Supplement of Hydrol. Earth Syst. Sci., 27, 2463–2478, 2023
https://doi.org/10.5194/hess-27-2463-2023-supplement

Hydrology and Earth System Sciences
Open Access

Supplement of

The precision of satellite-based net irrigation quantification in the Indus and Ganges basins

Søren J. Kragh et al.

Correspondence to: Søren J. Kragh (sjk@geus.dk)

Supplementary material

Table S1. Overview of calibration/validation statistics, calibrated parameters, and parameter bounds for all 16 calibrations.

	calibration (2003 - 2007)		validation (2008 - 2012)													
	MAE	SPAEF	MAE	SPAEF	canintfact	ptflowconst	ptflowdb	rotfrcoffore	rotfrcofsa	rotfrcofcl	fcmin	fcdelta	infshapef	pet_ap	pet_b	pet_c
Parameter range (low)					0.15	0.8	-0.27	0.94	0.0003	0.94	0.05	0.05	0.2	0.1	0.8	-1.2
Parameter range (high)					0.4	1.2	-0.07	0.97	0.1	0.999	0.15	0.3	1	0.3	1.4	-0.8
NTSG_CHIRPS	13.41	0.63	16.13	0.66	0.150	0.800	-0.270	0.942	0.044	0.996	0.142	0.069	0.200	0.196	0.953	-0.943
NTSG_ERA5-Land	15.07	0.63	17.70	0.63	0.150	0.857	-0.200	0.944	0.074	0.978	0.133	0.148	0.269	0.156	0.800	-0.930
NTSG_MSWEP	15.73	0.60	19.36	0.64	0.150	0.800	-0.270	0.940	0.051	0.978	0.139	0.084	0.387	0.110	0.875	-1.002
NTSG_PERSIAN-CDR	15.19	0.67	18.21	0.61	0.173	0.964	-0.270	0.940	0.084	0.997	0.145	0.053	0.200	0.100	1.044	-0.873
NTSG_TRMM	14.36	0.64	17.42	0.62	0.178	0.826	-0.270	0.940	0.087	0.992	0.104	0.210	0.200	0.206	0.958	-0.800
FLUXCOM_CHIRPS	15.95	0.75	15.82	0.73	0.243	1.175	-0.148	0.949	0.057	0.972	0.118	0.127	0.334	0.194	1.199	-0.800
FLUXCOM_ERA5-Land	15.39	0.74	16.06	0.72	0.150	1.025	-0.128	0.965	0.026	0.970	0.101	0.250	0.503	0.116	1.149	-0.816
FLUXCOM_MSWEP	14.92	0.74	16.44	0.76	0.278	1.124	-0.270	0.940	0.100	0.955	0.150	0.116	0.554	0.195	0.977	-1.001
FLUXCOM_PERSIAN-CDR	14.56	0.77	15.46	0.65	0.242	1.128	-0.146	0.970	0.074	0.999	0.081	0.108	0.200	0.108	1.308	-1.117
FLUXCOM_TRMM	15.55	0.73	16.45	0.70	0.196	0.961	-0.094	0.966	0.041	0.968	0.050	0.257	0.339	0.241	1.005	-1.029
PML-v2_CHIRPS	16.78	0.75	20.26	0.79	0.244	0.819	-0.241	0.940	0.100	0.966	0.129	0.236	1.000	0.300	0.814	-1.025
PML-v2_ERA5-Land	15.05	0.74	20.00	0.78	0.400	0.851	-0.134	0.953	0.084	0.957	0.132	0.266	1.000	0.227	0.800	-1.200
PML-v2_MSWEP	15.56	0.63	20.34	0.68	0.280	0.800	-0.197	0.941	0.091	0.959	0.150	0.238	0.980	0.300	0.800	-1.021
PML-v2_PERSIAN-CDR	14.25	0.81	18.72	0.74	0.400	1.161	-0.178	0.970	0.087	0.963	0.135	0.291	0.533	0.274	0.825	-1.166
PML-v2_TRMM	15.05	0.76	18.95	0.77	0.400	0.971	-0.104	0.940	0.099	0.940	0.138	0.193	1.000	0.300	0.800	-1.200
ERA5-Land_ERA5-Land	14.34	0.80	15.90	0.77	0.302	0.800	-0.070	0.944	0.100	0.970	0.150	0.264	0.974	0.300	0.869	-1.200

Supplementary material

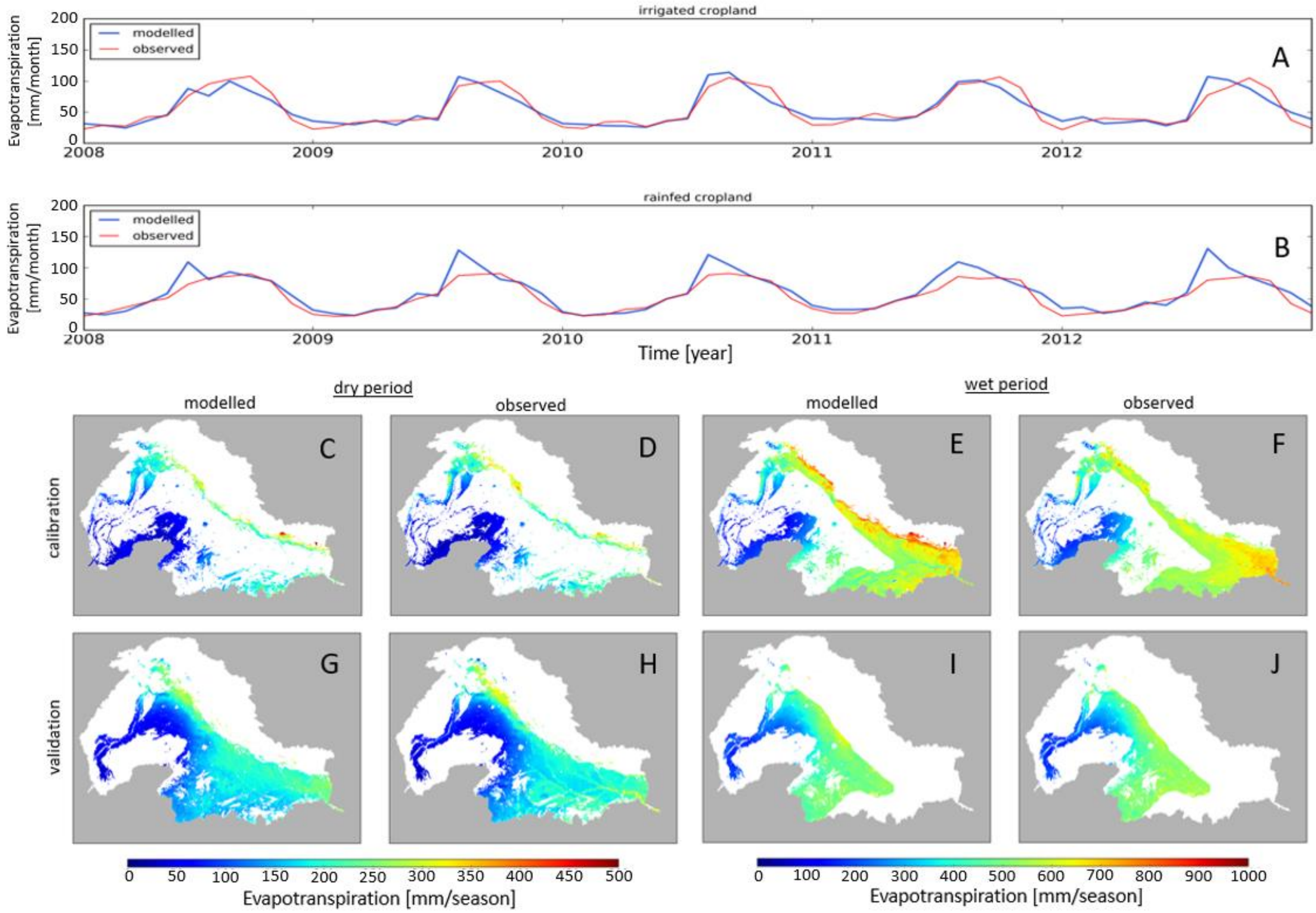

Figure S1. Overview of temporal and spatial ET bias time series and maps for ERA5-Land calibration from validation period 2008 - 2012. A-B: time series of monthly MAE of irrigated and rainfed areas. C-F: Modelled and observed ET maps for rainfed cropland and natural vegetation for dry and wet seasons. G-J: Modelled and observed ET maps for irrigated cropland for dry and wet seasons. White areas within the irrigation maps are not included in the calibration or validation.

To quantify irrigation, the model is first calibrated against rainfed cropland ET and then the model parameters are transferred to irrigated cropland to simulate a rainfed baseline. This parameter transfer can be validated by comparing the ERA5-Land remote sensing dataset that does not include irrigation thus representing rainfed conditions over the entire cropland and the modeled rainfed baseline over irrigated cropland. The two time series Figure S1A and S1B show the modeled and observed evapotranspiration from irrigated and rainfed areas respectively. We expect the modeled and observed time series for irrigated cropland to be similar as this would validate the ability of the parameter transfers to reproduce the rainfed ET for the irrigated cropland. Had ERA5-Land incorporated irrigation a second peak in ET would have been visible during the dry period as a consequence of irrigation and the difference between the reference peak and baseline would have been assumed to be net irrigation. It can be seen that modeled ET over rainfed cropland shows distinct peaks during the wet season which is due to conceptual errors within the model that seem to overestimate rainfed ET at rainfed croplands along the Himalayan mountains (Figure S1E and S1F). Nevertheless, the spati-temporal similarities between the rainfed baseline and ERA5-Land over irrigated cropland support the validity of our approach. The spatial maps also confirm the spatial parameter transfer from rainfed to irrigated was able to reproduce the rainfed ERA5-Land ET over irrigated cropland (Figure S1G – S1J).