

Integration of an unmanned aircraft system and ground based remote sensing to estimate spatially distributed crop evapotranspiration and soil water deficit through the vegetation soil root zone

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Abstract. In the United States, and around the world, applications using Unmanned Aircraft Systems (UAS) have rapidly evolved from solely military and intelligence operations to an ever increasing number of civilian applications. One of the fastest growing civilian applications is UAS integration with precision agriculture and irrigation management systems. Using UAS remote sensing platforms to conduct frequent, economical, high resolution remote sensing (RS) data collection allows for the development of spatially distributed soil water deficit and actual crop evapotranspiration for use in precision agriculture irrigation management systems. Although there are other platforms, such as satellite remote sensing or ground-based data collection, that produce similar products, their use is limited by the long frequency between data collection, low resolution of the data and cost associated with the data collection and processing. The spatially distributed soil water deficit and actual evapotranspiration estimates are essential to track the actual crop water requirements in a precision agriculture irrigation management system, providing a more efficient use of our limited water resources. During the summer of 2015, Colorado State University (CSU), in coordination with Utah State University, conducted four UAS and three manned aircraft RS operations at the CSU Agricultural Research Development and Education Center (ARDEC) in order to collect multispectral RS data covering the near infrared, red, green and thermal bands of the electromagnetic spectrum. A hybrid energy balance RS evapotranspiration and a soil water balance methods, along with weather and plant biophysical data, were used to estimate daily actual crop evapotranspiration and soil water deficit. Estimated values were compared to measured values over different levels of irrigated corn plots.