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Supplement of

Advancing ecohydrological modelling: coupling LPJ-GUESS with ParFlow for integrated vegetation and surface-subsurface hydrology simulations

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Figure S1. The basin characteristics used in the model: (a) Digital Elevation Model (DEM) processed by PriorityFlow, (b) Annual mean landuse distribution, (c) Thickness of unconsolidated bedrock, (d) Annual mean net water input (P-ET) used as recharge flux. Land use from IGBP Global Vegetation Classification (1-17): 1. Evergreen Needleleaf Forests; 4. Deciduous Broadleaf Forests; 5. Mixed Forests; 8. Woody Savannas; 9. Savannas; 10. Grasslands; 11. Permanent Wetlands; 12. Croplands;13. Urban; 14. Cropland/Natural Vegetation Mosaic 15. Snow and Ice.
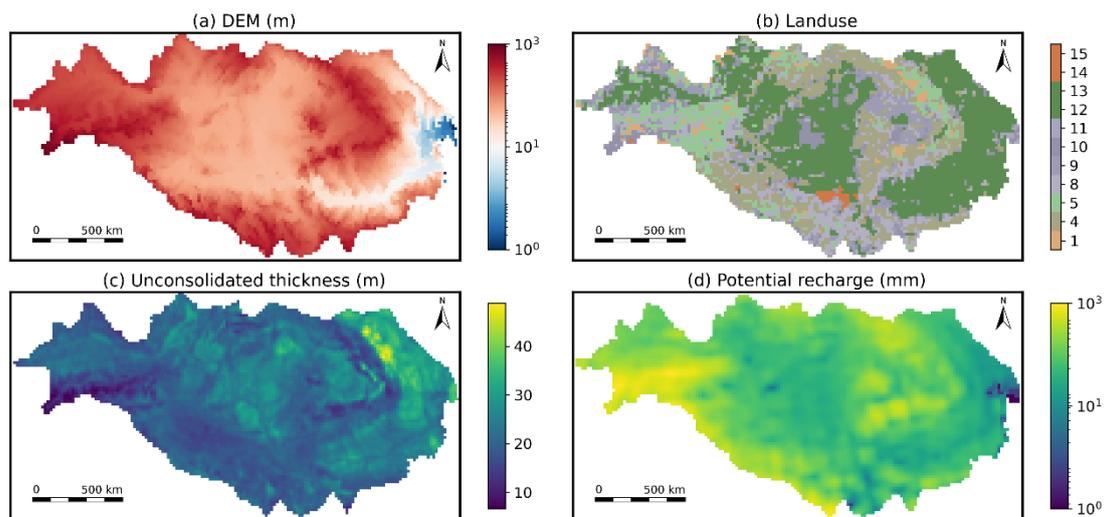
Figure S2. Classification of soil properties: (1) sand, (2) loamy sand, (3) sandy loam, (4) silt loam, (5) silt, (6) loam, (7) sandy clay loam, (8) silty clay loam, (9) clay loam, (10) sandy clay, (11) silty clay, (12) clay. Categories with few grid cells have been displayed using the same color.
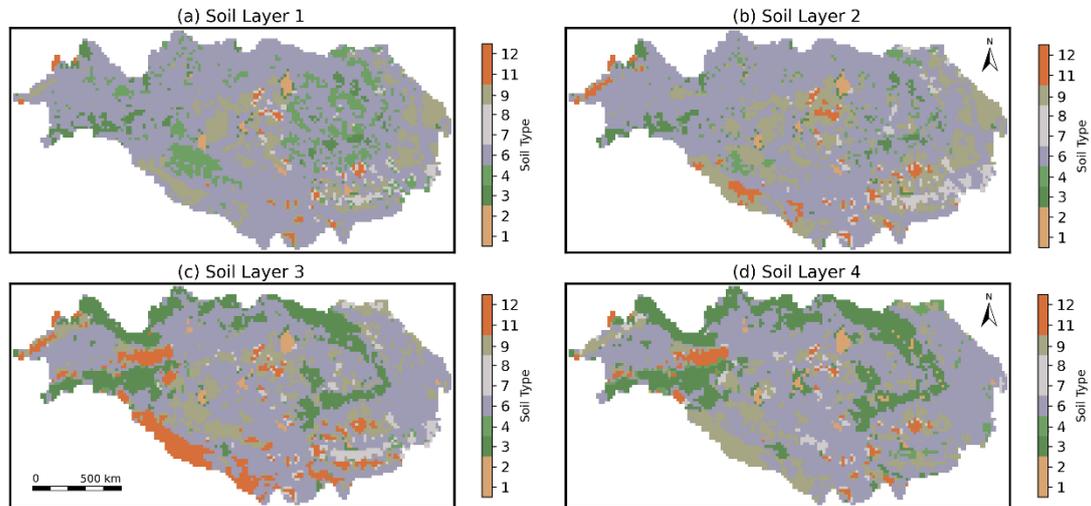
Figure S3. Classification of bedrock layers: (19) bedrock 1, (20) bedrock 2, (21) f.g. sil. sedimentary, (22) sil. sedimentary, (23) crystalline, (24) f.g. unconsolidated, (25) unconsolidated, (26) c.g. sil sedimentary, (27) carbonate. Note that f.g., sil., and c.g. represent fine-grained, siliciclastic sedimentary, and coarse-grained, respectively. Hydraulic conductivity increases with increasing layer number.
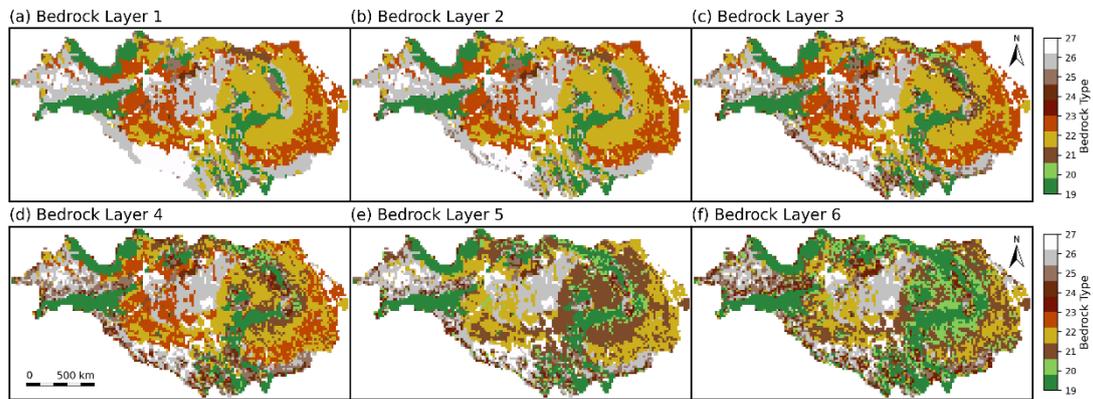
Figure S4. (a) Monthly soil moisture (SM) percentiles (P10, P50, P90) for PF-LPJG, LPJ-GUESS and ESA CCI-SM during 1980-2018. (b) Cross-plot of standardized SM anomalies comparing PF-LPJG and LPJ-GUESS against ESA CCI-SM.
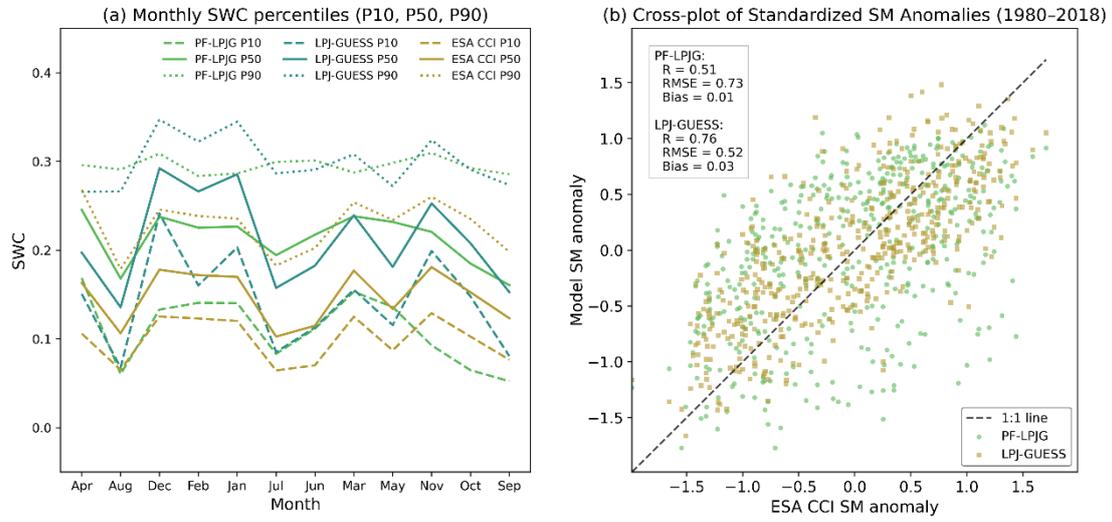
Figure S5. Histograms of RMSE and Spearman's ρ for surface SM in wet (4-9) and dry months (1-3, 10-12), comparing PF-LPJG and LPJ-GUESS simulations against ESA CCI-SM.
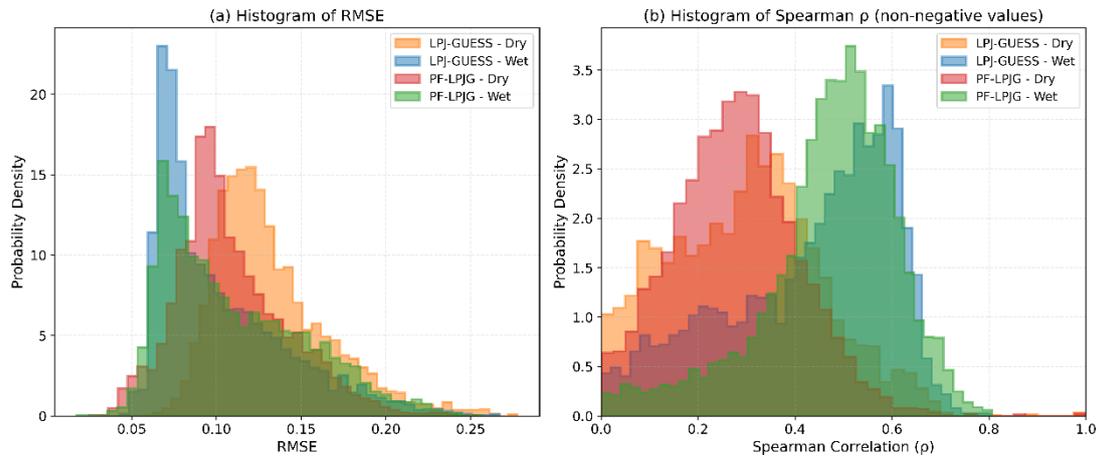
Figure S6. Monthly mean groundwater table depth (WTD) averaged over the period 1980-2018, based on simulated results.
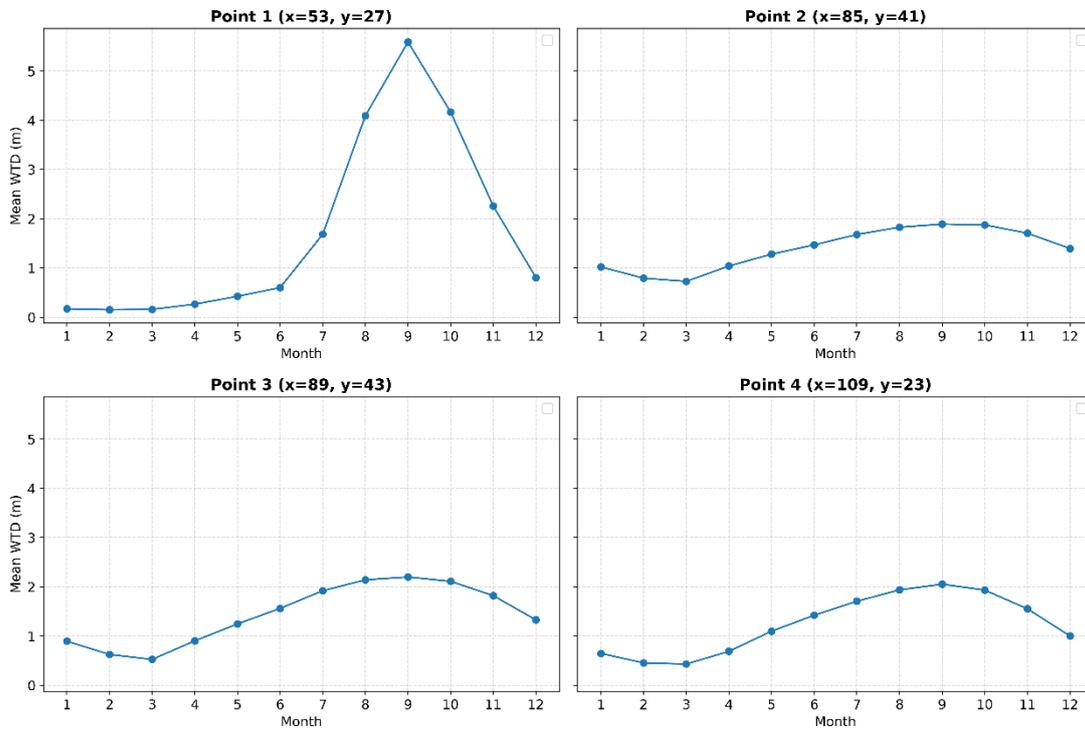
Table S1. Parameters of Soil and Bedrock Layers

Class	Unit Indicator	Classification	Ks (m/h)	porosity [-]	sres [-]	alpha (1/m)	n [-]
Soil Units	1	Sand	2.69E-01	0.38	0.14	3.55	4.16
	2	Laomy Sand	4.36E-02	0.39	1.26	3.47	2.74
	3	Sandy Loam	1.58E-02	0.39	0.10	2.69	2.45
	4	Silt Loam	7.58E-03	0.44	0.15	0.50	2.66
	5	Silt	1.82E-02	0.49	0.10	0.66	2.66
	6	Loam	5.01E-03	0.40	0.15	1.12	2.48
	7	Sandy clay loam	5.49E-03	0.38	0.16	2.09	2.32
	8	Silty clay loam	4.68E-03	0.48	0.19	0.83	2.51
	9	Clay loam	3.39E-03	0.44	0.18	1.58	2.41
	10	Sandy clay	4.78E-03	0.39	0.30	3.31	2.20
	11	Silty clay	3.98E-03	0.48	0.23	1.62	2.32
	12	Clay	6.16E-03	0.46	0.21	1.51	2.26
Bedrock Units	19	Bedrock 1	5.00E-03	0.33	0.001	1.00	3.00
	20	Bedrock 2	1.00E-02	0.33	0.001	1.00	3.00
	21	f.g. sil. Sedimentary	2.00E-02	0.30	0.001	1.00	3.00
	22	sil. Sedementary	3.00E-02	0.30	0.001	1.00	3.00
	23	crystalline	4.00E-02	0.10	0.001	1.00	3.00
	24	f.g. unconsolidated	5.00E-02	0.30	0.001	1.00	3.00
	25	unconsolidated	6.00E-02	0.30	0.001	1.00	3.00
	26	c.g. sil sedimentary	8.00E-02	0.30	0.001	1.00	3.00
	27	carbonate	1.00E-01	0.10	0.001	1.00	3.00