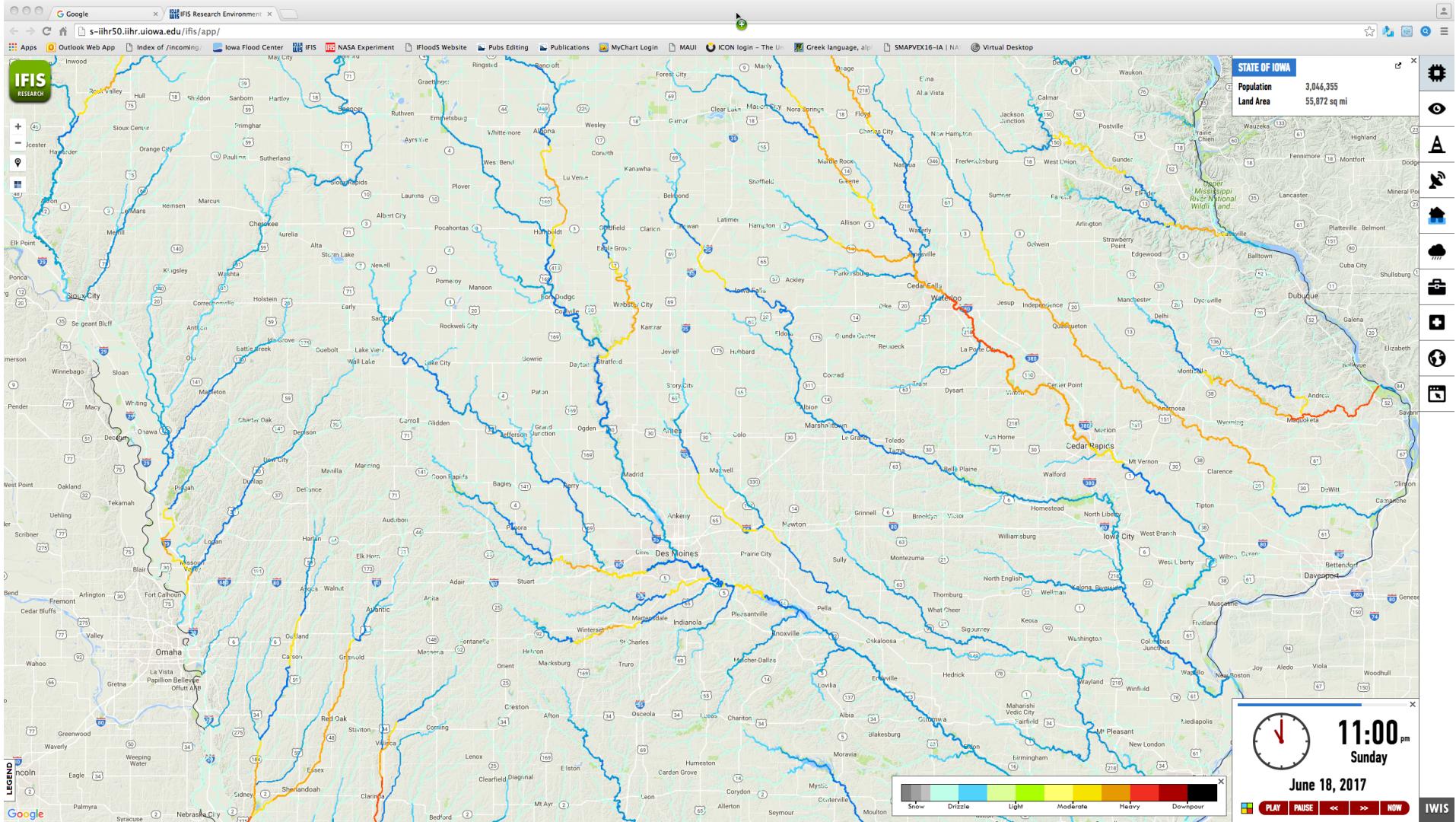
An aerial photograph showing a vast landscape of green fields and rolling hills, characteristic of the Iowa countryside. The fields are divided by roads and small farm buildings. In the distance, a large body of water is visible under a clear blue sky.

# Soil moisture variability from hillslope to SMAP grid scale over Iowa

Witold F. Krajewski, Ricardo Mantilla  
and Navid Jadidoleslam



**IFIS**  
RESEARCH

**STATE OF IOWA**

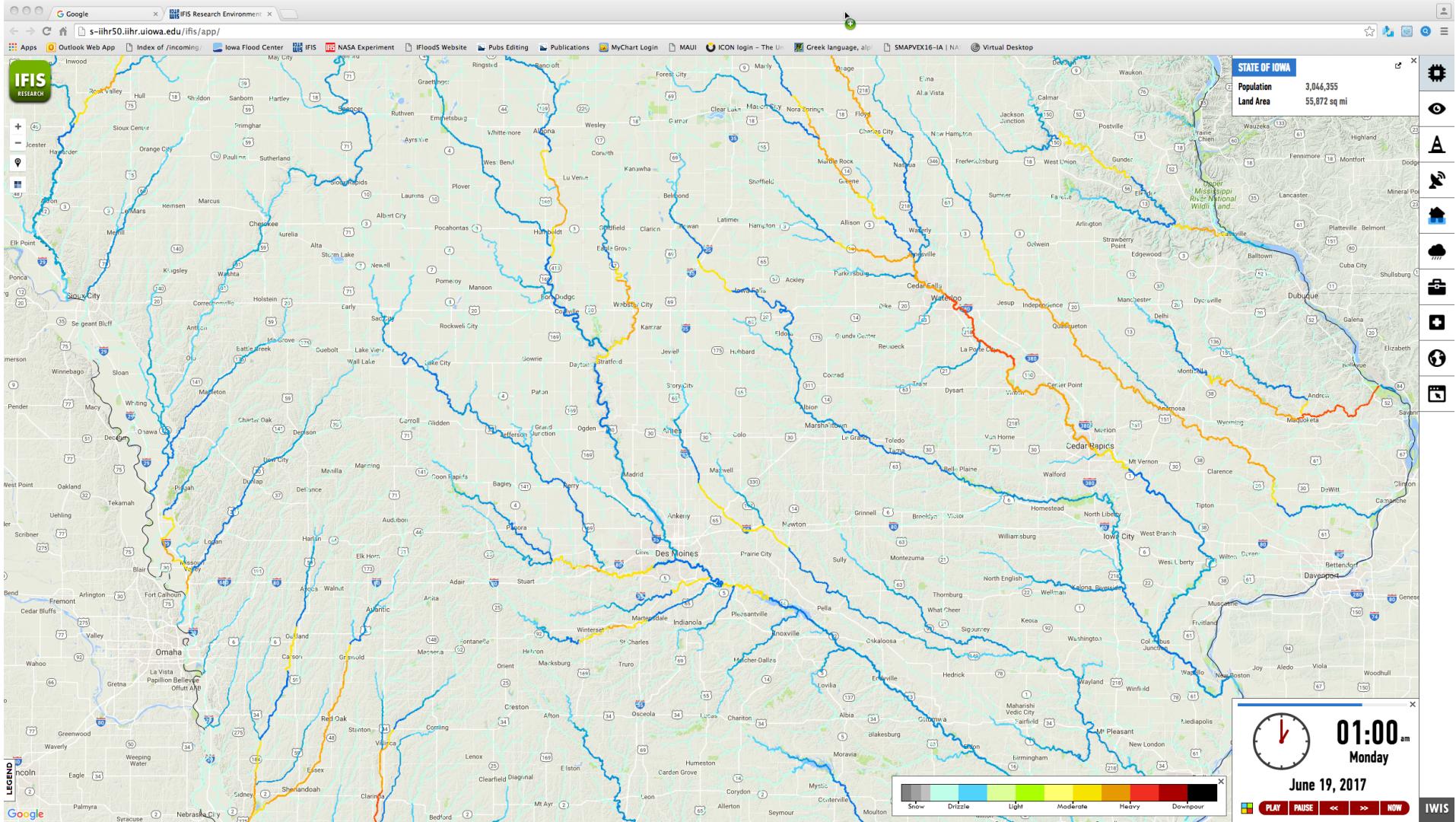
Population	3,046,355
Land Area	55.872 sq mi



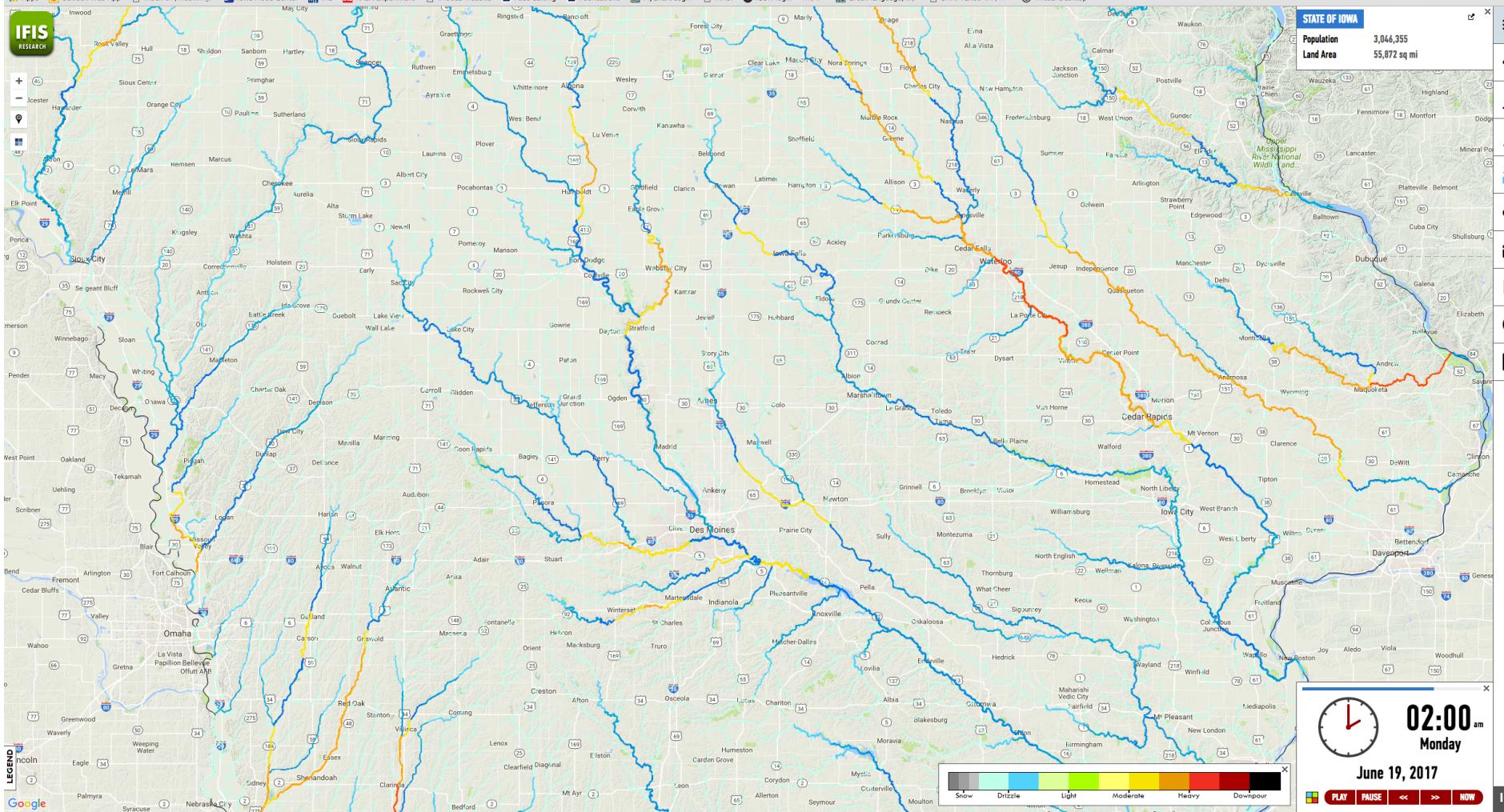
**12:00** am  
**Monday**

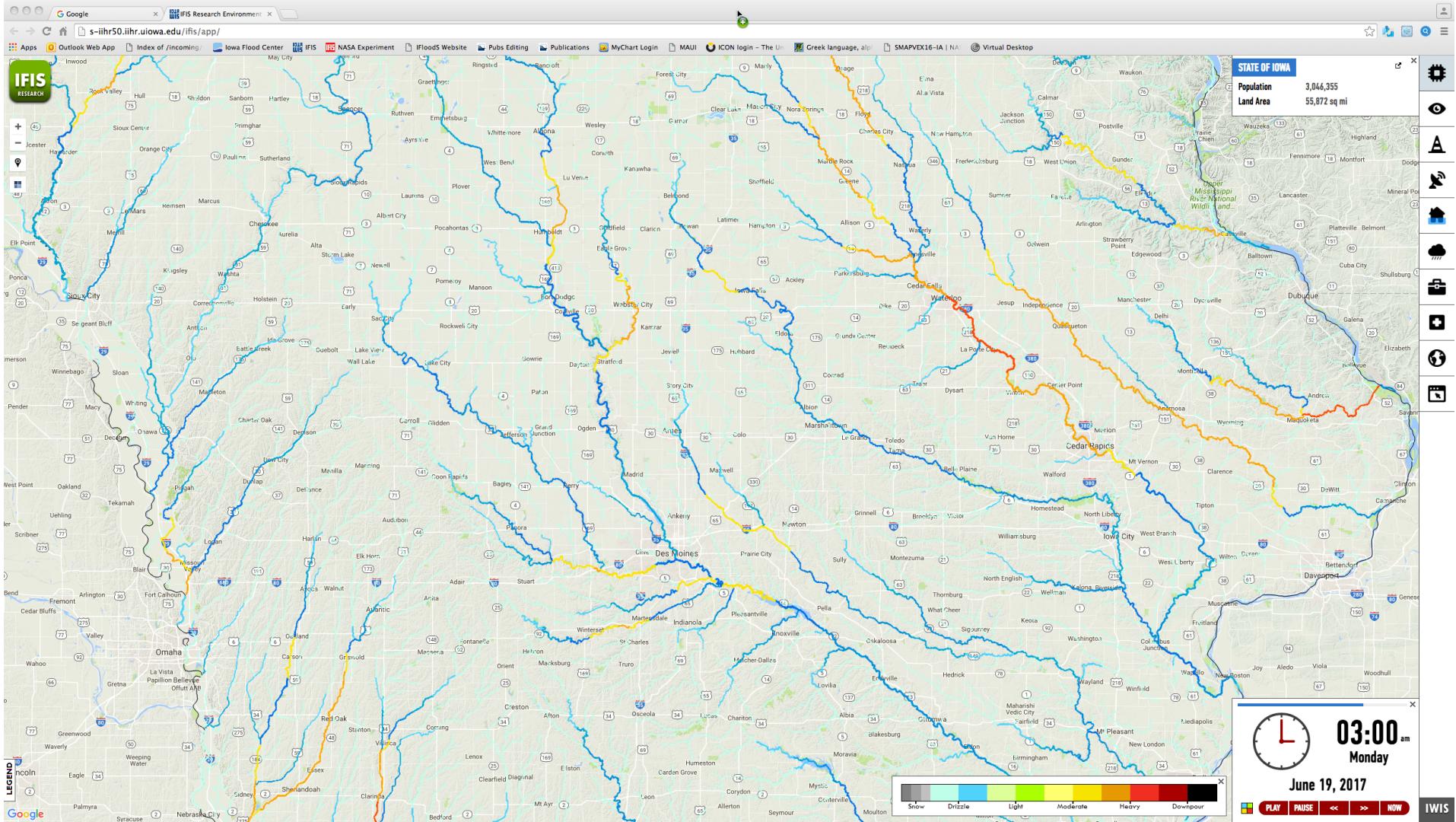
June 19, 2017





**IFIS**  
RESEARCH





**IFIS**  
RESEARCH

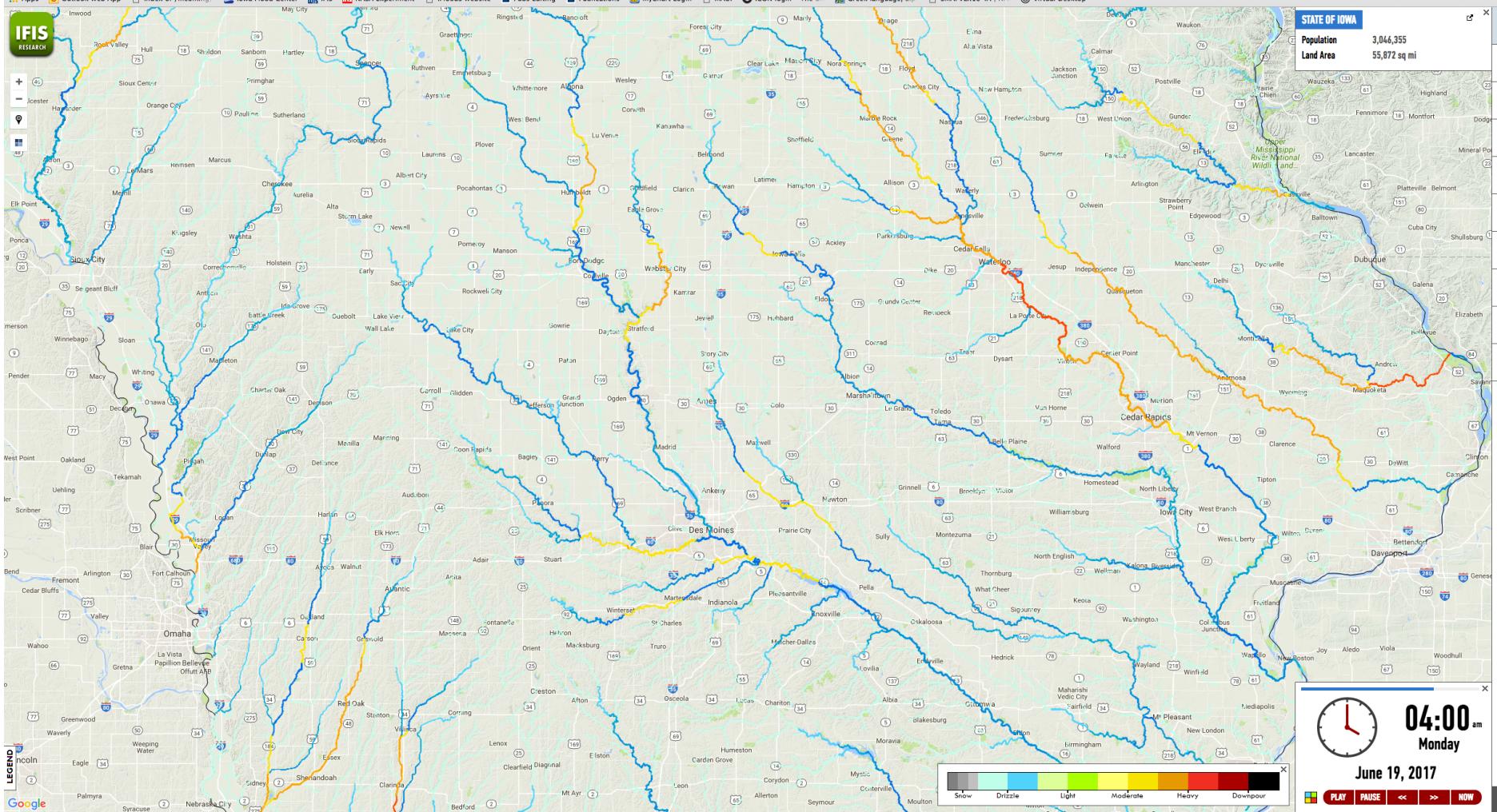
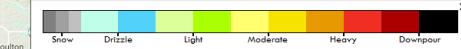
STATE OF IOWA

Population	3,046,355
Land Area	55,872 sq mi



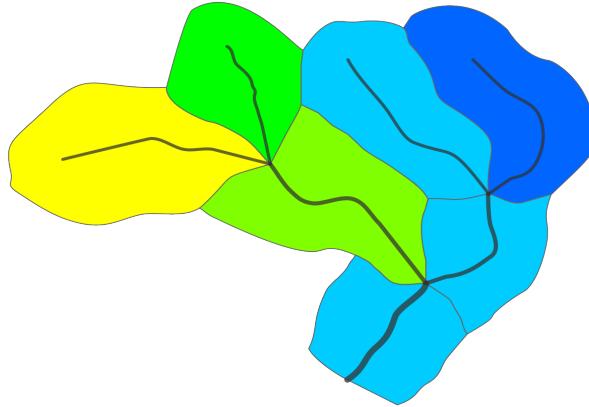
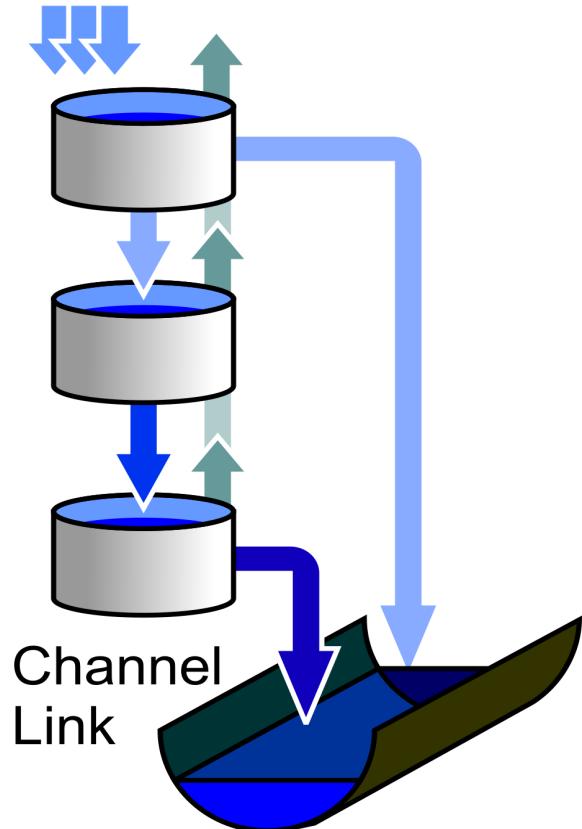
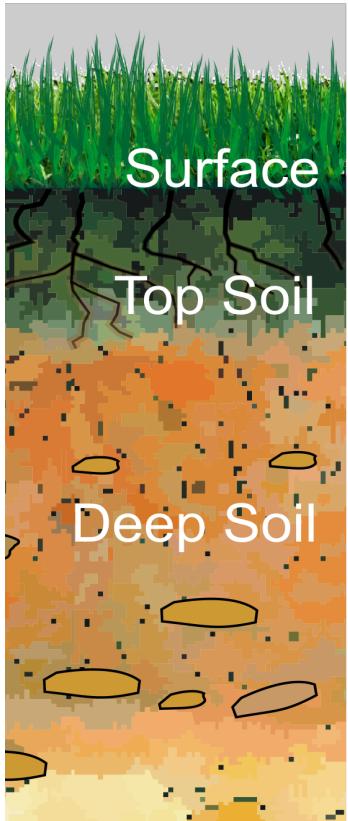
**04:00** am  
**Monday**

June 19, 2017





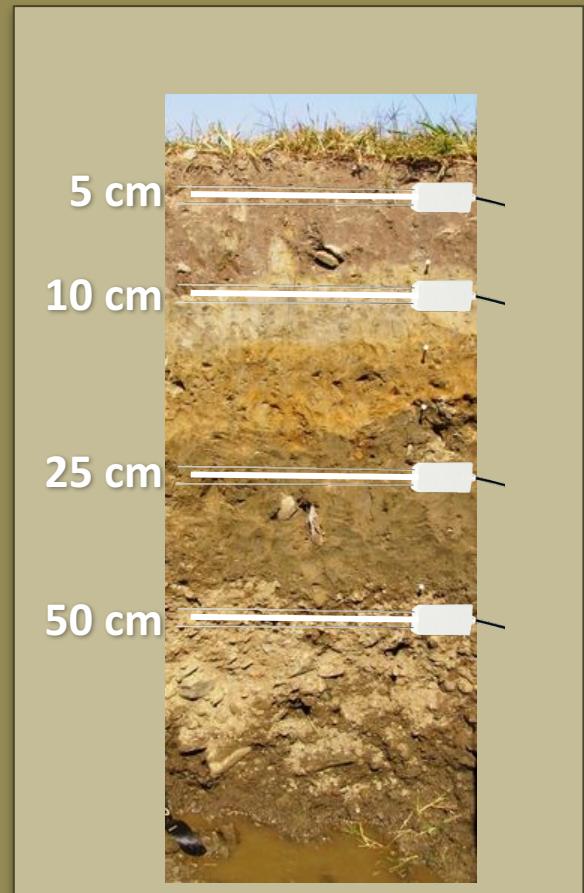
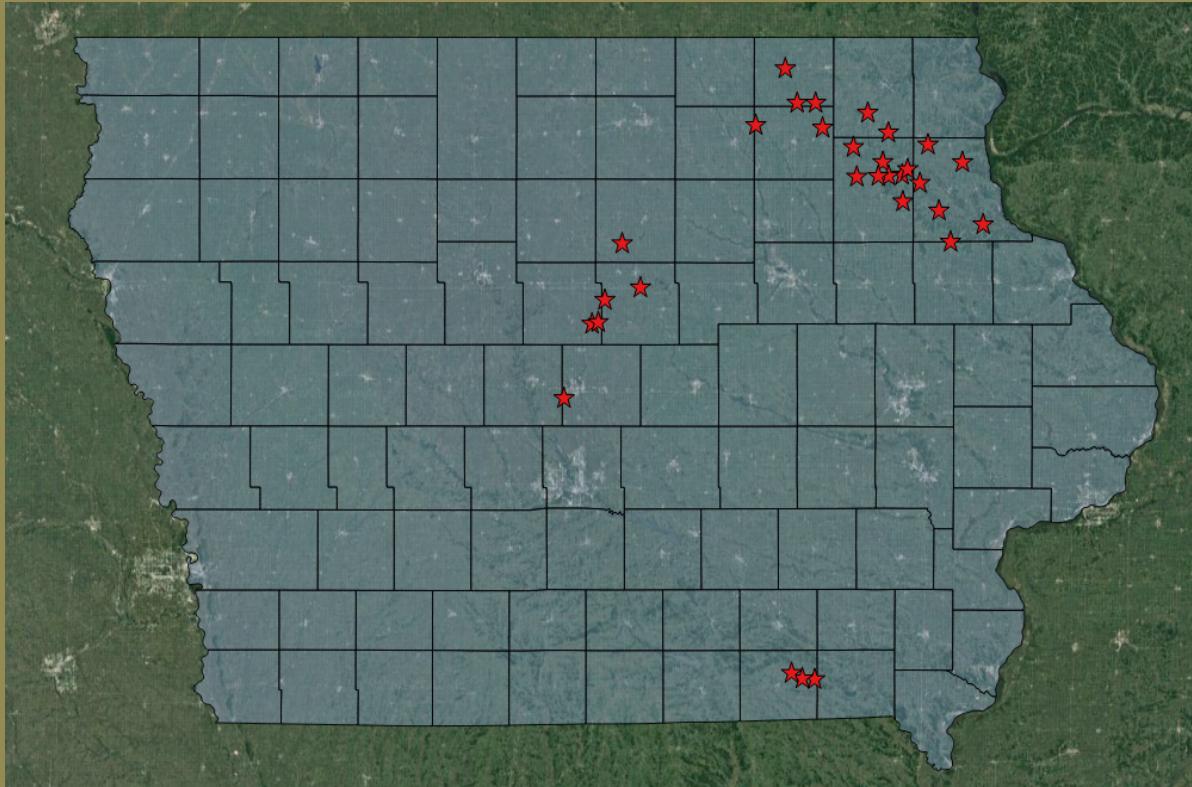




$$\frac{d\mathbf{S}}{dt} = \mathbf{f}(\mathbf{S}, \mathbf{I}, \mathbf{P})$$

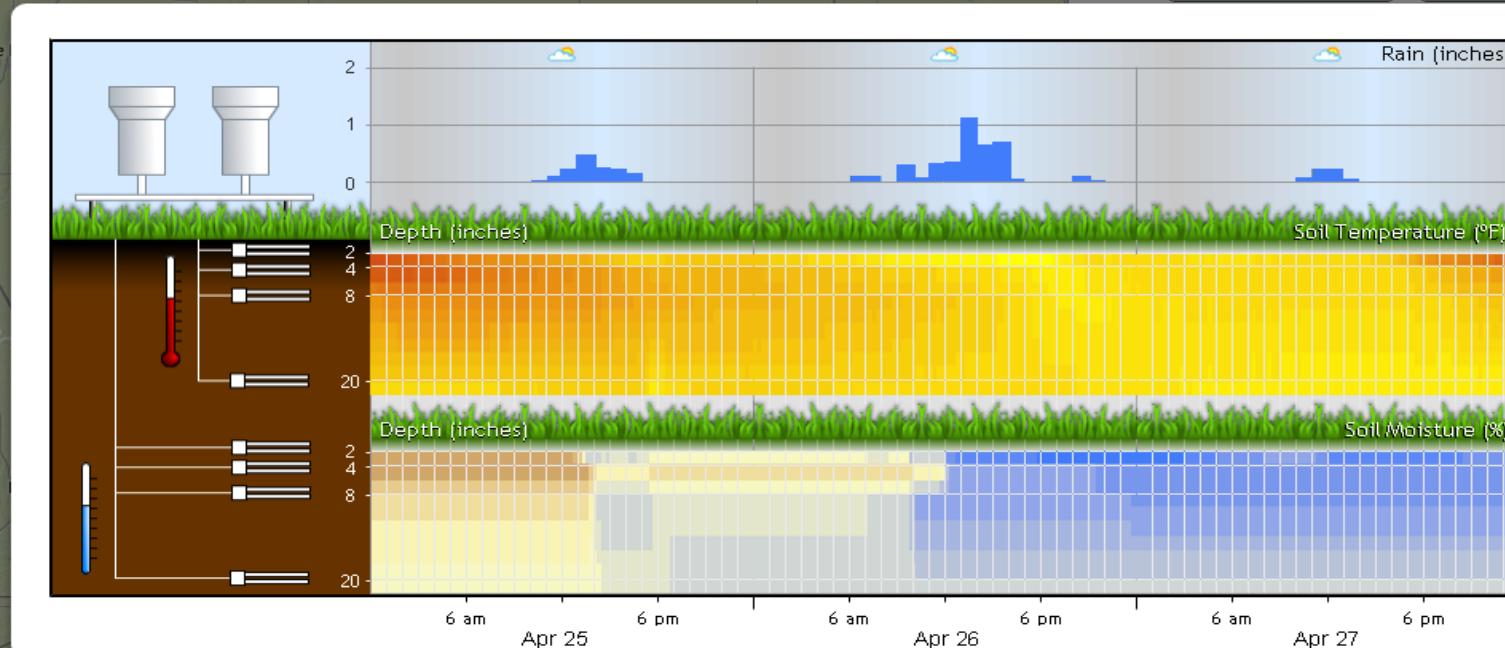
For Iowa the system of  
~500,000 equations

# IFC Soil Moisture Network





# Rain Gauge / Soil Moisture Visualization



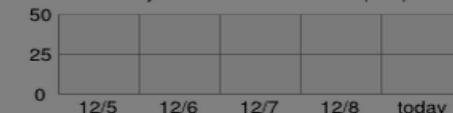
## IFC RAIN / SOIL MOISTURE STATION

Station ID: NASA0045

Last Observed: no rain [delay in data transmission]

Last Reported: Thu, Jul 18, 2013 6:36 am

### Daily Rainfall Accumulation (mm)

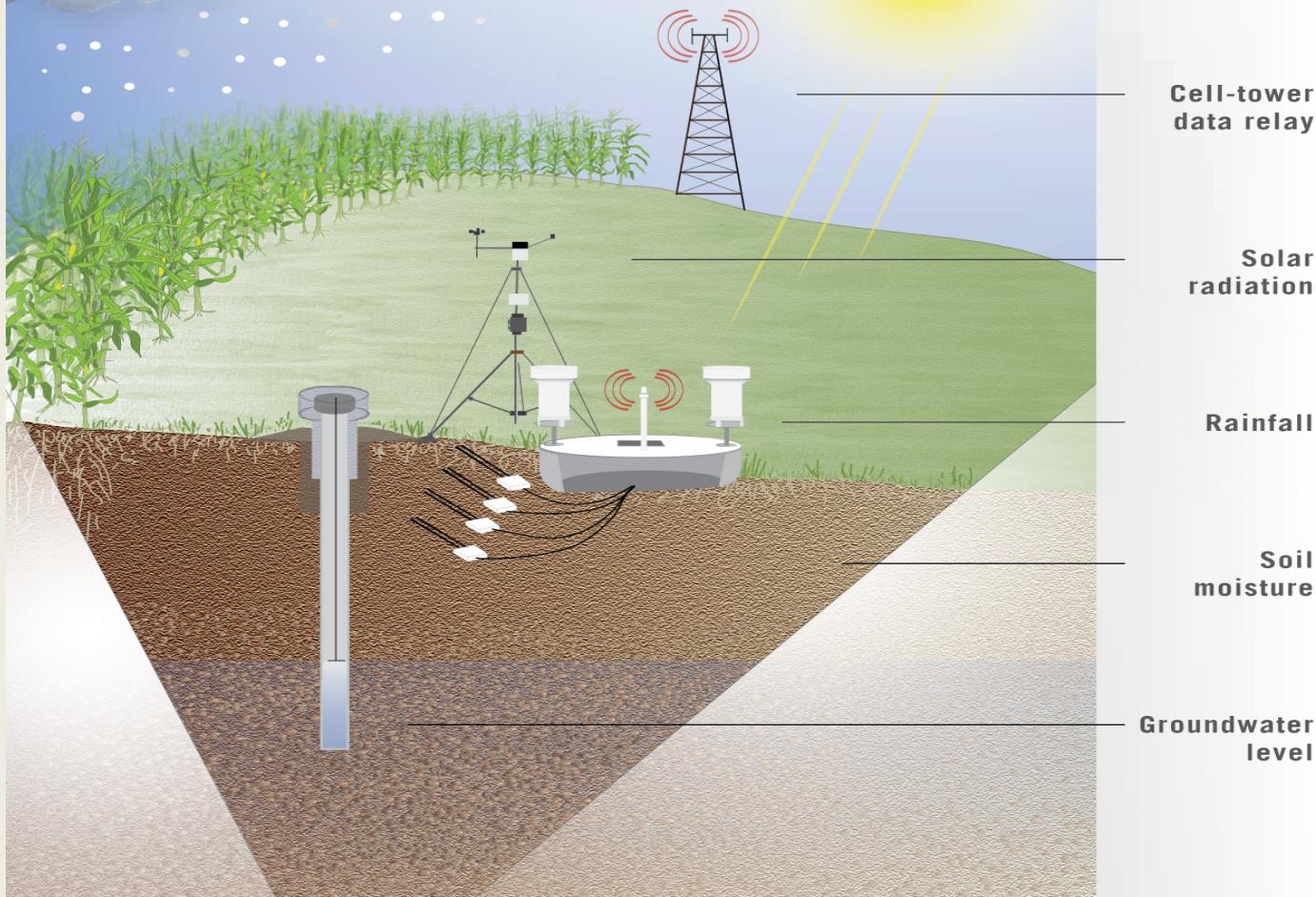


**RAIN GAUGE INFO**

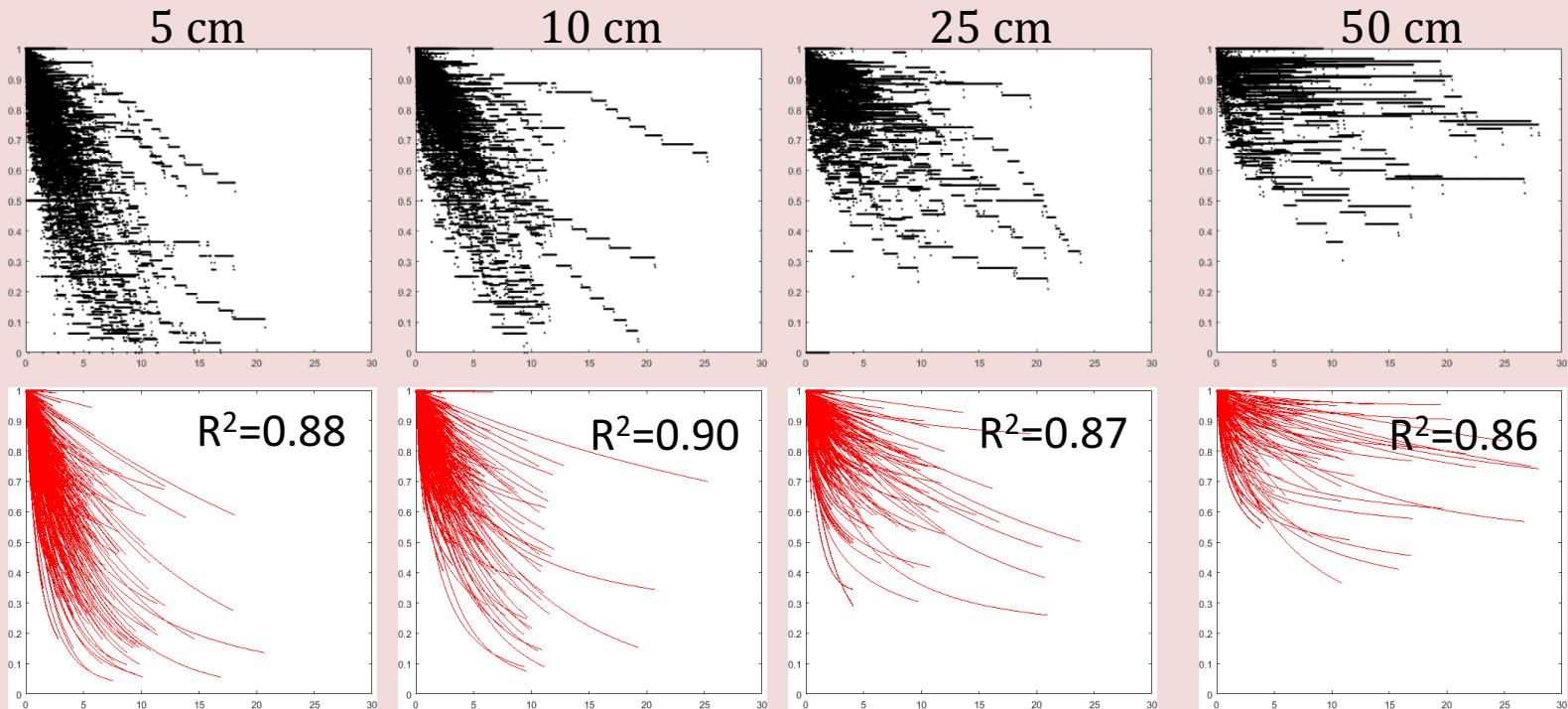
**SOIL MOISTURE INFO**



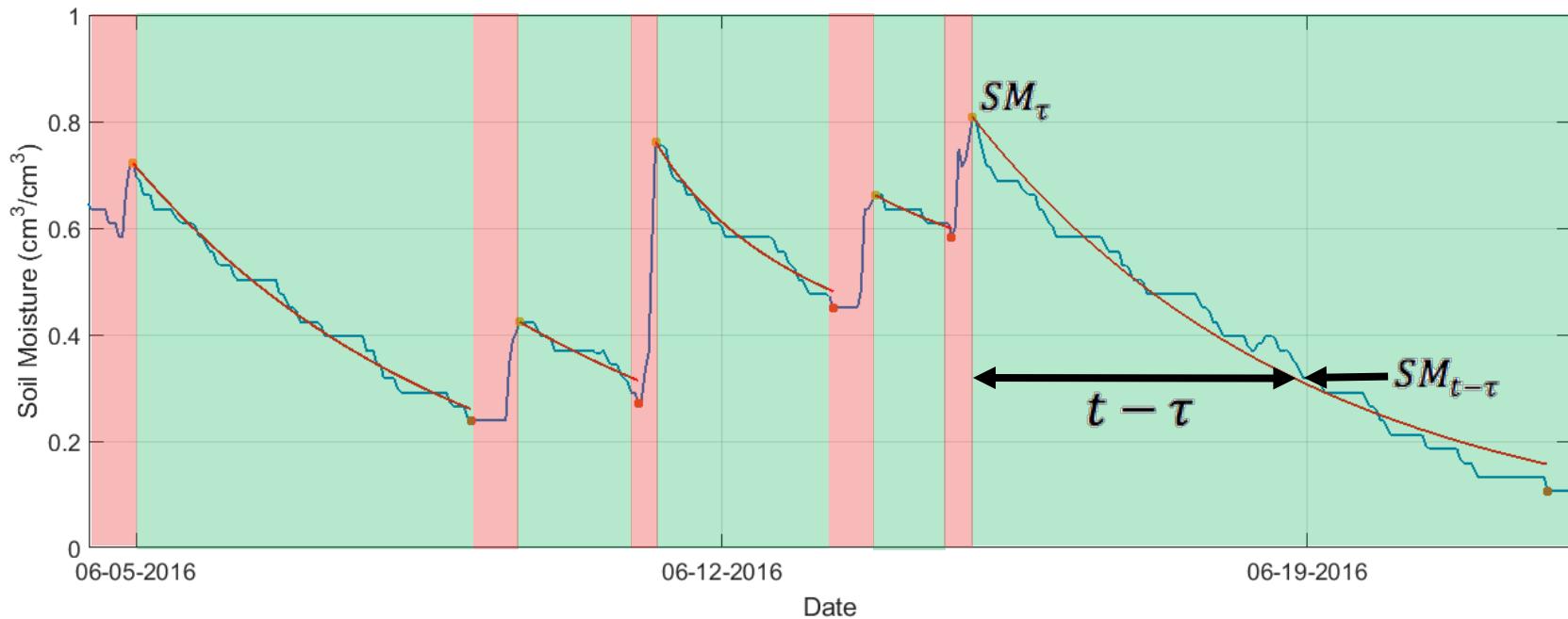
X



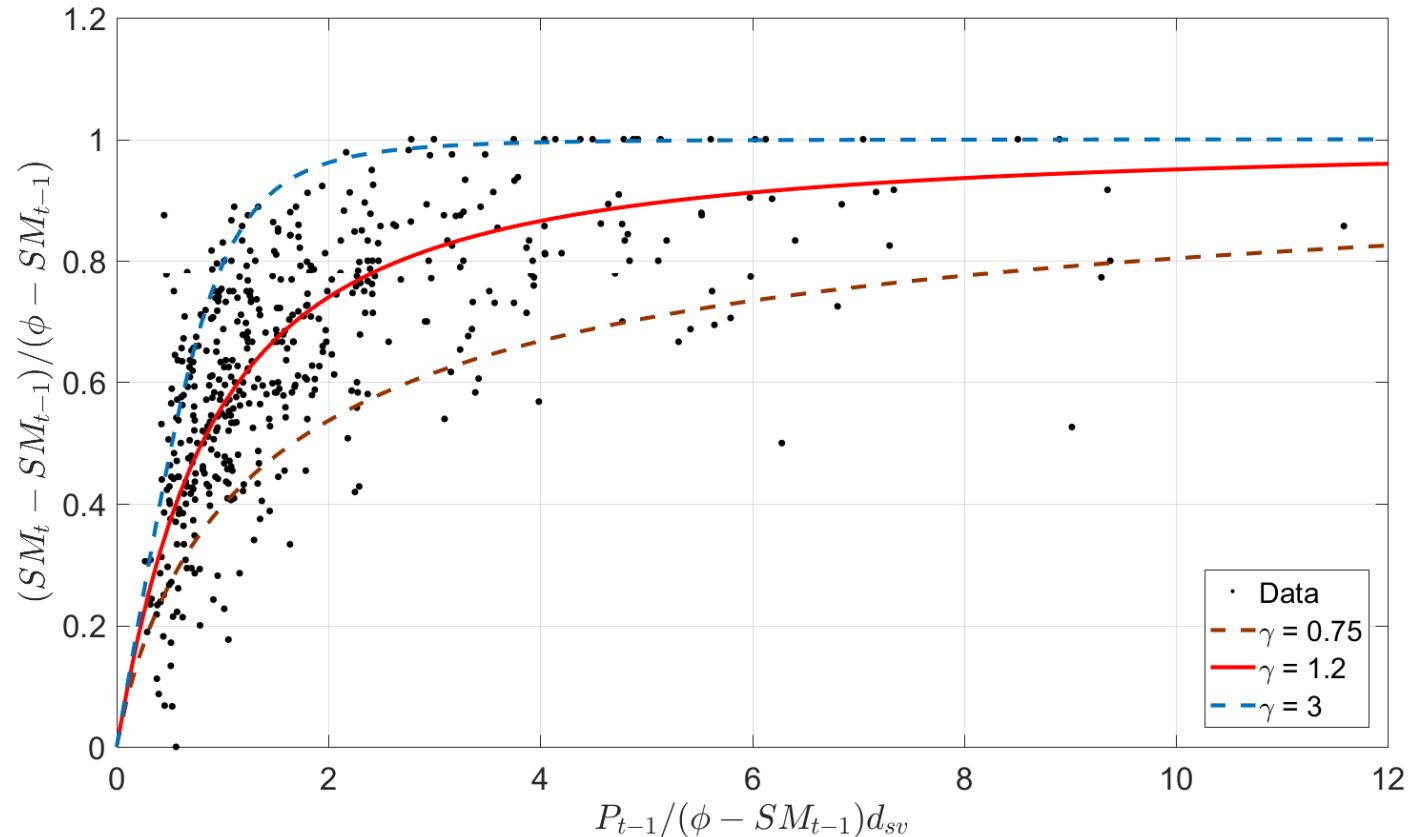
# Dry-out event fitting results



$$\frac{1}{SM_{\tau}} \frac{dSM_{(t-\tau)}}{dt} = \alpha \left( \frac{SM_{t-\tau}}{SM_{\tau}} \right)^{\beta}$$



# Precipitation feedback on soil moisture



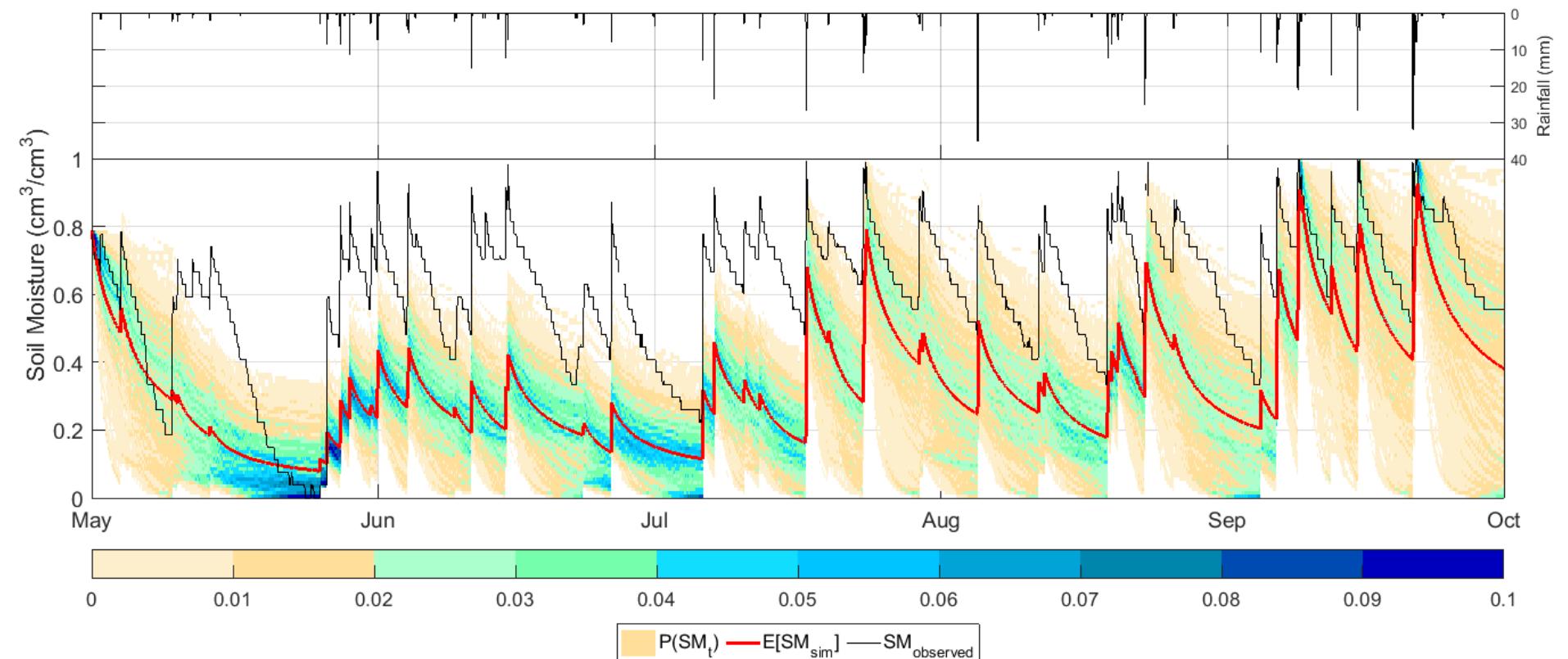
# Stochastic Model

$$\Delta SM^- \rightarrow SM_{t-\tau} = SM_\tau [(\beta - 1) \times (\alpha (t - \tau) + 1)]^{\frac{1}{1-\beta}}$$

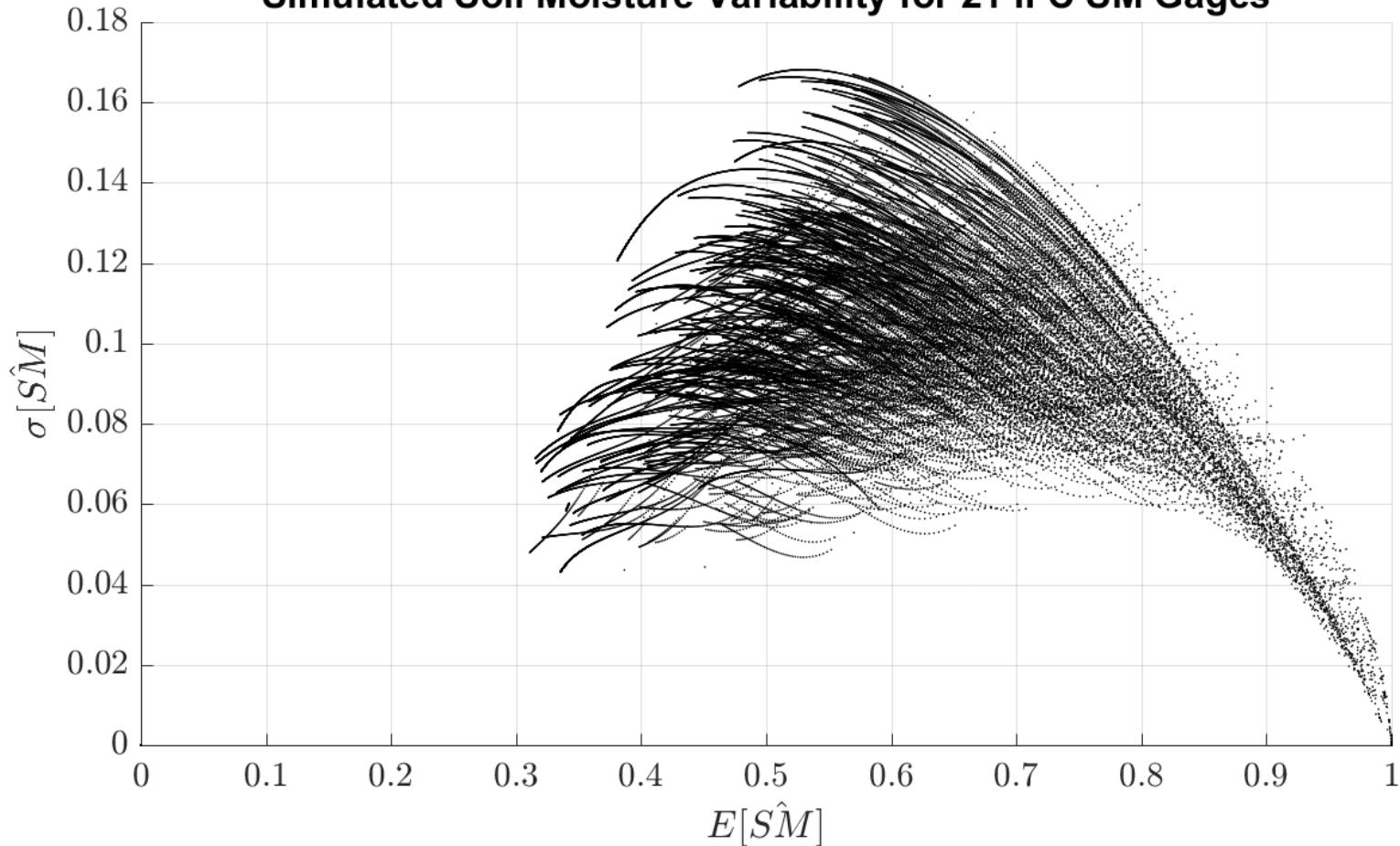
$$\begin{cases} 1 < \beta \leq 6 \\ 0 < \alpha \leq 1 \end{cases} \quad \text{$\alpha$ \& $\beta$ are generated randomly for each event}$$

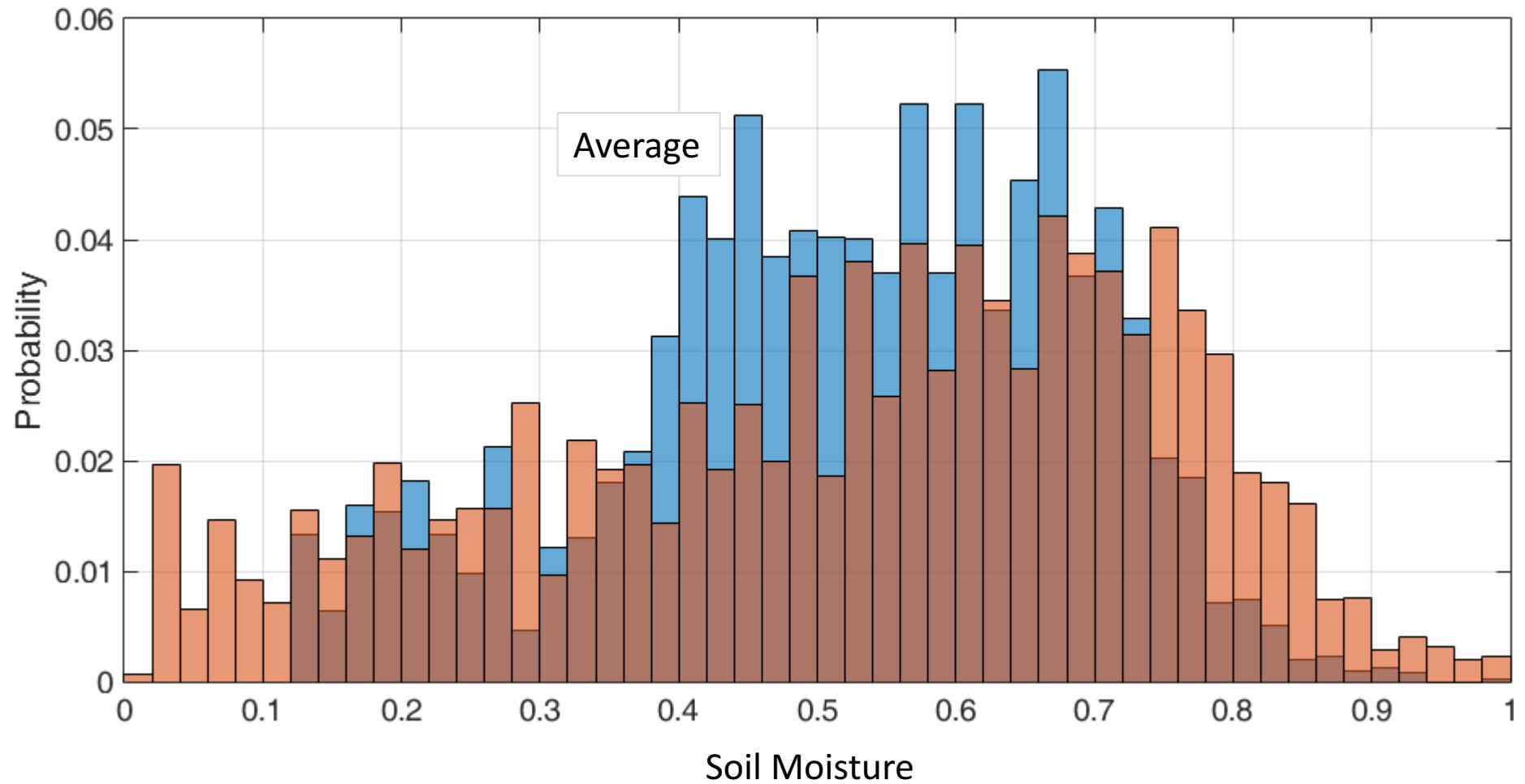
$$\Delta SM^+ \rightarrow SM_t = \frac{\frac{P_{t-1}}{d_{sv}}}{\left[ 1 + \left( \frac{P_{t-1}}{(\phi - SM_{t-1})d_{sv}} \right)^\gamma \right]^{1/\gamma}} + SM_{t-1}$$

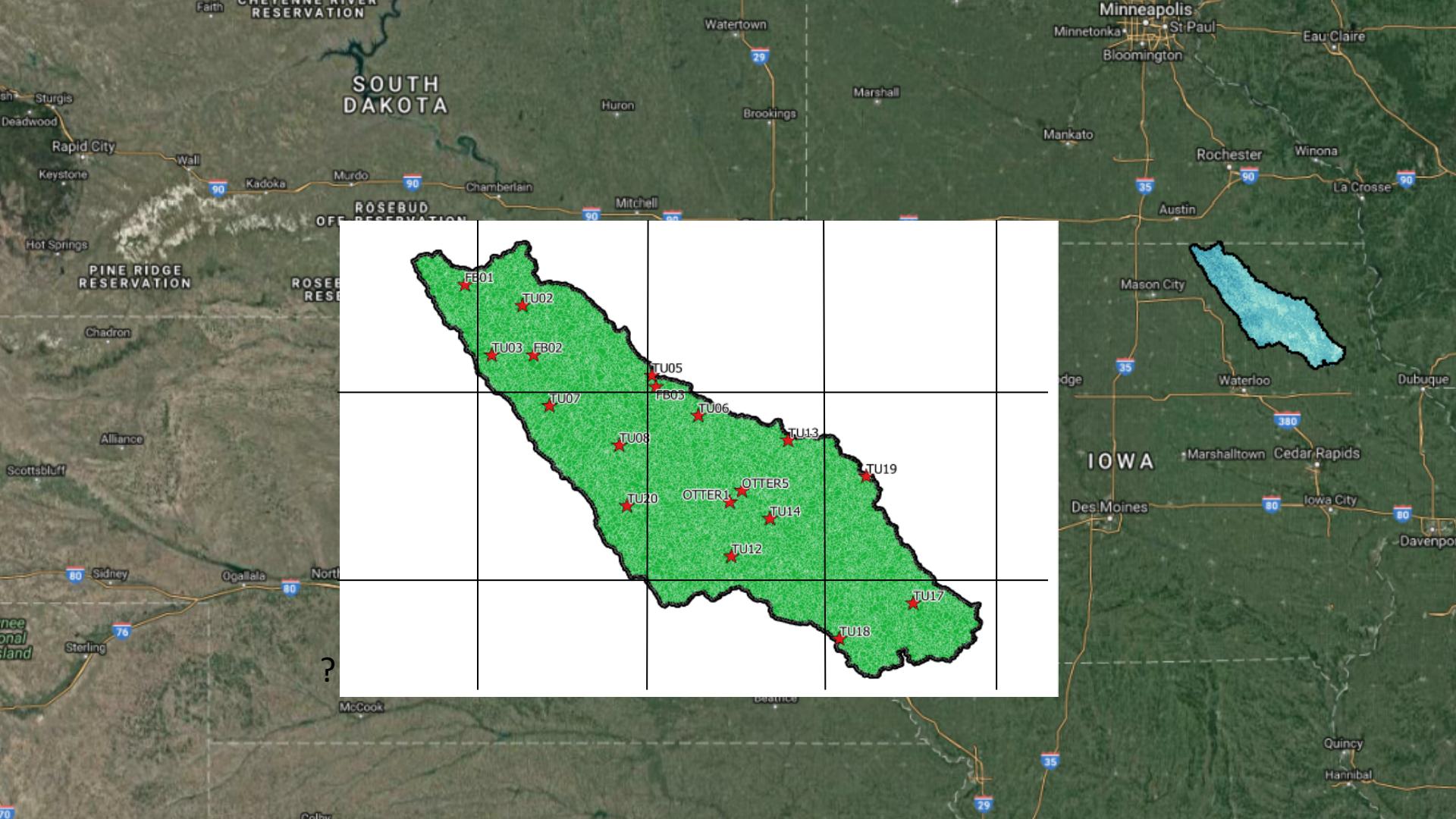
$$0.75 < \gamma < 3$$

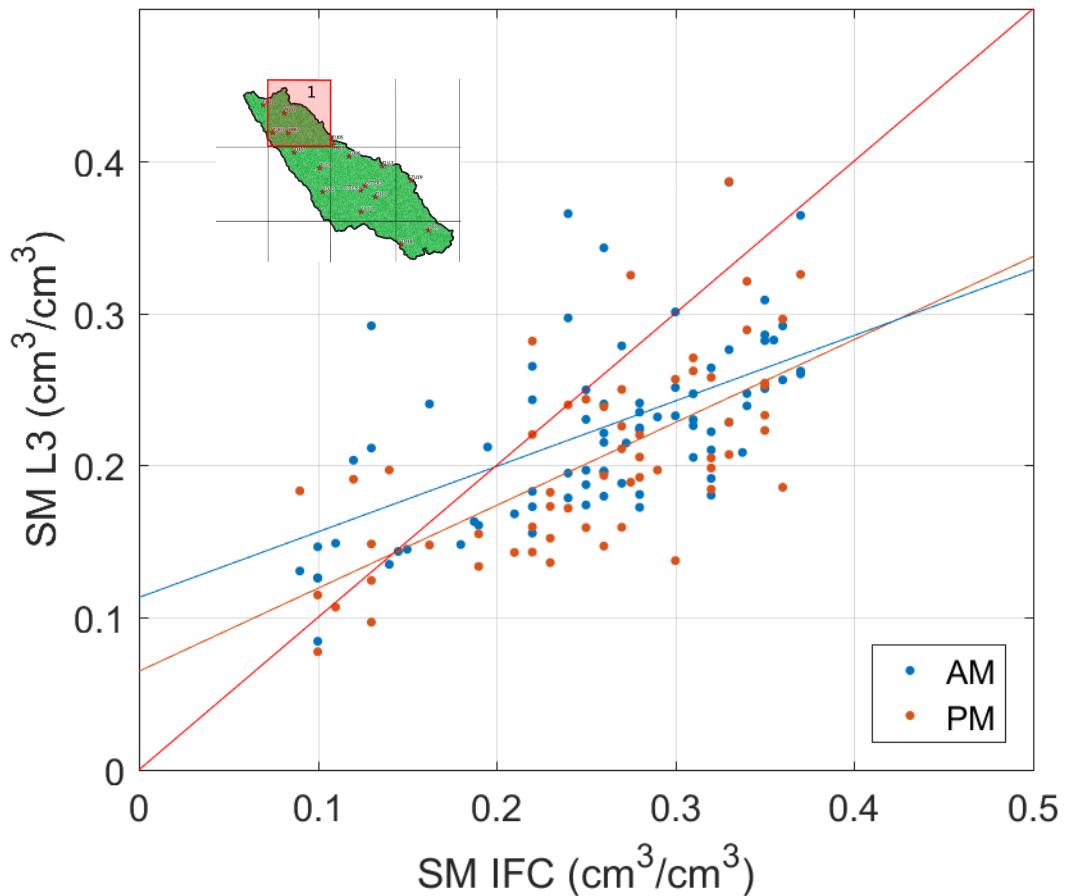


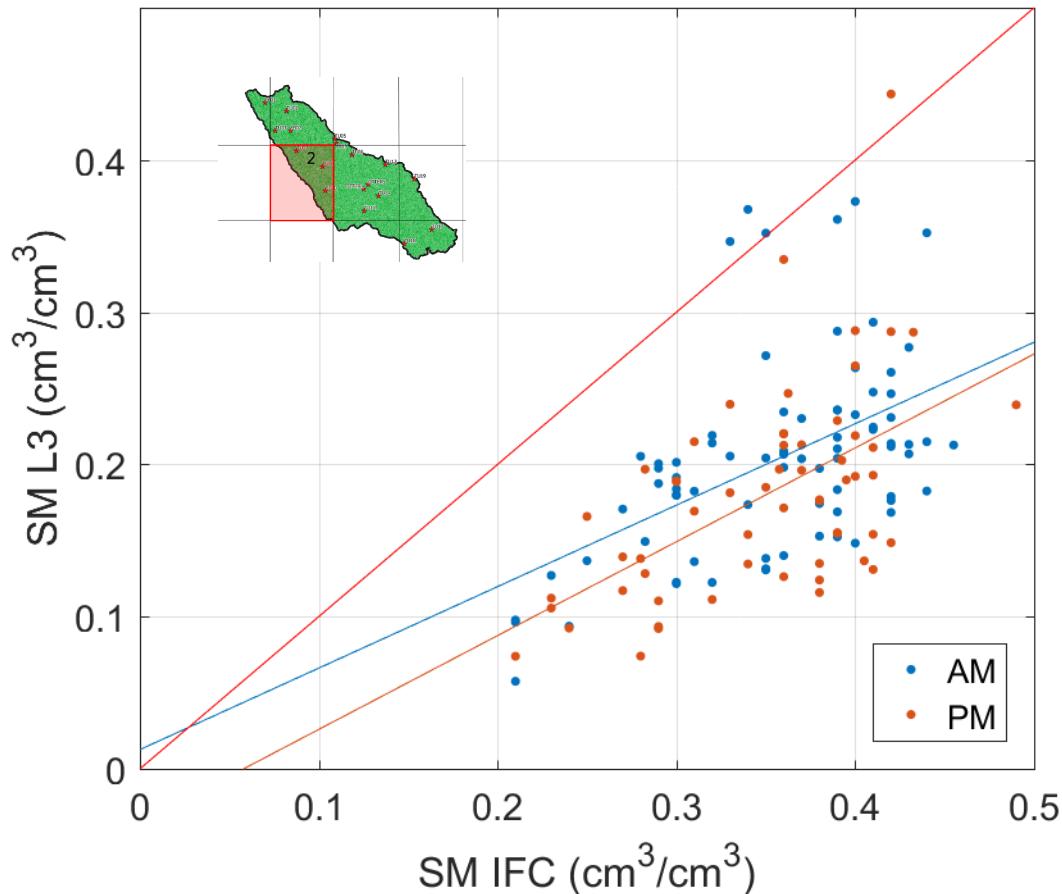
## Simulated Soil Moisture Variability for 21 IFC SM Gages

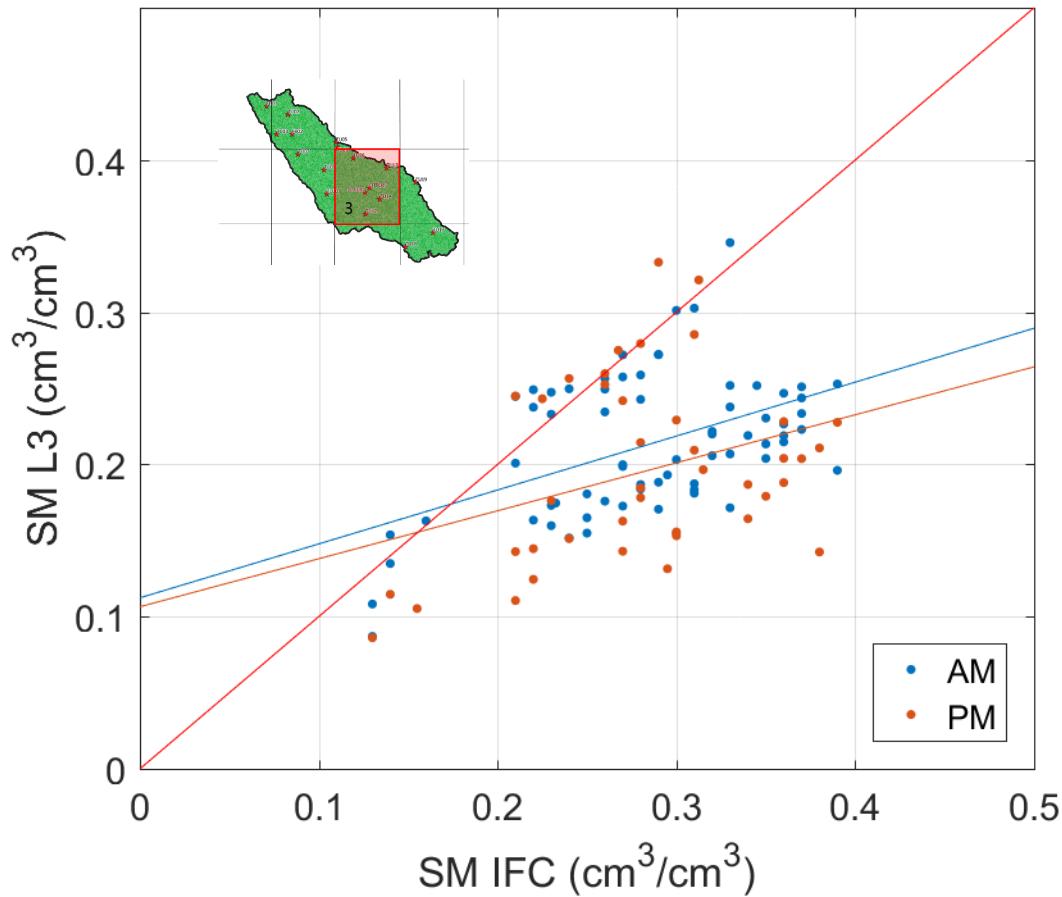




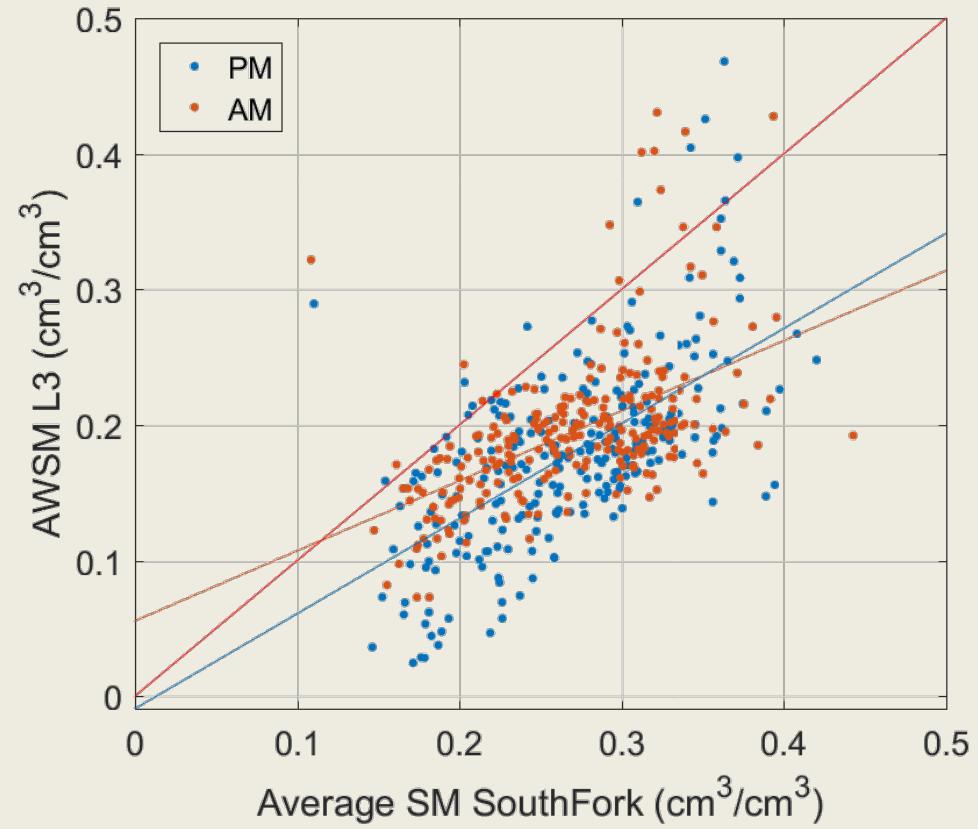
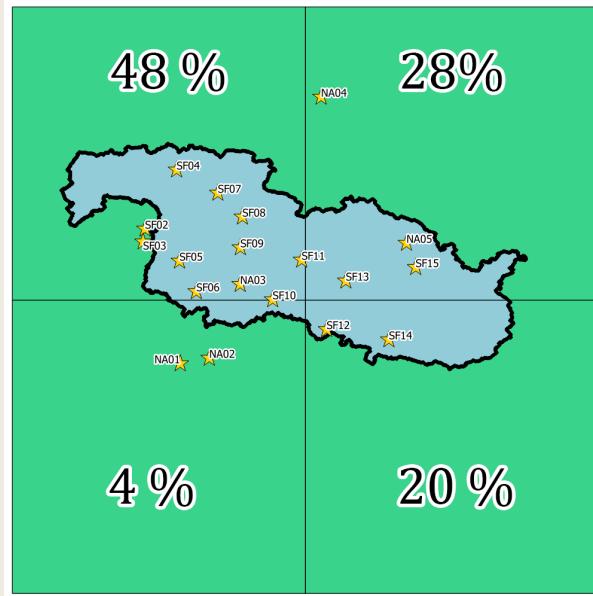








# SMAP L3 vs. South Fork





Thank You!