Soil Moisture Research in Oklahoma: Progress and Prospects

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Ochsner group objectives (from 2011)

• Serve the local support needs of the various MOISST research groups

• Collaborate with other MOISST investigators in areas of common interest

• Develop Oklahoma as a magnet for and center of international research and expertise in in situ soil moisture monitoring
MOISST-derived papers to date


MOISST-related grants to date


MOISST-facilitated community
Our primary focus is on enhanced multi-scale soil moisture monitoring and improved utilization of soil moisture observations in agriculture, ecology, hydrology, and related fields.
Ongoing soil moisture research

1. Estimating drainage and potential groundwater recharge using measured soil moisture

2. Comparing land surface vs. atmospheric controls on meso-scale spatial patterns of soil moisture

3. Understanding impacts of soil moisture on vegetation (fuel) moisture content in grassland

4. Developing effective soil-moisture based drought indicators

5. Evaluating an operational, high-resolution soil moisture mapping system for Oklahoma
Statewide mean annual soil moisture-based drainage rates for the years 1998-2014. Drainage rate labels for the Stillwater, Oklahoma City East, Porter, and Marena sites were excluded for clarity, but were 214, 82, 166, and 66 mm yr⁻¹, respectively.
Mesoscale spatial patterns in soil moisture

• One year of repeated cosmic-ray neutron measurements on a 150 km transect

• Strong and persistent mesoscale correlation between soil texture and soil moisture
Grassland vegetation (fuel) moisture content

- Two growing seasons of soil and vegetation moisture measurements
- Fuel moisture exhibits a threshold-type dependency on soil moisture.

Fraction of available water capacity (FAW) measured at 0-40 cm for Live Fuel Moisture Content Classes during the growing season for tallgrass prairie in Oklahoma from 2012-2013.
Soil moisture-based drought indicators

- Spring FAW anomaly significantly correlated with subsequent hay and wheat yields.

Scatterplot of hay grain yield anomaly and spring FAW anomaly (1-wk average) for 42 Oklahoma counties from 2000-2016.

Time series of correlation coefficients between FAW and hay yield for the Central agricultural district in Oklahoma.
Daily, 800-m resolution maps

Cross-validation RMSE: 0.075 cm$^3$ cm$^{-3}$

5-cm Volumetric Water Content

valid 12:00 AM March 21, 2016 CST

http://soilmoisture.okstate.edu/
Projects in early stages

• High resolution soil moisture modeling across heterogeneous vegetation types

• Soil moisture-informed crop forecasting

• Soil moisture-informed streamflow forecasting

• Quantifying soil moisture and temperature controls on soil organic carbon

• Too many ideas, too little time...
Acknowledgments and invitations

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  – Oklahoma Agricultural Experiment Station
  – USGS
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• Partners include:
  – Mike Cosh
  – MOISST collaborators
  – OSU Soil Physics group
  – NSF EPSCoR team
  – JFSP project team
  – Oklahoma Mesonet staff
  – Oklahoma Water Resources Board staff

Explore our websites and get in touch
http://soilmoisture.okstate.edu/
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Thank you!

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