Supporting Materials

Figure S1: Spatial distribution of long-term memory differences (a) between the Dual-Permeability model and SMAP; (b) between the Dual-Permeability and Mixed-Richards models; (c) between the Mixed-Richards models using Van Genuchten and Clapp-Hornberger parameterizations; and (d) between the Mixed-Richards models with zero and 200 mm ponding depths.
Figure S2 Scatterplot of root zone $\tau_z$ estimated from SMAP versus (a) MF_CH; (b) DMP_VGM; (c) MF_VGM; (d) MF_VGM0; and (e) MF_VGM200.
Figure S3 Spatial distribution of root zone $\tau_L$ estimated from (a) MF_CH (b) MF_VGM; (c) MF_VGM0; and (d) MF_VGM200.

Figure S4 Spatial distribution of root zone long-term memory differences (a) between the Dual-Permeability and Mixed-Richards models; (b) within the Mixed-Richards models contrasting zero ponding depth to a 200 mm ponding depth.
Figure S5 Scatterplot of root zone $\tau_e$ estimated from SMAP versus (a) MF_CH; (b) DMP_VGM; (c) MF_VGM; (d) MF_VGM0; and (e) MF_VGM200.
Figure S6 Average surface soil moisture over 2015–2019: (a) SMAP; (b) MF_CH; (c) DMP_VGM; (d) MF_VGM; (e) MF_VGM0; and (f) MF_VGM200
Figure S7: Spatial distribution of surface soil evaporation of (a) MF_CH; and (b) DPM_VGM.

Figure S8: Spatial distribution of surface soil evaporation of (a) DPM_VGM; (b) MF_VGM; (c) MF_VGM0; and (d) MF_VGM200.