Eddy Covariance Estimates of Evapotranspiration in Irrigated and Rainfed Soybean in Uruguay

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Abstract

Estimating total crop water use and the associated variability are critical for planning, for the design of supplementary irrigation strategies and for subsequent management. Tough there have been great advances in estimating actual evapotranspiration, achieving accurate estimates at the field level is still a challenge. The characterization of site specific characteristics influencing evapotranspiration like soil properties impose a great challenge to the use of modeling, and the accurate characterization of the variability within a field of crop status may bias estimates. Using remote sensing to estimate crop status and energy balance at a fine scale overcome some of these issues. Nevertheless there is a need to have accurate and precise measurements of evapotranspiration that can serve as validation sites. The eddy covariance method provides the accuracy and footprint necessary to be used as a reference. Two towers were installed between 2010 and 2015 at two contrasting locations each year in the south-west of Uruguay at agricultural fields with wheat-soybean crop rotation. The sites were maintained at the same location during wheat and soybean. Sites were managed with supplementary irrigation at full demand or without irrigation. Each tower had instruments to measure in parallel the energy balance (radiometers, flux plates and soil temperature probes), and evapotranspiration directly from eddy covariance (sonic anemometer, IRGA). All locations met fetch requirements, were representative of agricultural fields and were situated in an area dominated by agricultural land. Season long totals showed large variability depending on crop status and seasonal precipitation regime that determined crop growth and leaf area development. Totals for irrigated fields in the north (Salto, 650-800mm) were higher than in the south (Colonia-Soriano, 600-750), and higher than standard requirements for the region. This study provides reference values for a significant number of growing conditions and years for irrigated or rain-fed soybean crops.

Keywords: Eddy covariance, eta, water use efficiency, soybean