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Title: Gaussian Processes-Based Predictive Models to Estimate Reference ET From Alternative Meteorological Data Sources for Irrigation Scheduling

Abstract: Accurate estimates of daily crop evapotranspiration (ET) are needed for efficient irrigation management especially in arid and semi-arid irrigated regions where crop water demand exceeds rainfall. The impact of inaccurate ET estimates can be tremendous in both irrigation cost and the increased demands on U.S. freshwater resources, particularly within the Ogallala aquifer region. Daily grass or alfalfa reference ET and crop coefficients are widely used to estimate crop water demand. ET networks calculate both grass and alfalfa ET using local meteorological data. With the agriculture-based Texas High Plains ET (TXHPET) network in jeopardy due to lack of funding support and the ongoing requirement for additional data, there is an immediate need for alternative data sources with potential to help fill in data gaps without high maintenance and field-based support costs. Publicly accessible data are being collected from other (non-agricultural) weather stations located throughout Texas High Plains. However, there are concerns about the appropriateness of these data for estimating reference ET due to weather station siting, fetch requirements, data formats and parameters recorded, and data quality control issues. The research described in this paper seeks to evaluate alternative meteorological data sources by applying computational modeling algorithms. Gaussian processes were applied to the data collected from weather stations in order to generate predicted values for reference ET and augment the TXHPET reference ET database. Results show that Gaussian processes can produce predictive models with high accuracy when compared with ordinary least square regression models.