Introduction

➢ The Oklahoma Mesonet is a large-scale environmental monitoring network that provides real-time weather and soil moisture data for ~100 locations across the state of Oklahoma (McPherson et al., 2007).

➢ Soil moisture is monitored under grassland vegetation at 5, 25, and 60 cm soil depths and expressed as plant available water (PAW).

➢ The soil moisture under grassland vegetation may not accurately reflect the soil moisture condition of other land cover types such as winter wheat cropland and forest land (Fig. 1).

![PAW map from the Mesonet (left) and actual land cover (right) across Oklahoma.](image)

Objective

➢ The objective of this research was to develop a model-driven framework that uses Mesonet data, NRCS soil data and field specific information to estimate PAW in cropland.

Materials and Methods

➢ The framework is based on two independent models that predict the soil moisture dynamics under wheat cropland on a daily basis by using specific data about the soil-plant-atmosphere continuum at a given location (Fig. 2).

➢ The first model is an existing model driven by reference evapotranspiration and wheat fraction canopy cover, and does not make use of real-time soil moisture. This model is also known as the “Dual crop coefficient model”.

➢ The second model is a new model based on the assumption that deviations from the expected PAW under grassland vegetation are proportional to the deviations from the expected PAW under wheat cropland for each day of the year. This model has the distinct advantage of incorporating real-time soil moisture information from the nearest Mesonet station.

![Pictorial representation of information sources and flow.](image)

Results

➢ Average soil water dynamics under grassland at the Lahoma, OK Mesonet station were dramatically different than under nearby no-till continuous wheat.

➢ The soil moisture data from the Mesonet do not directly reflect the soil moisture conditions in nearby wheat cropland (Fig. 3).

![Mean (16-yr daily value of fraction plant available water (FAW)) under wheat cropland and grassland at Lahoma, OK.](image)

➢ Then, the soil moisture predictions by the models and the errors associated with each of them are combined using a Kalman filter in order to produce a more accurate prediction.

![Image of Kalman filter.](image)

➢ Single year RMSD values ranged from 52 mm using our new model to 19 mm using the dual crop coefficient model. These results confirm that the use of the Kalman filter on average provides better predictions than those based on either model alone (Table 1).

![Image of soil moisture dynamics under wheat cropland at Lahoma during the growing seasons of 2009-10, 2010-11, 2011-12, and 2012-13.](image)

<table>
<thead>
<tr>
<th>Crop-Year</th>
<th>Dual Crop Model</th>
<th>Kalman Filter</th>
<th>New Model</th>
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</thead>
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<tr>
<td>2009-10</td>
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<tr>
<td>Average</td>
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</table>

Summary

➢ The assumption that soil moisture deviations from expected grassland soil moisture values are proportional to the deviations from expected wheat cropland values for each day of the year was effective for model-data synthesis in this case.

➢ Evapotranspiration models coupled with real-time soil moisture and field-specific data showed potential to effectively estimate the soil moisture condition in wheat cropland.

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