Long-term Eddy Covariance Monitoring of Evapotranspiration in a Semi-Arid Region over a Mesquite and Desert Grass Surface

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Abstract:

Evaporation is a major component of the surface water and energy budgets. In semi-arid and arid regions the scarcity of water availability for evaporation and transpiration (ET) presents unique challenges to evaluating and understanding long-term evaporation or ET processes for desert biomes. In the northern extent of the Chihuahuan desert two distinct biomes are continuously monitored with eddy covariance and surface energy balance instrumentation to evaluate differences in evaporation and surface energy balance partitioning on daily and seasonal time scales. The biomes, native desert savannah grassland (black grama, Bouteloua eriopoda Torr.) and honey mesquite (Prosopis glandulosa Torr.) dunes are uniquely coupled landscapes that represent a striking modern day land surface transformation as a result from overgrazing of the grasslands. The transformation is such that not only has the grass vegetation (C3) been completely replaced with honey mesquite (C4) but also the actual grassland surface roughness has been significantly altered by the development of coppice dunes many of which exceed 2 m in height. Eddy covariance measurements of ET and sensible heat flux are in the sixth continuous year of monitoring. Additionally, net radiation (Q*) and ancillary measurements of air temperature, relative humidity are also monitored. Subtle but distinct differences in energy partitioning and water use are characterized as functions of vegetation type, surface roughness, and water availability. Water use trends are seasonal and respond to monsoonal precipitation patterns. Implications for modeling desert water use will be discussed.

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