



Biotic control of water use efficiency across global terrestrial ecosystems

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Ecosystem water use efficiency (WUE) is an important index to clarifying the coupling between ecosystem carbon and water cycle, and it also act as an emergent constraint for land models. Although many attempts have been made to address the spatial and temporal variations in ecosystem WUE, little is known about the underlying controlling mechanisms. In this study, we investigated the spatial pattern of WUE across 81 Fluxnet sites. Further, with a partitioning approach, we presented a framework to clarify the processes affecting the spatial variations in WUE. With the framework, our results indicate that biotic factors, i.e. leaf area index (LAI) and canopy level C_i/C_a are the key factors dominating the spatial pattern of WUE. Our results also reveal that the relative contributions of LAI and C_i/C_a to WUE vary under conditions with different magnitudes of water vapor deficit and degrees of the coupling between canopy and atmosphere. Finally, we compared the spatial pattern of WUE estimated with five land models and eddy covariance measurements. We found that some models failed to capture the key process affecting WUE and hence cannot reproduce the general spatial pattern of WUE.