Modeling soil moisture under various land cover types

Briana M. Wyatt*, Tyson E. Ochsner, and Chris B. Zou
Oklahoma State University
Soil moisture data challenges
Soil moisture data challenges

Figure 1. Map of vegetation types in Oklahoma. Multi-Resolution Land Cover Characteristics (MRLC) Consortium.
Our approach

In-situ meteorological data + remotely-sensed vegetation data + soil property information ↓ plant available water (PAW) estimates
Model Evaluation

- Soil moisture monitoring in non-grassland areas
  - Summer crop
  - Winter crop
  - Deciduous forest
  - Evergreen forest

Figure 2. CS-655 soil moisture sensor.
Model Evaluation

Figure 3. Locations of installed validation monitoring stations at the Cimarron Valley Research Station in Perkins, OK and the South Central Research Station in Chickasha, OK (red stars) as well as a future station to be installed near Broken Bow, OK (blue star).
Figure 4. Soil moisture sensors installed at 5, 25, 60, and 100 cm.

Figure 5. Above-ground installation in forest.
Figure 6. Location of Perkins Mesonet station (left star) and monitoring station in forest (right star). The sites are approximately 978 m apart.
Perkins data

Figure 7. Precipitation from the Perkins Mesonet station (top) and soil water content measured under forest (bottom).
Figure 8. Depth-weighted soil moisture under grass (blue) and under forest (orange).
Perkins data

- Potential explanations for discrepancies:
  - Higher sand content in forest than in grass
  - No response to small rainfall events in forest because of interception
  - Different sensor types
  - Vegetation

Figure 9. Sand content with depth at the Perkins Mesonet station (blue) and under nearby forest (orange).
Chickasha- July 11, 2018

Figure 10. Soil moisture sensors installed at 5, 25, 60, and 100 cm.

Figure 11. Above-ground installation in no-till field.
Figure 12. Location of Chickasha Mesonet stations (left star) and monitoring station in cropland (right star). The sites are approximately 150 m apart.
Figure 13. Precipitation from the Chickasha Mesonet station (top) and soil water content measured under fallow cropland (bottom).
Future work

• Install additional validation site
  • Pine forest

• Complete modeling simulations

• Compare model results to measured soil moisture in each land cover type

• Apply method state-wide
Thanks to:

Dr. Tyson Ochsner

Soil Physics Group
Questions or comments?

briana.wyatt@okstate.edu