Poster 322-519

Integration of remote reference surface meteorological data with field-specific observations for improved parameterization of actual evapotranspiration

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Introduction

-Reference ET (ET_0) and crop coefficients (K_c) are commonly used to schedule irrigation, but proper reference ET surfaces and meteorological stations are quite sparsely located.

-In heterogeneous meteorological environments (e.g. mountains and coastal regions), local on field meteorology can be significantly different than that of the nearest ET_0 station.

-Current approaches apply additional, empirical landscape and microclimate coefficients to correct K_c values determined under standard conditions. These landscape coefficients are highly variable and poorly parameterized.

-Irrigated lands in mountainous and coastal regions can have extremely limited and/or expensive water and may have particularly tight water management needs, making accurate ET estimation even more critical.

Study goals

-Test new ET_0 approaches with both meteorological station over non-reference surface and integration of local wind data from non-reference station with temperature and humidity from reference surface station.

-Compare ET_0 products with ET observations in two crops and parameterized K_c in grape field. Assess how various ET_0 products affect stability of K_c and comparison to literature values.

Study Region and Data

-Study in inland Southern California with five California Irrigation Management Information System (CIMIS) stations and local non-reference surface weather station at US Salinity Laboratory (USSL).

-Additional products consisting of merged dataset with local wind and reference meteorology, two non-advective equations (Hargreaves-Samani and Priestley-Taylor) from local station, and Spatial CIMIS.

-Validation ET data from summer 2015 from Jerusalem artichoke crop in sand tank volumetric lysimeter and grapes in individual weighing lysimeters[1].

-Fractional canopy cover data for grape lysimeter for comparison with existing literature K_c values[2].

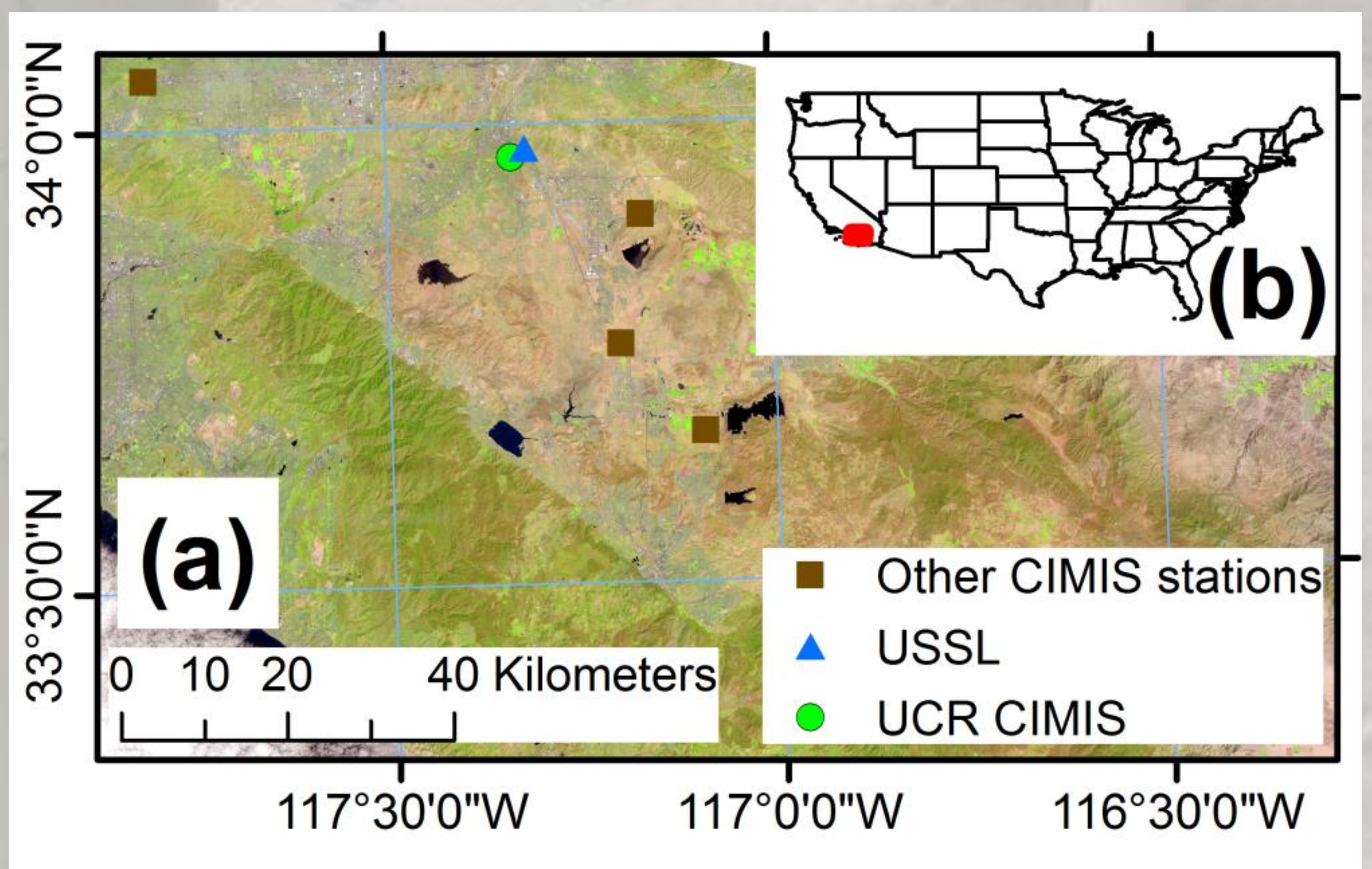


Figure 1: (a) Landsat false color image of inland Southern California showing the United States Salinity Laboratory (USSL) in relation to CIMIS stations. (b) Map of contiguous United States with extent of (a) shown in red.

Results

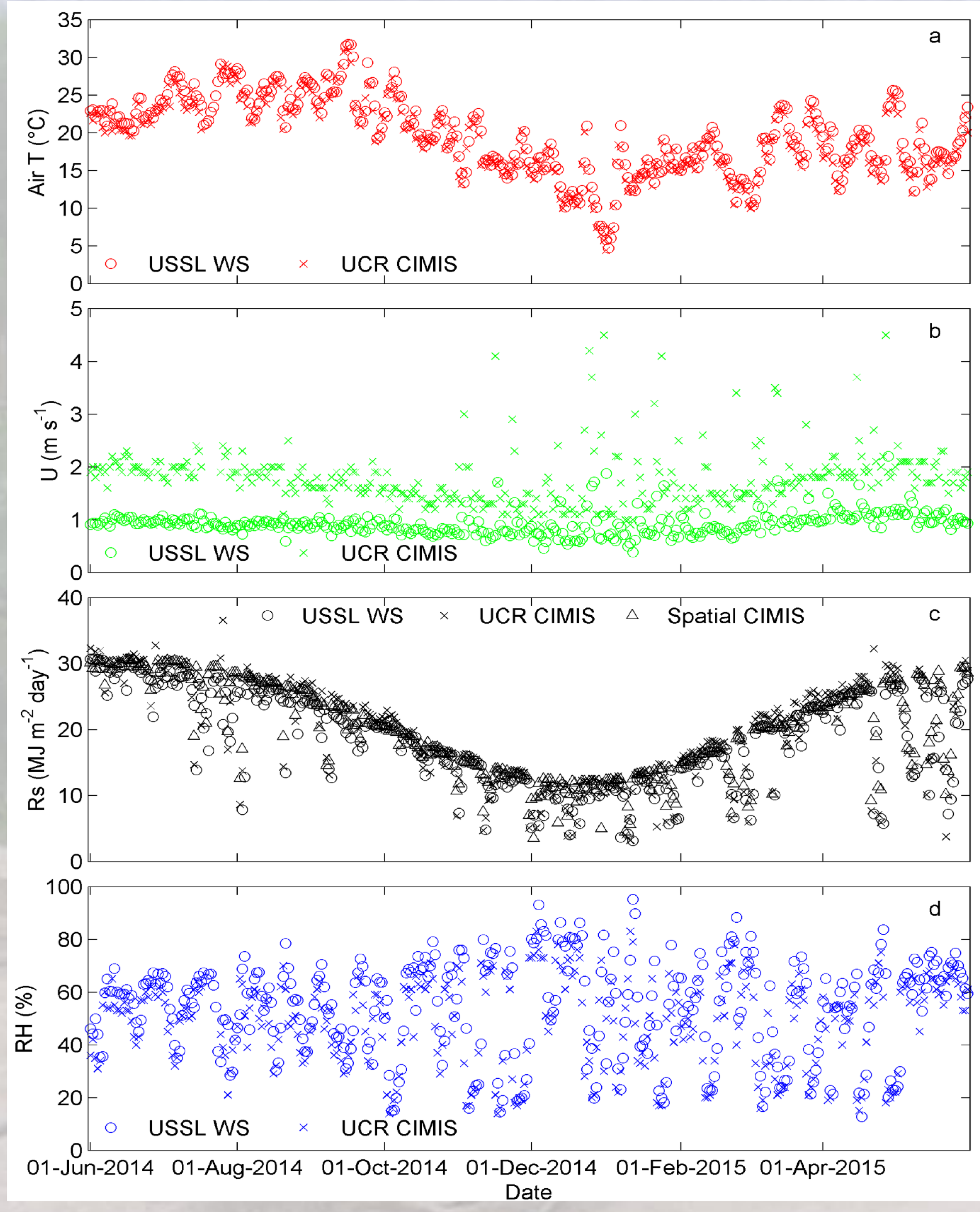


Figure 2: Meteorology for USSL and closest CIMIS station (UCR CIMIS - ~3km distance) for 1 June 2014 to 31 May 2015, including mean daily air temperature (a), wind speed (b), solar irradiance (c), and relative humidity (d). Only significant difference between sites is wind speed, which is about double at UCR CIMIS.

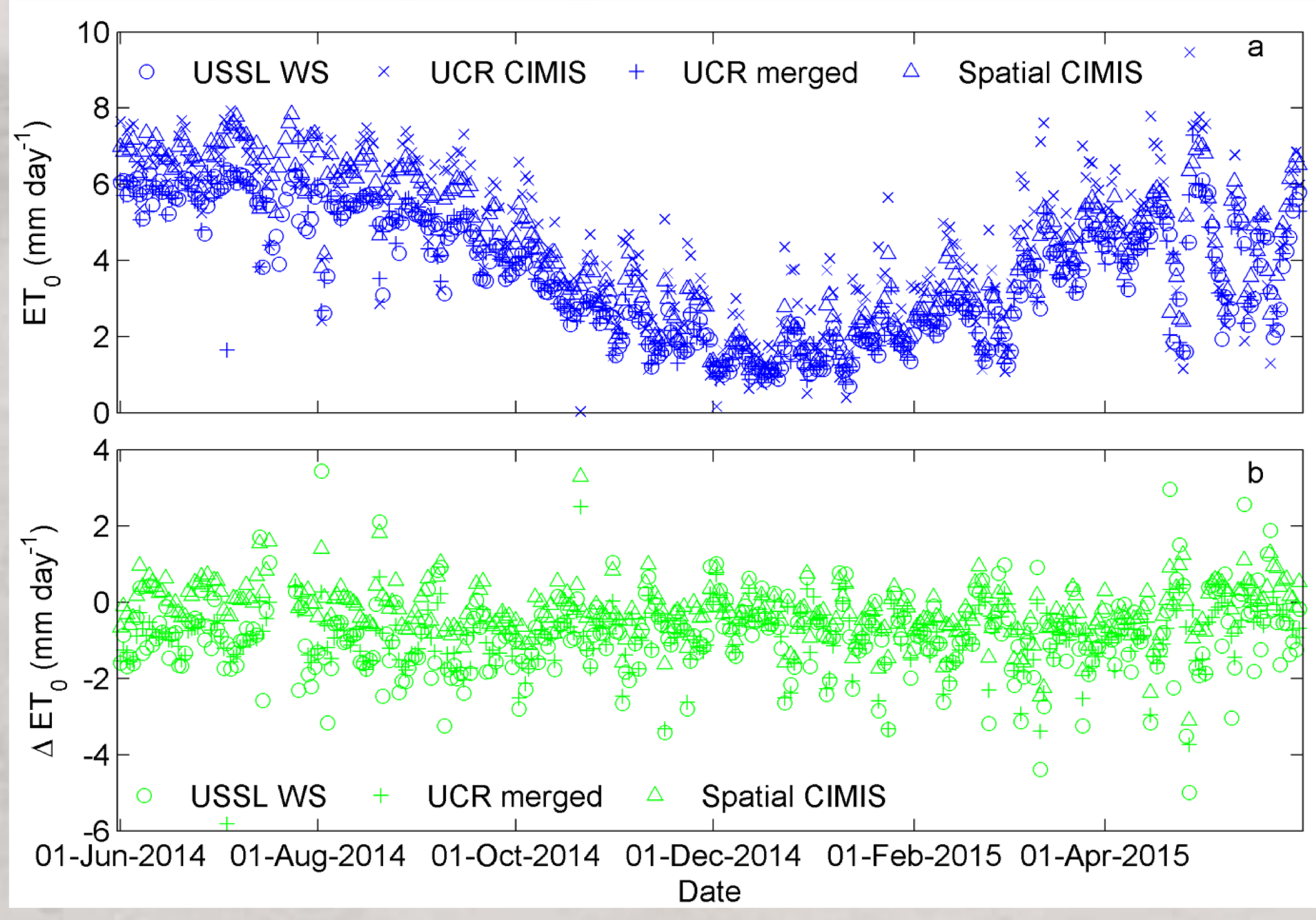


Figure 3: (a) daily ET_0 from different products, including non-reference station (USSL WS), UCR CIMIS, UCR merged (UCR CIMIS with USSL WS wind speed), and Spatial CIMIS. (b) Daily difference between UCR CIMIS and other products.

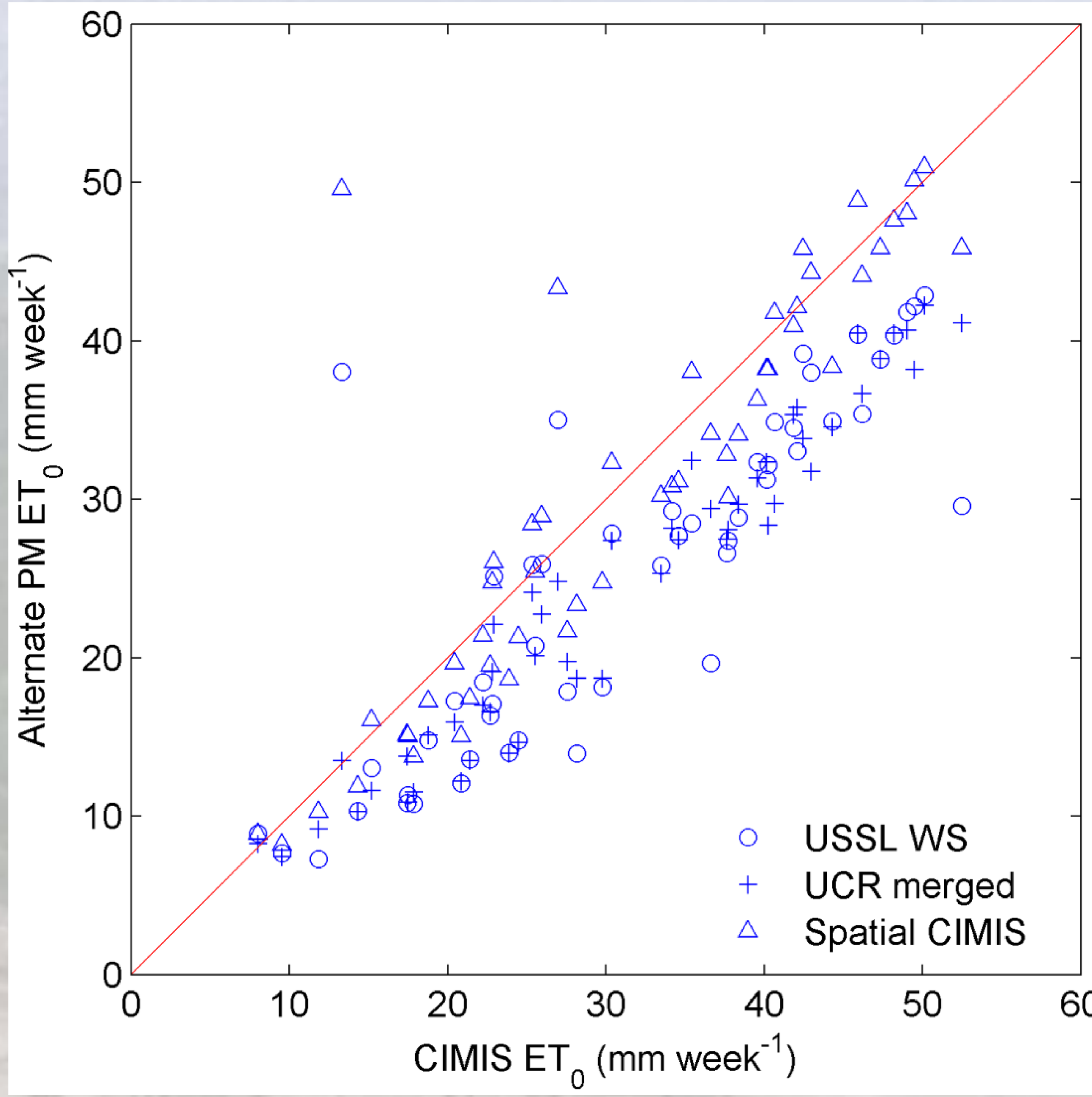
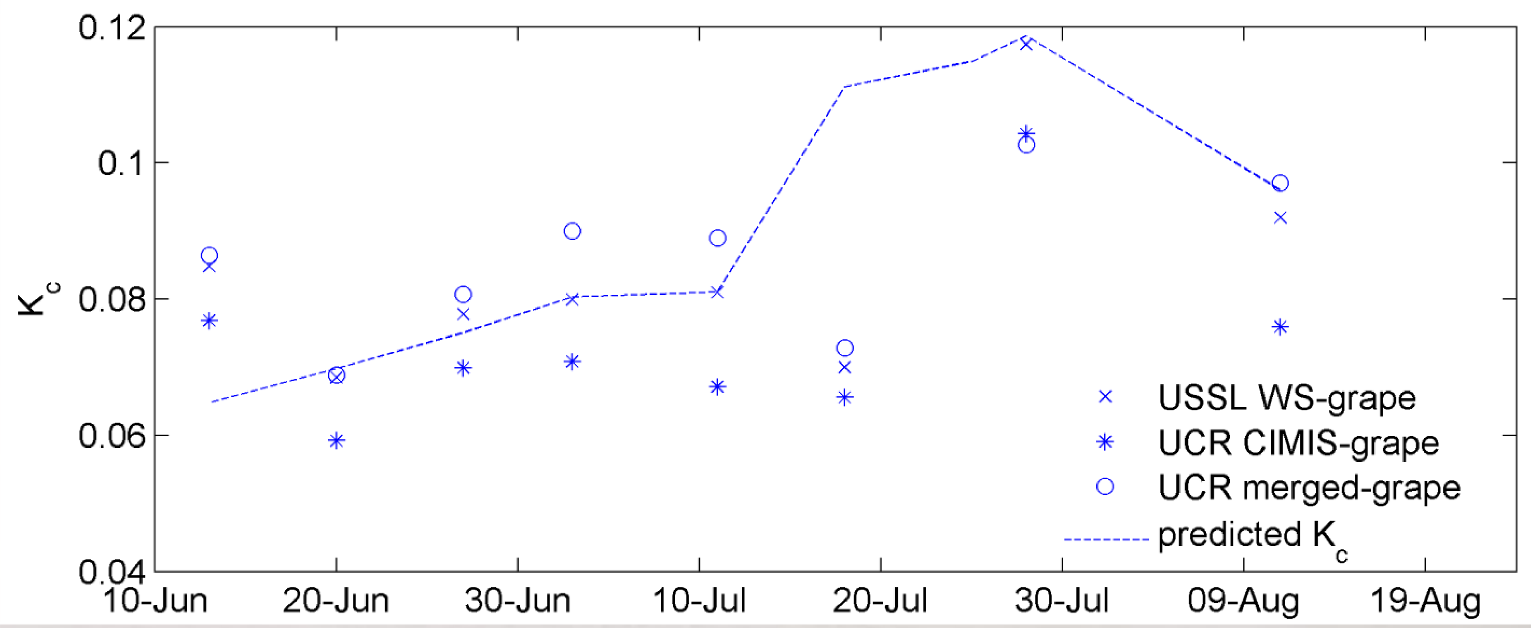


Figure 4 (left): Similar to Fig. 3a, Fig., 4 shows weekly ET_0 from alternative products and sources plotted against CIMIS ET_0.

Figure 5 (below) Comparison of K_c for grape lysimeters determined with various ET_0 products. Compared against fractional cover determination of K_c. Products with local wind speed had less variation in mid-season K_c.



Summary and Conclusions

-Incorporation of local wind speed into ET_0 equations improved ET_0 estimates. High variation in wind speed (~100%) across short distances (less than 5 km) emphasizes a need for on field wind estimates to accurately apply FAO-56 and other ET_0 equations

-Results with merged product is promising as relatively low cost sonic anemometers (with very low maintenance requirements) could lead to improved application of existing Kc values in heterogeneous environments.

-Where on field anemometers are not feasible, Large Eddy Simulations (LES) could be used to develop gridded wind relations to established meteorological stations. This could enable local wind speed corrections with better physical basis than additional coefficients to adjust ET_0.

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