Relating Evapotranspiration Rate, Soil and Plant Temperature, and SWIR Reflectance for Root Water Uptake Estimation

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Abstract
The combined application of optical and thermal data has shown great potential for estimation of evapotranspiration (ET) at large scales. In pursuit of developing physically-based models for remote sensing of root water uptake, a series of laboratory experiments with wheat grass have been conducted with 3 small lysimeters. Three treatments including bare- (BS), sparsely vegetated- (SV), and fully vegetated (FV)-soil were investigated for determining evaporation (E), evapotranspiration (ET) and transpiration (T) rates. The soil and plant canopy were imaged over time with shortwave (SWIR) and thermal infrared (FLIR) cameras. For the fully vegetated treatment the reduction function ($\alpha(h)$) is equal to unity and the change in SWIR reflectance and temperature are a measure of potential ET when soil water is sufficiently available. For sparsely vegetated conditions, the change in SWIR reflectance and surface temperature serves as a measure of actual ET due to the soil water deficit. The relative change in SWIR reflectance and surface temperature will be related to $\alpha(h)$ and the root water uptake.