Scintillometry for Evapotranspiration estimation over irrigated alfalfa and dry grassland

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Abstract. In recent years scintillometry technology has become a recognized tool for the estimation of spatially-averaged vegetative ET rates. In particular, a Large Aperture Scintillometer (LAS) can provide estimates of the surface sensible heat flux (H) and, in combination with measurements of surface net radiation (Rn) and ground heat flux (G), can be used to solve for evaporative heat flux (λE) using the surface energy balance method. The LAS can operate over path lengths between 250 and 4500 m approximately and reports a path-averaged signal whose largest weight is at the path center. Two separate deployments of a Kipp and Zonen model LAS were considered; the first case (alfalfa deployment) during the 2010 summer over a fully irrigated alfalfa field and the second case (grassland deployment) at a dry grassland site during the 2011 summer. In each case, ancillary instrumentation was deployed for capturing necessary meteorological inputs and measurements of Rn and G. For the alfalfa deployment, a two-week subset of near-reference condition (50 cm crop height) data was processed and analyzed to derive hourly estimates of energy-balance ET from the LAS signal. The resulting H for this condition was generally less than 50 W m^{-2} during the morning/early afternoon periods, and negative H between 50-150 W m^{-2} was observed during the afternoon/evening periods, which suggests advective conditions. ET rates for the same data subset had a generally consistent daytime peak near 0.8 mm h^{-1}. For the grassland deployment, hourly ET rates were derived from the LAS signal for a two-week subset of data following two significant precipitation events. Daytime peak hourly ET varied from approximately 0.6/0.7 mm h^{-1} following the precipitation events to approximately 0.3 mm h^{-1} at the end of the subset. Daytime peak H for the same period ranged from 150-300 W m^{-2}.

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