Supplementary Materials for

EcoTWIN 1.0: A Fully Distributed Tracer-Aided Ecohydrological Model Tracking Water, Isotopes, and Nutrients

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Content

Table S1

Figure S1-3

Tables

Table S1. The parameters in EcoTWIN 1.0.

Parameters	Description	Dependency	Unit	Min	Max
d_3	Depth of soil layer 3	Global	m	0.2	2
α	Coefficient for canopy storage estimation	Land use	-	1e-5	5e-2
rE	Extinction coefficient for PE/PT seperation	Land use	-	-3	-0.1
w_{irr}	The coefficient for irrigation water deficit	Land use	-	1e-2	1
$Thres_{SN}$	Temperature threshold for snow/rain separation	Soil	°C	-5	5
dd_{min}	Minimum of degree day factor	Soil	-	0	2e-3
dd_{max}	Maximum of degree day factor	Soil	-	2e-3	1e-2
dd_{inc}	Increase in degree-day factor based on temperature	Soil	-	0.1	0.9
$\theta_{s,ref}$	Reference porosity	Soil	-	0.3	0.99
$PTF_{VG,clay}$	Pedotransfer function parameter to estimate porosity from clay content	Soil	-	5e-8	5e-3
$PTF_{VG,BDdd}$	Pedotransfer function parameter in for estimate porosity from bulk density	Soil	-	5e-4	5e-1
Ks_{ref}	Pedotransfer function parameter linked to reference hydraulic conductivity	Soil	-	-3	-0.1
$PTF_{Ks,sand}$	Pedotransfer function parameter to estimate hydraulic conductivity from sand content	Soil	-	6e-3	3e-2
$PTF_{Ks,clay}$	Pedotransfer function parameter to estimate hydraulic conductivity from clay content	Soil	-	3e-3	2e-2
SWP	Soil water potential for field capacity estimation	Soil	kPa	10	33
w_{Ks}	Anisotropy ratio of vertical to horizontal Ks	Soil	-	1e-2	0.9
ψ	Soil air entry pressure	Soil	m/s	1e-2	1.3
β	Exponential parameter links percolation to the extent of soil saturation	Soil	-	1	50
γ_{root}	Parameter to estimate the root distribution along soil depths	Land use	-	0.8	0.999
p_{GW}	Weighting parameter for groundwater recharge	Soil	-	1e-6	1
p_{Ovf}	Parameter constraining the channel recharge from overland flow	Soil	-	1e-3	1
p_{Inf}	Parameter constraining the channel recharge from interflow	Soil	-	1e-2	10
p_{GWf}	Parameter constraining the channel recharge from groundwater flow	Soil	-	1e-3	10
K_{vadose}	Dimensionless lateral hydrological conductivity in vadose zone	Soil	-	1e-3	1
K_{GW}	Dimensionless lateral hydrological conductivity in groundwater	Soil	-	1e-9	1
exp_{Inf}	exponential parameter link interflow with vadose storage	Soil	-	1e-2	10
exp_{GW}	exponential parameter link groundwater flow with groundwater storage	Soil	-	1e-5	1
$roughness$	Dimensionless channel roughness	Land use	-	1e-4	10
$SrfMixing$	Mixing ratio between ponding water and top soil water storage	Land use	-	0	1

n	Advection term in diffusion-controlled kinetic isotopic separation	Global	-	0.5	1
$ref_{Dgd,s}$	Reference rates of soil degradation	Land use	g/m^2 S	1e-6	1e-4
$ref_{Minr,s}$	Reference rates of soil mineralisation	Land use	g/m^2 S	1e-4	0.4
$ref_{Deni,s}$	Reference rates of soil denitrification	Land use	g/m^2 S	1e-4	0.8
$ref_{Deni,w}$	Reference rates of in-stream denitrification (dimensionless)	Land use	-	1e-5	1e-1
$p_{\theta,deni}$	Saturation threshold for soil denitrification	Land use	-	0.5	0.85

Figures

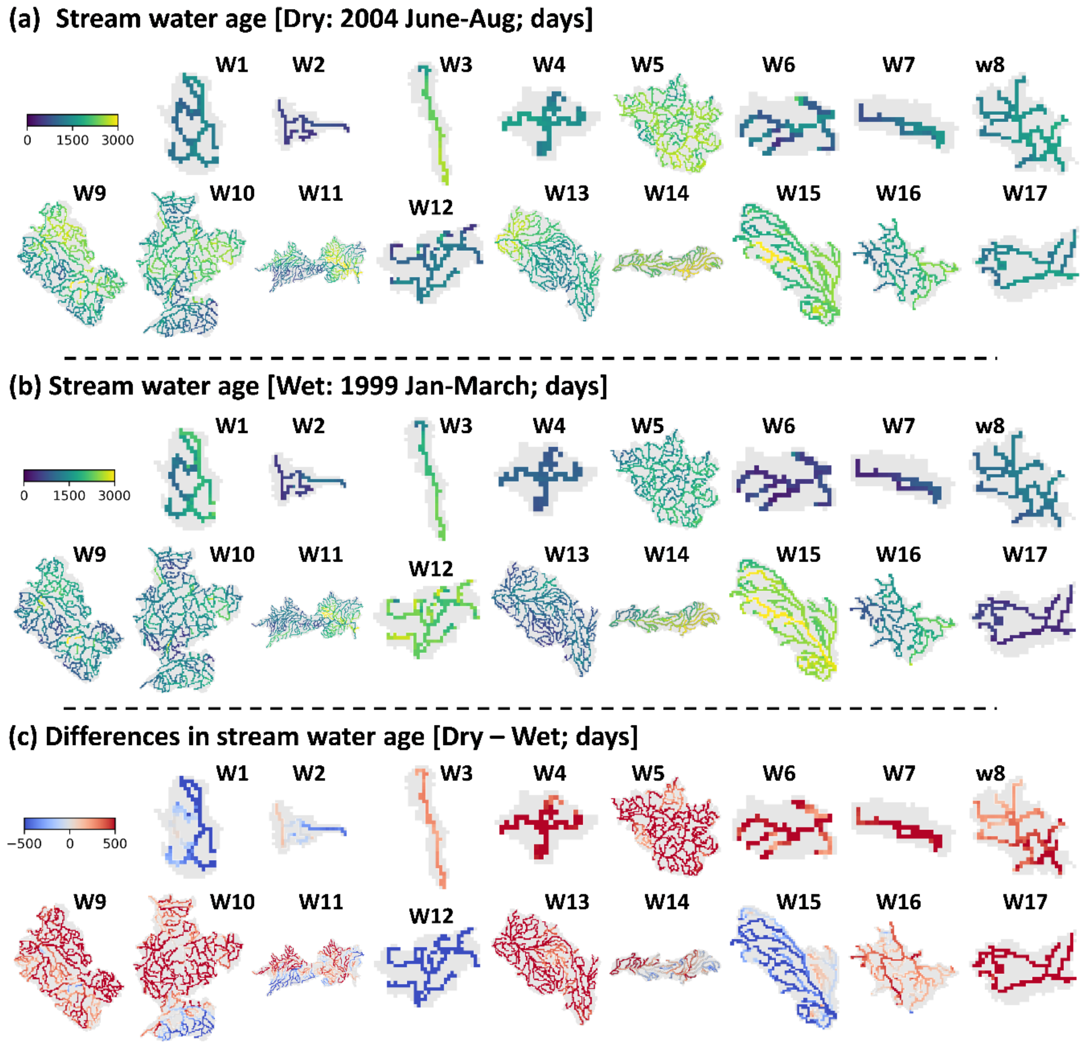

Figure S1. The simulated stream water ages in generally dry (summer 2004) and wet periods (winter 1999). The differences are shown in subplot c.

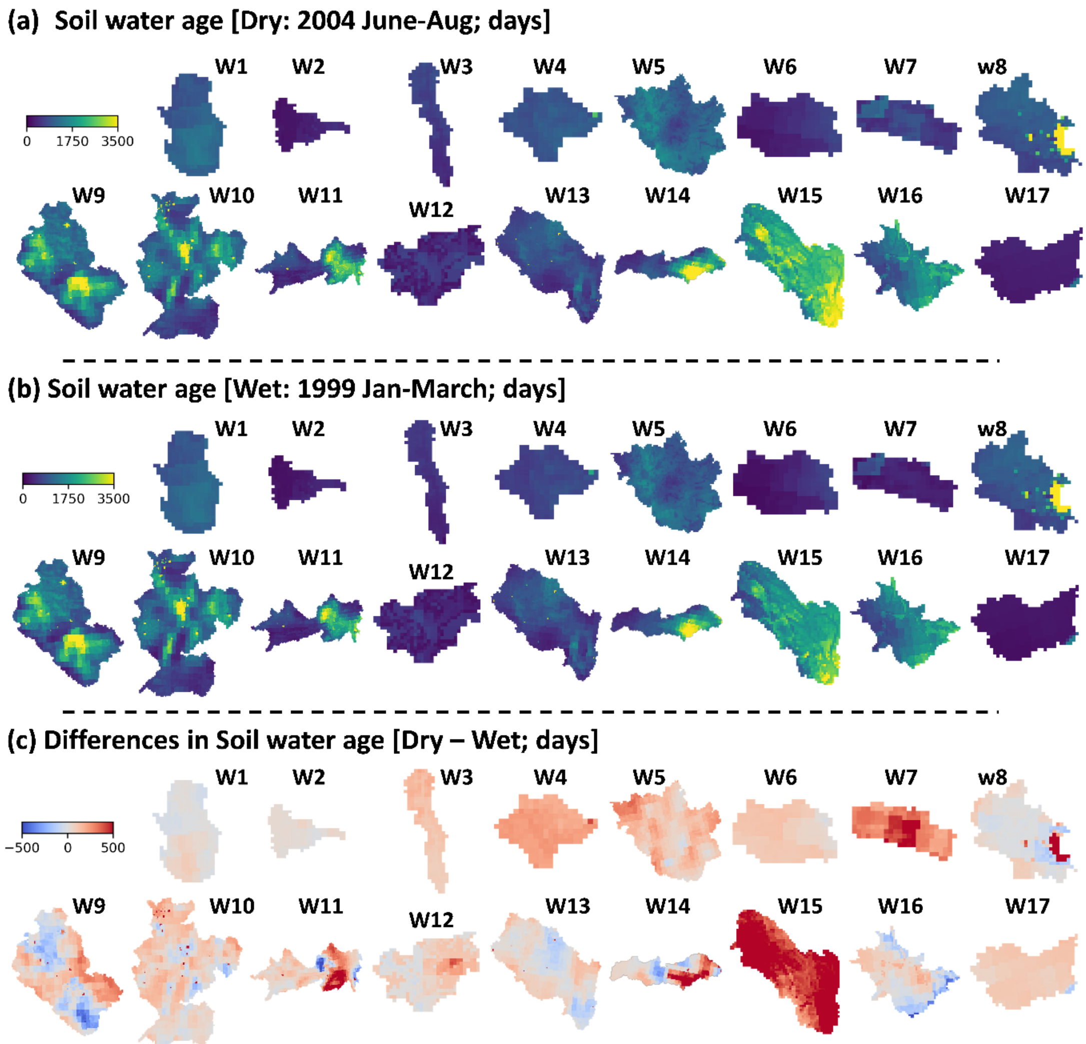

Figure S2. The simulated soil water ages in generally dry (summer 2004) and wet periods (winter 1999). The differences are shown in subplot c.

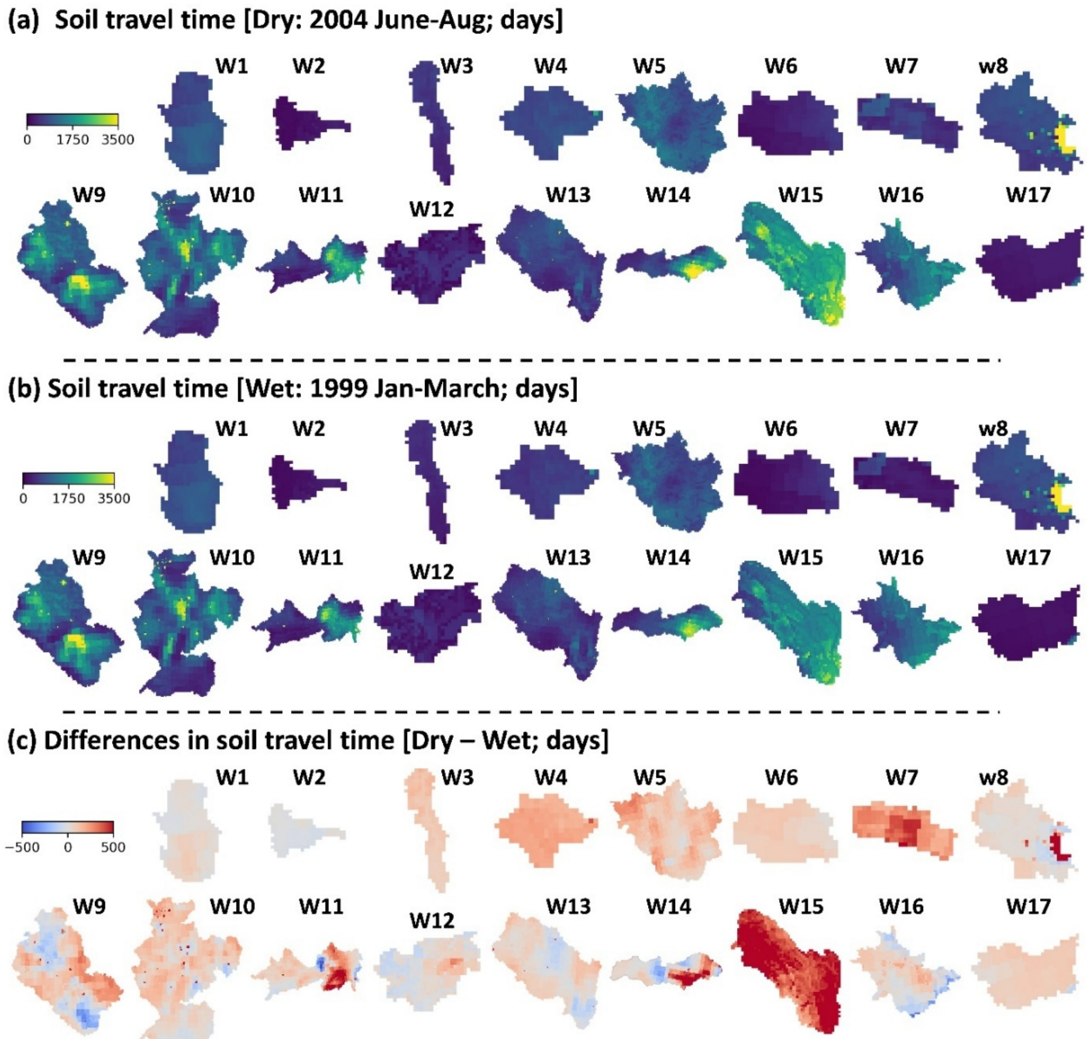

Figure S3. The simulated soil travel time in generally dry (summer 2004) and wet periods (winter 1999). The differences are shown in subplot c.