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Supplementary Materials:

An Empirical Model of Gross Primary Productivity (GPP) and Relations between GPP and Its Driving Factors, Biogenic Volatile Organic Compounds in a Subtropical Conifer Plantation in China

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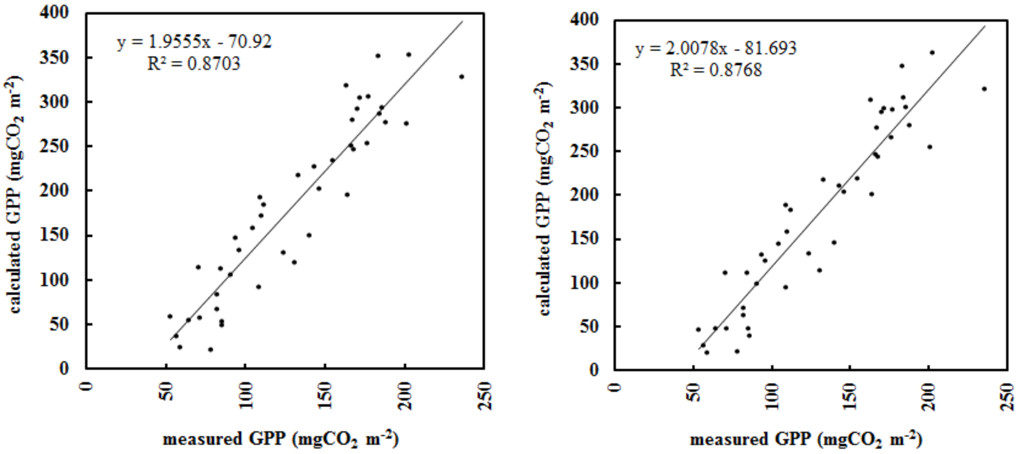

Figure S1. Scatter plot of calculated versus measured monthly sums of GPP in Qianyanzhou subtropical coiferous plantation under atmospheric conditions S/Q≥0.5, using the 3-factor (**left**) and 2-factor (**right**) EMGPP models.

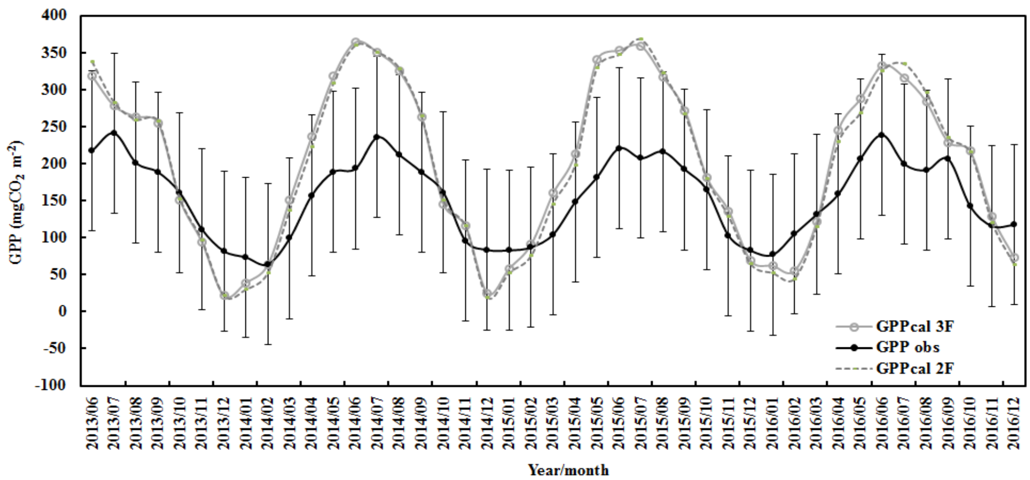

Figure S2. Observed and calculated monthly sums of GPP using the 3-factor and 2-factor EMGPP models (GPP_{obs}, $GPP_{cal\ 3F}$ and $GPP_{cal\ 2F}$, respectively) with error bars showing 2 times standard deviations of the observed GPPs during 2013-2016 (S/Q=0-1).

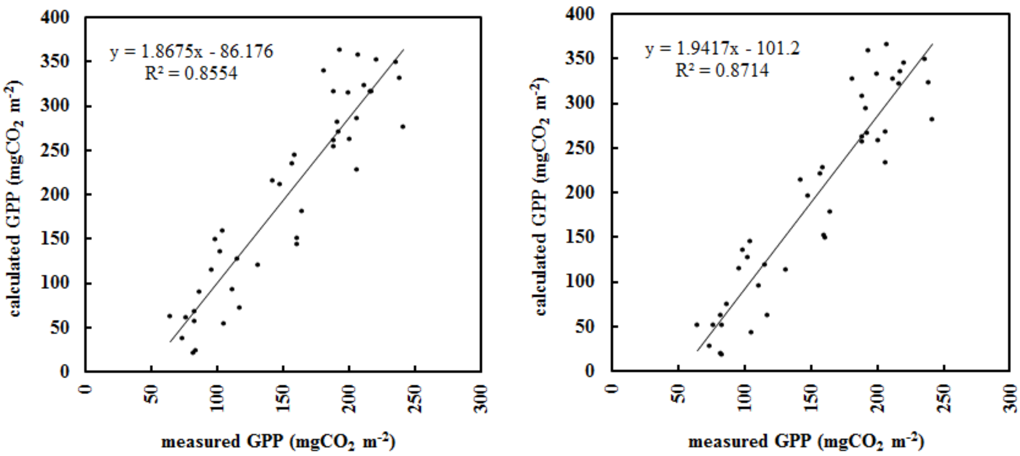

Figure S3. Scatter plot of calculated versus measured monthly sums of GPP in Qianyanzhou subtropical coniferous plantation under all-sky conditions (S/Q=0-1), using the 3-factor (**left**) and 2-factor (**right**) EMGPP models.

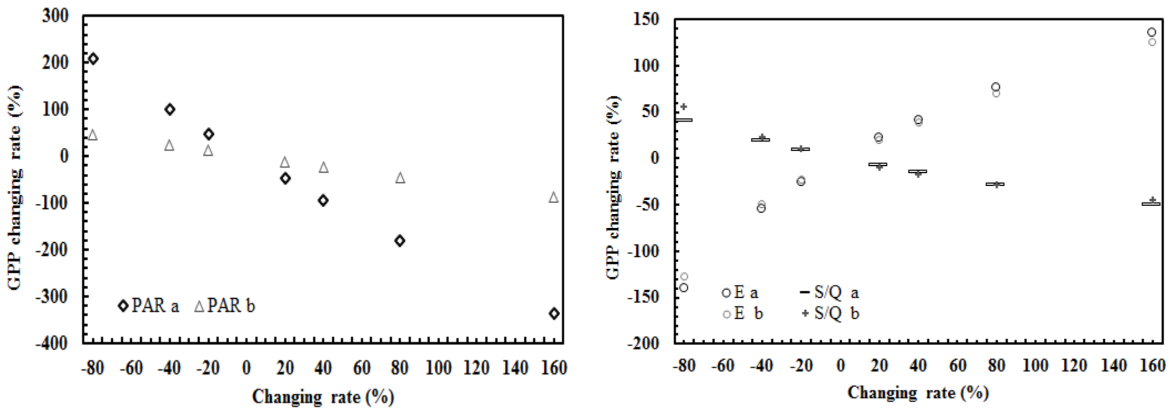

Figure S4. GPP change rates (%) with the change in one factor and other factors kept at their original levels under realistic atmospheric conditions. a and b represent the change rates that respond to each influencing factor for S/Q<0.5 and S/Q≥0.5, respectively. (GPP change rates with the change in PAR, left, and E and S/Q, right)

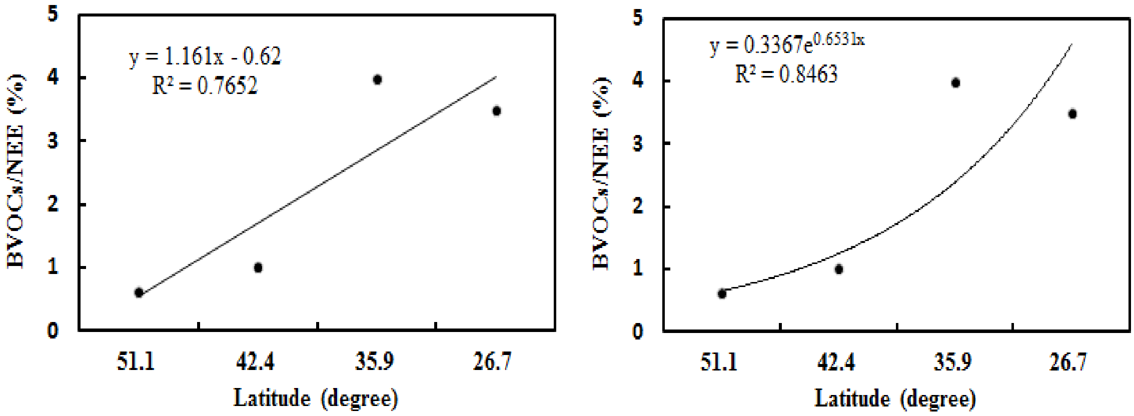

Figure S5. Linear (**left**) and nonlinear (**right**) relationships between BVOCs/NEE and latitude for the forests. The lines are linear and nonlinear fits to the data for BVOCs/NEE and latitude.

Table S1. Same as Table 9 but for annual sums of GPP simulations (mg CO_2 m^{-2}) (S/Q≥0.5).

3-F Time period	δ_{avg}	GPP_{cal}	GPP_{obs}	cal/obs	2-F Time period	δ_{avg}	GPP_{cal}	GPP_{obs}	cal/obs
2013	26.60	1189.02	939.18	1.26	2013	26.50	1188.05	939.18	1.26
2014	51.24	2205.43	1458.24	1.51	2014	46.94	2142.67	1458.24	1.47
2015	54.36	2317.56	1501.39	1.54	2015	49.96	2251.46	1501.39	1.50
2016	27.92	2151.60	1682.05	1.28	2016	25.46	2110.29	1682.05	1.25
2013–2014	41.59	3394.45	2397.42	1.42	2013–2014	38.93	3330.72	2397.42	1.39
2013–2016	40.90	7863.61	5580.85	1.41	2013–2016	37.84	7692.47	5580.85	1.38

Table S2. Same as Table 7 and for hourly GPP (mg CO_2 m^{-2}) simulations (S/Q=0-1) using a 3-factor model.

Time period	δ_{avg}	NMSE	σ_{cal}	σ_{obs}	cal/obs	n	MAD (mg CO_2 m^{-2} s^{-1})	MAD (%)	RMSE (mg CO_2 m^{-2} s^{-1})	RMSE (%)
2013	117.15	0.490	0.374	0.291	1.15	2493	0.287	59.43	0.535	111.05
2014	148.47	0.612	0.392	0.295	1.37	4181	0.301	71.90	0.549	130.99
2015	146.85	0.614	0.382	0.292	1.43	4065	0.329	74.79	0.574	130.36
2016	149.48	0.605	0.369	0.314	1.24	3880	0.347	71.33	0.590	121.03
2013–2014	136.77	0.563	0.390	0.295	1.28	6674	0.296	66.83	0.544	122.88
2013–2016	142.74	0.586	0.381	0.300	1.31	14748	0.318	70.03	0.398	87.60

Table S3. Same as Table S2 and for hourly GPP (mg CO_2 m^{-2}) simulations (S/Q=0-1) using a 2-factor model.

Time period	δ_{avg}	NMSE	σ_{cal}	σ_{obs}	cal/obs	n	MAD (mg CO_2 m^{-2} s^{-1})	MAD (%)	RMSE (mg CO_2 m^{-2} s^{-1})	RMSE (%)
2013	112.71	0.496	0.369	0.291	1.17	2493	0.281	58.31	0.530	110.00
2014	140.95	0.557	0.376	0.295	1.34	4181	0.289	69.00	0.536	127.94
2015	138.83	0.534	0.364	0.292	1.39	4065	0.306	69.62	0.554	125.78
2016	140.94	0.564	0.355	0.314	1.22	3880	0.329	67.57	0.574	117.80
2013–2014	130.40	0.532	0.373	0.295	1.27	6674	0.286	64.65	0.535	120.87
2013–2016	135.55	0.538	0.366	0.300	1.29	14748	0.303	66.62	0.378	83.23

Table S4. Same as Table 9 and for simulations of monthly sums of GPP (mg CO_2 m^{-2}) (S/Q=0-1).

3-F Time period	δ_{avg}	δmax	GPP_{cal}	GPP_{obs}	cal/obs	2-F Time period	δavg	δmax	GPP_{cal}	GPP_{obs}	cal/obs
2013	31.80	73.50	197.43	171.70	1.15	2013	32.80	73.62	201.21	171.70	1.17
2014	45.86	88.40	199.72	146.00	1.37	2014	46.37	86.21	195.03	146.00	1.34
2015	41.72	87.58	212.56	149.11	1.43	2015	40.40	81.43	206.60	149.11	1.39
2016	35.53	58.44	196.01	157.48	1.25	2016	37.51	67.51	191.66	157.48	1.22
2013–2014	40.68	88.40	198.88	155.47	1.28	2013–2014	41.37	86.21	197.31	155.47	1.27
2013–2016	39.53	88.40	201.90	154.26	1.31	2013–2016	40.02	86.21	198.32	154.26	1.29

Table S5. Same as Table 9 but for annual sums of GPP simulations (mg CO_2 m^{-2}) (S/Q=0-1).

3-F Time period	δ_{avg}	GPP_{cal}	GPP_{obs}	cal/obs	2-F Time period	δavg	GPP_{cal}	GPP_{obs}	cal/obs
2013	14.99	1382.02	1201.88	1.15	2013	17.19	1408.45	1201.88	1.17
2014	36.79	2396.67	1752.05	1.37	2014	33.58	2340.39	1752.05	1.34
2015	42.56	2550.77	1789.31	1.43	2015	38.55	2479.16	1789.31	1.39
2016	24.47	2352.14	1889.81	1.24	2016	21.70	2299.12	1889.81	1.22
2013–2014	27.92	3778.69	2953.92	1.28	2013–2014	26.91	3748.84	2953.92	1.27
2013–2016	30.88	8681.61	6633.04	1.41	2013–2016	28.57	8527.92	6633.04	1.29

Table S6. GPP change rates (%) for S/Q<0.5 and S/Q≥0.5 due to the change of one factor (%), while keeping all other factors at their original value. The averages of PAR, E, S/Q and air temperature (PAR_{avg}, E_{avg}, $(S/Q)_{avg}$, T_{avg}) in different time periods for S/Q<0.5 and S/Q≥0.5 are also given.

S/Q	PAR		E		S/Q		PAR_{avg}	T_{avg}	E_{avg}	$(S/Q)_{avg}$
	+20%	–20%	+20%	–20%	+20%	–20%	μmol m^{-2} s^{-1}	℃	hPa	
S/Q<0.5	–47.23	49.05	21.89	–24.74	–8.19	8.91	4.57	32.50	27.98	0.38
S/Q≥0.5	–11.46	11.60	20.09	–22.64	–9.04	10.68	3.37	28.27	27.71	0.76

Table S7. Isoprene and monoterpene emission changing rates (Iso REA and MT REA, %) for using relaxed eddy accumulation technique (REA) caused by the change of one factor (%), while keeping all other factors at their original value [27].

	PAR		E		S/Q	
	+20%	–20%	+20%	–20%	+20%	–20%
Iso REA	161.6	–156.2	86.9	–90.7	28.7	–30.6
MT REA	31.9	–26.2	6.4	–7.1	1.8	–2.0

[27] Bai, J.; Duhl, T. A primary generalized empirical model of BVOC emissions for some typical forests in China. *Atmos. Pollut. Res.* **2021**, *12*, 101126. https://doi.org/10.1016/j.apr.2021.101126.