Supporting Information for

"Implementing plant hydraulics in the Community Land Model, version 5"

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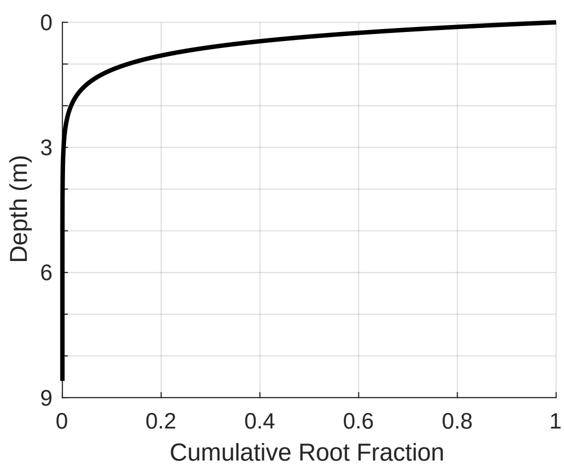

Figure S1. Cumulative rooting distribution.

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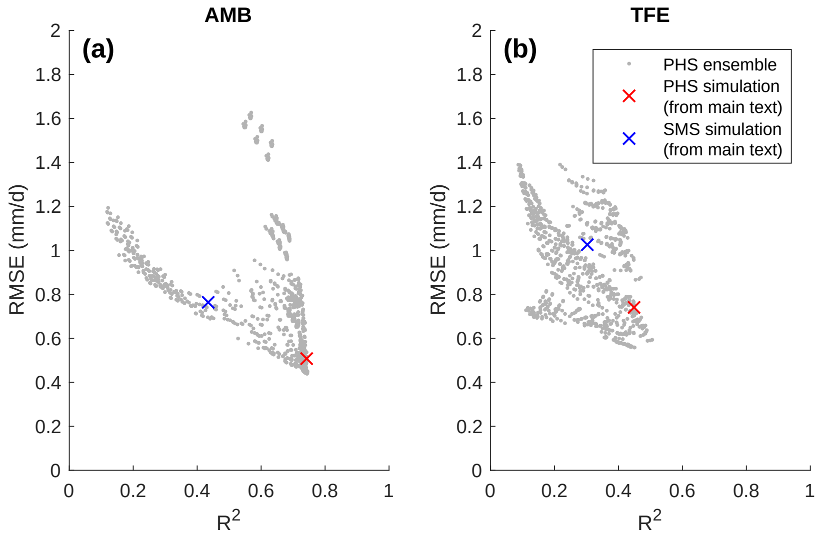

Figure S2. Results of the PHS parameter tuning exercise. The main text PHS simulation was chosen to maximize R^2 - RMSE.

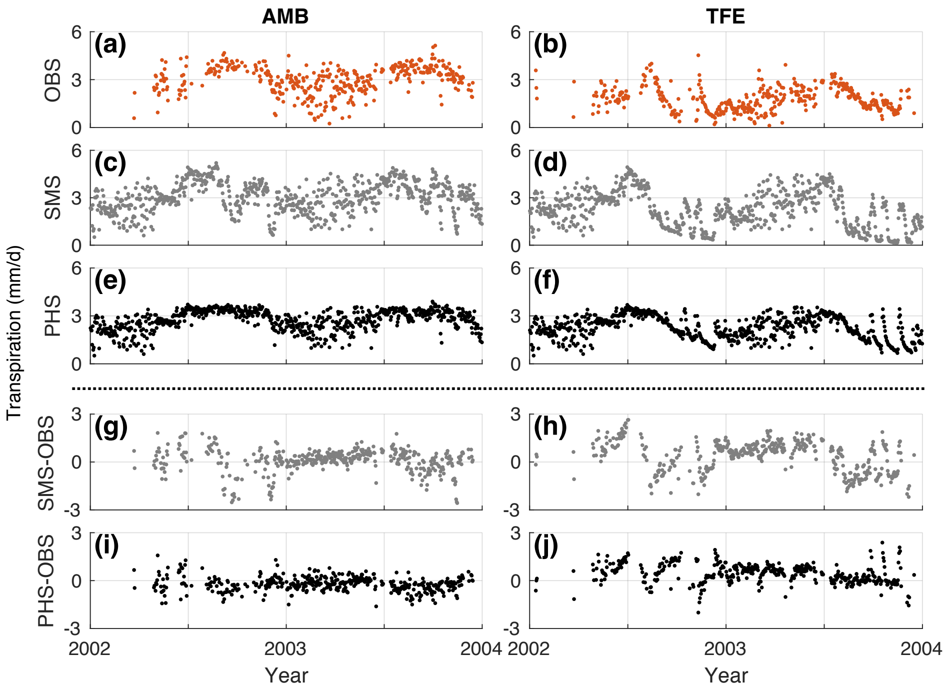

Figure S3. (a-f) Time-series of daily total transpiration (mm/d), from (a,b) observations, (c,d) SMS model configuration, and (e,f) PHS model configuration under ambient and TFE conditions.

(g-j) Difference between modeled and observed transpiration (mm/d), for (g,h) SMS and (i,j) PHS under ambient and TFE conditions.

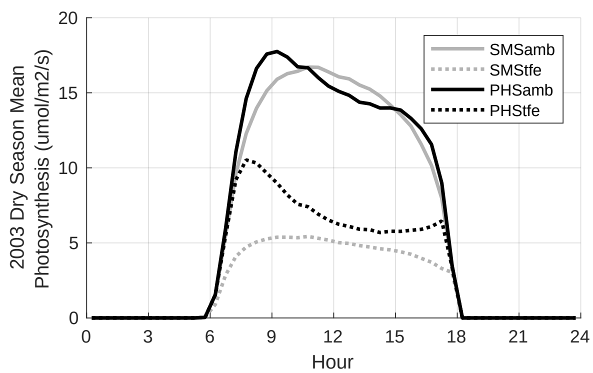

Figure S4. 2003 dry season diurnal mean photosynthesis under ambient and TFE conditions for the two model configurations.

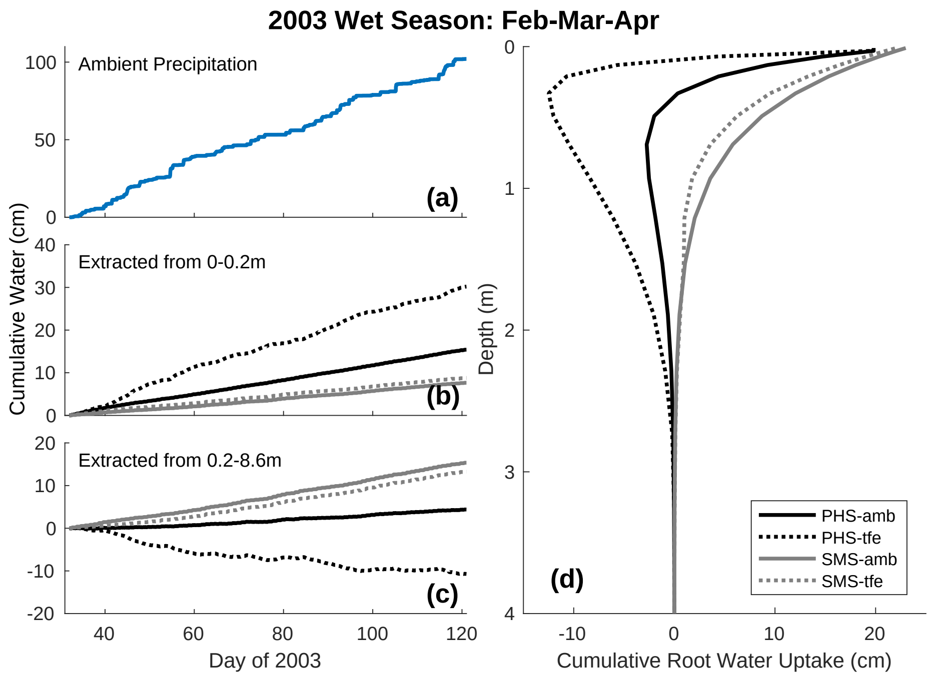

Figure S5. 2003 wet season (FMA) cumulative root water uptake and precipitation. (a) Cumulative precipitation over time under ambient conditions (b,c) Cumulative water uptake over time from above and below 0.2m, respectively. (d) Cumulative root water uptake with depth.

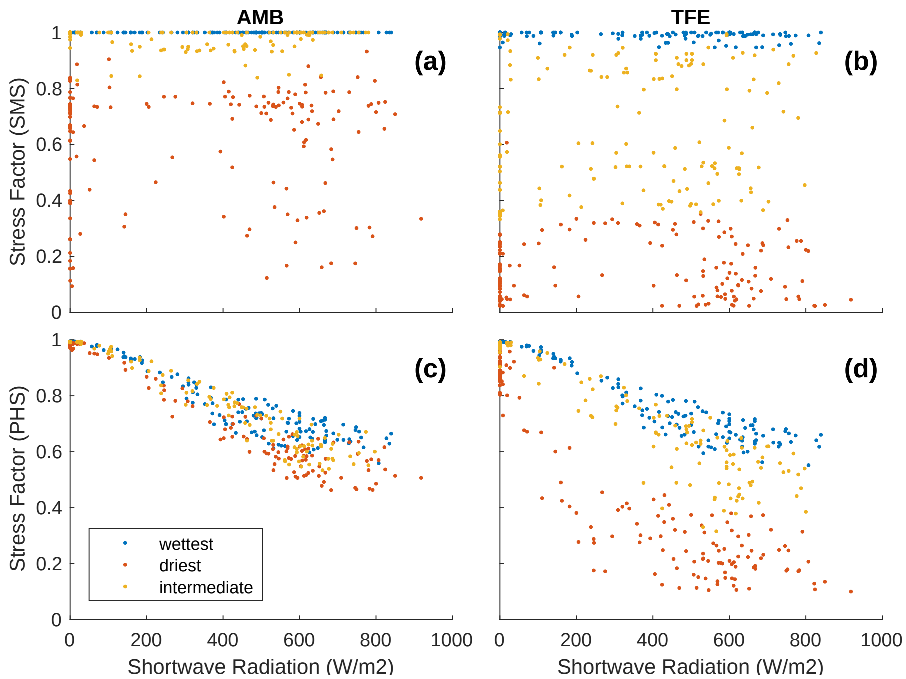

Figure S6. Water stress factor versus downwelling shortwave radiation (2002-2003), for timesteps with VPD between 1 and 1.0559 kPa (n=470). VPD is controlled to highlight the relationship with downwelling radiation, the reverse (controlling for radiation) is shown in Figure 7. For SMS (a,b), data are subdivided based on average soil matric potential, weighted by root fraction. For PHS (c,d), data are subdivided based on predawn (5h) root water potential. Blue dots represent the wettest tercile, yellow dots represent the intermediate tercile, and red dots represent the driest tercile.

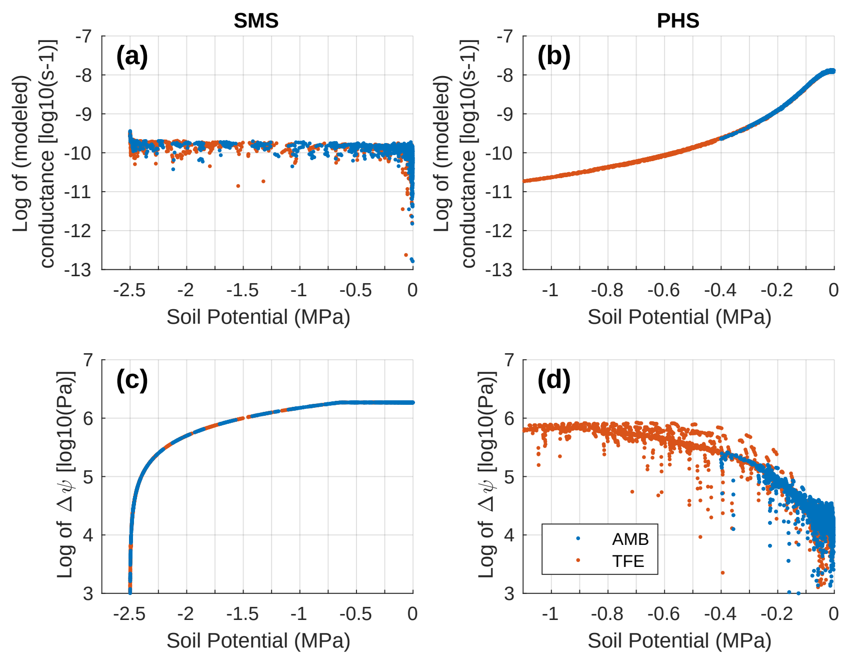

Figure S7. (a,b) Log of conductance ($k_{s,r}$) versus soil potential for Soil Layer 5. (c,d) Log of hydraulic gradient ($\Delta\psi$) versus soil potential for Soil Layer 5. Note that the soil potential axes vary for PHS vs. SMS. Multiplied together $k_{s,r}$ and $\Delta\psi$ yield the Layer-5 root water uptake. PHS conductance decreases by almost 3 orders of magnitude between 0 and -1MPa, which leads to reduced RWU, though this is offset (by about half) due to increases in $\Delta\psi$.

while SMS $\Delta\psi$ decreases by less than 1 order of magnitude between 0 and -2MPa, leading to higher sensitivity to soil potential with PHS, see Figure 10.

Only midday (12h-14h, 2002-2003) timesteps are shown to emphasize the relationship with soil potential. With SMS, conductance is not modeled explicitly, but rather calculated as k=$q/\Delta\psi$ (see Section 2.4.2). For soil potentials greater than or equal to 2.5MPa, $\Delta\psi$=0, and SMS implied conductance is undefined, but could probably be considered to equal 0. PHS conductance captures both root tissue and soil matrix resistances (operating in series).

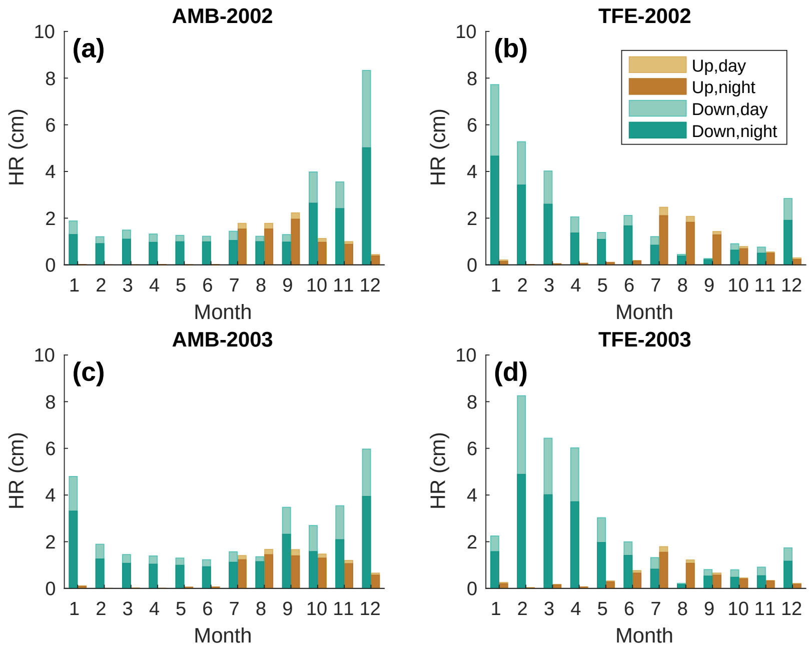

Figure S8. PHS hydraulic distribution during 2002 and 2003, partitioning by direction and time of day.

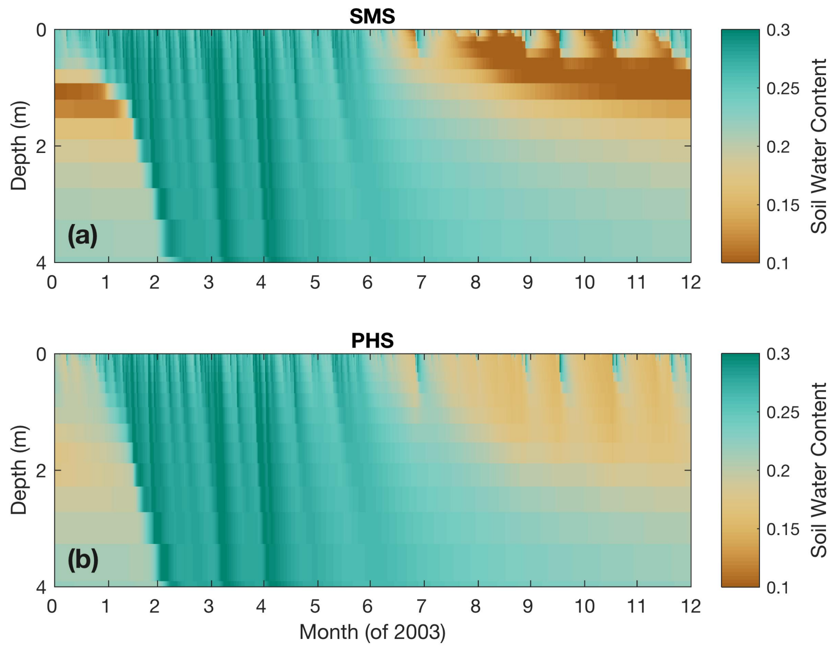

Figure S9. Vertical profile of soil water content (by volume) through time under ambient through-fall conditions, for (a) PHS, and (b) SMS.

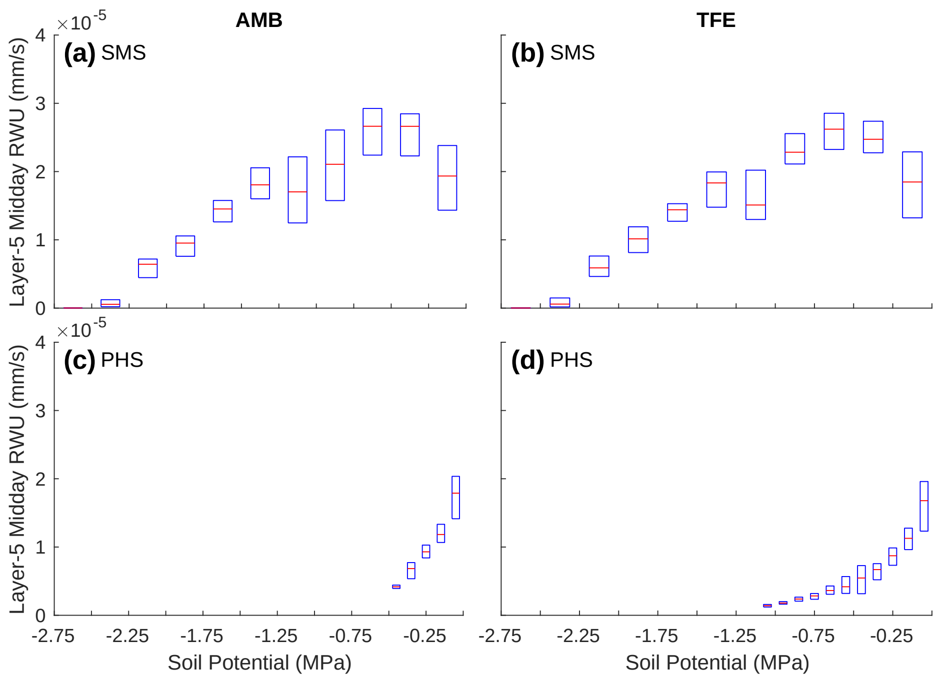

Figure S10. Binned boxplot of root water uptake versus soil potential for Soil Layer 5 (2002-3). Red lines mark the median, with boxes spanning the interquartile range. Bin widths are 0.25 MPa for SMS and 0.1 MPa for PHS. Soil Layer 5 is shown, because it is close enough to the surface (20 to 32 cm) to experience a significant range in soil potential, and it has a large root fraction (14.4%, only Soil Layer 6 has a larger root fraction). Only midday (12h-14h) timesteps are used to highlight the relationship with soil potential.

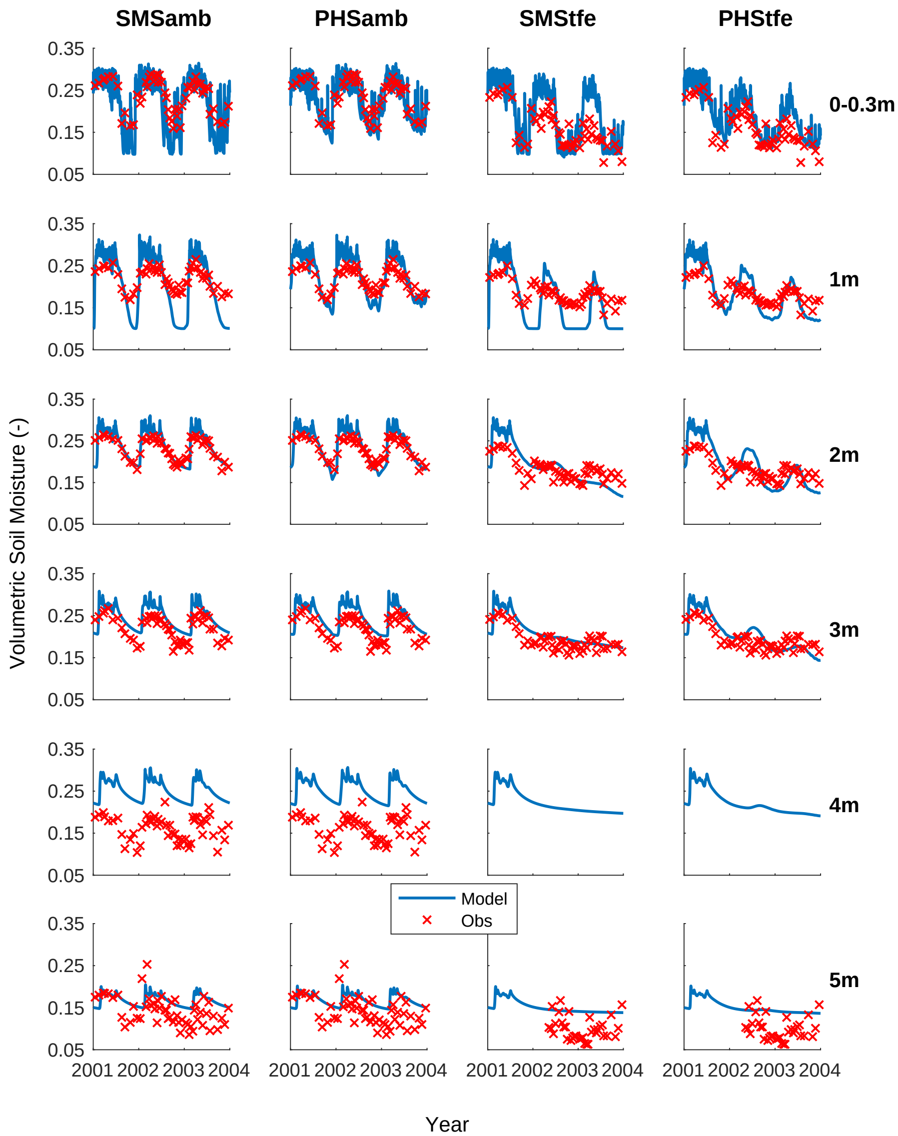

Figure S11. Time series of soil moisture by soil layer. Complements Figure 9.

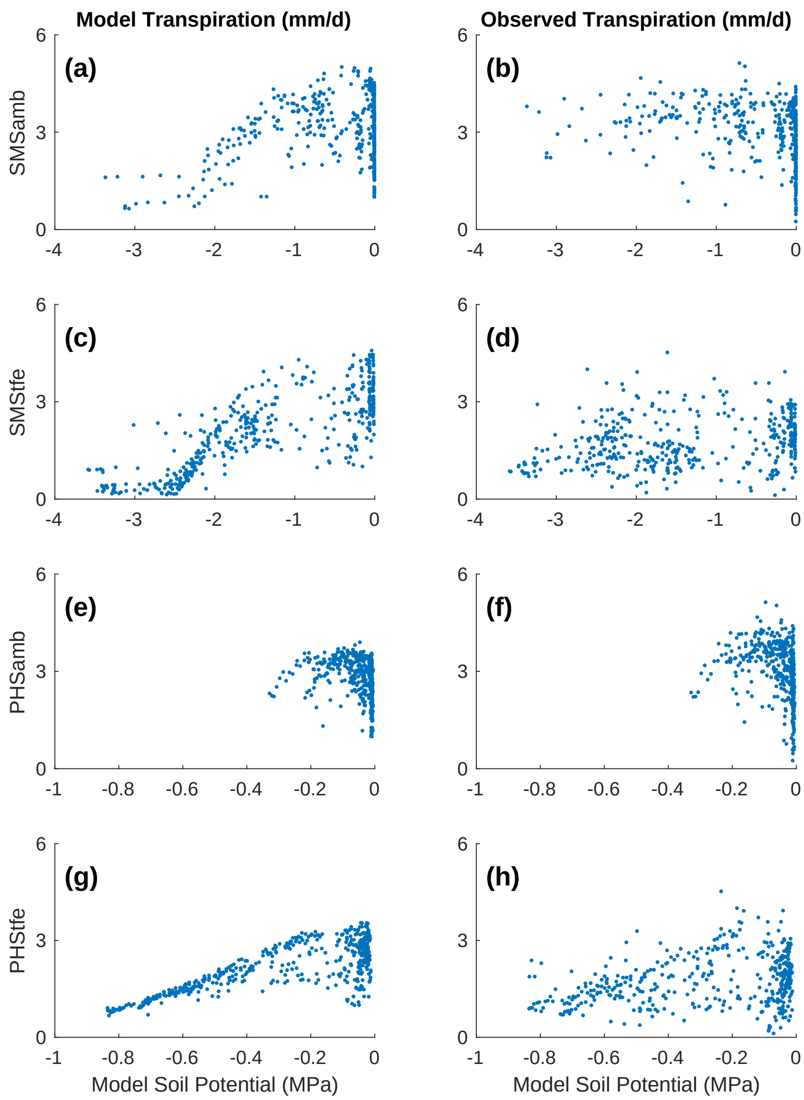

Figure S12. Modeled (left column) and observed (right column) transpiration vs. model soil potential. Complements Figure 13.