We thank Professor Bohrer for the positive comments and suggestions.

The development of FATES-HYDRO is important and represents an advance in modeling capability.

The study is conducted well, the code is made available through Zenoto, and the analysis is clear.

I have few minor comments that would help improve the comprehension of the results

Please add explicit vertically resolved formulation of how the soil interacts with the root. As is, the description is rather confusing (I could not figure out lines 220-225, or what “The stack of vertical soil-root interaction layers” at L190 means). I do not expect all the formulation of FATES to be repeated here, but the soil-root water interaction is the key physical process studied here, so at least that component of the formulation should be detailed to completion.

We apologize for the confusion. The following figure with explicit compartment numbers is used 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, Q1,2 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 soil layers are the same as those corresponding compartments of 4 to 9 in the top layer.

When aggregated, total number of compartments is reduced by (number of layers aggregated -1) x 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.

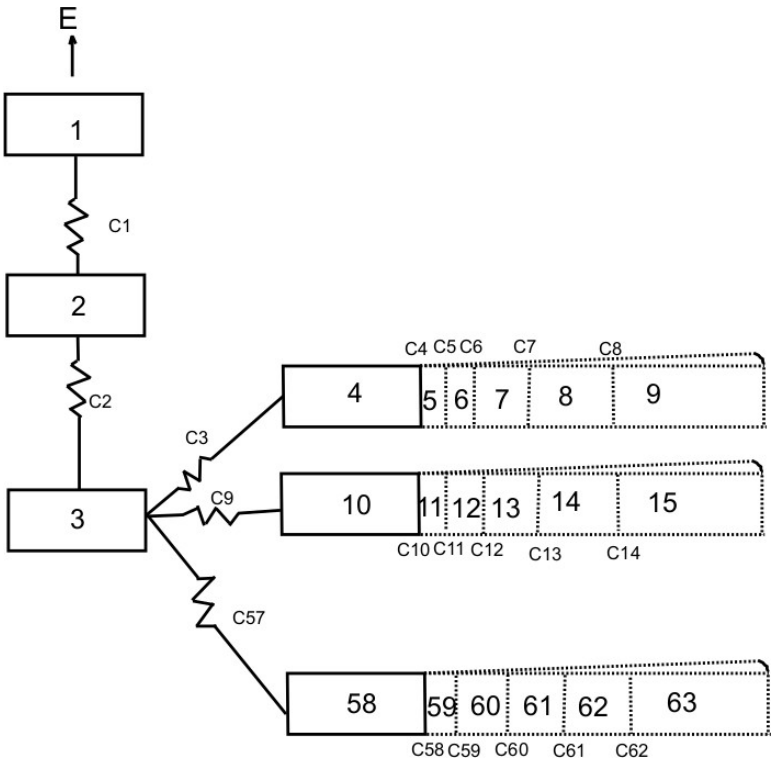

Figure R1. Example discretization of FATES-hydro

Also, list how betta (water stress factor) enters the transpiration/stomatal conductance calculation.

The stress factor modifies the top of canopy leaf photosynthetic capacity and the Ball-Berry leaf stomatal conductance as shown in Eqs. R1 and R2 below:

$$V_{c,max} = \beta V_{c,max} \quad \text{(R1)}$$

$$g_s = m\frac{A_n}{C_s/P_{atm}}h_s + \beta b \quad \text{(R2)}$$

where $V_{c,max}$ is the maximum rate of carboxylation (μmol CO_2 m^{-2} s^{-1}), g_s is the leaf stomal conductance (μmol m^{-2} s^{-1}), m is a plant functional type dependent parameter, A_n is leaf net photosynthesis (μmol CO_2 m^{-2} s^{-1}), C_s is the leaf surface CO_2 partial pressure (Pa), P_{atm} is the atmospheric pressure (Pa), h_s is the leaf surface humidity, and b is the minimum stomatal conductance (μmol m^{-2} s^{-1}), β is the stress factor defined by Eq. 4 in the manuscript.

You treated above ground biomass as the only tested indicator of model performance differences. I am very curious about other model related predictions, specifically, evapotranspiration and water use efficiency. Can you add some analysis of differences regarding these?

Thanks for the suggestion. The comparison of evapotranspiration (ET) and water use efficiency (WUE) are shown below for single point simulations. WUE is defined as the ratio of gross primary productivity (GPP) and ET. In general, the impact of grid aggregation on ET and WUE are small compared to that on AGB.

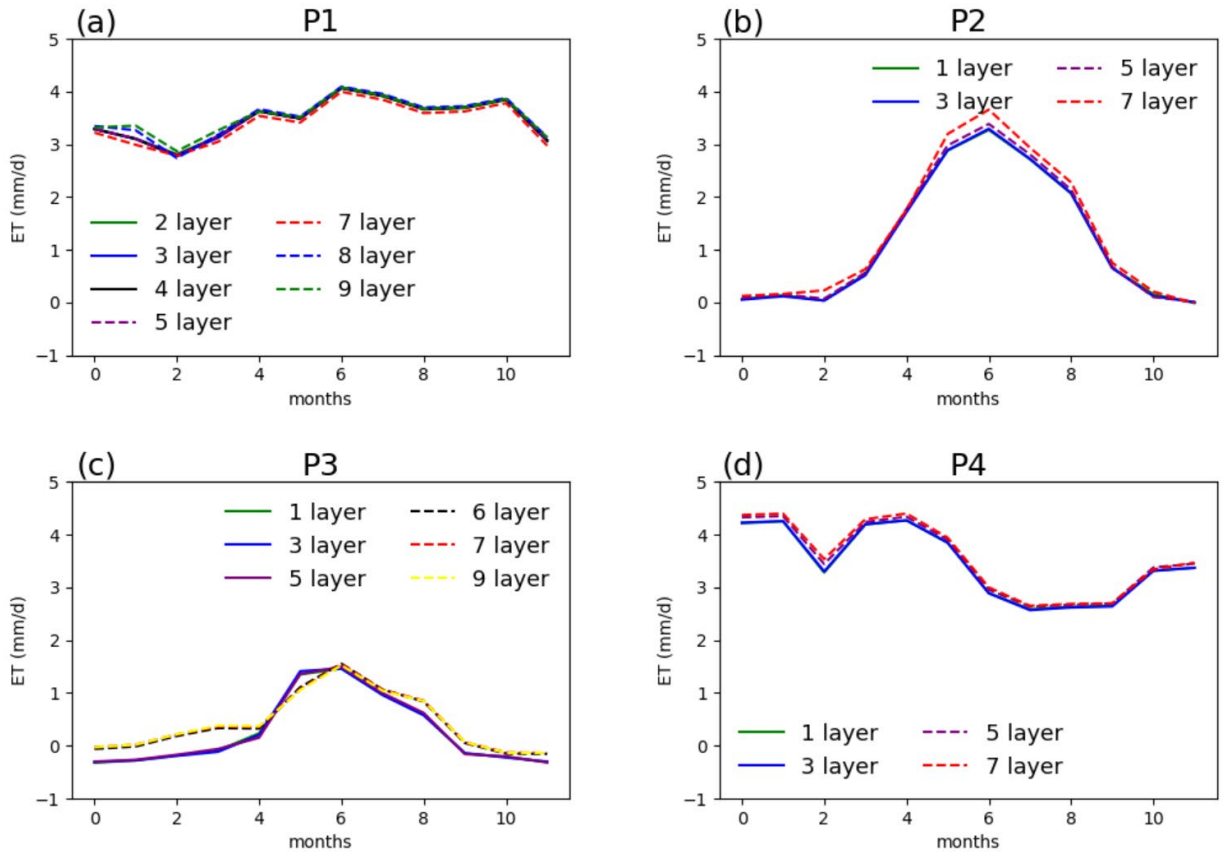

Figure R2. Evapotranspiration from single point simulations at selected locations (P1 – P4) at year 100 of the simulations.

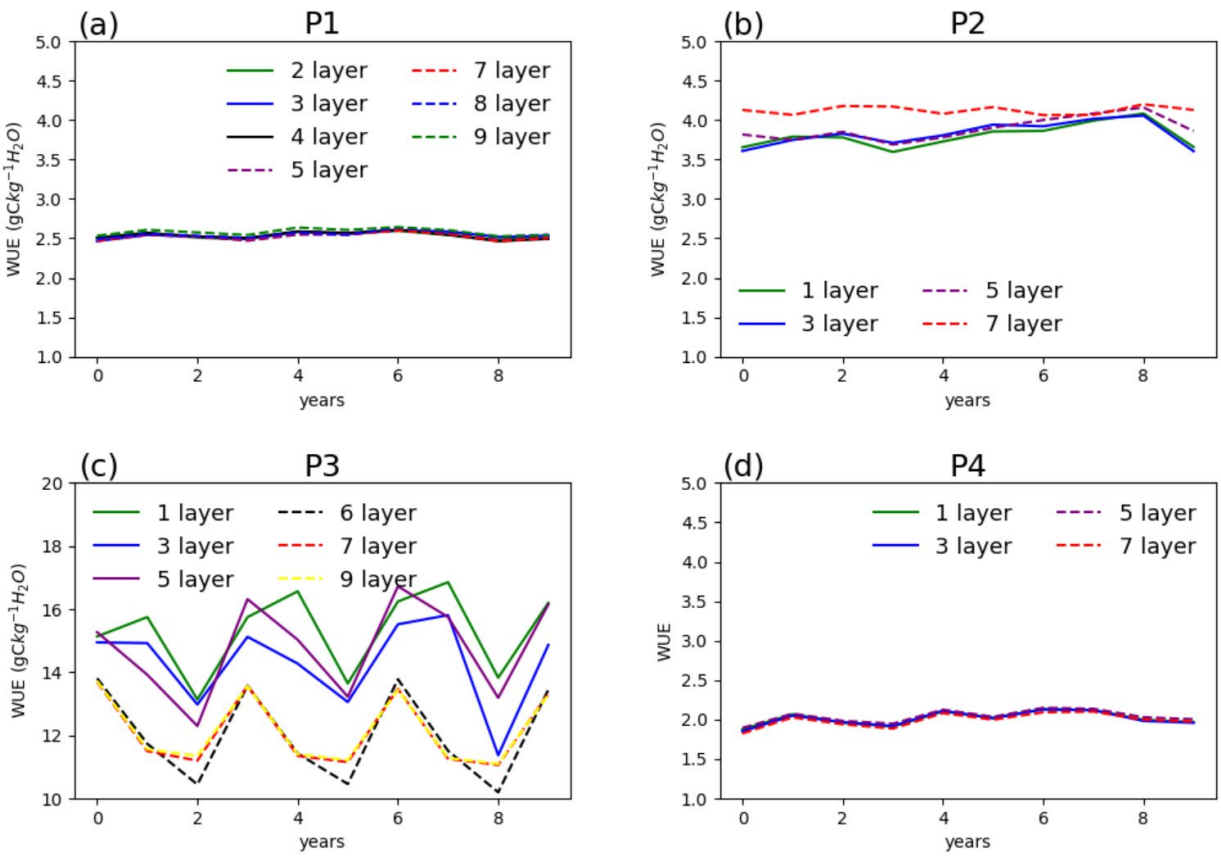

Figure R3. Annual water use efficiency (WUE) from single point simulations at selected locations (P1 – P4) during the last 10 years of the simulations.