Water and Energy Cycles Coupling Diagnosed From Remotely Sensed Global Observations

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Abstract: The water and energy cycles - the two principal cycles of the Earth system – are coupled together over land through evaporation (latent heat flux). Evaporation – (transpiration where it occurs through vegetation) transitions from water-limited to energy-limited regimes depending on environmental conditions. The representation of transitions between these regimes and its dependence on soil moisture and other factors determines how the water and energy balance couple and vary at the land surface. This representation is the closure equation between the water and energy balance over terrestrial surfaces. The simulation of current weather and climate and model-based projections of future climate are highly dependent on the form of this closure equation. Important as this closure function is to Earth system science understanding and models for it, the function is mostly unknown. Most models currently use empirical relations for this important coupling and hence their representations of the terrestrial branch of the hydrologic cycle vary widely among the models. The focus of this talk is the observation-driven estimation of this closure relationship. In order to characterize this function across diverse climates and landscapes, remote sensing measurements are used. Multiple types of measurements from several different space-borne platforms are combined to constrain the estimation problem.