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Connections between groundwater flow and transpiration partitioning: using integrated continental-scale simulations at high resolution to diagnose hydrologic process interaction

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Understanding freshwater fluxes at continental scales will help us better predict hydrologic response and manage our terrestrial water resources. The partitioning of evapotranspiration into bare soil evaporation and plant transpiration remains a key uncertainty in the terrestrial water balance. We used integrated hydrologic simulations that couple vegetation and land energy processes with surface and subsurface hydrology to study transpiration partitioning at the continental scale. These high resolution, transient simulations encompass the major watersheds of the United States and demonstrate great complexity in hydrologic and land energy states. Two simulations were used to study the role lateral groundwater flow plays in transpiration partitioning. Results show that both latent heat flux and partitioning are connected to water table depth, and including lateral groundwater flow in the model increases transpiration partitioning from 47$\pm$13% to 62$\pm$12%. This suggests that lateral groundwater flow, which is generally simplified or excluded in earth system models, may provide a missing link to reconciling observations and global models of terrestrial water fluxes.