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Supplement of

Improving the representation of cropland sites in the Community Land Model (CLM) version 5.0

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Evaluation of default parameterization for temperate corn (supplement to section 4.2)

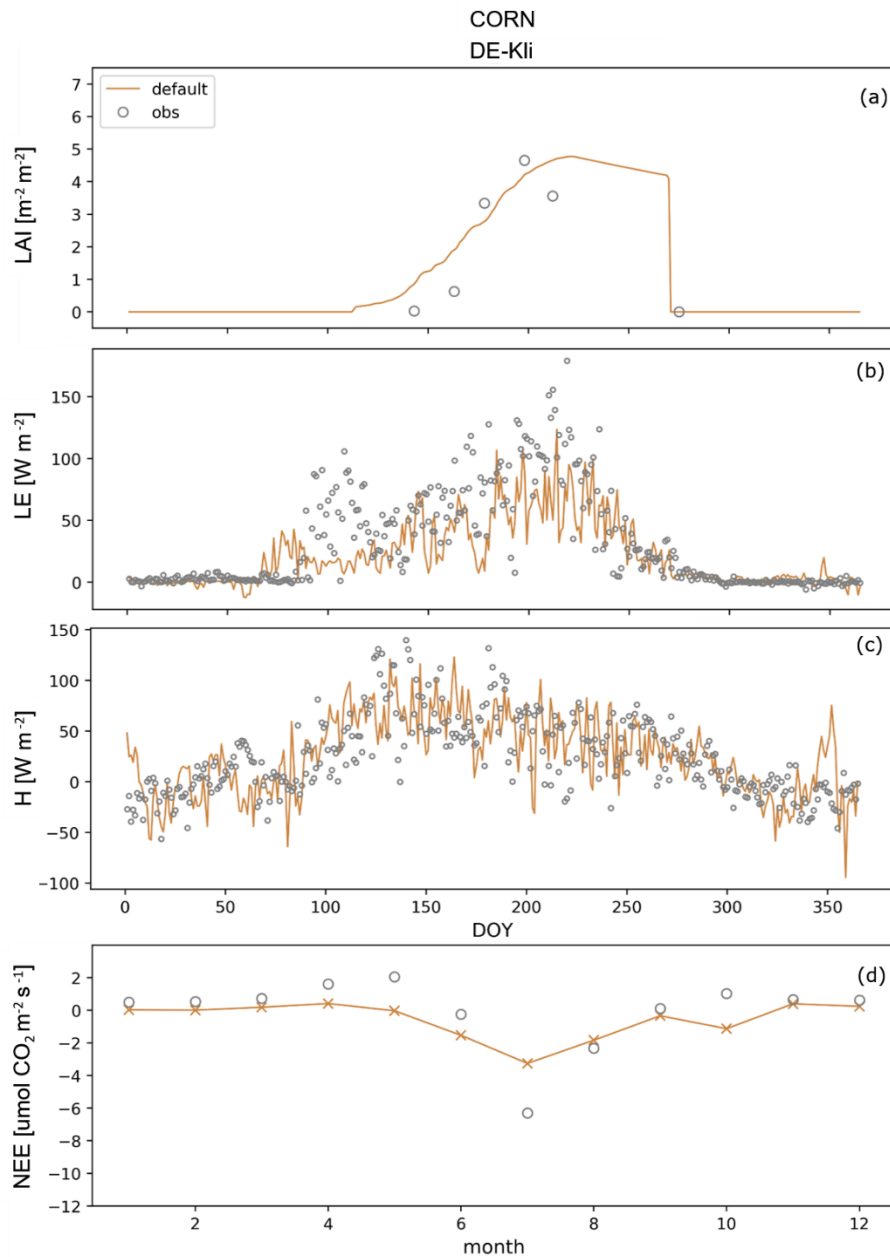


Figure S1: Daily simulation results of (a) LAI, (b) LE, (c) H, and (d) monthly averaged NEE rates over all corn years at DE-Kli using the default parameterization (orange). Site observation data on LAI (all available observations plotted) and fluxes (averaged over all respective years) are indicated in grey. Corresponding statistical analysis is listed in Table S1.

There is already a specific set of parameters available for the CFT temperate corn. This parameterization was tested for the site DE-Kli, where it resulted in a reasonable representation of seasonal LAI variation and magnitude (Figure S1). A moderate correlation was obtained for latent heat flux (0.56), with underestimation of latent heat flux during the early growing cycle of corn, as well as for sensible heat flux (0.41). Similar to winter wheat at BE-Lon and DE-RuS, the simulated NEE shows a negative bias with an underestimation of peak NEE (Figure S1, Table S1).

Table S1: Bias, root mean square error (RMSE) and Pearson correlation coefficient (r) for the simulated daily NEE [$\mu\text{mol CO}_2 \text{ W m}^{-2} \text{ s}^{-1}$], LE [W m^{-2}], H [W m^{-2}] and Rn [W m^{-2}]) using the default parameterization for the CFT temperate corn at DE-Kli. Values were calculated for the time between recorded planting and harvest dates (averaged over all respective CFT years at each site) using simulation output and observation data at daily time step.

CFT		CORN
Site		DE-Kli
Year(s)		2007
Parameter set		<i>default</i>
<i>NEE</i>		
Bias		-1
RMSE		2.59
r		0.46
<i>LE</i>		
Bias		-0.33
RMSE		37.82
r		0.56
<i>H</i>		
Bias		-0.01
RMSE		39.21
r		0.41
<i>Rn</i>		
Bias		-0.12
RMSE		52.33
r		0.51

Annual metrics for winter wheat, temperate corn, sugar beet and potatoes simulation runs

Table S2: Bias, root mean square error (RMSE) and Pearson correlation coefficient (r) of the simulated daily NEE [$\mu\text{mol CO}_2/\text{m}^2/\text{s}$], LE [W/m^2], H [W/m^2] and Rn [W/m^2] averaged for all winter wheat years at the sites BE-Lon, DE-RuS, DE-RuM and DE-Kli respectively, simulated with CLM_WW and the control configuration.

CFT	WINTERWHEAT								
	Site	BE-Lon		DE-RuS		DE-RuM		DE-Kli	
Year(s)		2010/2011 2012/2013 2014/2015 2016/2017		2017/2018		2016/2017		2010/2011 2015/2016	
Model	<i>control</i>	<i>CLM_WW</i>	<i>control</i>	<i>CLM_WW</i>	<i>control</i>	<i>CLM_WW</i>	<i>control</i>	<i>CLM_WW</i>	
<i>NEE</i>									
Bias	-0.9	-0.36	-1.06	-0.41	-	-	-0.48	0.97	
RMSE	5.52	4.96	5.61	5.03	-	-	2.5	6.82	
r	-0.03	0.43	0.26	0.46	-	-	0.56	0.28	
<i>LE</i>									
Bias	-0.73	-0.34	-0.40	-0.30	-55.55	-27.83	-0.48	-0.10	
RMSE	52.24	44.37	38.40	36.53	53.07	44.02	37.01	35.73	
r	0.44	0.52	0.45	0.72	0.47	0.57	0.61	0.71	
<i>H</i>									
Bias	2.50	1.20	0.96	0.79	-28.00	-16.72	1.83	0.42	
RMSE	41.30	31.49	30.19	25.64	37.79	32.23	32.33	30.83	
r	0.48	0.53	0.68	0.78	0.47	0.53	0.47	0.63	
<i>Rn</i>									
Bias	-0.21	-0.11	-0.09	-0.05	-11.29	-0.06	-0.08	-0.04	

RMSE	34.77	35.49	35.17	35.95	16.05	39.23	38.76	38.21
r	0.78	0.79	0.79	0.79	0.82	0.78	0.78	0.80

Table S3: Bias, root mean square error (RMSE) and Pearson correlation coefficient (r) for the simulated daily NEE [$\mu\text{mol CO}_2 \text{ W m}^{-2} \text{ s}^{-1}$], LE [W m^{-2}], H [W m^{-2}] and Rn [W m^{-2}]) using the crop-specific parameterization (*specific*) for the CFTs sugar beet and potatoes at the sites BE-Lon and DE-RuS respectively. Results are compared to those from the control simulation runs (*control*). Values were calculated over the whole year (averaged over all respective CFT years at each site) using simulation output and observation data at daily time step.

CFT	CORN		SUGARBEET			POTATOES			
Site	DE-Kli	DE-RuS	BE-Lon		DE-RuS	BE-Lon			
Year(s)	2007	2017	2004 2008 2016		2019	2006 2010 2014 2018			
Parameter set	<i>control</i>	<i>control</i>	<i>crop-specific</i>	<i>control</i>	<i>crop-specific</i>	<i>control</i>	<i>crop-specific</i>	<i>control</i>	<i>crop-specific</i>
NEE									
Bias	-0.99	-0.81	-0.73	-0.41	-0.39	-	-	6.96	6.03
RMSE	2.59	7.31	6.21	5.83	4.41	-	-	3.73	3.54
r	0.26	0.05	0.31	0.16	0.56	-	-	0.43	0.55
LE									
Bias	-0.93	-0.45	-0.07	-0.46	-0.41	-0.37	0.16	-0.98	-0.47
RMSE	51.65	47.84	20.43	49.39	39.88	48.9	40.59	53.14	38.54
r	0.24	0.38	0.61	0.43	0.65	0.23	0.55	0.2	0.39
H									
Bias	0.04	4.89	1.45	4.15	3.37	1.57	-0.29	0.1	0.14
RMSE	35.12	35.43	14.37	33.39	27.85	42.14	27.11	30.06	30.09
r	0.58	0.32	0.83	0.31	0.59	0.17	0.41	0.44	0.47
Rn									
Bias	-0.22	-0.08	0.01	-0.2	-0.18	-0.08	0.02	-	-
RMSE	43.09	15.75	11.7	32.01	30.83	39.86	40.82	-	-
r	0.79	0.81	0.82	0.63	0.64	0.69	0.7	-	-