AGU PUBLICATIONS

Earth's Future

Supporting Information for

Soil Moisture Memory in Commonly-used Land Surface Models Differ Significantly from SMAP Observation

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Introduction

This document contains supplementary figures and tables supporting the main context.

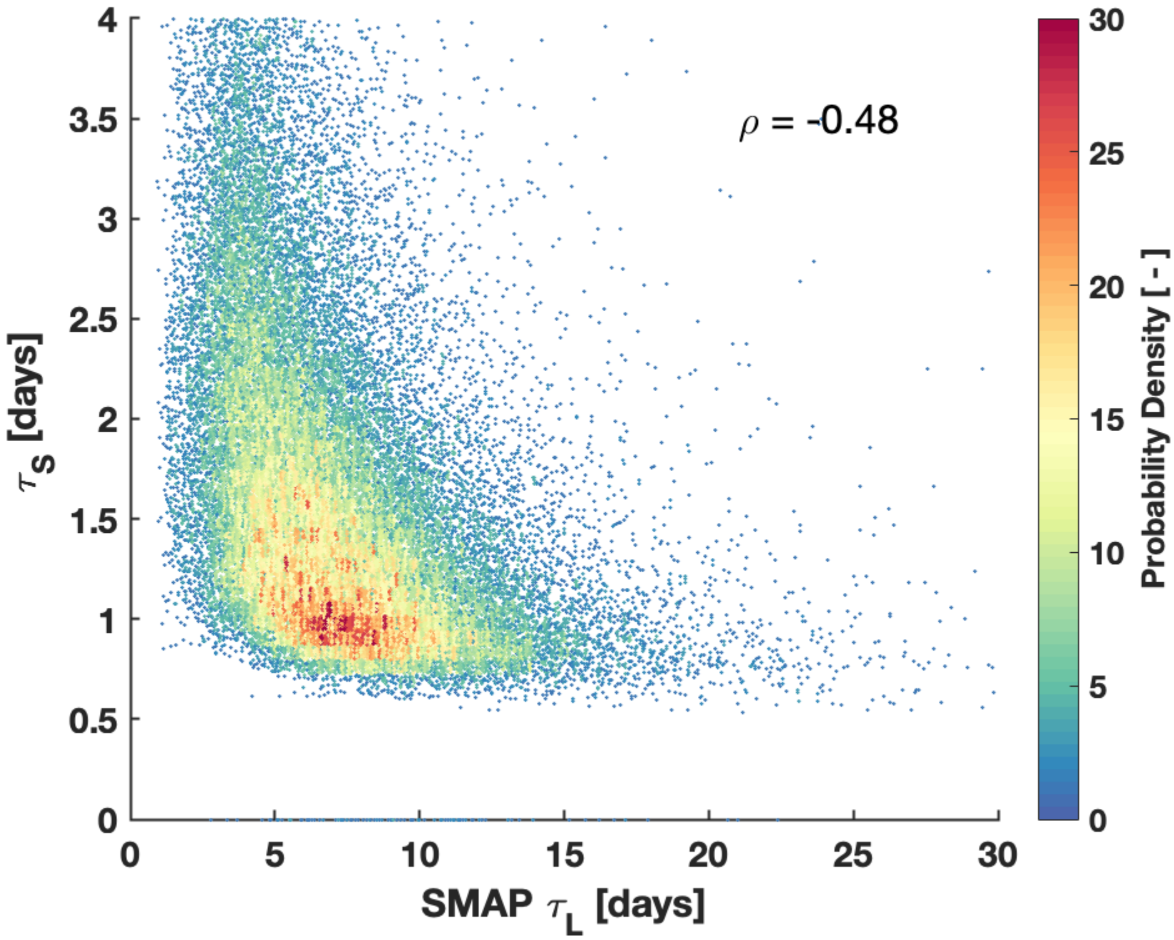

Figure S1. Scatter plot of energy-limited (τ_S) and water-limited soil memory (τ_L)

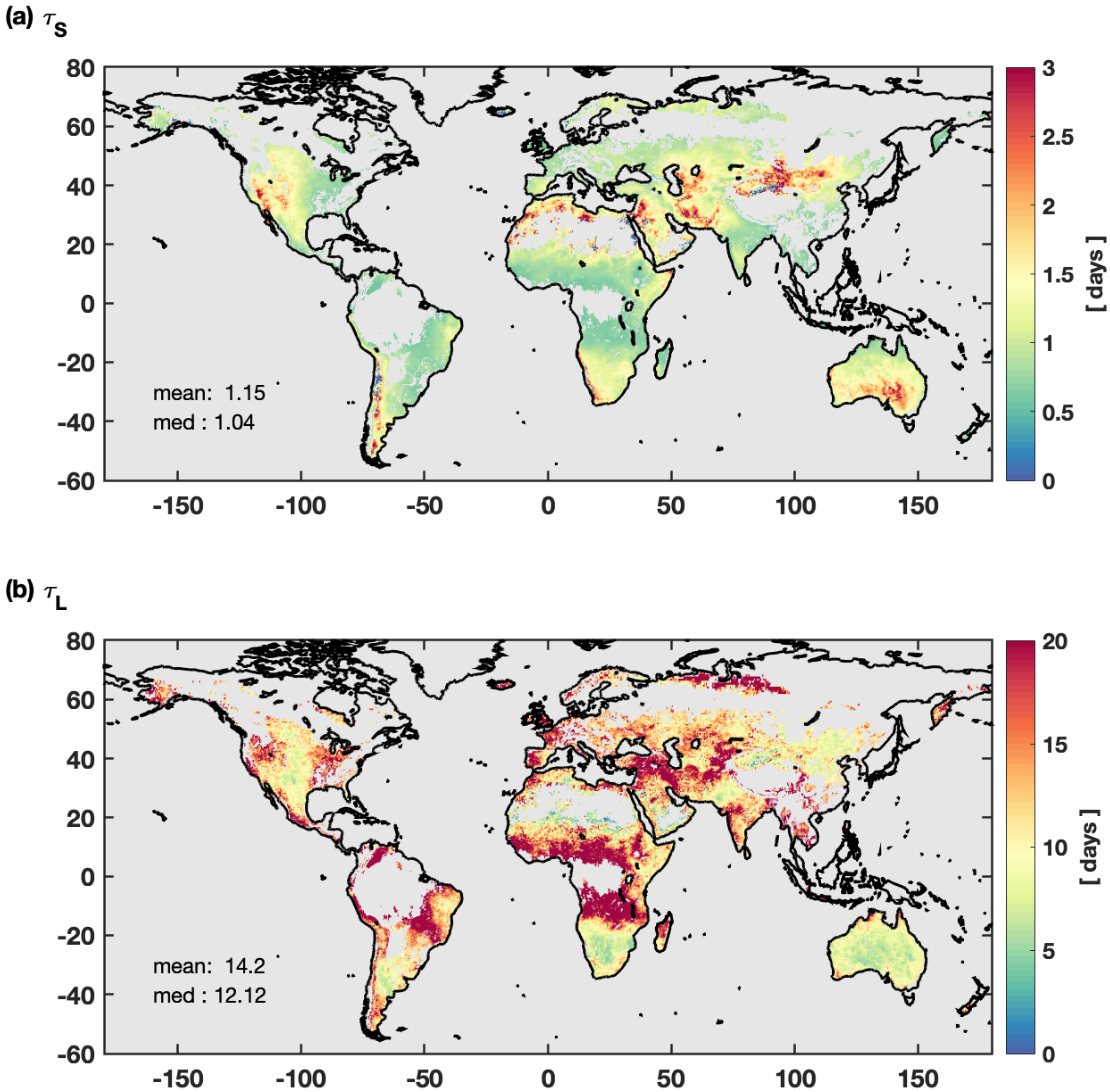

Figure S2. Global distribution of multi-model-mean τ_S (a) and τ_L (b) from six reanalysis datasets

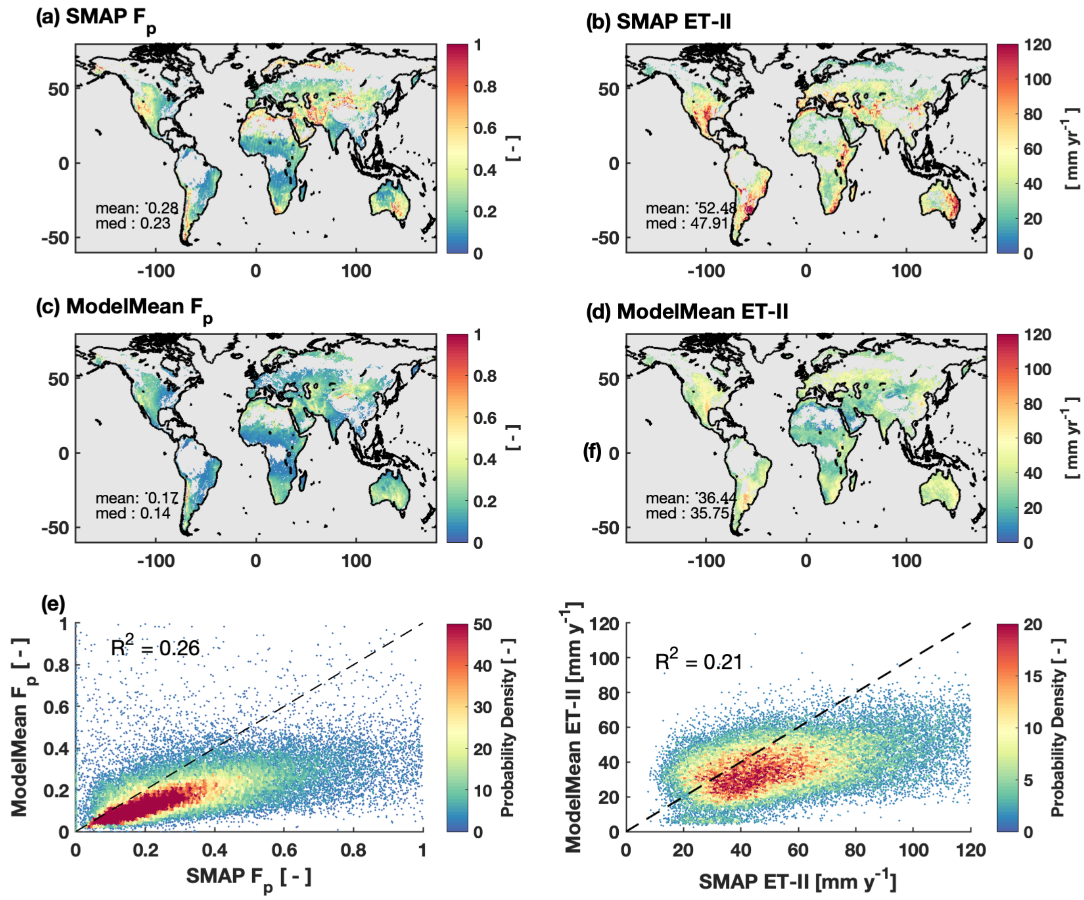

Figure S3. Same as Figure 7 but for all datasets.

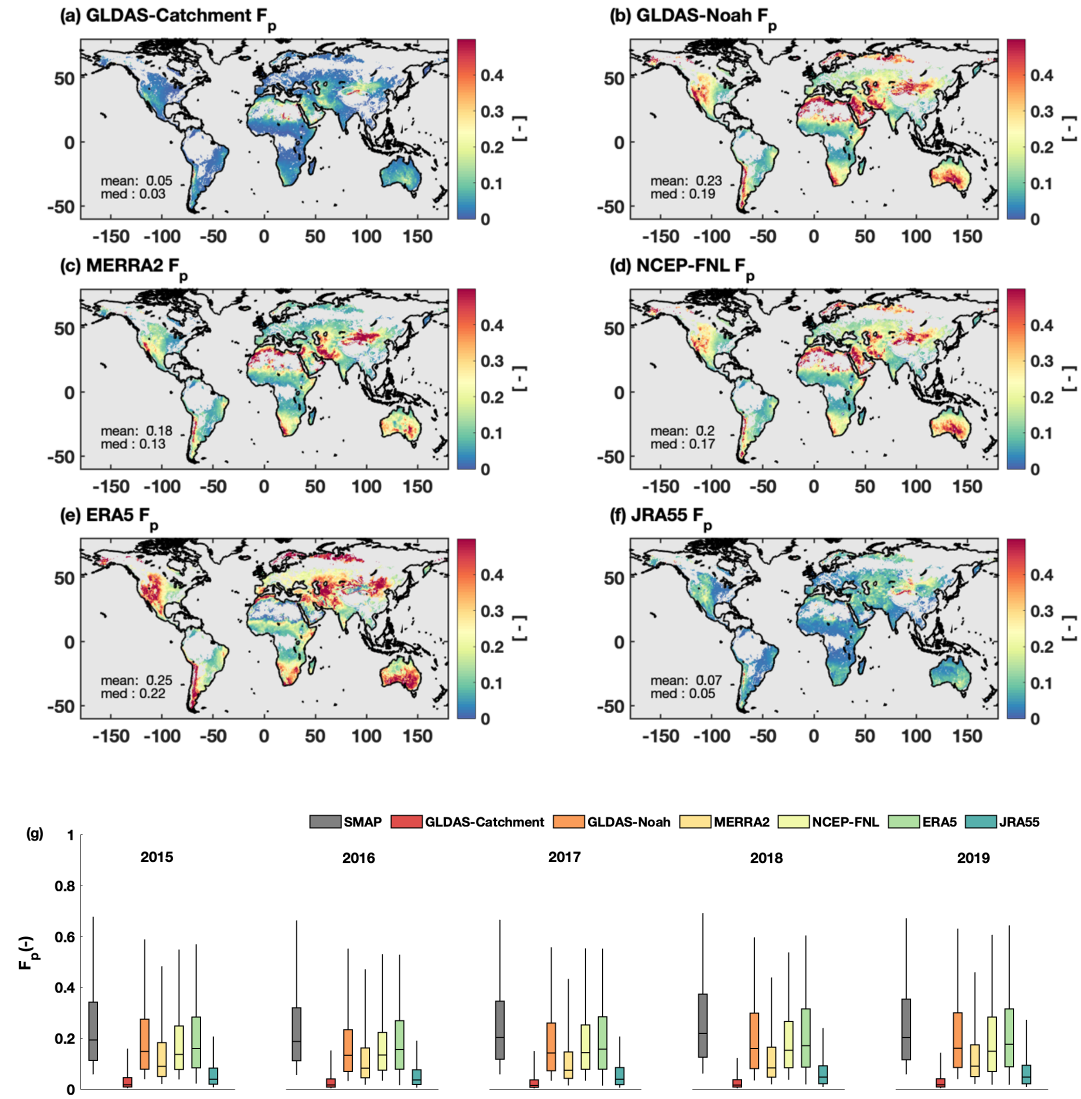

Figure S4 Global distribution of precipitation fraction F_p from individual dataset (a – f) and comparison of their annual variability (g)

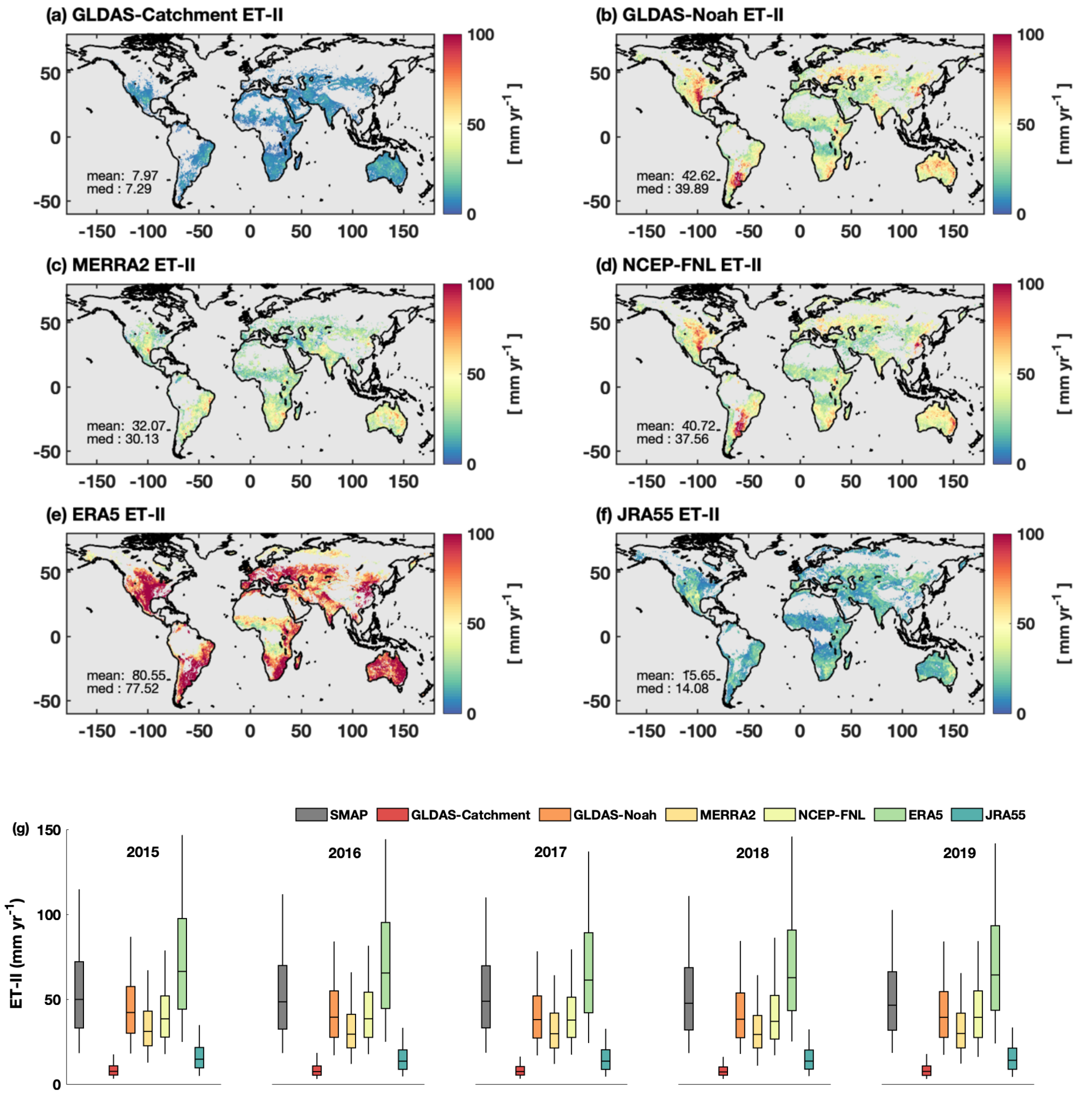

Figure S5 Same as Figure S4 but for Stage-II ET

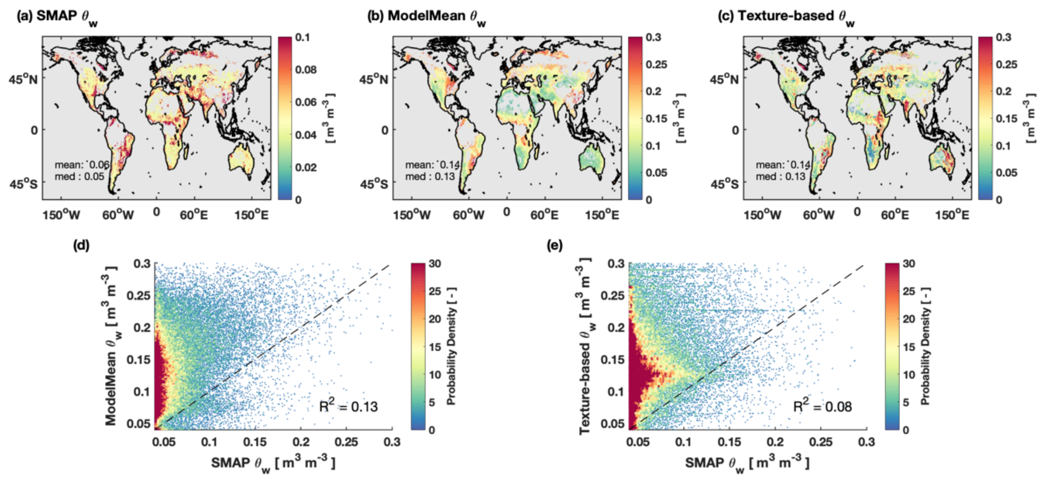

Figure S6 Global distribution of soil wilting point θ_w from satellite estimation (a), multi-model means(b), and from texture-based result (c); (d) and (e) indicates scatter plot of multi-model mean against satellite estimation and texture-based (SR06 scheme) result, respectively.

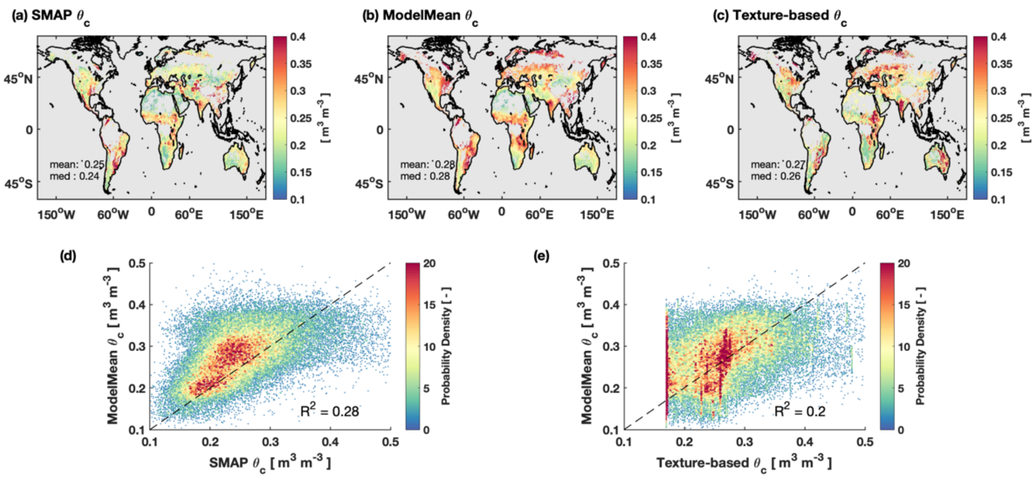

Figure S7 Same as Figure S6 but for soil critical point θ_c

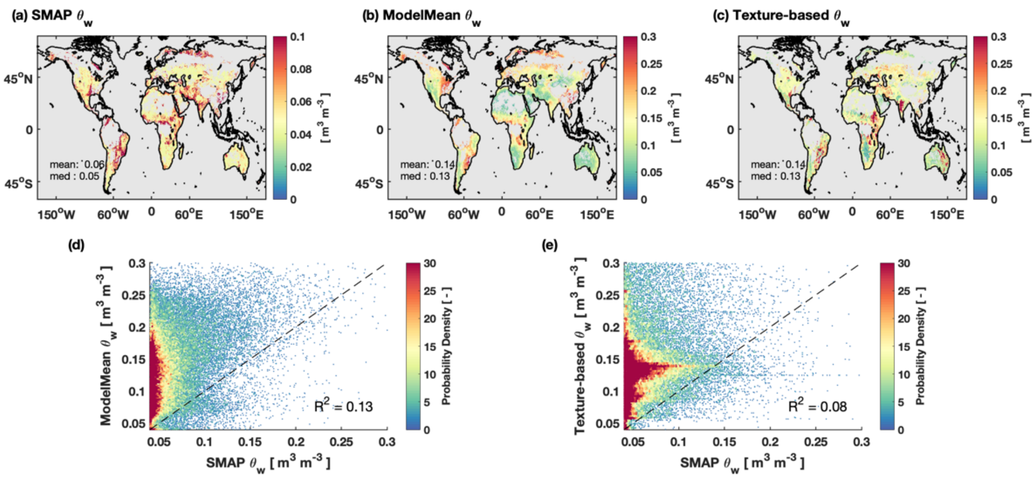

Figure S8 Global distribution of soil wilting point θ_w from satellite estimation (a), multi-model means(b), and from texture-based result (c); (d) and (e) indicates scatter plot of multi-model mean against satellite estimation and texture-based (Clapp and Hornberger (1978) scheme) result, respectively.

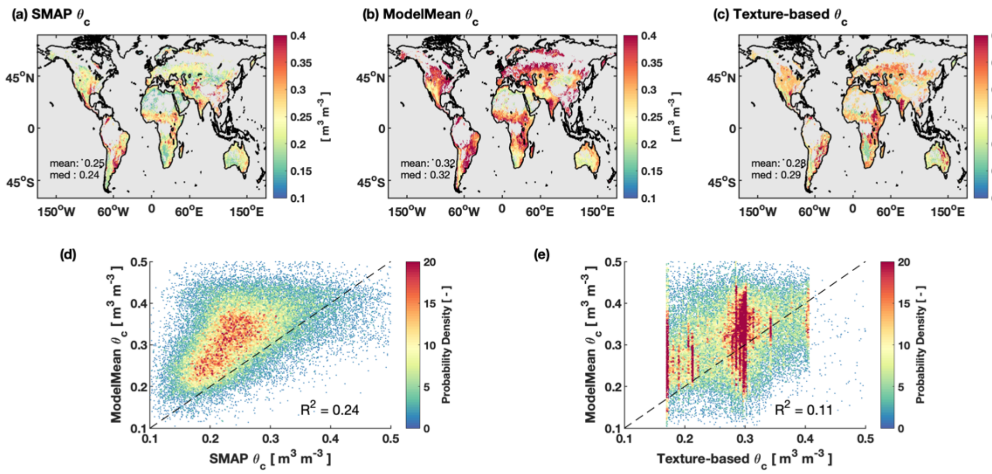

Figure S9 Same as Figure S8 but the texture-based θ_c is calculated from Clapp and Hornberger (1978) scheme.

Table S1 Pedotransfer Function from Saxton and Rawls (2006) (left column) and Clapp and Hornberger (1978) (right column). C, S, OC refers to soil clay content (%), sand content (%), and organic carbon (%) respectively.

	PTF-SR06	PTF-CH
Soil Wilting Point θ_w	$\theta_w = \theta_{1500t} + (0.14\theta_{1500t} - 0.02)$ $\theta_{1500t} = -0.024S + 0.487C + 0.006OC + 0.005(S*OC) - 0.013(C*OC) + 0.068(S*OC) + 0.031$	$\theta_w = (\frac{15.0}{\alpha})^{(\frac{1}{\beta})}$ $\alpha = \exp(-4.36 - 0.0715C - 4.88e - 4S^2 - 4.285e - 5S^2C)$ $\beta = -3.140 - 0.0022C^2 - 3.484e - 5S^2C$
Critical Point θ_{ref}	$\theta_{ref} = \theta_{33t} + 1.283\theta_{33t}^2 - 0.374\theta_{33t} - 0.015$ $\theta_{33t} = -0.251S + 0.195C + 0.011OC + 0.006(S*OC) - 0.027(C*OC) + 0.452(S*OC) + 0.299$	$\theta_{ref} = 0.01(11.83 + 0.96C - 0.008C^2)$
Saturated Point θ_{sat}	$\theta_{sat} = \theta_{33} + \theta_{s-33} - 0.097S + 0.043$ $\theta_{s-33} = \theta_{(s-33)t} + 0.636\theta_{(s-33)t} - 0.107$ $\theta_{(s-33)t} = 0.278S + 0.034C + 0.022OC + 0.018(S*OC) - 0.027(C*OC) - 0.584(S*OC) + 0.078$	$\theta_{sat} = 0.489 - 0.00126S$
$bexp(-)$	$bexp = \frac{3.8167}{\log(\theta_{ref}) - \log(\theta_w)}$	$bexp = 2.91 + 0.159C$
Saturated Soil Matric Potential ψ_{sat} (m)	$\psi_{sat} = \psi_{et} + 0.02\psi_{et}^2 - 0.113\psi_{et} - 0.70$ $\psi_{sat} = \psi_{sat} * 0.101997$ $\psi_{et} = -21.67S - 27.93C - 81.97\theta_{s-33} + 71.12(S*\theta_{s-33}) + 8.29(C*\theta_{s-33}) + 14.05(S*C) + 27.16$	$\psi_{sat} = 10(10^{(1.88-0.131S)})/1000$
Saturated soil conductivity κ_{sat} (m/s)	$\kappa_{sat} = 1930(\theta_{sat} - \theta_{33})^{1-bexp}$ $\kappa_{sat} = \kappa_{sat}/3600000$	$\kappa_{sat} = 0.0070556(10^{(-0.884-0.0153S)})$ $\kappa_{sat} = \kappa_{sat}/1000$

Saturated soil diffusivity $\lambda_{sat}(m2/s)$	$\lambda_{sat} = \frac{\kappa_{sat} \cdot \psi_{sat} \cdot bexp}{\theta_{sat}}$	$\lambda_{sat} = \frac{\kappa_{sat} \cdot \psi_{sat} \cdot bexp}{\theta_{sat}}$
Quartz	*Quartz = sand/2*	*Quartz = sand/2*