

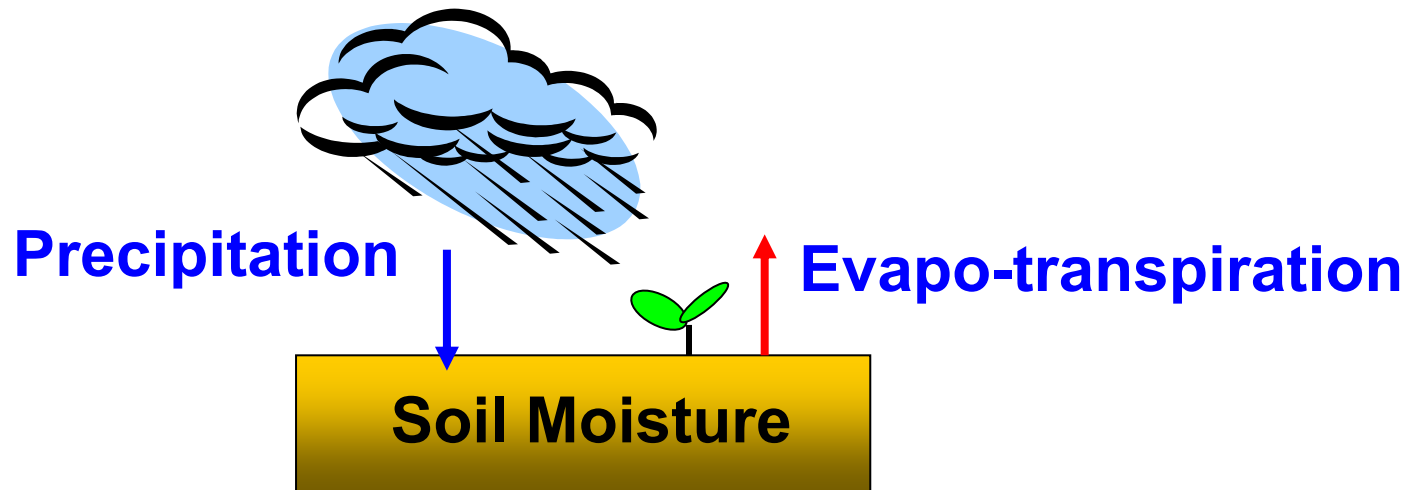
Relationship between Rainfall and Soil moisture based on AMSR-E Data

Kyoung-Wook Jin, Eni Njoku, Steven Chan

Jet Propulsion Laboratory
California Institute of Technology



Motivation

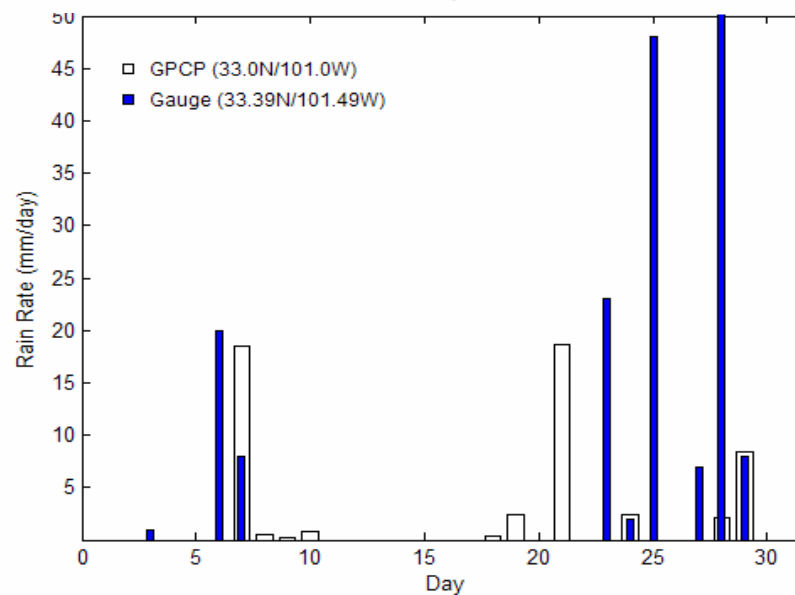
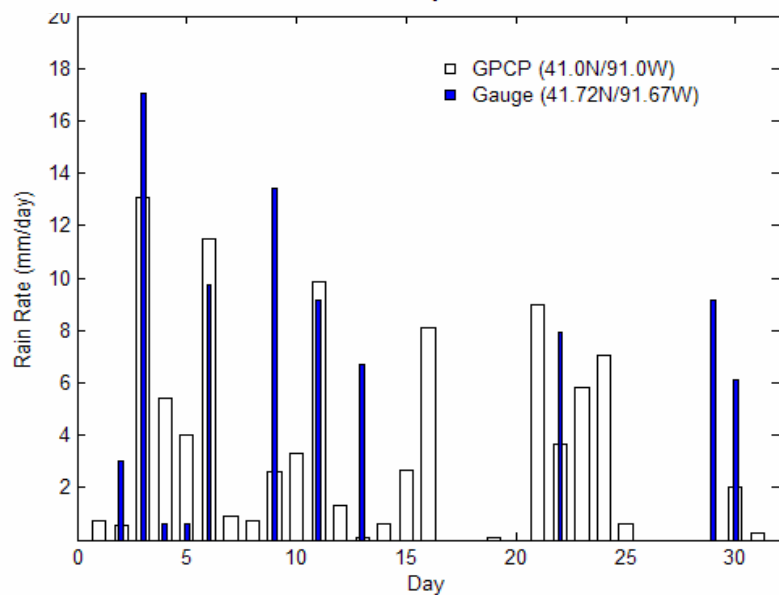
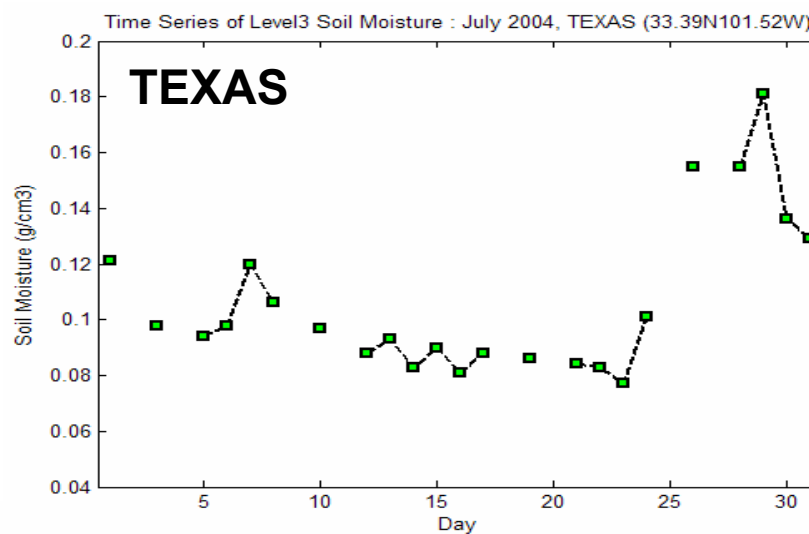
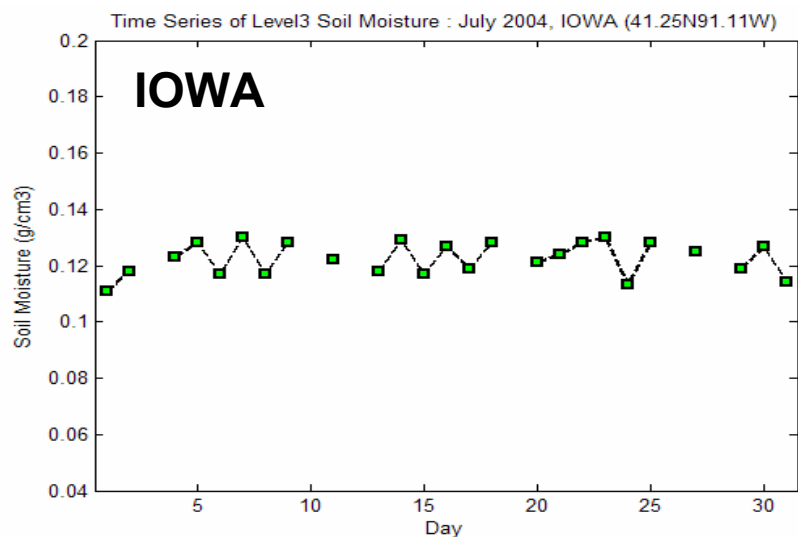


- Key parameters on interaction between Atmosphere and Land
- The role of precipitation and soil moisture for hydrological cycle and energy budget of the earth

Issue and Challenge

- Rainfall over land is a primary uncertainty source and limitation for the soil moisture retrieval.
- Discerning the signal emitted by the surface from emission of a raining atmosphere is **extremely complicated** -- Retrieval of soil moisture is not attempted in the presence of precipitation using a rain-screening method:
Tb24v-Tb89v > 8K and Tb89v < 270K

Sensitivity to Vegetation



Physical Tools

- **Soil Moisture Algorithm**

(Njoku et al., 2003; Njoku and Chan, 2006)

$$\text{SM} = 5.0 + 2.0 \text{wbar} + 150.0 \times (\text{Pr10} - \text{Pr10}_{\min}) \cdot \text{EXP}(0.3 \text{wbar})$$

$$\text{wbar} = -3.5845 - 1.6605 \times \text{Ln}(\text{Pr10}_{\min})$$

Where, $\text{Pr10} = (\text{Tb10v} - \text{Tb10h}) / (\text{Tb10v} + \text{Tb10h})$

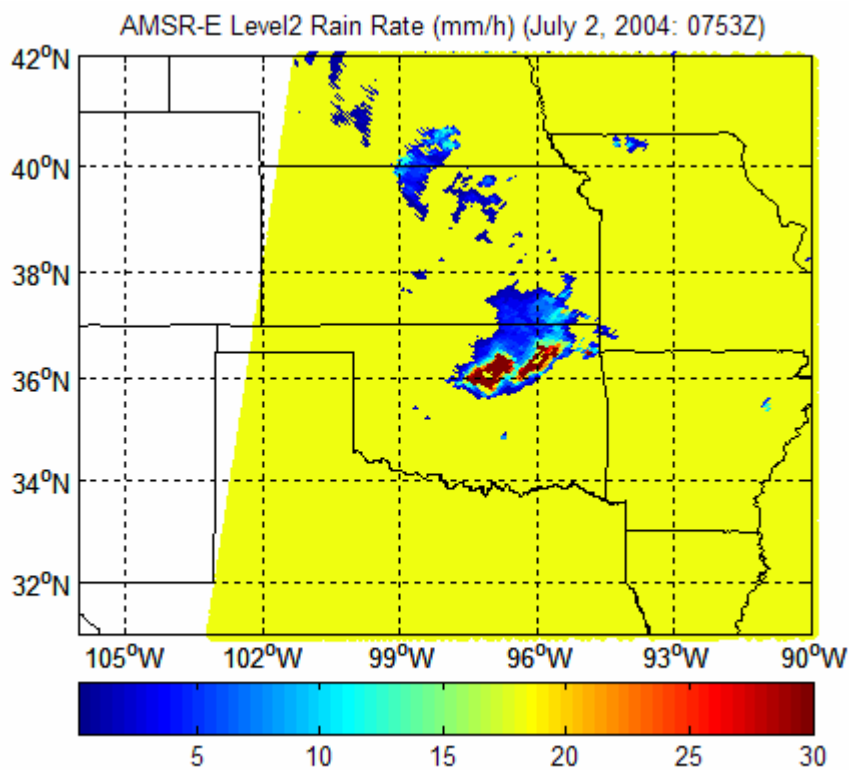
- **Land Rainfall Algorithm**

(McCollum and Ferraro, 2003)

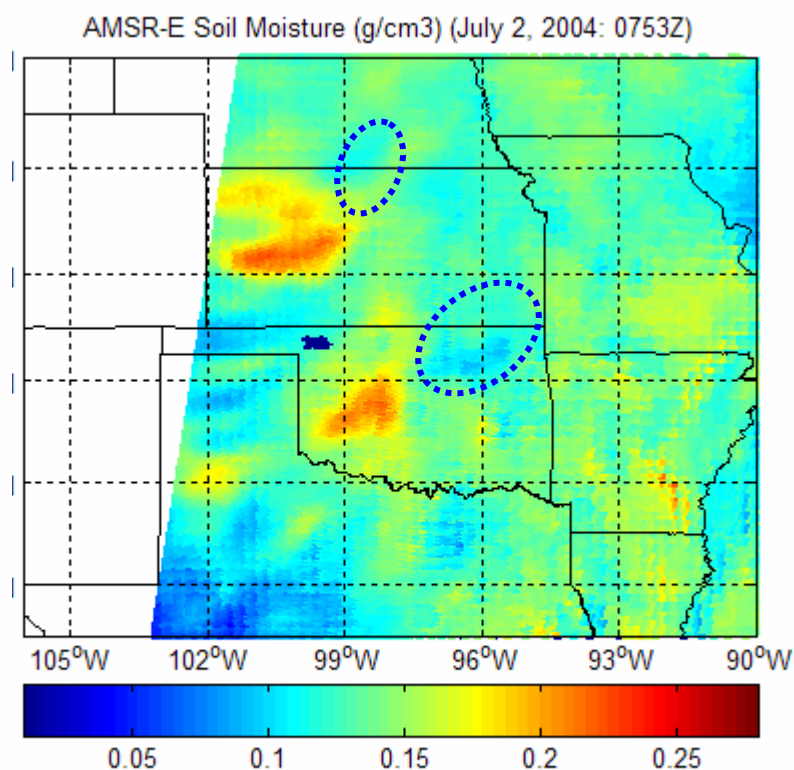
Over Land (Warm Background) - Brightness temperature depression signature from the scattering of ice particles.

$$\text{SI} = a - b \cdot \text{Tb19} - c \cdot \text{Tb22} + d \cdot (\text{Tb22})^2 - \text{Tb85}$$

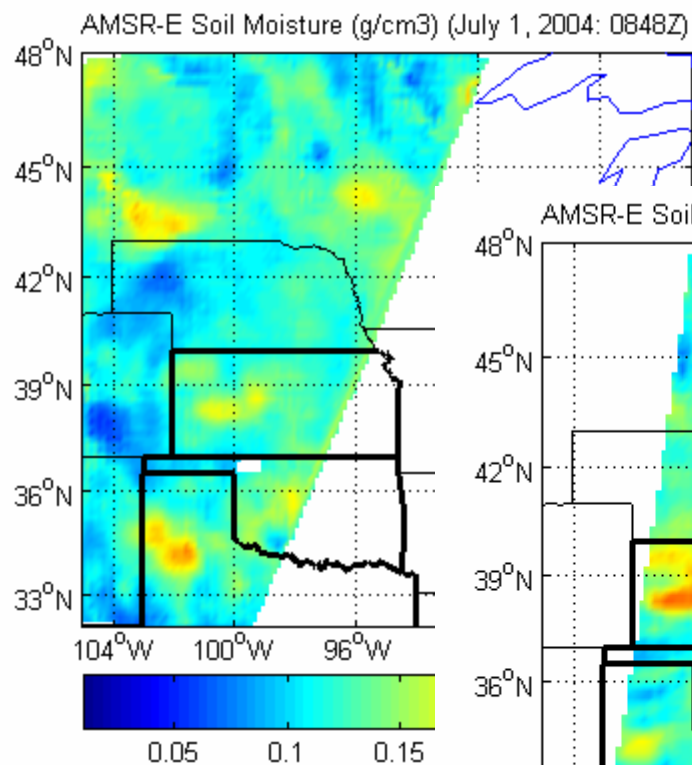
Swath-basis analysis



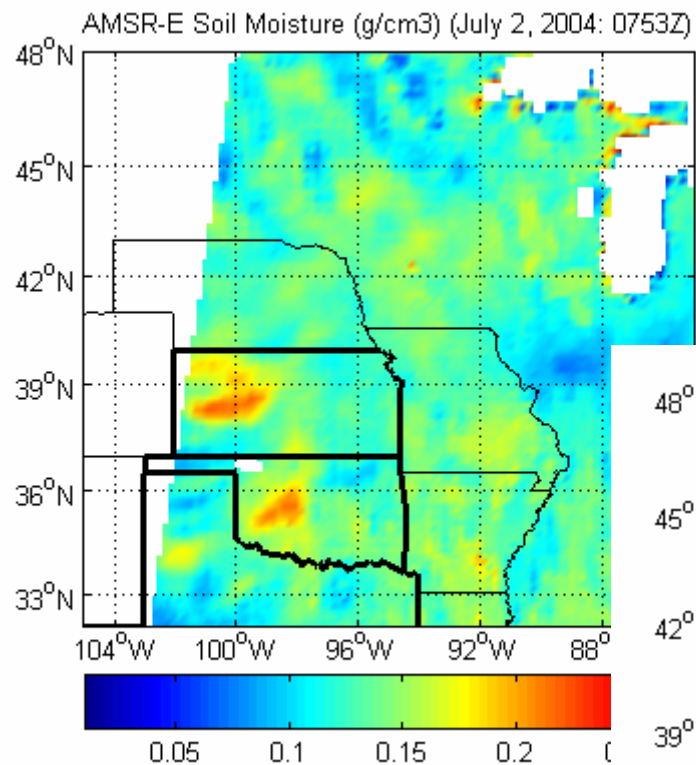
Rain Rate (mm/h)



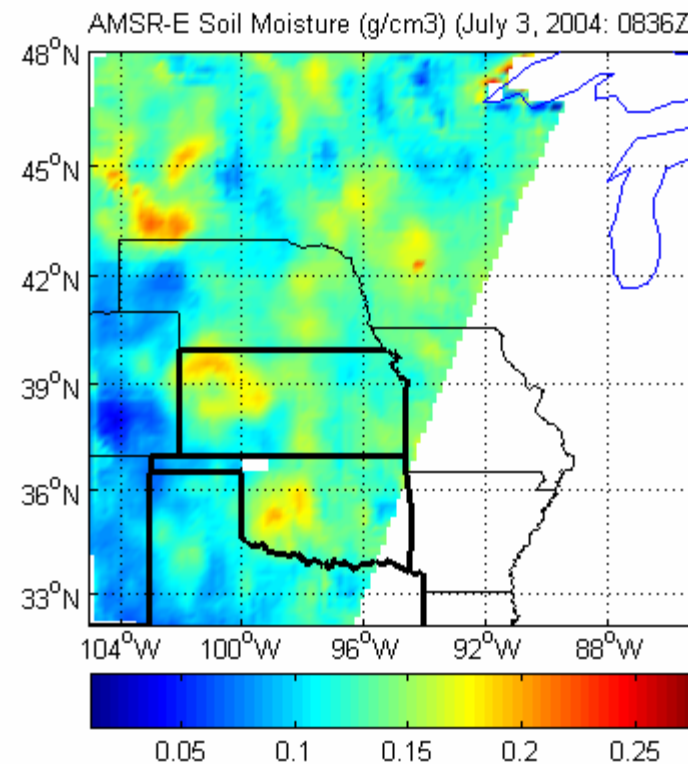
Soil Moisture (g/cm3)



JULY1

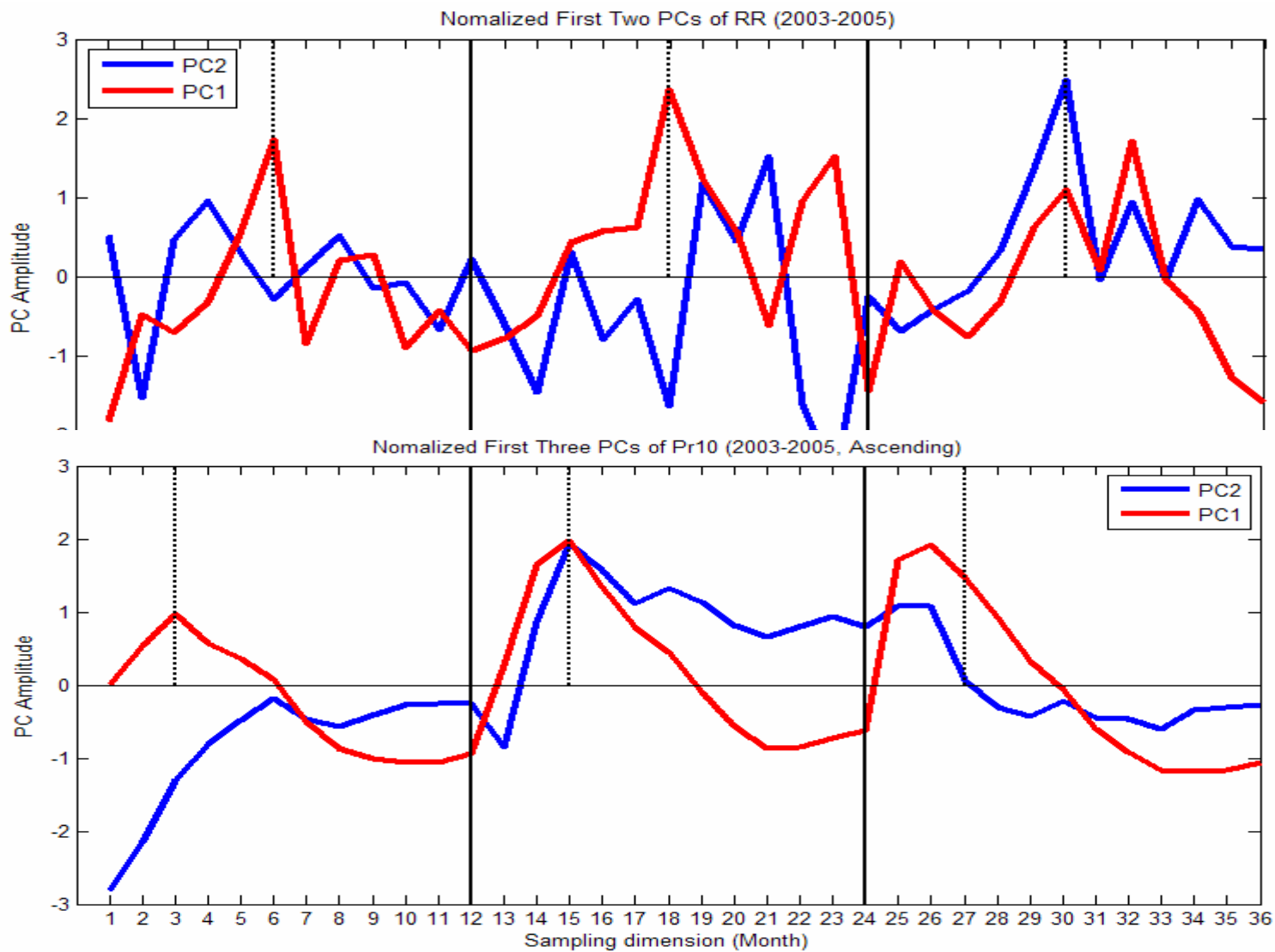


JULY2

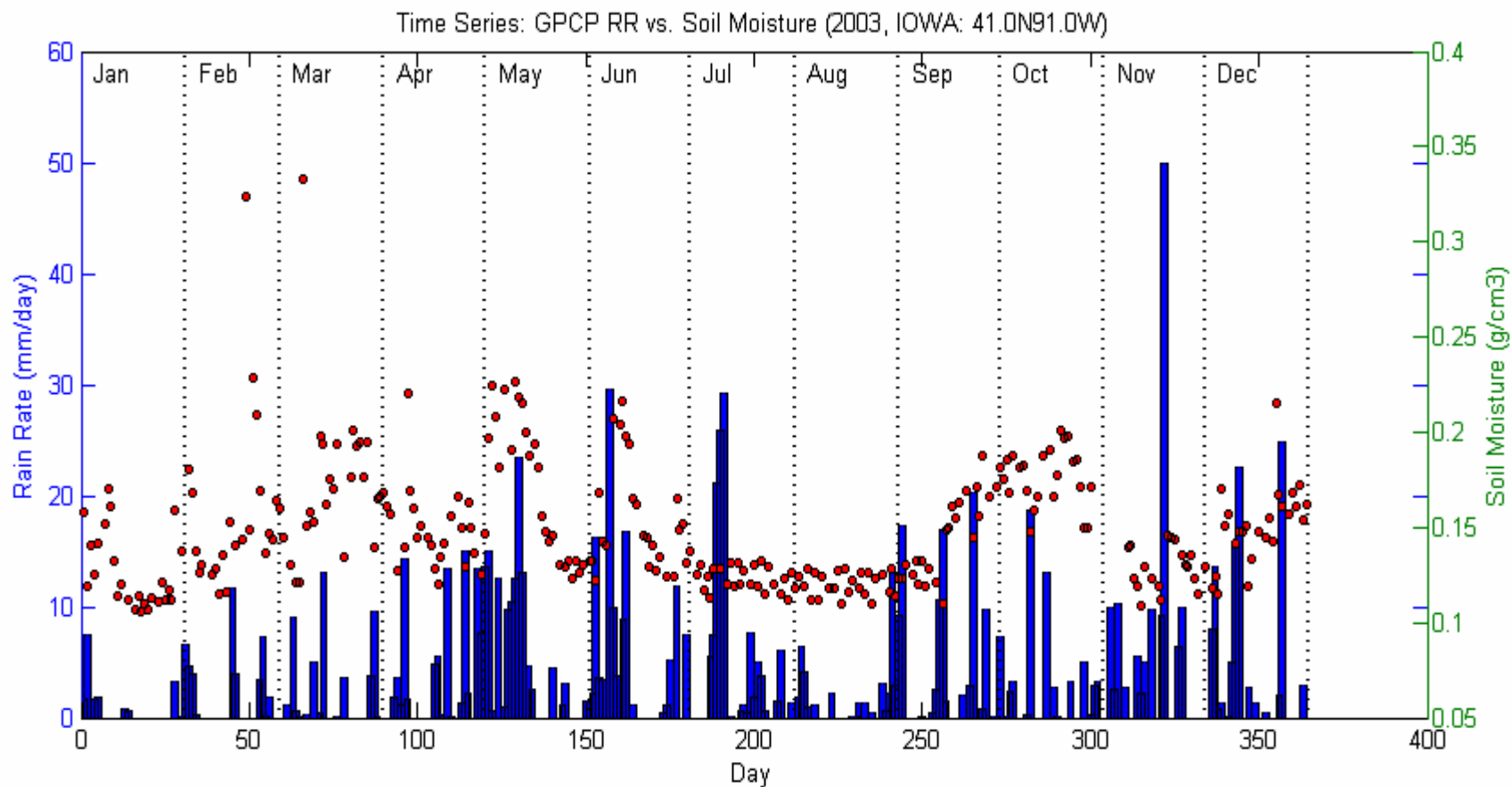


JULY3

PC Analysis



Daily Time Series Analysis



Conclusion and Future Direction

- Results show some insights of the relationship between precipitation and soil moisture **according to spatio-temporal scales**
- We are working on investigating **consistency between the retrieved soil moisture data and the model data (NARR)** to study how satellite-based soil moisture observations can contribute to simulate improved large-scale soil moisture estimation through data assimilation.