Ground-based multispectral remote sensing to estimate actual crop coefficients for alfalfa and grass pastures in the western slope Colorado

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Abstract. Knowledge of crop evapotranspiration (ETc) is important for effective irrigation water management. Among the various methods used to estimate ETc, the FAO56 Penman-Monteith approach, using tabulated generalized Kc values, has been widely adopted to estimate crop evapotranspiration. However, this generalized crop coefficients values are not effective in characterizing the actual crop transpiration when soil water is not adequate, or crop is not well irrigated. This research project aimed to develop quantitative relationships to improve the estimation of actual crop coefficients using remotely sensed data for alfalfa and grass pastures in the western slope of Colorado. Remote sensing techniques are growing rapidly as a way to monitor actual crop water use. Some remotely sensed data, from multispectral sensors, acquire spectral reflectance of crop canopies on several bands. The differences in reflectance values, at different bandwidths from typical multispectral signatures (libraries), help determining the current or actual canopy properties like crop height, leaf area index, percent cover, water stress, nutrient level, etc. In this study, the actual crop coefficients (Kca) values were calculated using actual crop evapotranspiration (ETa) and reference crop evapotranspiration (ETr). The Campbell Scientific CS655 and the Watermark 200SS soil water content sensors were used to derive the volumetric soil water content for performing the soil water balance (SWB) to estimate ETa for grass and alfalfa fields during the 2016 growing season at Montrose and Delta County. A handheld multispectral radiometer was used to collect the crop canopy reflectance data. Vegetation indices (VI) were calculated using the radiometer data. Vegetation indices are the mathematical combination or transformation of surface reflectance in different spectral bands. These VI were related to Kca to develop the improved models for estimation of actual crop coefficients. This presentation will focus on the vegetation indices used in this study, models developed to estimate actual crop coefficients (Kca), some preliminary results, and the performance evaluation of the models developed.