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Impact of the numerical solution approach of a plant hydrodynamic model (v0.1) on vegetation dynamics

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Figure S1 is an example of Figure 1 in the manuscript with explicit compartment numbers to illustrate how soil interacts with the roots. In this figure, the roots interact with a total of 10 soil layers. Compartment 1 represents leaf, 2 is stem, 3 is transporting root, 4, 10, …, 58 are absorbing roots in soil layer 1, 2, …, and 10, respectively. Each soil shell layer is divided into 5 compartments, with the innermost compartment (i.e., 5,11,…,59) directly interfacing with the absorbing root in each layer. The discretized mass balance equation for each compartment becomes:

$\rho_w V_1 \frac{d\theta_1}{dt} = Q_{1,2} - E$, for compartment 1, $Q_{1,2}$ is positive when flux is towards the atmosphere

$\rho_w V_2 \frac{d\theta_2}{dt} = Q_{2,3} - Q_{1,2}$, for compartment 2

$\rho_w V_3 \frac{d\theta_3}{dt} = Q_{3,4} + Q_{3,10} + Q_{3,16} + Q_{3,22} + Q_{3,28} + Q_{3,34} + Q_{3,40} + Q_{3,46} + Q_{3,52} + Q_{3,58} - Q_{2,3}$, for compartment 3

$\rho_w V_4 \frac{d\theta_4}{dt} = Q_{4,5} - Q_{3,4}$, for compartment 4

$\rho_w V_5 \frac{d\theta_5}{dt} = Q_{5,6} - Q_{4,5}$, for compartment 5 and similarly for compartments 6,7, and 8

$\rho_w V_9 \frac{d\theta_9}{dt} = -Q_{8,9}$, for compartment 9

Equation formulations for compartments 10 to 63 in the rest of the soil layers are the same as those corresponding compartments of 4 to 9 in the top layer.

When aggregated, the total number of compartments is reduced by (number of layers aggregated -1) × 6. For example, when the top two layers are aggregated, compartments 58 to 63 disappear, and the sizes of the new compartments 4 to 9 are the combination of the old compartments 4 and 10, 5 and 11, and so on.

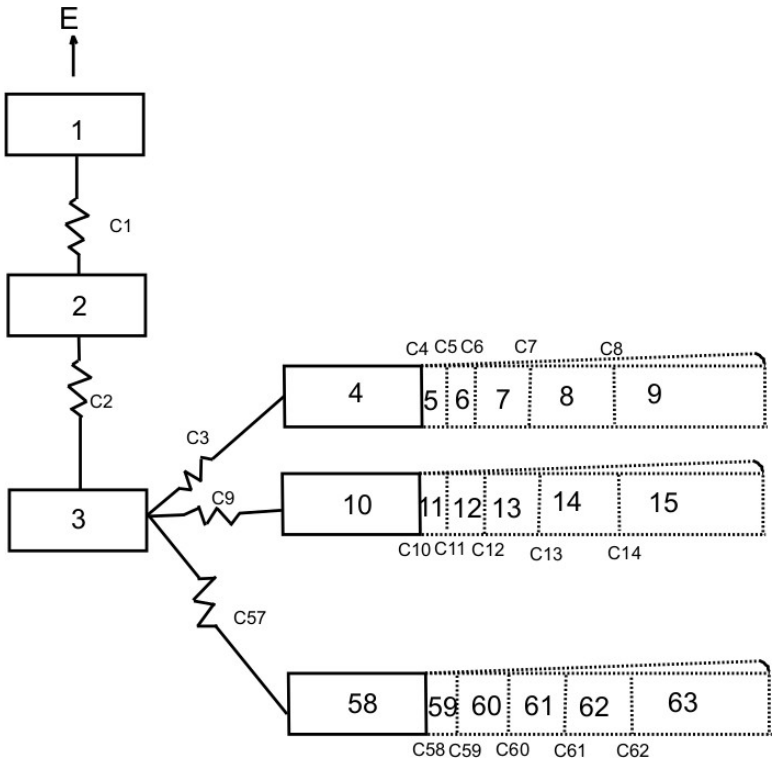

Figure S1. Example discretization of FATES-hydro

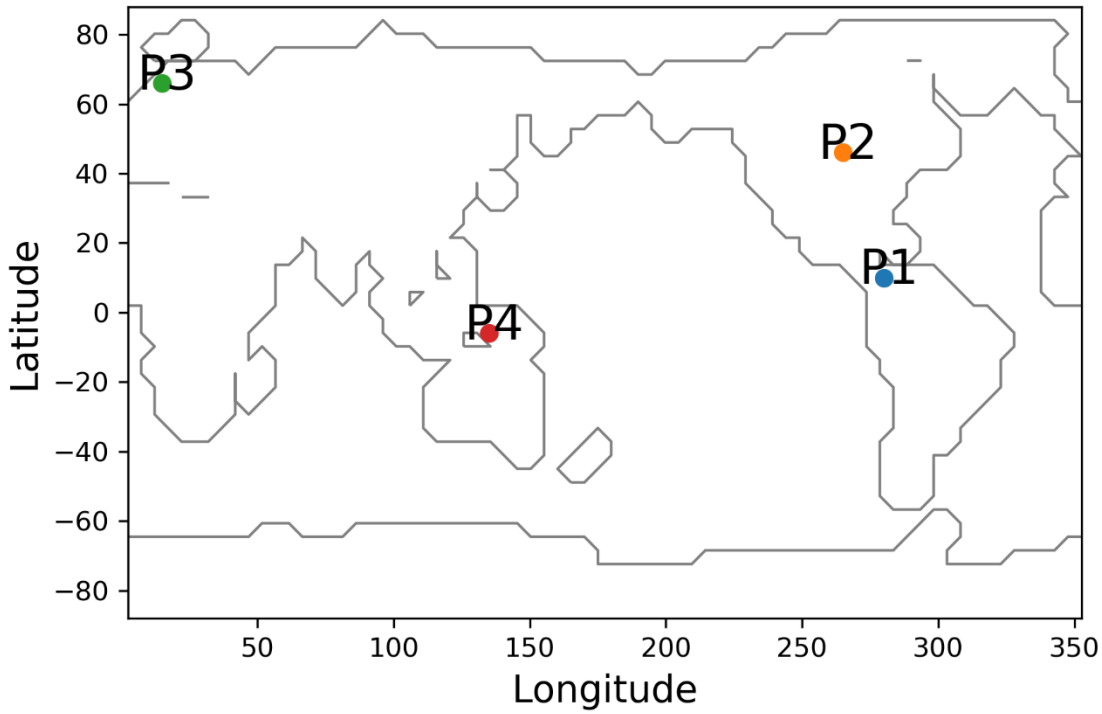

Figure S2. Selected points for single point simulations

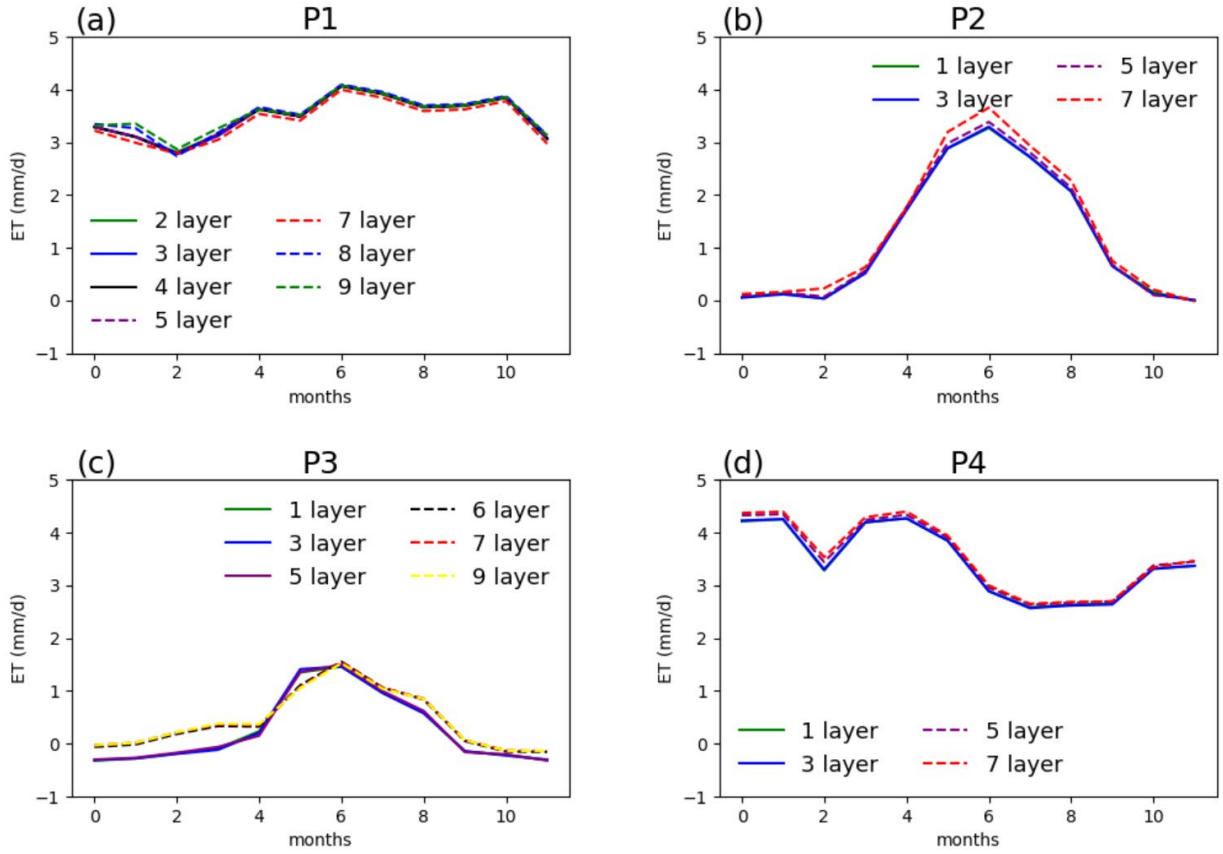

Figure S3. Evapotranspiration from single point simulations at selected locations (P1 – P4) at year 100 of the simulations.

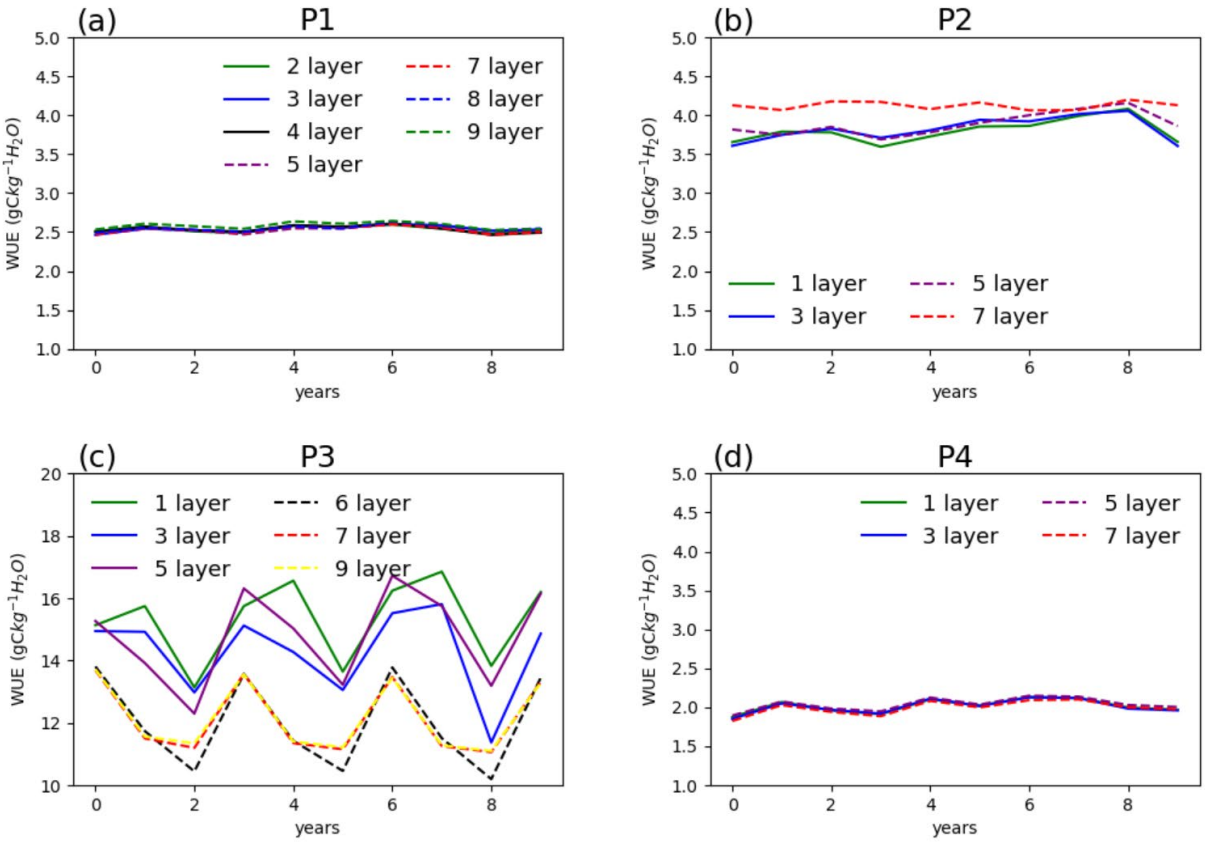

Figure S4. Annual water use efficiency (WUE) from single point simulations at selected locations (P1 – P4) during the last 10 years of the simulations.

Table S1. Clay content and organic matter density at sites P1 to P4

P1		P2		P3		P4	
Clay (%)	Organic (kg m^{-3})	Clay (%)	Organic (kg m^{-3})	Clay (%)	Organic (kg m^{-3})	Clay (%)	Organic (kg m^{-3})
30	35.5	36	51.6	21	119.7	35	67.9
30	35.2	36	45.3	21	111.2	35	67.4
31	30.2	36	37.5	21	97.7	35	60.0
32	24.8	35	29.7	21	65.8	27	49.4
34	19.9	35	22.7	21	50.0	27	39.5
39	15.7	32	17.0	21	26.6	27	31.1
42	12.4	31	12.8	21	16.8	27	24.3
42	9.7	30	9.7	21	10.8	27	19.0
39	0.0	24	0.0	20	0.0	26	0.0
40	0.0	24	0.0	19	0.0	26	0.0