

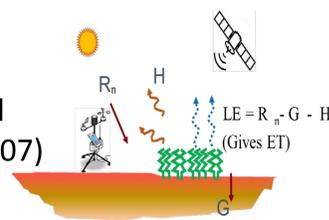
Pilot Application of METRIC Crop Demand Modeling

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INTRODUCTION

Agricultural water use in a watershed varies due to climatic, soil and topographic conditions as well as factors such as crop selection, irrigation and management practices. Wide spatial and temporal variability of these factors presents a significant challenge in modeling current water use as well as predicting it for the future.

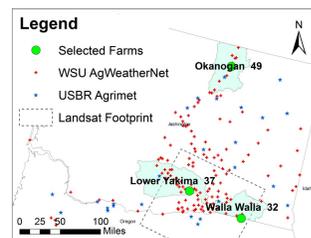
METRIC (Mapping Evapotranspiration at high resolution with Internalized Calibration) (Allen et al., 2007) is a satellite based image processing model which can estimate consumptive water use (as evapotranspiration) at a watershed scale. The use of satellite images helps to estimate ET which is spatially variable across the watershed without the need of additional data on soil, land use type and crop stages. Incorporating management aspects to estimate and predict agricultural water use is done using a cropping system model (CropSyst (Stockle, 2003)).



The purpose of this work is to develop an algorithm which uses METRIC to inform agricultural water use modeling (CropSyst) to estimate as well as predict crop demands at a watershed scale.

STUDY AREA

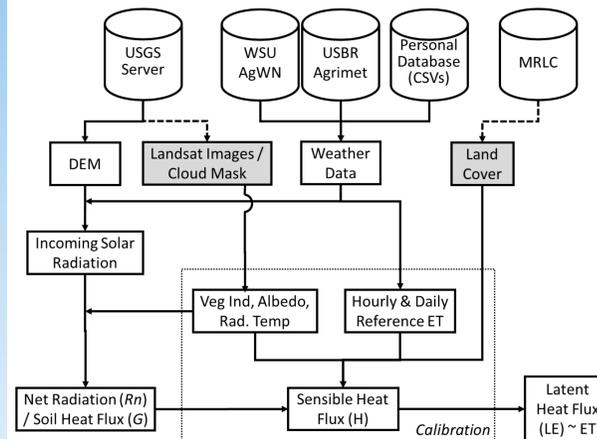
- Three pilot watersheds (Walla Walla, Yakima and Okanogan)
- Weather station with soil moisture probes installed in 3 farms
- Water use data collected from farmers



FORMULATION OF METRIC

Data Requirements

- **Satellite Imagery:** 30m resolution cloud-masked Landsat images from NASA
- **Weather Data:** Hourly data to compute ASCE reference evapotranspiration
- **Digital Elevation Model:** 30m resolution DEM data from USGS.
- **Land Use:** 30m resolution National Land Cover Dataset



Salient features:

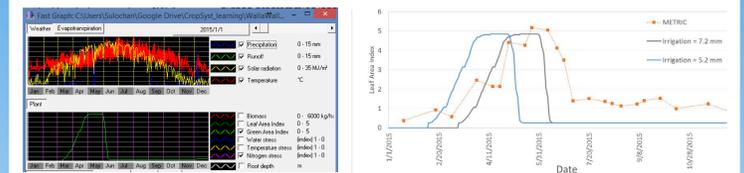
- Developed using freely available python programming language with some ArcGIS functionalities
- Automated extraction of DEM and weather data for easy batch processing of multiple images and calibration using multiple weather stations.
- Working towards a “hands-free” formulation

Issues:

- Proper validation would require lysimeter/ eddy covariance station measurements.
- Uncertainty estimates have not been estimated
- Sensitivity analysis needs to be performed.

METRIC - CROPSYST

- Comparison of METRIC intermediate results (LAI) and final results (ET) with CropSyst results helped with parameterization of Crop model.



PRELIMINARY CONCLUSIONS

- METRIC ET estimates were compared with CropSyst, “loosely” validated using crop coefficients and calibrated for eastern Washington.
- Use of METRIC to calibrate CropSyst parameters by comparing the results showed some promising results.

FUTURE STEPS

- Sensitivity of more CropSyst parameters will be analyzed and comparison with METRIC will be performed.
- Coupled CropSyst-METRIC will be used to investigate effects of crop management in crop water use.

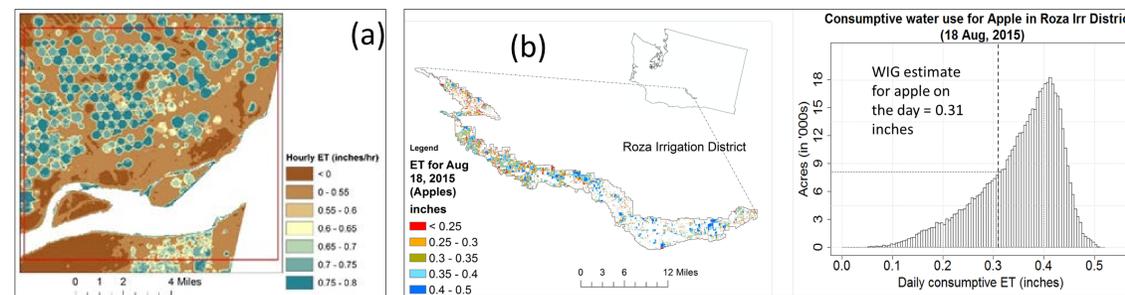
LITERATURE CITED

Allen R, Tasumi M, Trezza R. 2007. Satellite-Based Energy Balance for Mapping Evapotranspiration with Internalized Calibration (METRIC)—Model. *Journal of Irrigation and Drainage Engineering* 133: 380-394

Stöckle CO, Donatelli M, Nelson R. 2003. CropSyst, a cropping systems simulation model. *European Journal of Agronomy* 18: 289-307.



METRIC RESULTS



(a) High Resolution evapotranspiration (ET) maps obtained using METRIC (b) Consumptive water use for Apple orchards in Roza Irrigation District. About 66% of apple orchards are using more water than recommended by Washington’s Irrigation Guidelines (WIG). (c) Validation using crop coefficients

