	0.209	0.001

		NOAH	0.013	1.694	0.262	0.013
		TEMIR	0.029	0.709	0.13	0.079
		ZHANG	0	0.645	0.11	0.001
	Spring	CMAQ_J	0	0.866	0.085	0.022
		CMAQ_P	0.01	1.087	0.161	0.025
		DO3SE	0.001	1.88	0.294	0.092
		MESSY	0.001	1	0.261	0.182
		NOAH	0.013	1.064	0.149	0.055
		TEMIR	0.027	0.74	0.137	0.073
		ZHANG	0	0.527	0.094	0.018
	Summer	CMAQ_J	0.001	0.97	0.142	0.049
		CMAQ_P	0.001	1.578	0.212	0.025
		DO3SE	0.001	1.808	0.21	0.094
		MESSY	0.001	1.163	0.305	0.283
		NOAH	0.013	1.875	0.471	0.349
		TEMIR	0.078	0.98	0.323	0.228
		ZHANG	0.001	0.701	0.176	0.097
	Winter	CMAQ_J	0	0.069	0.002	0
		CMAQ_P	0.011	0.285	0.036	0.024
		MESSY	0.001	0.391	0.052	0.001
		NOAH	0.013	0.428	0.022	0.013
		TEMIR	0.025	0.119	0.036	0.027
		ZHANG	0	0.165	0.008	0.001
US-Ne3-M (Crop)	Fall	CMAQ_J	0	1.058	0.103	0.016
		CMAQ_P	0.021	0.749	0.139	0.093
		DO3SE	0.001	0.707	0.111	0.001
		MESSY	0.001	0.971	0.185	0.001
		NOAH	0.013	1.238	0.172	0.013
		TEMIR	0.017	0.683	0.093	0.026
		ZHANG	0	0.912	0.174	0.001
	Spring	CMAQ_J	0	0.916	0.138	0.021
		CMAQ_P	0.052	0.832	0.208	0.101
		DO3SE	0.001	0.955	0.227	0.092
		MESSY	0.001	0.877	0.234	0.142
		NOAH	0.013	0.655	0.107	0.036
		TEMIR	0.016	0.747	0.133	0.034
		ZHANG	0	0.626	0.131	0.001
	Summer	CMAQ_J	0.012	1.71	0.5	0.369

		CMAQ_P	0.046	1.258	0.389	0.108
		DO3SE	0.001	1.512	0.362	0.138
		MESSY	0.001	1.299	0.456	0.51
		NOAH	0.013	1.485	0.374	0.29
		TEMIR	0.03	1.141	0.36	0.168
		ZHANG	0	0.912	0.309	0.194
	Winter	CMAQ_J	0	0.336	0.003	0
		CMAQ_P	0.039	0.448	0.102	0.092
		MESSY	0.001	0.452	0.03	0.001
		NOAH	0.013	0.24	0.017	0.013
		TEMIR	0.015	0.149	0.027	0.018
		ZHANG	0.001	0.325	0.002	0.001
US-Ne3-S (Crop)	Fall	CMAQ_J	0	1.058	0.103	0.016
		CMAQ_P	0.021	0.749	0.139	0.093
		DO3SE	0.001	0.36	0.032	0.001
		MESSY	0.001	0.971	0.185	0.001
		NOAH	0.013	1.238	0.172	0.013
		TEMIR	0.017	0.683	0.093	0.026
		ZHANG	0	0.912	0.174	0.001
	Spring	CMAQ_J	0	0.916	0.138	0.021
		CMAQ_P	0.052	0.832	0.208	0.101
		DO3SE	0.001	0.14	0.034	0.011
		MESSY	0.001	0.877	0.234	0.142
		NOAH	0.013	0.655	0.107	0.036
		TEMIR	0.016	0.747	0.133	0.034
		ZHANG	0	0.626	0.131	0.001
	Summer	CMAQ_J	0.012	1.71	0.5	0.369
		CMAQ_P	0.046	1.258	0.389	0.108
		DO3SE	0.001	1.774	0.255	0.054
		MESSY	0.001	1.299	0.456	0.51
		NOAH	0.013	1.485	0.374	0.29
		TEMIR	0.03	1.141	0.36	0.168
		ZHANG	0	0.912	0.309	0.194
	Winter	CMAQ_J	0	0.336	0.003	0
		CMAQ_P	0.039	0.448	0.102	0.092
		MESSY	0.001	0.452	0.03	0.001
		NOAH	0.013	0.24	0.017	0.013
		TEMIR	0.015	0.149	0.027	0.018

		ZHANG	0.001	0.325	0.002	0.001

Table S6. Statistics of the canopy-level total stomatal flux of O3 (ppb ms^{-1}). Statistics represent data within growing season and solar radiation beyond 50 Wm^{-2}.

Site	Season	Model	Min	Max	Mean	Median
Amberd (Grass)	Fall	CMAQ_J	0.001	0.59	0.162	0.131
		CMAQ_P	0.008	0.914	0.273	0.277
		DO3SE	0	0.839	0.063	0.01
		MESSY	0.019	0.813	0.354	0.352
		NOAH	0.003	0.629	0.197	0.166
		TEMIR	0.02	0.396	0.147	0.133
		ZHANG	0	0.964	0.337	0.342
	Spring	CMAQ_J	0	0.698	0.121	0.053
		CMAQ_P	0.01	0.798	0.293	0.302
		DO3SE	0	1.273	0.131	0.013
		MESSY	0.023	0.895	0.37	0.341
		NOAH	0.005	0.717	0.195	0.169
		TEMIR	0.024	0.554	0.203	0.178
		ZHANG	0	1.133	0.257	0.189
	Summer	CMAQ_J	0.015	0.817	0.411	0.44
		CMAQ_P	0.01	1.273	0.58	0.649
		DO3SE	0	1.524	0.408	0.296
		MESSY	0.21	1.134	0.649	0.676
		NOAH	0.141	1.165	0.532	0.531
		TEMIR	0.035	0.713	0.357	0.376
		ZHANG	0	1.263	0.654	0.722
	Winter	CMAQ_J	0	0.147	0.009	0.004
		CMAQ_P	0.007	0.453	0.099	0.09
		DO3SE	0	0.016	0.008	0.008
		MESSY	0.018	0.431	0.116	0.093
		NOAH	0.003	0.168	0.052	0.008
		TEMIR	0.023	0.157	0.063	0.061
		ZHANG	0	0.465	0.016	0
FI-Hyy (Forest)	Fall	CMAQ_J	0.001	0.28	0.102	0.096
		CMAQ_P	0	0.371	0.149	0.14
		DO3SE	0	0.558	0.221	0.215

		MESSY	0.004	0.551	0.223	0.21
		NOAH	0.002	0.187	0.096	0.09
		TEMIR	0.002	0.18	0.083	0.075
		ZHANG	0.002	0.14	0.072	0.073
	Spring	CMAQ_J	0.001	0.489	0.104	0.056
		CMAQ_P	0.002	0.531	0.16	0.131
		DO3SE	0.002	0.584	0.172	0.158
		MESSY	0.009	0.812	0.265	0.22
		NOAH	0.001	0.185	0.078	0.071
		TEMIR	0.007	0.366	0.119	0.096
		ZHANG	0.001	0.179	0.082	0.082
	Summer	CMAQ_J	0.006	0.566	0.193	0.18
		CMAQ_P	0.001	0.807	0.248	0.237
		DO3SE	0.004	0.62	0.218	0.206
		MESSY	0.017	0.917	0.347	0.338
		NOAH	0.009	0.392	0.128	0.118
		TEMIR	0.005	0.484	0.169	0.16
		ZHANG	0	0.234	0.089	0.089
FR-Gri (Crop)	Fall	CMAQ_J	0	0.605	0.128	0.081
		CMAQ_P	0	0.718	0.143	0.092
		DO3SE	0	0.641	0.041	0.006
		MESSY	0.002	0.617	0.196	0.173
		NOAH	0.002	0.672	0.201	0.159
		TEMIR	0.001	0.276	0.09	0.078
		ZHANG	0	0.315	0.069	0.045
	Spring	CMAQ_J	0	1.926	0.43	0.341
		CMAQ_P	0	1.743	0.417	0.389
		DO3SE	0	4.147	0.609	0.162
		MESSY	0	1.756	0.521	0.458
		NOAH	0	1.909	0.534	0.501
		TEMIR	0	1.092	0.282	0.251
		ZHANG	0	1.316	0.266	0.209
	Summer	CMAQ_J	0	2.535	0.674	0.568
		CMAQ_P	0	2.635	0.58	0.491
		DO3SE	0	4.174	0.618	0.329
		MESSY	0	1.899	0.659	0.597
		NOAH	0	2.059	0.674	0.604
		TEMIR	0	1.478	0.408	0.37

		ZHANG	0	1.488	0.426	0.386
	Winter	CMAQ_J	0	0.631	0.076	0.044
		CMAQ_P	0	0.648	0.144	0.09
		DO3SE	0	1.021	0.019	0.009
		MESSY	0	0.786	0.196	0.165
		NOAH	0	0.771	0.164	0.113
		TEMIR	0	0.302	0.09	0.075
		ZHANG	0	0.425	0.04	0.008
IT-Cpz (Forest)	Fall	CMAQ_J	0.005	0.696	0.274	0.278
		CMAQ_P	0.001	0.972	0.312	0.332
		DO3SE	0	1.221	0.201	0.11
		MESSY	0.02	0.936	0.389	0.377
		NOAH	0.005	1.159	0.27	0.218
		TEMIR	0.009	0.484	0.174	0.178
		ZHANG	0	0.414	0.145	0.153
	Spring	CMAQ_J	0.008	0.692	0.283	0.284
		CMAQ_P	0.001	0.771	0.321	0.328
		DO3SE	0	1.021	0.226	0.15
		MESSY	0.02	1.219	0.559	0.541
		NOAH	0.01	1.558	0.646	0.637
		TEMIR	0.005	0.487	0.216	0.212
		ZHANG	0	0.362	0.159	0.16
	Summer	CMAQ_J	0.013	0.757	0.346	0.354
		CMAQ_P	0.003	1.016	0.47	0.511
		DO3SE	0	1.205	0.09	0.038
		MESSY	0.029	0.716	0.271	0.262
		NOAH	0.004	1.314	0.381	0.34
		TEMIR	0.018	0.611	0.28	0.287
		ZHANG	0	0.44	0.16	0.163
MKenya (Grass)	Fall	CMAQ_J	0.047	0.58	0.248	0.241
		CMAQ_P	0.011	0.997	0.374	0.387
		DO3SE	0	1.145	0.298	0.239
		MESSY	0.118	0.712	0.382	0.384
		NOAH	0.084	0.835	0.345	0.323
		TEMIR	0.068	0.496	0.281	0.283
		ZHANG	0	0.837	0.407	0.432
	Spring	CMAQ_J	0.042	0.465	0.23	0.238
		CMAQ_P	0.022	0.651	0.347	0.365

		DO3SE	0	0.913	0.243	0.225
		MESSY	0.122	0.698	0.369	0.368
		NOAH	0.069	0.611	0.292	0.292
		TEMIR	0.072	0.483	0.264	0.271
		ZHANG	0	0.797	0.367	0.379
	Summer	CMAQ_J	0.05	0.599	0.244	0.242
		CMAQ_P	0.012	0.878	0.358	0.365
		DO3SE	0	1.233	0.381	0.338
		MESSY	0.158	0.924	0.418	0.416
		NOAH	0.104	0.618	0.314	0.311
		TEMIR	0.026	0.558	0.26	0.251
		ZHANG	0	1.06	0.394	0.396
	Winter	CMAQ_J	0.063	0.592	0.27	0.278
		CMAQ_P	0.013	0.902	0.417	0.426
		DO3SE	0	1.082	0.394	0.386
		MESSY	0.168	0.893	0.438	0.452
		NOAH	0.144	0.71	0.328	0.324
		TEMIR	0.109	0.61	0.311	0.319
		ZHANG	0	1.099	0.458	0.497
Peru (Grass)	Fall	CMAQ_J	0.001	0.278	0.098	0.097
		CMAQ_P	0.007	0.661	0.319	0.341
		DO3SE	0	0.271	0.023	0.008
		MESSY	0.035	0.514	0.275	0.282
		NOAH	0.003	0.401	0.177	0.169
		TEMIR	0.018	0.471	0.21	0.213
		ZHANG	0	0.697	0.347	0.378
	Spring	CMAQ_J	0.003	0.374	0.129	0.126
		CMAQ_P	0.011	0.87	0.416	0.449
		DO3SE	0	0.85	0.067	0.012
		MESSY	0.052	0.821	0.396	0.409
		NOAH	0.004	0.447	0.213	0.21
		TEMIR	0.025	0.623	0.291	0.304
		ZHANG	0	0.958	0.435	0.469
	Summer	CMAQ_J	0.001	0.343	0.106	0.103
		CMAQ_P	0.007	0.826	0.354	0.378
		DO3SE	0.001	0.639	0.04	0.008
		MESSY	0.044	0.684	0.304	0.297
		NOAH	0.003	0.511	0.197	0.183

		TEMIR	0.017	0.615	0.258	0.266
		ZHANG	0	0.836	0.34	0.363
	Winter	CMAQ_J	0.001	0.197	0.075	0.077
		CMAQ_P	0.009	0.535	0.272	0.301
		DO3SE	0	0.443	0.04	0.01
		MESSY	0.033	0.622	0.306	0.315
		NOAH	0.002	0.306	0.165	0.167
		TEMIR	0.018	0.345	0.168	0.179
		ZHANG	0	0.867	0.386	0.447
PhaDin (Forest)	Fall	CMAQ_J	0.017	0.912	0.303	0.295
		CMAQ_P	0.002	1.054	0.329	0.334
		DO3SE	0	1.11	0.19	0.15
		MESSY	0.08	1.011	0.359	0.338
		NOAH	0.003	0.694	0.195	0.178
		TEMIR	0.006	0.446	0.136	0.135
		ZHANG	0	0.215	0.058	0.053
	Spring	CMAQ_J	0.012	1.349	0.458	0.431
		CMAQ_P	0.004	1.327	0.478	0.477
		DO3SE	0.008	1.318	0.246	0.205
		MESSY	0.047	1.273	0.568	0.524
		NOAH	0.008	0.794	0.237	0.212
		TEMIR	0.003	0.518	0.222	0.219
		ZHANG	0	0.253	0.076	0.069
	Summer	CMAQ_J	0.03	0.659	0.213	0.195
		CMAQ_P	0.002	0.795	0.246	0.238
		DO3SE	0.009	0.36	0.08	0.066
		MESSY	0.067	0.766	0.251	0.23
		NOAH	0.009	0.611	0.134	0.123
		TEMIR	0.005	0.378	0.12	0.113
		ZHANG	0.005	0.127	0.038	0.035
	Winter	CMAQ_J	0.04	0.657	0.284	0.284
		CMAQ_P	0.004	0.68	0.296	0.317
		DO3SE	0.019	1.015	0.268	0.219
		MESSY	0.092	0.909	0.403	0.398
		NOAH	0.046	0.475	0.212	0.203
		TEMIR	0.007	0.233	0.116	0.121
		ZHANG	0.011	0.198	0.077	0.074
Quabbin (Forest)	Fall	CMAQ_J	0	0.261	0.059	0.049

		CMAQ_P	0.002	0.421	0.095	0.076
		DO3SE	0	0.656	0.163	0.126
		MESSY	0.018	0.44	0.168	0.149
		NOAH	0.002	0.84	0.232	0.22
		TEMIR	0.013	0.43	0.095	0.072
		ZHANG	0.003	0.271	0.1	0.098
	Spring	CMAQ_J	0.003	0.459	0.099	0.085
		CMAQ_P	0.005	0.648	0.172	0.154
		DO3SE	0.001	1.149	0.275	0.21
		MESSY	0.05	0.62	0.264	0.259
		NOAH	0.019	0.459	0.155	0.132
		TEMIR	0.013	0.376	0.129	0.108
		ZHANG	0.012	0.279	0.101	0.103
	Summer	CMAQ_J	0.002	0.397	0.09	0.061
		CMAQ_P	0	0.679	0.142	0.098
		DO3SE	0.005	0.662	0.139	0.102
		MESSY	0.032	0.621	0.199	0.162
		NOAH	0.007	1.026	0.313	0.293
		TEMIR	0.019	0.69	0.199	0.186
		ZHANG	0.01	0.554	0.117	0.112
US-Ne3-M (Crop)	Fall	CMAQ_J	0.005	0.253	0.07	0.058
		CMAQ_P	0.004	0.246	0.06	0.053
		DO3SE	0	0.143	0.04	0.029
		MESSY	0.011	0.266	0.095	0.084
		NOAH	0.01	0.333	0.097	0.086
		TEMIR	0.003	0.173	0.046	0.038
		ZHANG	0	0.32	0.094	0.085
	Spring	CMAQ_J	0.02	0.386	0.18	0.186
		CMAQ_P	0.021	0.338	0.158	0.164
		DO3SE	0.004	0.409	0.15	0.129
		MESSY	0.045	0.388	0.209	0.202
		NOAH	0.02	0.266	0.112	0.102
		TEMIR	0.008	0.316	0.144	0.141
		ZHANG	0.006	0.323	0.138	0.139
	Summer	CMAQ_J	0.005	0.595	0.196	0.184
		CMAQ_P	0.008	0.415	0.14	0.134
		DO3SE	0	0.453	0.152	0.136
		MESSY	0.026	0.424	0.175	0.168

		NOAH	0.004	0.477	0.143	0.132
		TEMIR	0.006	0.398	0.136	0.131
		ZHANG	0	0.327	0.123	0.118
US-Ne3-S (Crop)	Fall	CMAQ_J	0.009	0.253	0.078	0.067
		CMAQ_P	0.005	0.246	0.065	0.054
		DO3SE	0	0.112	0.014	0.007
		MESSY	0.019	0.266	0.115	0.109
		NOAH	0.014	0.333	0.113	0.102
		TEMIR	0.003	0.173	0.057	0.051
		ZHANG	0.003	0.32	0.106	0.094
	Spring	CMAQ_J	0.043	0.307	0.179	0.191
		CMAQ_P	0.021	0.324	0.161	0.17
		DO3SE	0.001	0.069	0.025	0.019
		MESSY	0.065	0.365	0.227	0.224
		NOAH	0.041	0.257	0.106	0.09
		TEMIR	0.016	0.283	0.149	0.145
		ZHANG	0.024	0.323	0.153	0.16
	Summer	CMAQ_J	0.005	0.595	0.196	0.184
		CMAQ_P	0.008	0.415	0.14	0.134
		DO3SE	0	0.528	0.113	0.084
		MESSY	0.026	0.424	0.175	0.168
		NOAH	0.004	0.477	0.143	0.132
		TEMIR	0.006	0.398	0.136	0.131
		ZHANG	0	0.327	0.123	0.118

Table S7. Statistics of the leaf-level sunlit stomatal O3 flux (ppb ms^{-1}). Statistics represent data within growing seasons and solar radiation beyond 50 Wm^{-2}.

Site	Season	Model	Min	Max	Mean	Median
Amberd (Grass)	Fall	CMAQ_P	0	0.229	0.082	0.087
		DO3SE	0	0.191	0.017	0.003
		TEMIR	0.006	0.182	0.06	0.056
		ZHANG	0	0.293	0.117	0.122
	Spring	CMAQ_P	0	0.204	0.085	0.094
		DO3SE	0	0.258	0.03	0.003
		TEMIR	0.007	0.232	0.077	0.068
		ZHANG	0	0.261	0.099	0.097
	Summer	CMAQ_P	0	0.27	0.14	0.157

		DO3SE	0	0.313	0.094	0.082
		TEMIR	0.008	0.296	0.139	0.142
		ZHANG	0.019	0.32	0.171	0.173
	Winter	CMAQ_P	0	0.158	0.038	0.036
		DO3SE	0	0.004	0.002	0.002
		TEMIR	0.007	0.064	0.025	0.024
		ZHANG	0.001	0.157	0.047	0.038
FI-Hyy (Forest)	Fall	CMAQ_P	0	0.126	0.06	0.06
		DO3SE	0	0.169	0.087	0.089
		TEMIR	0.001	0.091	0.041	0.037
		ZHANG	0.001	0.054	0.028	0.029
	Spring	CMAQ_P	0	0.191	0.061	0.054
		DO3SE	0.001	0.167	0.067	0.064
		TEMIR	0.003	0.178	0.058	0.052
		ZHANG	0.002	0.06	0.03	0.031
	Summer	CMAQ_P	0	0.201	0.077	0.073
		DO3SE	0.003	0.175	0.077	0.076
		TEMIR	0.003	0.192	0.075	0.07
		ZHANG	0.001	0.065	0.028	0.028
FR-Gri (Crop)	Fall	CMAQ_P	0	0.251	0.064	0.052
		DO3SE	0	0.19	0.014	0.002
		TEMIR	0.001	0.103	0.036	0.031
		ZHANG	0	0.12	0.03	0.019
	Spring	CMAQ_P	0	0.4	0.113	0.108
		DO3SE	0	0.829	0.142	0.048
		TEMIR	0.003	0.383	0.103	0.091
		ZHANG	0	0.388	0.086	0.071
	Summer	CMAQ_P	0	0.712	0.161	0.137
		DO3SE	0	0.873	0.134	0.065
		TEMIR	0.004	0.595	0.177	0.157
		ZHANG	0.004	0.416	0.128	0.116
	Winter	CMAQ_P	0	0.239	0.06	0.051
		DO3SE	0	0.25	0.006	0.004
		TEMIR	0	0.122	0.035	0.028
		ZHANG	0	0.169	0.028	0.018
IT-Cpz (Forest)	Fall	CMAQ_P	0	0.196	0.079	0.082
		DO3SE	0	0.194	0.046	0.028
		TEMIR	0.003	0.133	0.052	0.053

		ZHANG	0.001	0.102	0.039	0.041
	Spring	CMAQ_P	0	0.156	0.067	0.067
		DO3SE	0	0.16	0.043	0.034
		TEMIR	0.001	0.155	0.061	0.06
		ZHANG	0	0.101	0.04	0.04
	Summer	CMAQ_P	0	0.208	0.103	0.107
		DO3SE	0	0.203	0.018	0.007
		TEMIR	0.004	0.211	0.088	0.089
		ZHANG	0.001	0.104	0.041	0.042
MKenya (Grass)	Fall	CMAQ_P	0	0.169	0.091	0.097
		DO3SE	0	0.212	0.067	0.075
		TEMIR	0.033	0.201	0.111	0.112
		ZHANG	0.028	0.206	0.109	0.108
	Spring	CMAQ_P	0	0.163	0.088	0.093
		DO3SE	0	0.179	0.058	0.059
		TEMIR	0.042	0.188	0.106	0.104
		ZHANG	0.031	0.185	0.1	0.096
	Summer	CMAQ_P	0	0.198	0.088	0.09
		DO3SE	0	0.242	0.087	0.084
		TEMIR	0.006	0.22	0.105	0.103
		ZHANG	0.033	0.229	0.11	0.106
	Winter	CMAQ_P	0	0.223	0.102	0.108
		DO3SE	0	0.203	0.084	0.089
		TEMIR	0.066	0.228	0.129	0.129
		ZHANG	0.039	0.255	0.122	0.124
Peru (Grass)	Fall	CMAQ_P	0	0.171	0.09	0.092
		DO3SE	0	0.064	0.005	0.002
		TEMIR	0.005	0.152	0.074	0.074
		ZHANG	0.002	0.184	0.09	0.096
	Spring	CMAQ_P	0	0.227	0.123	0.129
		DO3SE	0	0.186	0.016	0.003
		TEMIR	0.007	0.211	0.107	0.11
		ZHANG	0.003	0.277	0.124	0.133
	Summer	CMAQ_P	0	0.218	0.1	0.103
		DO3SE	0	0.14	0.008	0.002
		TEMIR	0.005	0.204	0.091	0.094
		ZHANG	0.002	0.216	0.092	0.097
	Winter	CMAQ_P	0	0.147	0.086	0.09

		DO3SE	0	0.094	0.009	0.002
		TEMIR	0.005	0.128	0.063	0.066
		ZHANG	0.003	0.252	0.114	0.124
PhaDin (Forest)	Fall	CMAQ_P	0	0.159	0.054	0.053
		DO3SE	0	0.174	0.053	0.047
		TEMIR	0.002	0.178	0.061	0.06
		ZHANG	0.001	0.065	0.013	0.012
	Spring	CMAQ_P	0	0.252	0.086	0.082
		DO3SE	0.002	0.253	0.055	0.043
		TEMIR	0.001	0.371	0.107	0.102
		ZHANG	0.001	0.082	0.018	0.016
	Summer	CMAQ_P	0	0.128	0.04	0.038
		DO3SE	0.005	0.154	0.038	0.035
		TEMIR	0.001	0.175	0.054	0.05
		ZHANG	0.001	0.037	0.008	0.007
	Winter	CMAQ_P	0	0.123	0.059	0.062
		DO3SE	0.004	0.124	0.037	0.029
		TEMIR	0.002	0.111	0.054	0.057
		ZHANG	0.002	0.049	0.02	0.019
Quabbin (Forest)	Fall	CMAQ_P	0	0.153	0.039	0.035
		DO3SE	0	0.188	0.05	0.044
		TEMIR	0.005	0.274	0.046	0.037
		ZHANG	0.001	0.1	0.031	0.03
	Spring	CMAQ_P	0	0.265	0.069	0.061
		DO3SE	0.001	0.26	0.081	0.069
		TEMIR	0.006	0.259	0.068	0.058
		ZHANG	0.007	0.115	0.056	0.059
	Summer	CMAQ_P	0	0.158	0.037	0.027
		DO3SE	0.004	0.2	0.047	0.034
		TEMIR	0.004	0.306	0.082	0.075
		ZHANG	0.003	0.142	0.034	0.032
US-Ne3-M (Crop)	Fall	CMAQ_P	0	0.131	0.04	0.037
		DO3SE	0	0.068	0.018	0.014
		TEMIR	0.001	0.12	0.037	0.031
		ZHANG	0.003	0.143	0.045	0.04
	Spring	CMAQ_P	0	0.202	0.096	0.1
		DO3SE	0	0.239	0.097	0.096
		TEMIR	0.006	0.237	0.105	0.104

		ZHANG	0.006	0.251	0.097	0.098
	Summer	CMAQ_P	0	0.206	0.069	0.065
		DO3SE	0	0.239	0.074	0.068
		TEMIR	0.002	0.247	0.083	0.08
		ZHANG	0.005	0.23	0.065	0.062
US-Ne3-S (Crop)	Fall	CMAQ_P	0	0.131	0.039	0.034
		DO3SE	0	0.064	0.008	0.004
		TEMIR	0.001	0.118	0.04	0.033
		ZHANG	0.003	0.143	0.045	0.039
	Spring	CMAQ_P	0	0.201	0.093	0.1
		DO3SE	0	0.034	0.009	0.004
		TEMIR	0.019	0.202	0.105	0.103
		ZHANG	0.015	0.251	0.107	0.104
	Summer	CMAQ_P	0	0.206	0.069	0.065
		DO3SE	0	0.249	0.055	0.044
		TEMIR	0.002	0.247	0.083	0.08
		ZHANG	0.005	0.23	0.065	0.062

Table S8. Yearly accumulated PODy values (mmol m^{-2}) over the growing period (Exp#1, Base run).

Site	CMAQ_P	DO3SE	TEMIR	ZHANG
Amberd (Grass)	32.5	7.9	26.2	34.1
FI-Hyy (Forest)	15.1	7	13.3	2.3
FR-Gri (Crop)	9.3	5.3	8.3	3.6
IT-Cpz (Forest)	25.8	2.8	19.3	7.3
MKenya (Grass)	29.1	10.9	37.4	32.8
Peru (Grass)	25.2	2.6	19	26.6
PhaDin (Forest)	15.1	1.1	20.3	0.4
Quabbin (Forest)	10	8.2	16.8	6.5
US-Ne3-M (Crop)	11.3	13.5	13.6	10.5
US-Ne3-S (Crop)	8.7	0	11	7.9

Table S9. Accumulated PODy values (mmol m^{-2}) over the growing period in Exp#3 (Model Input data varying runs)

		Model Run

Site	Model	Base	LAI_14dEarly	LAI_14dLate	O3_minus40	O3_plus40	Q_minus30	Q_plus30	SWC_minus30	SWC_plus30	T_minus3	T_plus3
Amberd (Grass)	CMAQ_P	32.5	32.5	32.5	15.1	50.2	22.5	41	26	32.6	25.5	40.5
	DO3SE	7.9	NA	NA	7.9	7.9	7	8.9	0.7	13.9	6	10.6
	TEMIR	26.2	26.2	26.2	11.7	41.5	18.8	34.5	22.8	29.1	26	25.2
	ZHANG	34.1	34.1	34.1	17	51.5	34.1	34	34.1	34.1	29	38.7
FI-Hyy (Forest)	CMAQ_P	15.1	15.1	15.1	6.5	23.9	9.6	19.4	11.8	15.1	13.2	15.6
	DO3SE	7	NA	NA	7	7	3.6	NA	0	10.3	7.1	NA
	TEMIR	13.3	13.3	13.4	5.6	21.4	9.1	17.7	13.3	13.3	13.7	11.9
	ZHANG	2.3	2.3	2.3	0.2	5.4	1.6	3.2	2.3	2.3	3.3	1.2
FR-Gri (Crop)	CMAQ_P	9.3	9.3	9.2	1.6	21.7	3.8	15.5	5.8	10	6.6	12.5
	DO3SE	5.3	4.8	6	5.3	5.3	2.7	8.1	0	9.7	3.8	5.3
	TEMIR	8.3	8.4	8.2	1.4	19	4	14.3	7.1	8.8	9.6	6.3
	ZHANG	3.6	3.7	3.6	0.3	10.2	3.6	3.6	3.6	3.6	2.7	4.4
IT-Cpz (Forest)	CMAQ_P	25.8	25.8	25.8	11.9	39.8	16.8	33.6	25.4	25.8	22.8	28
	DO3SE	2.8	NA	NA	2.8	2.8	2.4	6.8	0	21.9	3.1	2.5
	TEMIR	19.3	19.3	19.3	8.2	30.6	12.8	26.8	18.9	20	21.8	16.1
	ZHANG	7.3	7.4	7.3	1.9	13.5	4.7	11.1	7.3	7.3	9.8	4.4
MKenya (Grass)	CMAQ_P	29.1	29.1	29.1	12.2	46	19.7	36.7	21.9	29.3	24.2	34.2
	DO3SE	10.9	NA	NA	10.9	10.9	10.1	11.8	1.1	16.7	8.1	12.4
	TEMIR	37.4	37.4	37.4	16.7	58.1	27.6	47.6	35.2	38.9	38.4	34.7
	ZHANG	32.8	32.8	32.8	14.5	51.2	32.8	32.7	32.8	32.8	29.8	33.8
Peru (Grass)	CMAQ_P	25.2	25.2	25.2	9.8	40.8	16.6	32.2	21.1	25.3	19.2	31.4
	DO3SE	2.6	NA	NA	2.6	2.6	2.6	2.6	0.6	2.7	0.7	8.7
	TEMIR	19	19	19	6.5	32	13.1	25.4	18	19.2	16	21.1
	ZHANG	26.6	26.6	26.6	11.1	42.4	26.7	26.5	26.6	26.6	21.8	30
PhaDin (Forest)	CMAQ_P	15.1	15.1	15.1	5.7	25.3	10.3	18	3	15.4	16.4	6.4
	DO3SE	1.1	NA	NA	1.1	1.1	0.3	2.8	0.1	2.2	1.2	1
	TEMIR	20.3	20.3	20.3	8.3	32.8	14.1	26.1	20.3	20.3	22.9	16.8
	ZHANG	0.4	0.4	0.4	0	1.2	0.1	0.7	0.4	0.4	1	0.1
Quabbin (Forest)	CMAQ_P	10	9.8	10.2	3.7	16.7	5.9	13.7	4	16	8.3	11.1
	DO3SE	8.2	7.4	7.6	8.2	8.2	5.9	13	0.1	19.3	7.9	8.2
	TEMIR	16.8	16.7	17	6.9	27	10.9	23.5	16.5	16.9	18.8	13.9
	ZHANG	6.5	6.2	6.8	1.8	12.1	4.2	10	6.5	6.5	8.9	3.9
US-Ne3-M (Crop)	CMAQ_P	11.3	11.2	11.4	4.8	18.1	8.5	13.5	3.6	12.7	10.9	11.5
	DO3SE	13.5	13.8	11.1	13.5	13.5	10.6	18.2	1.4	17.8	13.6	13.2

	TEMIR	13.6	13.5	13.7	6	21.4	9.2	18.3	12.8	14.7	15.7	10.9
	ZHANG	10.5	10.3	10.6	4.2	17	10.5	10.4	10.5	10.5	10	10.2
US-Ne3-S (Crop)	CMAQ_P	8.7	8.6	8.8	3.7	14	6.6	10.4	2.8	10	8.4	8.9
	DO3SE	0	0.2	0	0	0	0	0.1	0	0.1	0	0.1
	TEMIR	11	10.9	11.1	4.8	17.3	7.5	14.7	10.4	11.8	12.8	8.8
	ZHANG	7.9	7.8	8.1	3.1	13	7.9	7.9	7.9	7.9	7.8	7.5

Table S10. Percentage (%) change of PODy (mmol/m2) values in different runs of Exp#3 with respect to the Base runs.

Site	Model	LAI_14dEarly	LAI_14dLate	O3_minus40	O3_plus40	Q_minus30	Q_plus30	SWC_minus30	SWC_plus30	T_minus3	T_plus3
Amberd (Grass)	CMAQ_P	0	0	-54	54	-31	26	-20	0	-22	25
	DO3SE	NA	NA	0	0	-11	13	-91	76	-24	34
	TEMIR	0	0	-55	58	-28	32	-13	11	-1	-4
	ZHANG	0	0	-50	51	0	0	0	0	-15	13
FI-Hyy (Forest)	CMAQ_P	0	0	-57	58	-36	28	-22	0	-13	3
	DO3SE	NA	NA	0	0	-49	NA	-100	47	1	NA
	TEMIR	0	1	-58	61	-32	33	0	0	3	-11
	ZHANG	0	0	-91	135	-30	39	0	0	43	-48
FR-Gri (Crop)	CMAQ_P	0	-1	-83	133	-59	67	-38	8	-29	34
	DO3SE	-9	13	0	0	-49	53	-100	83	-28	0
	TEMIR	1	-1	-83	129	-52	72	-14	6	16	-24
	ZHANG	3	0	-92	183	0	0	0	0	-25	22
IT-Cpz (Forest)	CMAQ_P	0	0	-54	54	-35	30	-2	0	-12	9
	DO3SE	NA	NA	0	0	-14	143	-100	682	11	-11
	TEMIR	0	0	-58	59	-34	39	-2	4	13	-17
	ZHANG	1	0	-74	85	-36	52	0	0	34	-40
MKenya (Grass)	CMAQ_P	0	0	-58	58	-32	26	-25	1	-17	18
	DO3SE	NA	NA	0	0	-7	8	-90	53	-26	14
	TEMIR	0	0	-55	55	-26	27	-6	4	3	-7
	ZHANG	0	0	-56	56	0	0	0	0	-9	3
Peru (Grass)	CMAQ_P	0	0	-61	62	-34	28	-16	0	-24	25
	DO3SE	NA	NA	0	0	0	0	-77	4	-73	235
	TEMIR	0	0	-66	68	-31	34	-5	1	-16	11
	ZHANG	0	0	-58	59	0	0	0	0	-18	13

PhaDin (Forest)	CMAQ_P	0	0	-62	68	-32	19	-80	2	9	-58
	DO3SE	NA	NA	0	0	-73	155	-91	100	9	-9
	TEMIR	0	0	-59	62	-31	29	0	0	13	-17
	ZHANG	0	0	-100	200	-75	75	0	0	150	-75
Quabbin (Forest)	CMAQ_P	-2	2	-63	67	-41	37	-60	60	-17	11
	DO3SE	-10	-7	0	0	-28	59	-99	135	-4	0
	TEMIR	-1	1	-59	61	-35	40	-2	1	12	-17
	ZHANG	-5	5	-72	86	-35	54	0	0	37	-40
US-Ne3-M (Crop)	CMAQ_P	-1	1	-58	60	-25	19	-68	12	-4	2
	DO3SE	2	-18	0	0	-21	35	-90	32	1	-2
	TEMIR	-1	1	-56	57	-32	35	-6	8	15	-20
	ZHANG	-2	1	-60	62	0	-1	0	0	-5	-3
US-Ne3-S (Crop)	CMAQ_P	-1	1	-57	61	-24	20	-68	15	-3	2
	DO3SE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	TEMIR	-1	1	-56	57	-32	34	-5	7	16	-20
	ZHANG	-1	3	-61	65	0	0	0	0	-1	-5

Table S11. Absolute Change of PODy (mmol m^{-2}) values in different runs of Exp#3 with respect to the Base runs.

		Model Runs									
Site	Model	LAI_14dEarly	LAI_14dLate	O3_minus40	O3_plus40	Q_minus30	Q_plus30	SWC_minus30	SWC_plus30	T_minus3	T_plus3
Amberd (Grass)	CMAQ_P	0	0	-17.4	17.7	-10	8.5	-6.5	0.1	-7	8
	DO3SE	NA	NA	0	0	-0.9	1	-7.2	6	-1.9	2.7
	TEMIR	0	0	-14.5	15.3	-7.4	8.3	-3.4	2.9	-0.2	-1
	ZHANG	0	0	-17.1	17.4	0	-0.1	0	0	-5.1	4.6
FI-Hyy (Forest)	CMAQ_P	0	0	-8.6	8.8	-5.5	4.3	-3.3	0	-1.9	0.5
	DO3SE	NA	NA	0	0	-3.4	NA	-7	3.3	0.1	NA
	TEMIR	0	0.1	-7.7	8.1	-4.2	4.4	0	0	0.4	-1.4
	ZHANG	0	0	-2.1	3.1	-0.7	0.9	0	0	1	-1.1
FR-Gri (Crop)	CMAQ_P	0	-0.1	-7.7	12.4	-5.5	6.2	-3.5	0.7	-2.7	3.2
	DO3SE	-0.5	0.7	0	0	-2.6	2.8	-5.3	4.4	-1.5	0
	TEMIR	0.1	-0.1	-6.9	10.7	-4.3	6	-1.2	0.5	1.3	-2
	ZHANG	0.1	0	-3.3	6.6	0	0	0	0	-0.9	0.8

IT-Cpz (Forest)	CMAQ_P	0	0	-13.9	14	-9	7.8	-0.4	0	-3	2.2
	DO3SE	NA	NA	0	0	-0.4	4	-2.8	19.1	0.3	-0.3
	TEMIR	0	0	-11.1	11.3	-6.5	7.5	-0.4	0.7	2.5	-3.2
	ZHANG	0.1	0	-5.4	6.2	-2.6	3.8	0	0	2.5	-2.9
MKenya (Grass)	CMAQ_P	0	0	-16.9	16.9	-9.4	7.6	-7.2	0.2	-4.9	5.1
	DO3SE	NA	NA	0	0	-0.8	0.9	-9.8	5.8	-2.8	1.5
	TEMIR	0	0	-20.7	20.7	-9.8	10.2	-2.2	1.5	1	-2.7
	ZHANG	0	0	-18.3	18.4	0	-0.1	0	0	-3	1
Peru (Grass)	CMAQ_P	0	0	-15.4	15.6	-8.6	7	-4.1	0.1	-6	6.2
	DO3SE	NA	NA	0	0	0	0	-2	0.1	-1.9	6.1
	TEMIR	0	0	-12.5	13	-5.9	6.4	-1	0.2	-3	2.1
	ZHANG	0	0	-15.5	15.8	0.1	-0.1	0	0	-4.8	3.4
PhaDin (Forest)	CMAQ_P	0	0	-9.4	10.2	-4.8	2.9	-12.1	0.3	1.3	-8.7
	DO3SE	NA	NA	0	0	-0.8	1.7	-1	1.1	0.1	-0.1
	TEMIR	0	0	-12	12.5	-6.2	5.8	0	0	2.6	-3.5
	ZHANG	0	0	-0.4	0.8	-0.3	0.3	0	0	0.6	-0.3
Quabbin (Forest)	CMAQ_P	-0.2	0.2	-6.3	6.7	-4.1	3.7	-6	6	-1.7	1.1
	DO3SE	-0.8	-0.6	0	0	-2.3	4.8	-8.1	11.1	-0.3	0
	TEMIR	-0.1	0.2	-9.9	10.2	-5.9	6.7	-0.3	0.1	2	-2.9
	ZHANG	-0.3	0.3	-4.7	5.6	-2.3	3.5	0	0	2.4	-2.6
US-Ne3-M (Crop)	CMAQ_P	-0.1	0.1	-6.5	6.8	-2.8	2.2	-7.7	1.4	-0.4	0.2
	DO3SE	0.3	-2.4	0	0	-2.9	4.7	-12.1	4.3	0.1	-0.3
	TEMIR	-0.1	0.1	-7.6	7.8	-4.4	4.7	-0.8	1.1	2.1	-2.7
	ZHANG	-0.2	0.1	-6.3	6.5	0	-0.1	0	0	-0.5	-0.3
US-Ne3-S (Crop)	CMAQ_P	-0.1	0.1	-5	5.3	-2.1	1.7	-5.9	1.3	-0.3	0.2
	DO3SE	0.2	0	0	0	0	0.1	0	0.1	0	0.1
	TEMIR	-0.1	0.1	-6.2	6.3	-3.5	3.7	-0.6	0.8	1.8	-2.2
	ZHANG	-0.1	0.2	-4.8	5.1	0	0	0	0	-0.1	-0.4

Table S12. Accumulated PODy values (mmol m^{-2}) over the growing period in Exp#4 (Model GsMax/VcMax varying).

		Model Run		
Site	Model	100perc	120perc	80perc
Amberd (Grass)	CMAQ_P	32.5	38.4	26
	DO3SE	7.9	8.8	7
	TEMIR	26.2	32.5	19.9
	ZHANG	34.1	41.8	26.3

FI-Hyy (Forest)	CMAQ_P	15.1	17.9	12
	DO3SE	7	5.6	5.6
	TEMIR	13.3	16.4	10.1
	ZHANG	2.3	3.8	1
FR-Gri (Crop)	CMAQ_P	9.3	12.6	6
	DO3SE	5.3	6.1	4.4
	TEMIR	8.3	12.3	4.8
	ZHANG	3.6	6.6	1.5
IT-Cpz (Forest)	CMAQ_P	25.8	30.5	20.6
	DO3SE	2.8	4	2.8
	TEMIR	19.3	24	14.5
	ZHANG	7.3	10.3	4.6
MKenya (Grass)	CMAQ_P	29.1	34.5	23.1
	DO3SE	10.9	12.2	9.6
	TEMIR	37.4	45	29.1
	ZHANG	32.8	40.8	24.6
Peru (Grass)	CMAQ_P	25.2	30.9	19.1
	DO3SE	2.6	3.1	2.2
	TEMIR	19	24.3	13.6
	ZHANG	26.6	33.5	19.6
PhaDin (Forest)	CMAQ_P	15.1	18.1	11.8
	DO3SE	1.1	1.6	0.7
	TEMIR	20.3	24.2	16
	ZHANG	0.4	0.7	0.1
Quabbin (Forest)	CMAQ_P	10	12.2	7.6
	DO3SE	8.2	9.5	6.7
	TEMIR	16.8	20.5	12.9
	ZHANG	6.5	9.2	4
US-Ne3-M (Crop)	CMAQ_P	11.3	11.1	11.4
	DO3SE	13.5	15.1	11.7
	TEMIR	13.6	16.6	10.4
	ZHANG	10.5	13.6	7.4
US-Ne3-S (Crop)	CMAQ_P	8.7	8.5	8.8
	DO3SE	0	0.1	0
	TEMIR	11	13.3	8.4
	ZHANG	7.9	10.3	5.6

Table S13. Percentage (%) change of PODy (mmol/m2) values in different runs of Exp#4 with respect to the Base runs.			
	Model Runs		
Site	Model	120perc	80perc
Amberd (Grass)	CMAQ_P	18	-20
	DO3SE	11	-11
	TEMIR	24	-24
	ZHANG	23	-23
FI-Hyy (Forest)	CMAQ_P	19	-21
	DO3SE	-20	-20
	TEMIR	23	-24
	ZHANG	65	-57
FR-Gri (Crop)	CMAQ_P	35	-35
	DO3SE	15	-17
	TEMIR	48	-42
	ZHANG	83	-58
IT-Cpz (Forest)	CMAQ_P	18	-20
	DO3SE	43	0
	TEMIR	24	-25
	ZHANG	41	-37
MKenya (Grass)	CMAQ_P	19	-21
	DO3SE	12	-12
	TEMIR	20	-22
	ZHANG	24	-25
Peru (Grass)	CMAQ_P	23	-24
	DO3SE	19	-15
	TEMIR	28	-28
	ZHANG	26	-26
PhaDin (Forest)	CMAQ_P	20	-22
	DO3SE	45	-36
	TEMIR	19	-21
	ZHANG	75	-75
Quabbin (Forest)	CMAQ_P	22	-24
	DO3SE	16	-18
	TEMIR	22	-23
	ZHANG	42	-38
US-Ne3-M (Crop)	CMAQ_P	-2	1
	DO3SE	12	-13
	TEMIR	22	-24

	ZHANG	30	-30
US-Ne3-S (Crop)	CMAQ_P	-2	1
	DO3SE	NA	NA
	TEMIR	21	-24
	ZHANG	30	-29

S14. Absolute Change of PODy (mmol m^{-2}) values in different runs of Exp#4 with respect to the Base runs.			
	Model Runs		
Site	Model	120perc	80perc
Amberd (Grass)	CMAQ_P	5.9	-6.5
	DO3SE	0.9	-0.9
	TEMIR	6.3	-6.3
	ZHANG	7.7	-7.8
FI-Hyy (Forest)	CMAQ_P	2.8	-3.1
	DO3SE	-1.4	-1.4
	TEMIR	3.1	-3.2
	ZHANG	1.5	-1.3
FR-Gri (Crop)	CMAQ_P	3.3	-3.3
	DO3SE	0.8	-0.9
	TEMIR	4	-3.5
	ZHANG	3	-2.1
IT-Cpz (Forest)	CMAQ_P	4.7	-5.2
	DO3SE	1.2	0
	TEMIR	4.7	-4.8
	ZHANG	3	-2.7
MKenya (Grass)	CMAQ_P	5.4	-6
	DO3SE	1.3	-1.3
	TEMIR	7.6	-8.3
	ZHANG	8	-8.2
Peru (Grass)	CMAQ_P	5.7	-6.1
	DO3SE	0.5	-0.4
	TEMIR	5.3	-5.4
	ZHANG	6.9	-7
PhaDin (Forest)	CMAQ_P	3	-3.3
	DO3SE	0.5	-0.4
	TEMIR	3.9	-4.3

	ZHANG	0.3	-0.3
Quabbin (Forest)	CMAQ_P	2.2	-2.4
	DO3SE	1.3	-1.5
	TEMIR	3.7	-3.9
	ZHANG	2.7	-2.5
US-Ne3-M (Crop)	CMAQ_P	-0.2	0.1
	DO3SE	1.6	-1.8
	TEMIR	3	-3.2
	ZHANG	3.1	-3.1
US-Ne3-S (Crop)	CMAQ_P	-0.2	0.1
	DO3SE	0.1	0
	TEMIR	2.3	-2.6
	ZHANG	2.4	-2.3

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