Supplementary

Heterogeneity effects on land surface modeling of water and energy partitioning

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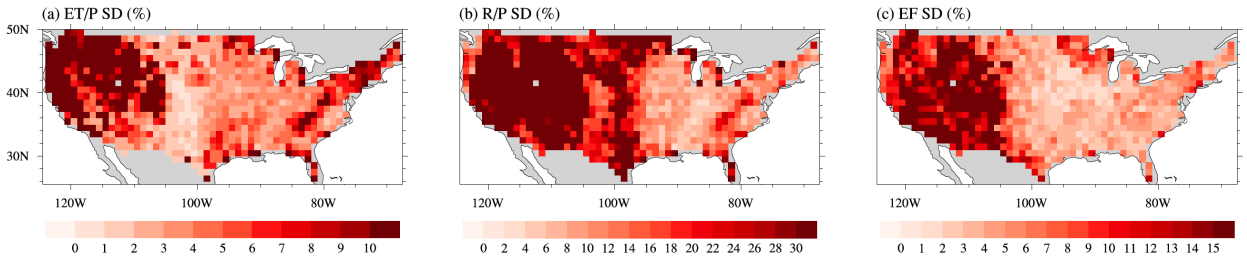

Figure S1. The normalized standard deviation (SD) range of 16 experiments for the annual climatology of (a) ET/P, (b) R/P, and (c) EF. For a given variable (e.g., ET/P), The range of SD is calculated as the difference between the maximum and minimum (i.e., 0 of the experiment A0S0L0T0) SD of these 16 experiments. The climatology mean from experiment A0S0L0T0 is used to normalize the SD, the ratio between SD and mean, to obtain normalized SD. The normalized SD represents how large the heterogeneity effects on the spatial variability of a given variable compared to its climatology mean.

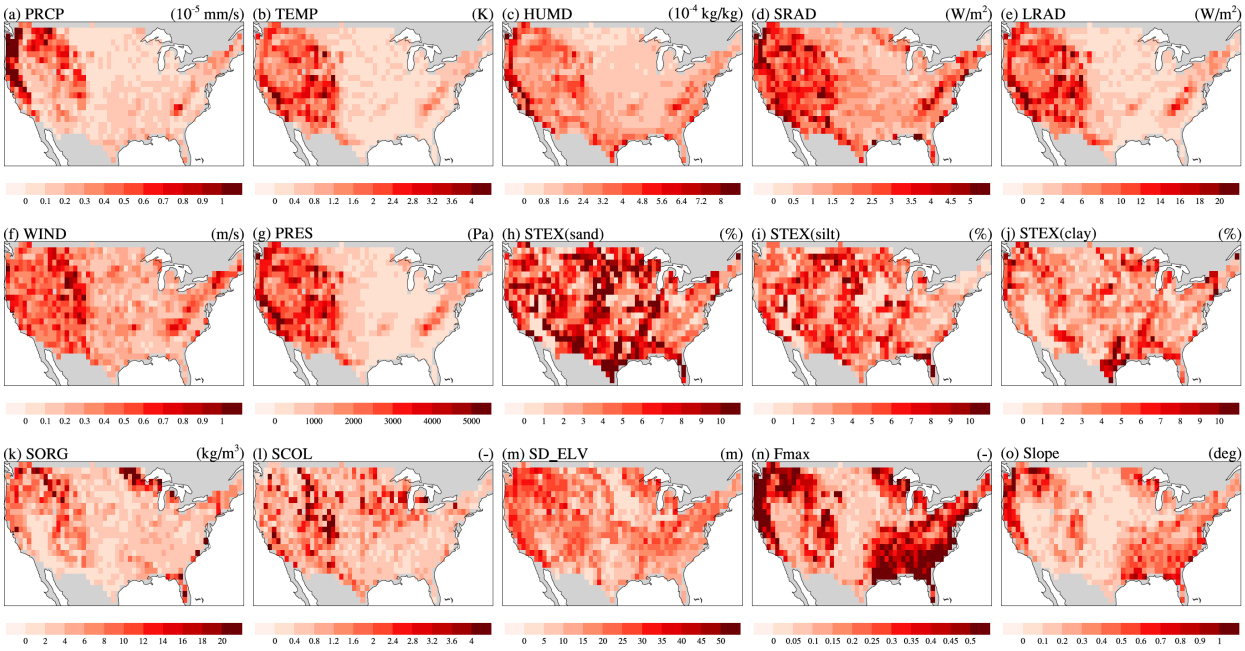

Figure S2 Spatial variability (i.e., SD) of each component of three heterogeneity sources. SD is calculated at each 1°×1° region based on 0.125° data. ATM: the annual climatology mean of (a) precipitation, (b) temperature, (c) humidity, (d) short wave radiation, (e) long wave radiation, (f) wind speed, (g) air pressure. SOIL: (h) percentage of sand at surface five soil layers, (i) percentage of silt at surface five soil layers, (j) percentage of clay at surface five soil layers, (k) soil organic matter at surface five soil layers, (l) soil color. TOPO: (m) standard deviation of elevation, (n) Fmax, (o) slope.

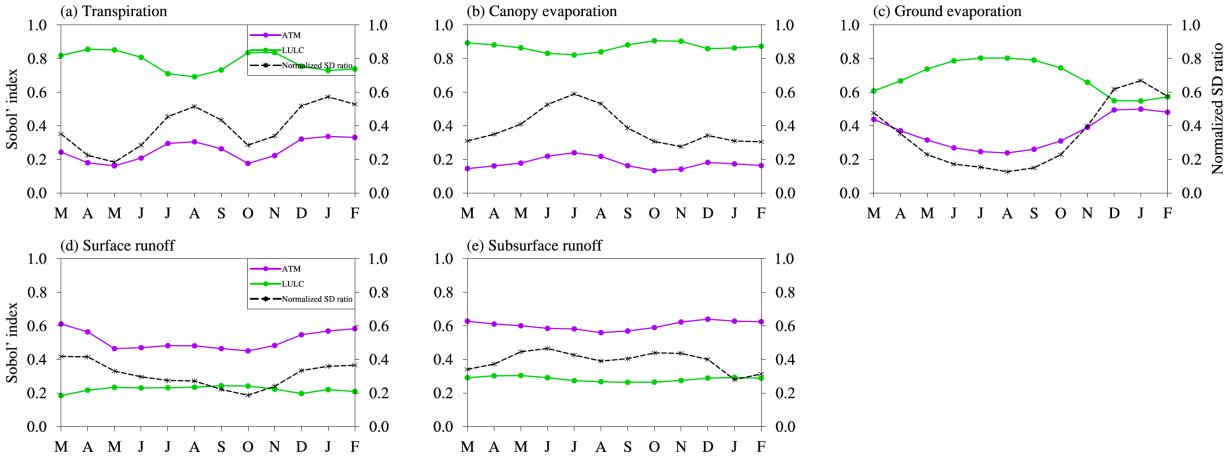

Figure S3. Monthly variations of CONUS averaged ATM and LULC Sobol' index to ATM and normalized SD ratio for (a) Transpiration, (b) Canopy evaporation, (c) Ground evaporation, (d) Surface runoff, and (e) Subsurface runoff

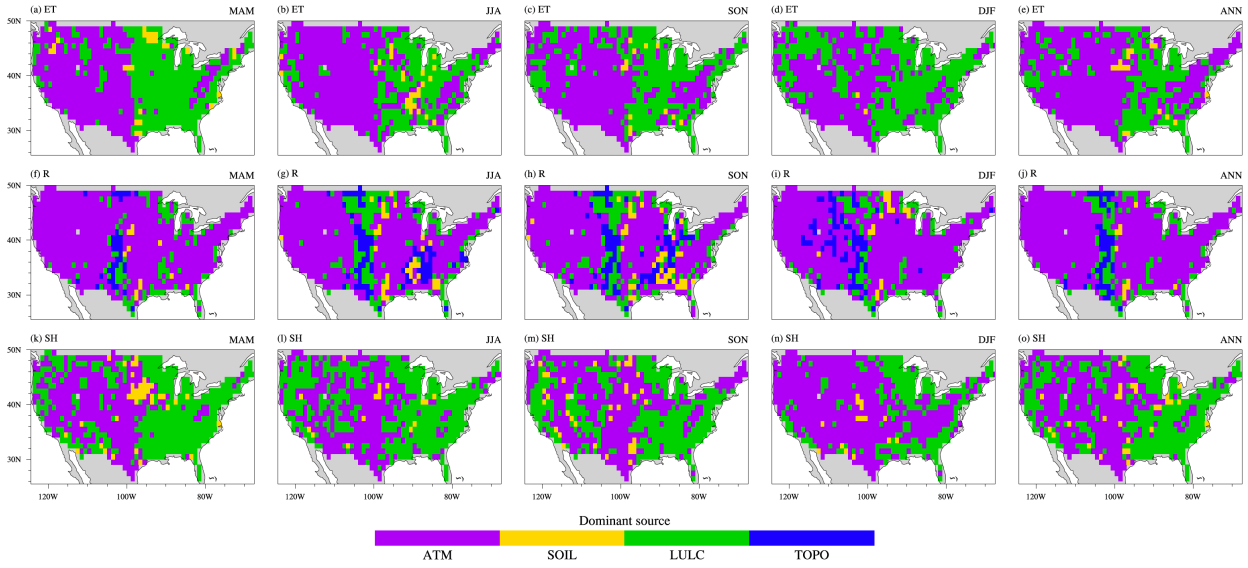

Figure S4 Spatial patterns of the most sensitive heterogeneity source for ET, R, and SH in four seasons and annual mean.

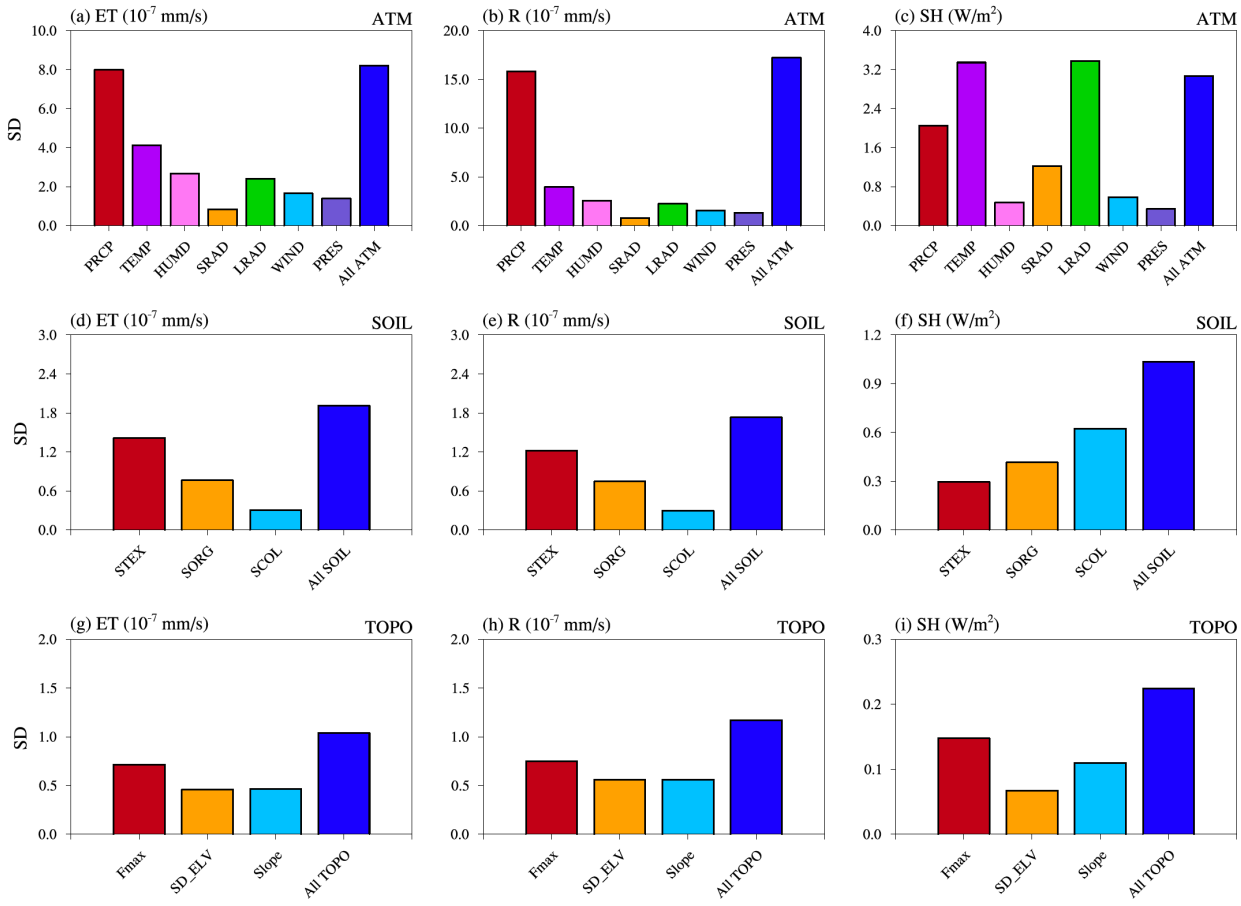

Figure S5. CONUS averaged spatial variability for the annual climatology mean of ET (left column), R (middle column), and SH (right column) by each component or all components of ATM (top panel), SOIL (middle panel), and TOPO (bottom panel).

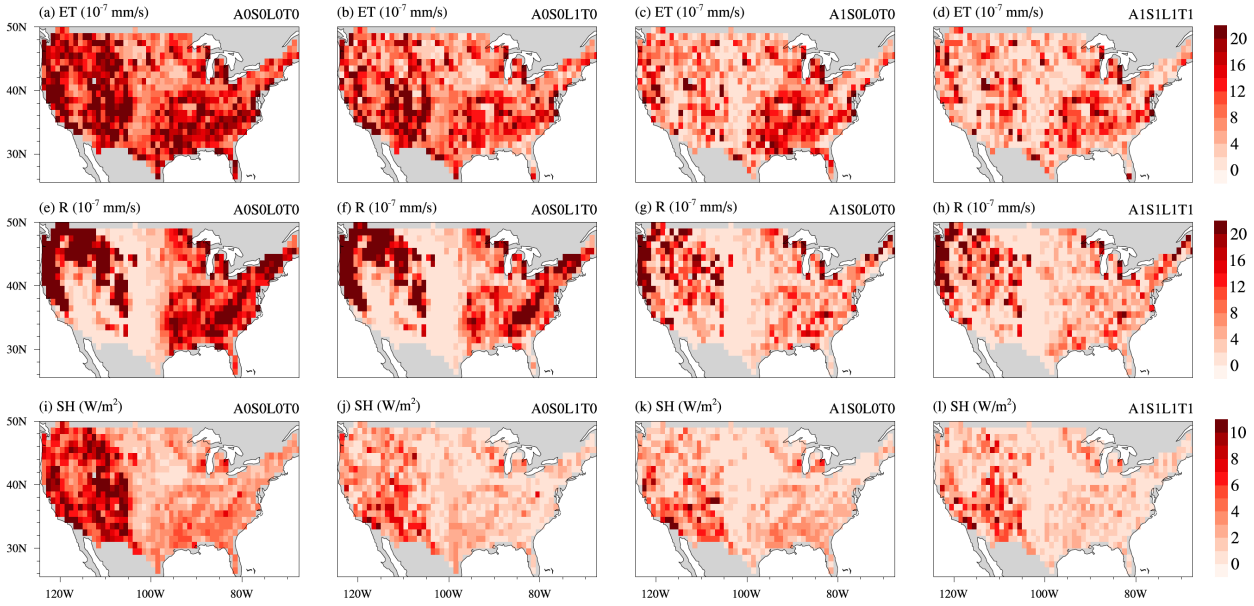

Figure S6. CONUS spatial patterns of SD's absolute difference between four ELM experiments and ERA5-Land reanalysis for the annual climatology mean of ET (top panel), R (middle panel), and SH (bottom panel). 1st column figures represent the homogeneous experiment (A0S0L0T0); 2nd column figures show only LULC effects based on EXP3 (A0S0L1T0); 3rd column figures represent only ATM effects based on EXP3 (A0S0L1T0); 4th column figures represent effects from all four heterogeneity sources based on EXP16 (A1S1L1T1).