South Fork Watershed of the Iowa River: 
*In Situ* Soil Moisture Validation

- A representative, agricultural location in central Iowa: (Hamilton & Hardin Counties)
- Prime farmland
- Provides numerous precipitation and soil moisture data products
Calibration of an Hourly Soil Moisture Model: The Diagnostic Soil Moisture Equation (Pan et al, 2012)

\[ y = \alpha \sin(x-h) + v \]

\[ \beta = \sum_{i=2}^{n-1} \left[ \frac{p_i}{\eta_i} \left(1 - e^{\frac{\eta_i}{z}} \right) e^{-\sum_{j=1}^{i-1} \left(\frac{\eta_j}{z}\right)} \right] + \frac{p_1}{\eta_1} \left(1 - e^{\frac{\eta_1}{z}} \right) \]

Residual Soil Moisture
Effective Porosity
Soil Drainage Constant

\[ \theta_{estimated} = \theta_{re} + (\phi_e - \theta_{re}) \left(1 - e^{-c_4 \beta}\right) \]
South Fork Watershed of the Iowa River:
Joint Experiment for Crop Assessment and Monitoring (JECAM)
Determining a field’s average soil moisture

Pitfalls of simple averaging
### Potential pitfalls...

**Spatial averaging:**
Voronoi weights
Replacement of missing values:
Anchor and model

\[ \theta_x = f\{\theta_1, \theta_2, \theta_3, \theta_4, P_t, P_{t-1}, P_{t-2}, \ldots\} \]
Finally, we remove the temporary sensors.

The (more extensive) “temporary network”…
… used to model the surface

The “permanent network”

The modeled surface can be integrated with the remaining sensors.
Hydrologic Weighting: Topographic and Edaphic Similarity

Ames, IA (Generated with LiDAR data)

Next, soil type / texture can be overlaid to ensure similarity
Future Work: Sources of Error

Replacement of missing values:
Anchor and model

\[ e_x = f(e_1, e_2, \ldots, P_{en}, P_{en+1}, \ldots) \]

Ames, IA (Generated with LiDAR data)

Finally, we remove the temporary sensors.

The (more extensive) “temporary network”…

… used to model the surface

The “permanent network”