Supplementary Information for "Evapotranspiration partitioning for three agro-ecosystems with contrasting moisture conditions: a comparison of an isotope method and a two-source model calculation"

Zhongwang Wei[1,2], Xuhui Lee[1,2], Xuefa Wen[3], Wei Xiao[1]

[1] Yale-NUIST Center on Atmospheric Environment, Nanjing University of Information Science & Technology, Nanjing, Jiangsu, China

[2] School of Forestry and Environmental Studies, Yale University, New Haven, Connecticut, USA

[3]Key Laboratory of Ecosystem Network Observation and Modeling, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing, China.

Corresponding authors: Zhongwang Wei (zhongwang.wei@yale.edu) and Xuhui Lee (xuhui.lee@yale.edu)

Table S1 Description of the isotopic sub-model. D0 is the vapor pressure deficit constant (kPa), NSS is non-steady state isotopic behavior of transpiration and W is bulk leaf water content (g m^{-2})

Site	Crop	Observation year	Field condition	Optimized D0	NSS	W variation	Péclet effect
Mase	Rice	2014	Flooding	0.245	Yes	No	Yes
Luancheng	Wheat	2008	Irrigated	0.250	Yes	Yes	Yes
Luancheng	Corn	2008	Irrigated	0.160	Yes	Yes	Yes
US-NE1	Soybean	2001	Irrigated	0.35	-	-	-
US-NE1	Corn	2002	Irrigated	0.40	-	-	-
US-NE2	Soybean	2001	Irrigated	0.35	-	-	-
US-NE2	Corn	2002	Irrigated	0.40	-	-	-
US-NE3	Soybean	2001	Rain-fed	0.35	-	-	-
US-NE3	Corn	2002	Rain-fed	0.40	-	-	-
US-RO3	Soybean	2006	Rain-fed	0.35	-	-	-

Table S2. Sensitivity coefficient (SC_j) for the simulated latent heat flux (LE) and transpiration fraction (T/ET) for Luancheng and Mase sites. A positive SC_j value of 0.1 means that a 1% increase in the assigned variable will induce a 0.1% increase in the simulated result. S-W represents Shuttleworth and Wallace model. SSA indicates steady state isotopic behavior of transpiration and NSS indicates non-steady state isotopic behavior of transpiration.

Variable	LE (S-W model)			T/ET (S-W model)			T/ET (Isotope, SSA)			T/ET (Isotope, NSS)		
	Rice	Wheat	Corn	Rice	Wheat	Corn	Rice	Wheat	Corn	Rice	Wheat	Corn
Rn	1.04	0.45	-0.61	-0.60	0.12	-0.32	0.00	0.00	0.00	0.06	0.04	0.01
U	-0.01	-0.01	-0.03	0.04	0.00	0.03	0.00	0.00	0.00	-0.00	-0.11	0.01
Ta	0.30	0.53	0.72	-0.31	0.05	-0.23	0.00	-0.02	-0.18	0.07	0.01	-0.14
Ts	0.00	0.00	0.00	0.00	0.00	0.00	-0.11	0.01	-0.03	0.06	-0.02	-0.13
RH	-0.92	-0.59	-0.91	-0.30	0.01	-0.11	-0.45	-0.04	0.17	-0.48	0.06	0.01
P	-0.10	-0.34	-0.36	-0.32	0.10	-0.14	0.00	0.00	0.00	-0.01	-0.01	0.00
LAI	0.04	0.20	0.22	0.43	0.10	0.36	0.00	0.00	0.00	0.00	0.04	0.01
θ_s	0.00	0.21	0.62	0.00	0.23	-0.07	0.00	0.00	0.00	0.00	0.01	-0.01
W	NA	NA	NA	NA	NA	NA	0.00	0.00	0.00	-0.05	-0.07	0.03
δ_v	NA	NA	NA	NA	NA	NA	-0.39	0.01	-0.37	-0.36	-0.09	-0.25
δ_s	NA	NA	NA	NA	NA	NA	0.17	-0.01	0.00	0.16	0.01	0.00
δ_x	NA	NA	NA	NA	NA	NA	0.00	-0.16	0.9	0.00	-0.17	0.18
δ_{ET}	NA	NA	NA	NA	NA	NA	-0.29	-0.21	-0.24	-0.39	-0.21	-0.25

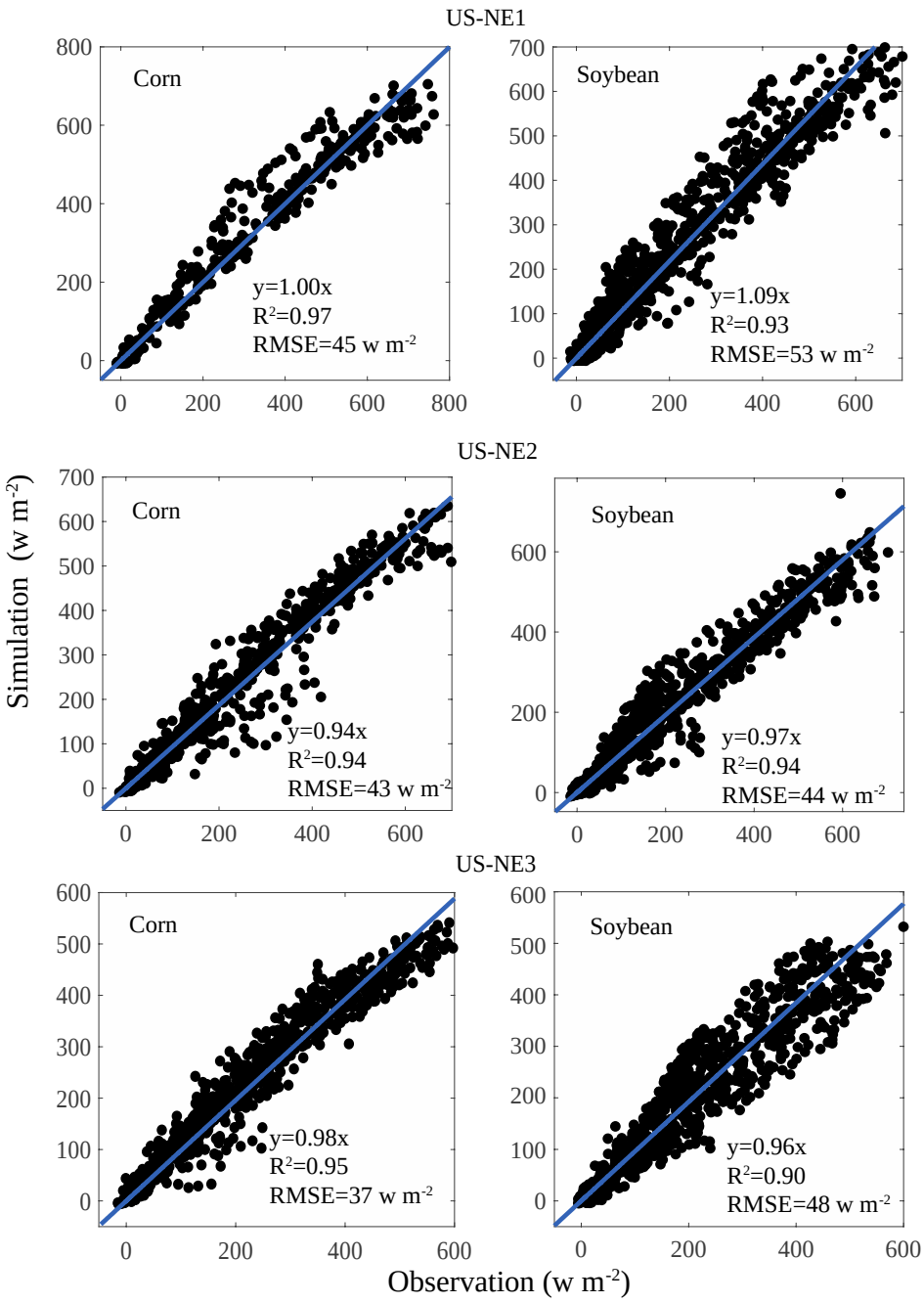

Figure S1. Comparison of hourly model estimated and observed ET (Data those flux imbalance > 40% and u*<0.05 are excluded) using AmeriFlux US-NE1, US-NE2 and US-NE3 datasets (2001 for corn and 2002 for Soybean).

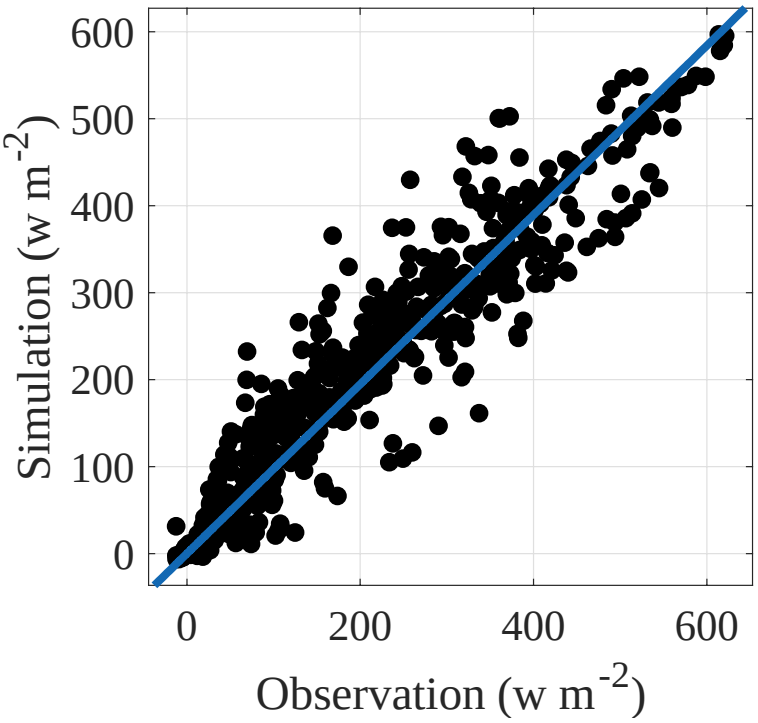

Figure S2. Comparison of hourly model estimated and observed ET (Data those flux imbalance > 40% and u*<0.05 are excluded) using AmeriFlux US-RO3 datasets (2006 June - August).

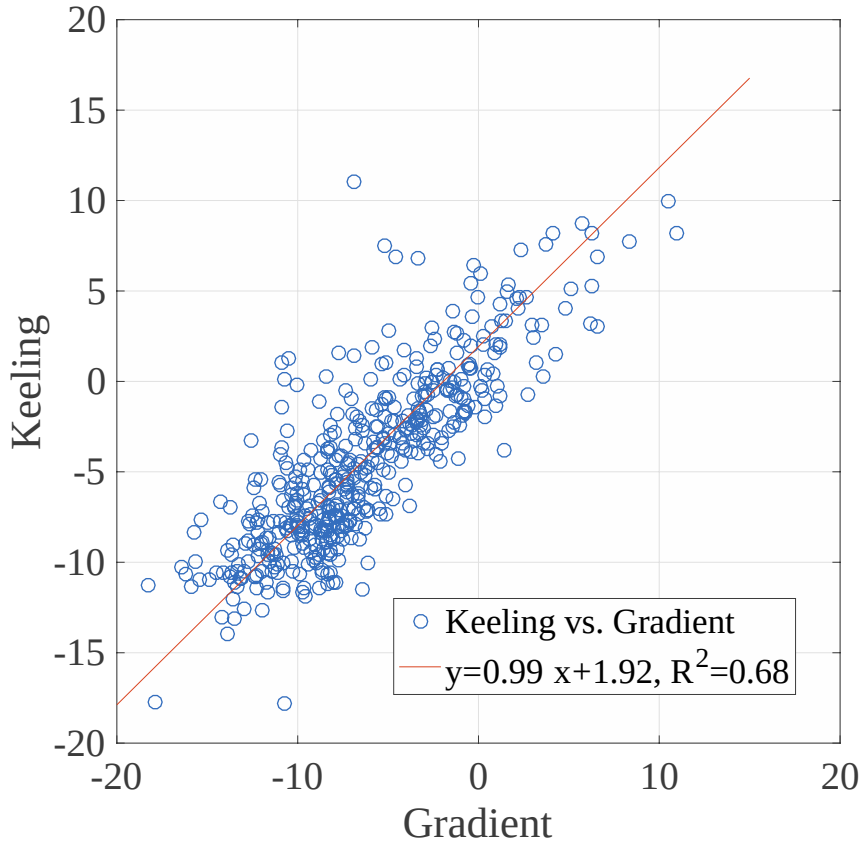

Figure S3. Comparison of hourly δ_{ET} estimated with the Keeling plot and the gradient approach during midday periods (11:00 to 15:00 local time). Calculations were made using data obtained from two measurement heights. The heights of the two intakes increased over the season from 0.6 m and 1.6 m above the ground at the beginning to 2.6 m and 3.6 m by the end of the maize season to adjust for canopy growth. Water vapor isotope experiment was conducted at Heihe site (arid artificial oasis), Zhangye, China (38.85N, 100.37E) from May 27, 2012 to Sep 22, 2012 (Wen et al., 2016). The Keeling plot analysis was made with high frequency (2 Hz) observations of the vapor mole fraction and the $^{18}O/^{16}O$ ratio for each hourly interval. The gradient method determined the δ_{ET} using the gradient measurements of the mole fractions of the major and the minor isotopologues measured at the two intake heights (Lee et al., 2007).