

U.S. Climate Reference Network: Soil Moisture/Temperature

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US Climate Reference Network

Outline

- USCRN: Background
- USCRN: Soil Probes
- Research: Phenology/Temperature
- Research: Soil Moisture/Modeling
- Future Work

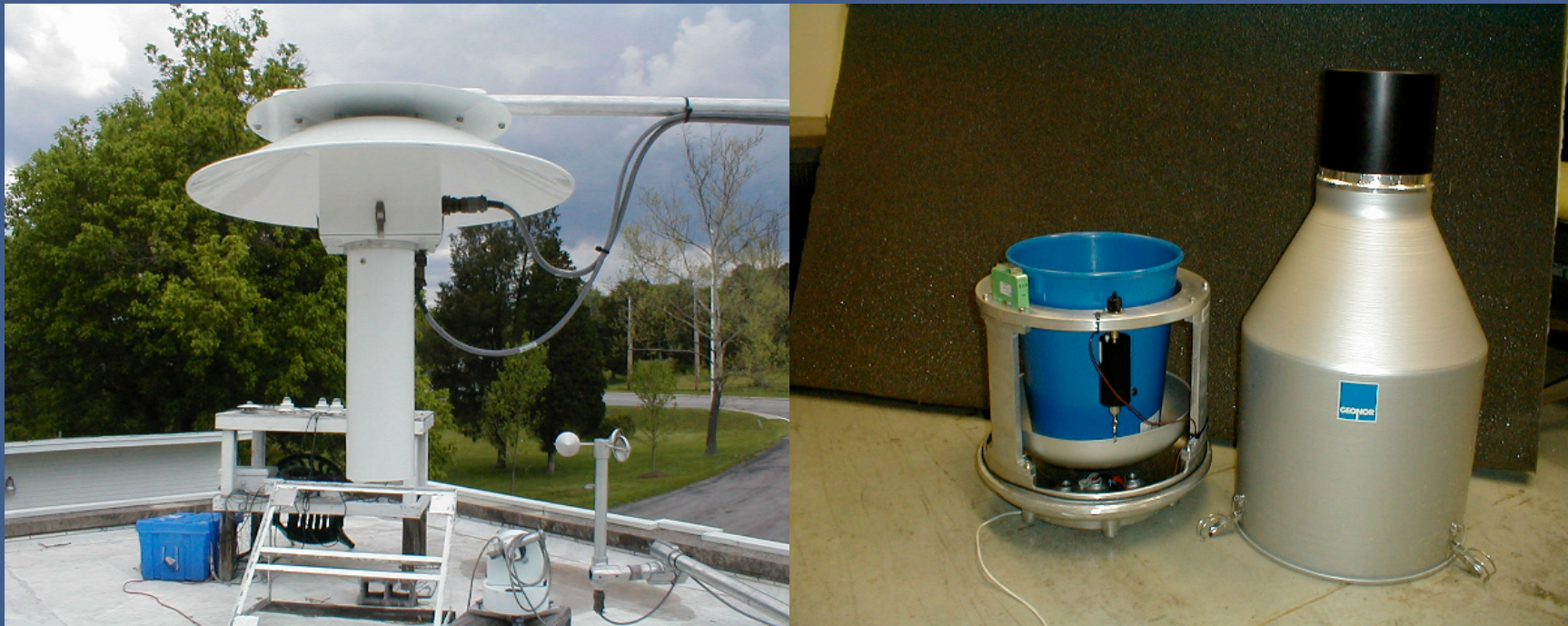
USCRN: Background

- Sites are Stable and Undisturbed Locations



USCRN: Background

- Calibrated to the standards set by National Institute of Standards and Technology

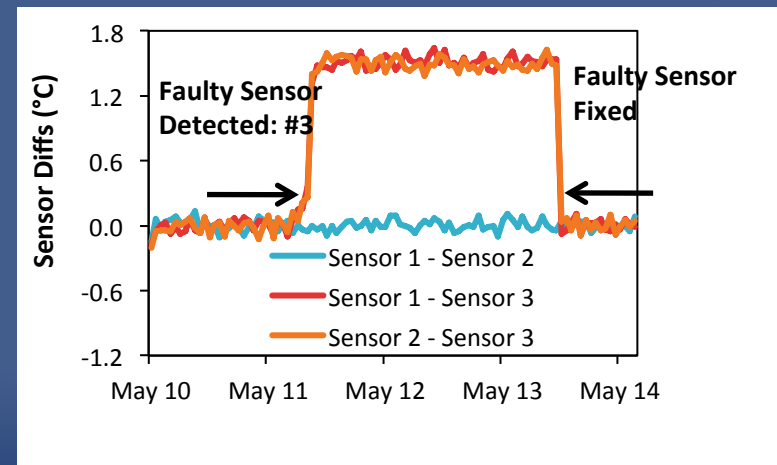


USCRN: Background

- Triplicate Configuration

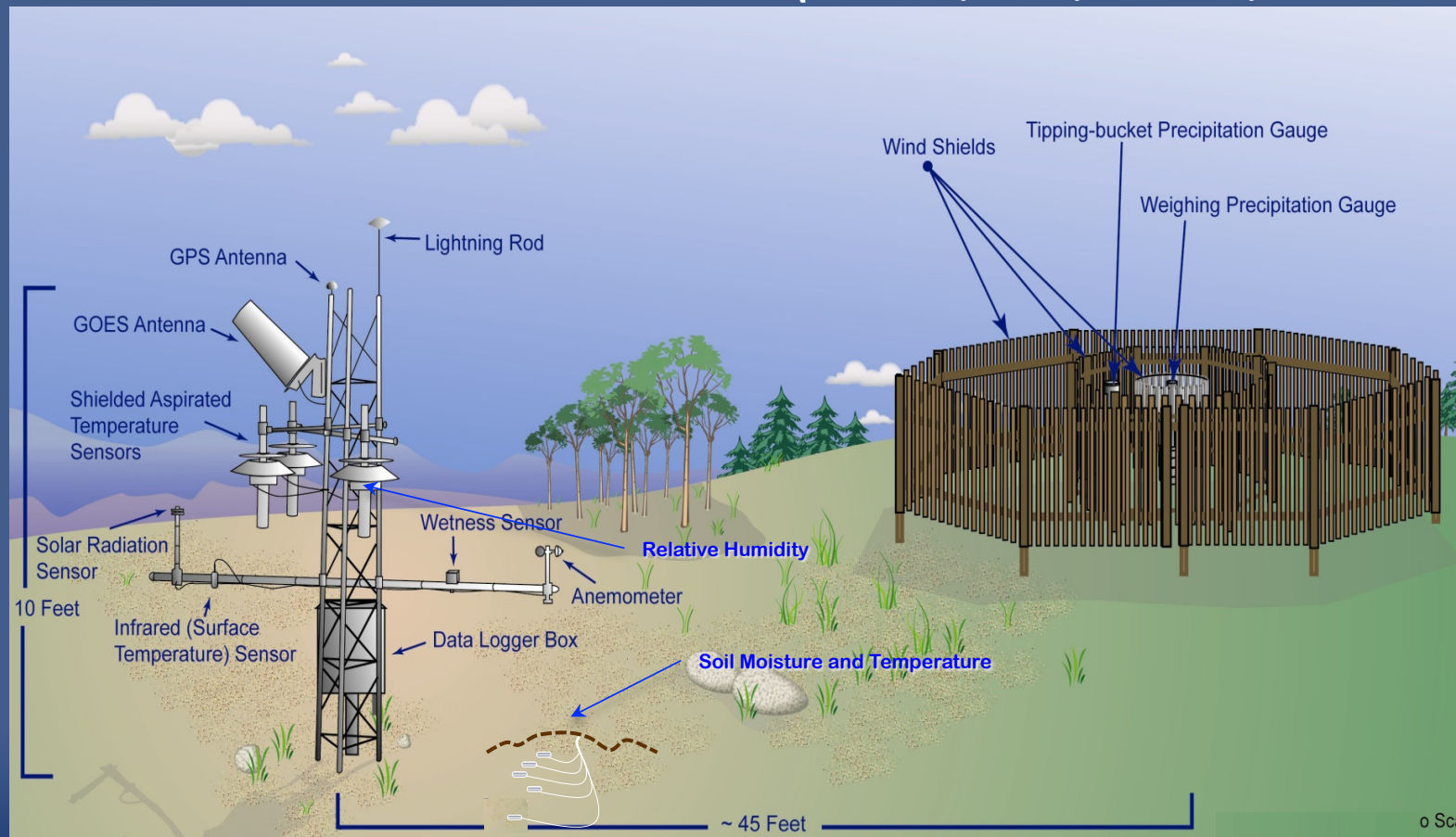


- Redundancy
- Consistency

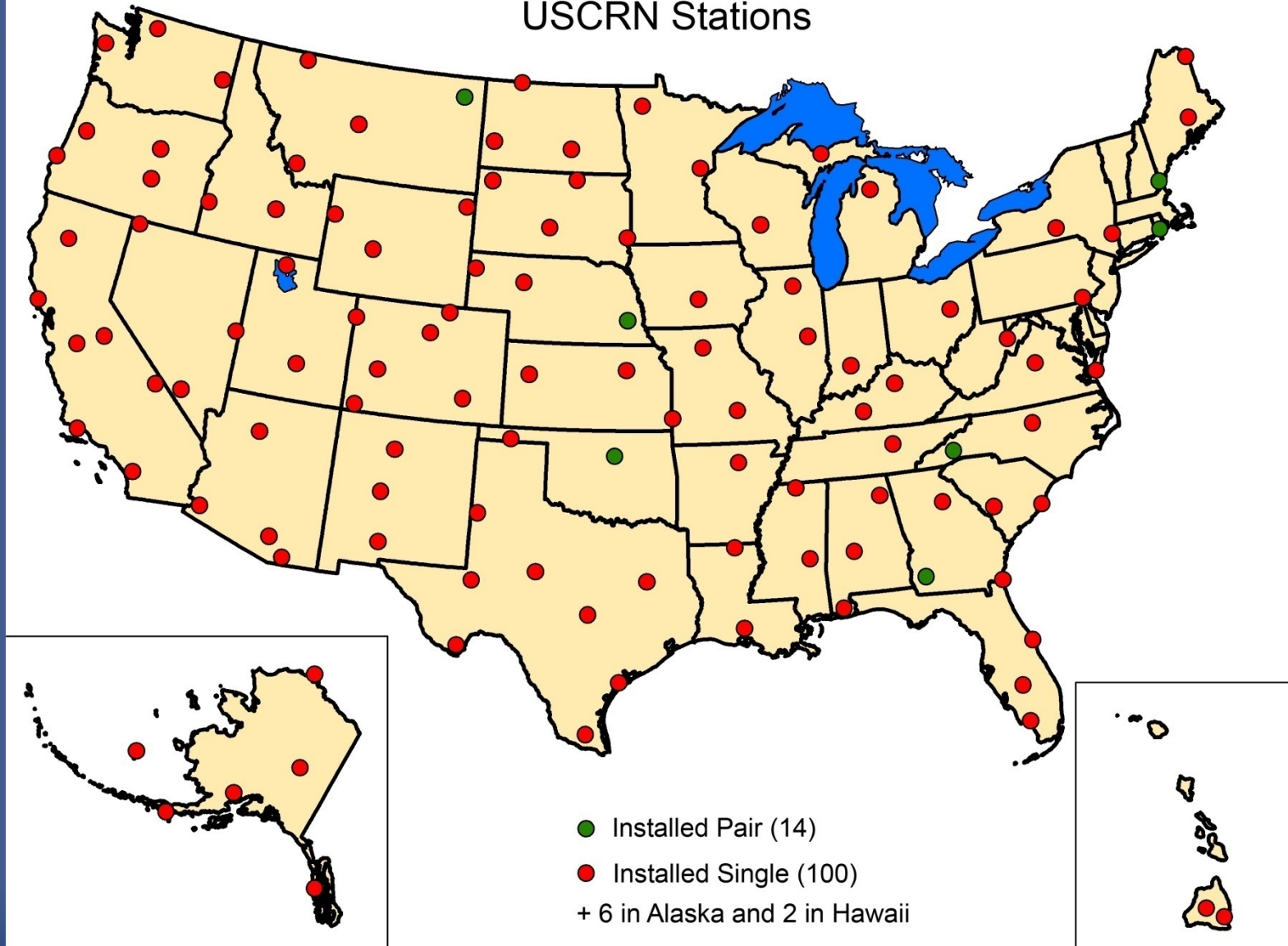


USCRN: Background

- Additional Measurements (Wind, RH, Solar, and IR)



USCRN Stations



Soil Moisture/Temperature

- Workshop on March 2009
- Triplicate configuration for Soil Probes
- 5, 10, 20, 50, 100cm depths
- QA/QC needs
- Soil sampling needs
- Satellite cal/val

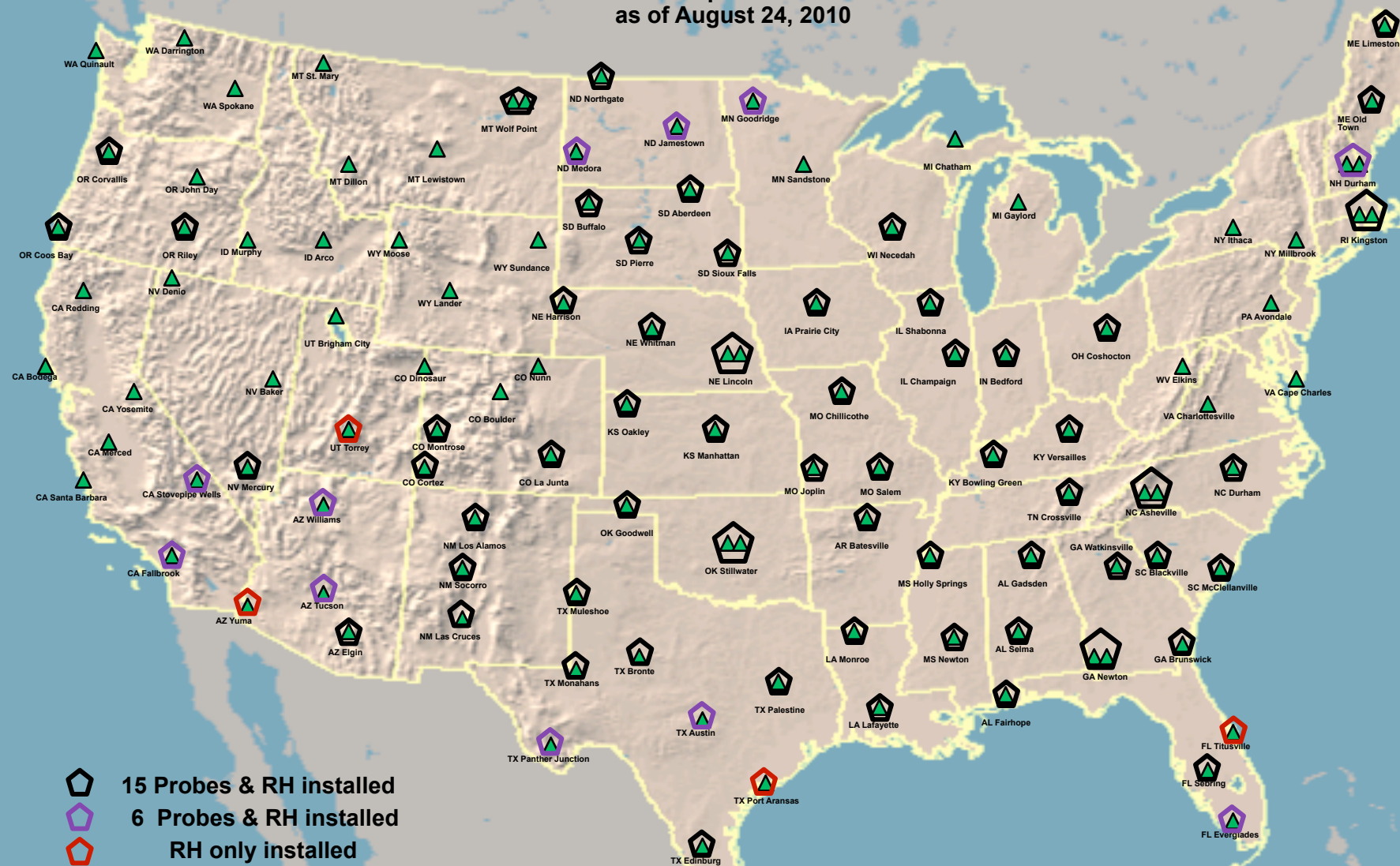
First Soil Probe Installed



- Crossville, TN
- April 2009
- ATDD
 - Oak Ridge
 - Maintenance
 - Installation

USCRN Soil Moisture Network 2010

Status of Soil Moisture/Soil Temperature Sensors at USCRN Stations
as of August 24, 2010



Research: Soil Temperature and Plant Growth



Phenology

- Study of biological life cycles in association with weather and climate
- Plant growth closely associated with temperature
 - Soil temperature
 - Cytokinin produced in roots
 - Cell division

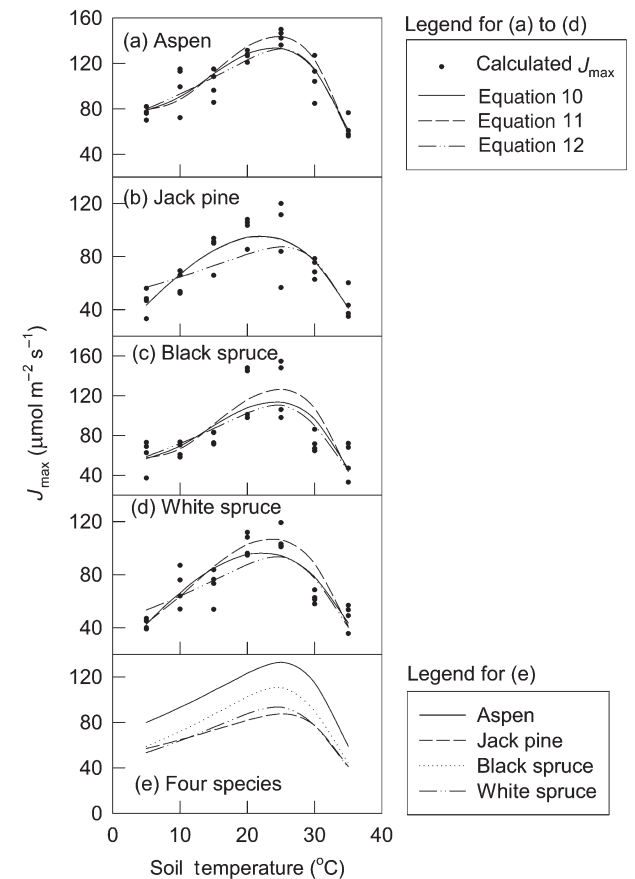


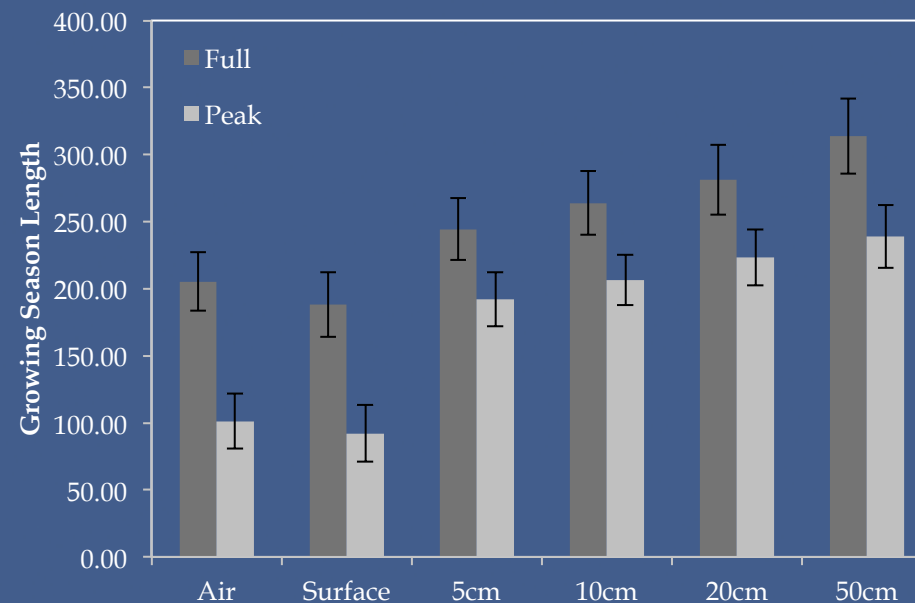
Figure 2. Relationship between light-saturated rate of electron transport (J_{\max}) and soil temperature for aspen, jack pine, black spruce and white spruce. Figure 2e was generated with Equation 12 (see Tables 2–4 for parameter values). The lines for Equations 10 and 11 overlapped for jack pine.

~ Cai and Dang Tree Physiology 2002

Comparison of Air and Soil Temperature

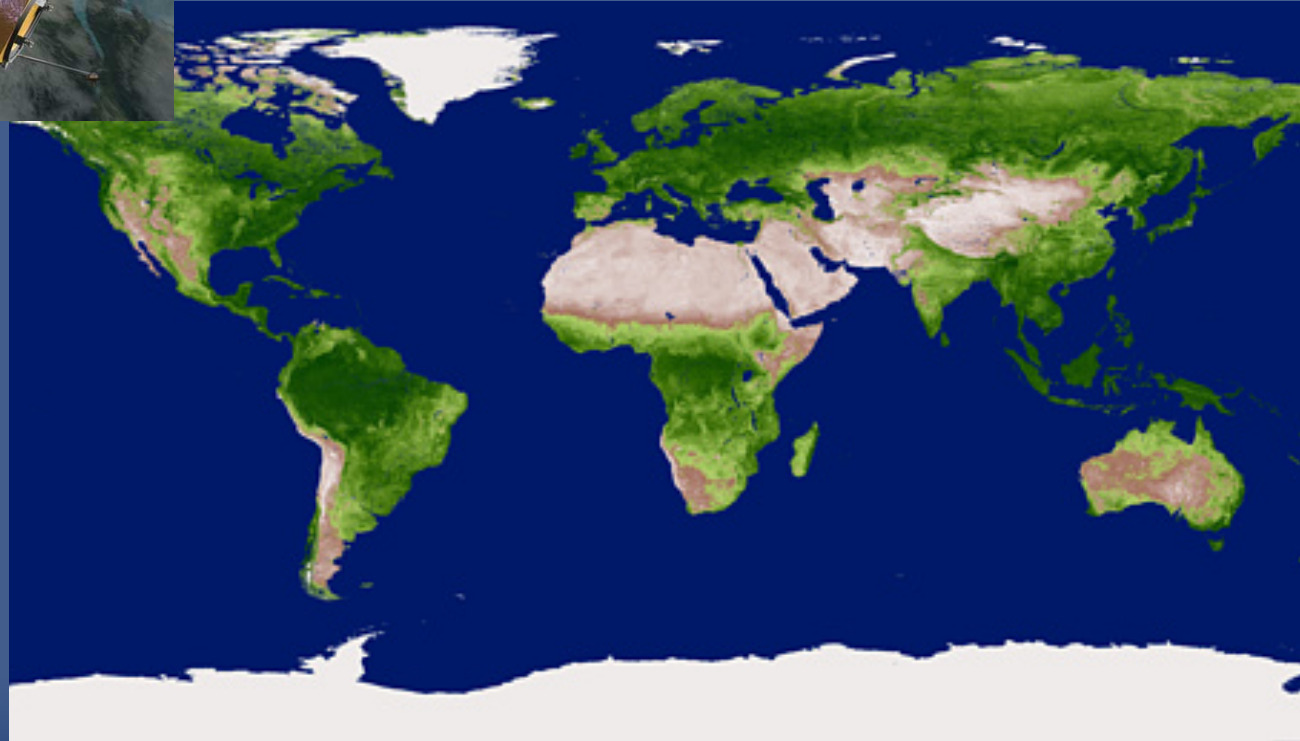
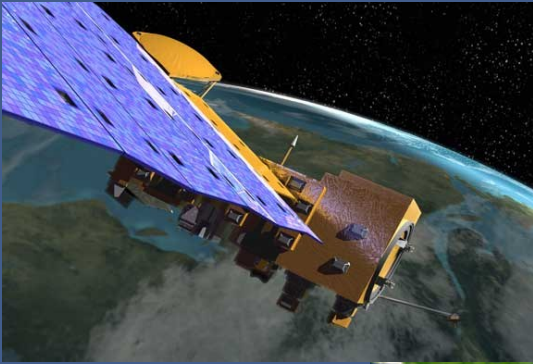
- Traditional Method 0°C
- My method 5°C
 - Peak Growing Season (10°C)
- 38 Stations that had a complete record for 2010
- Start and End dates of Growing Season
- Calculate Length of Growing Season

Results of Growing Season Length

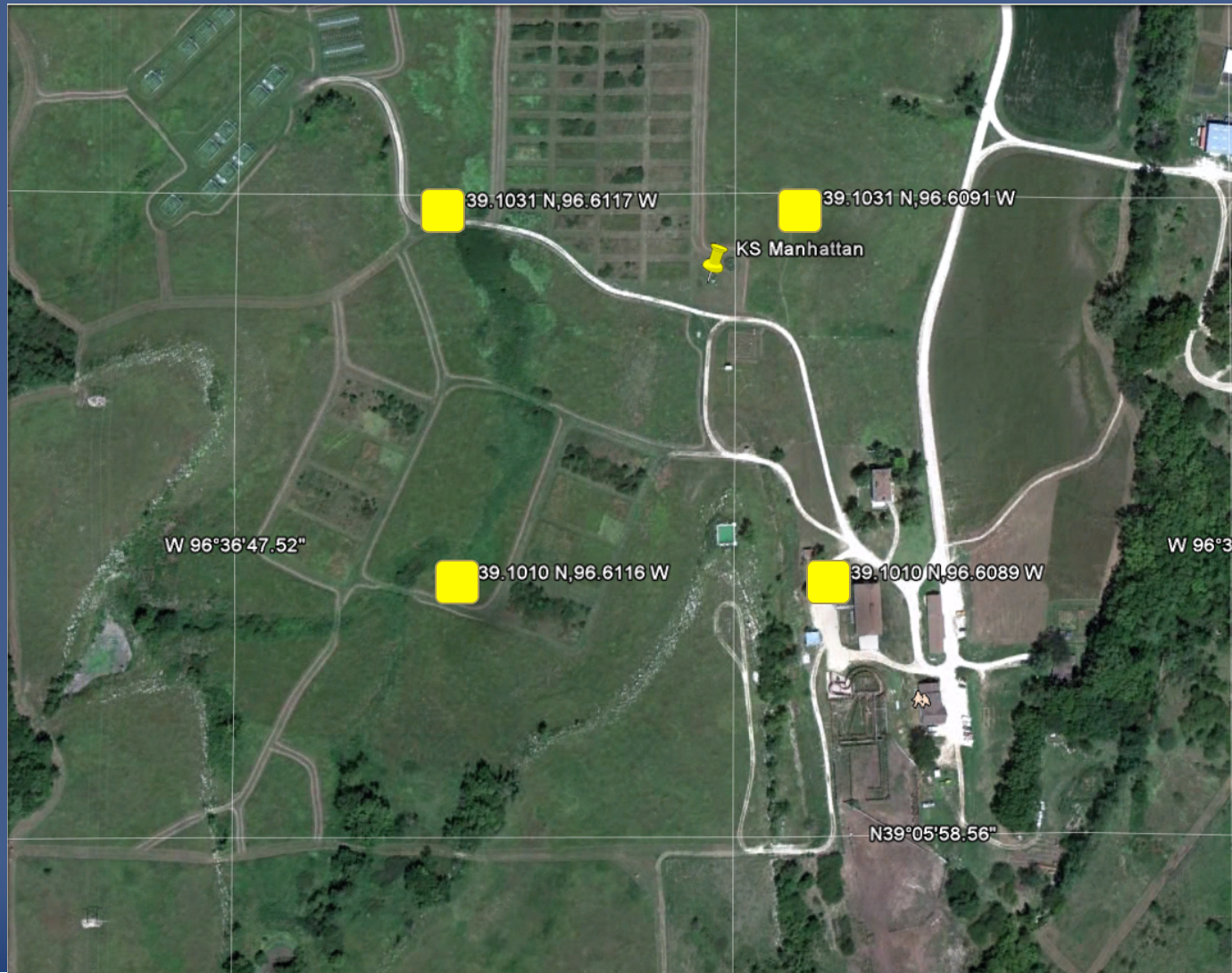


Average Difference between Air and 5cm = 39 days
Average Difference between Surface and 5cm = 56 days

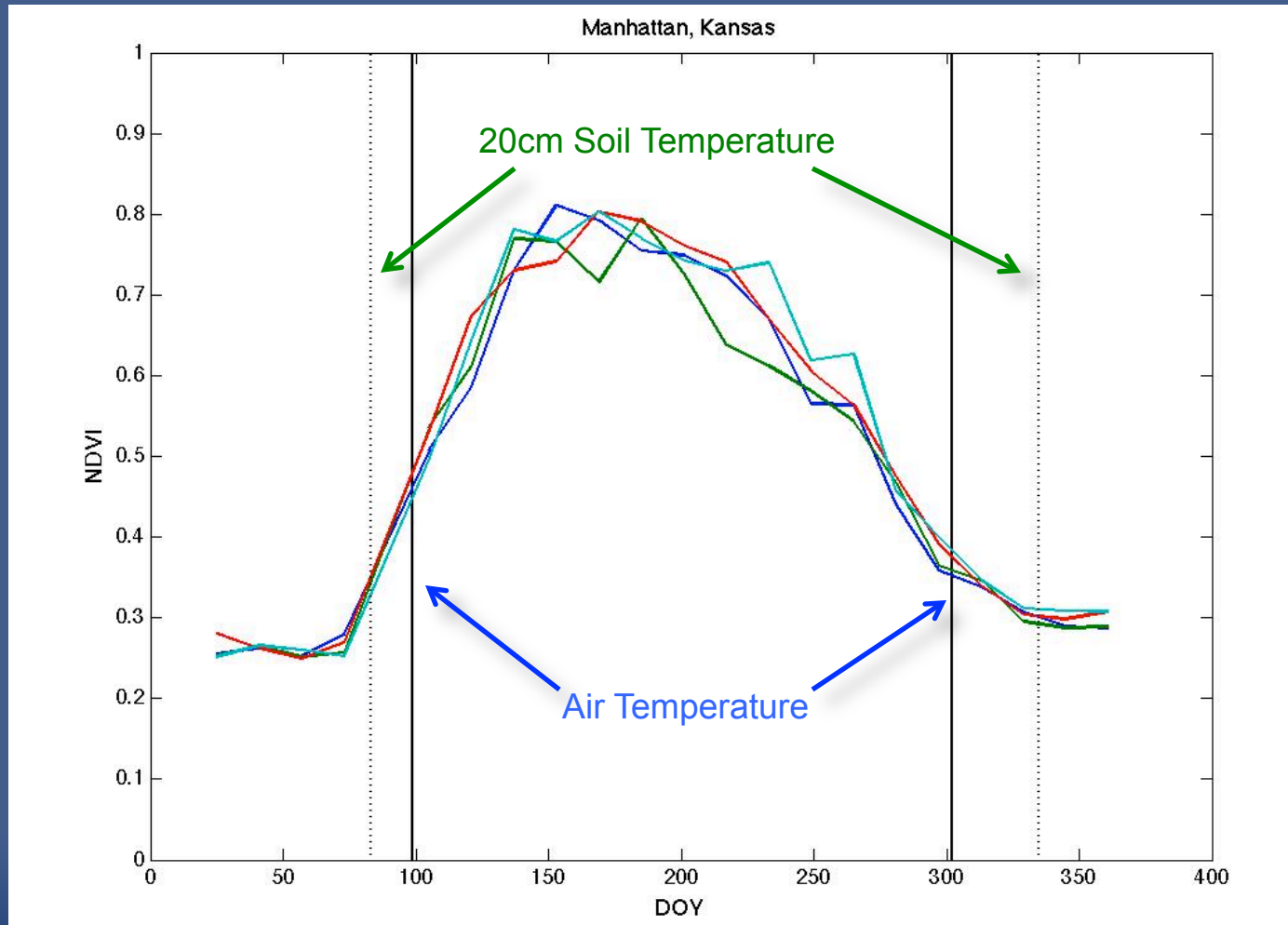
MODIS: Normal Difference Vegetation Index



USCRN KS Manhattan: NDVI



NDVI and Temperature



Research: Soil Moisture Modeling



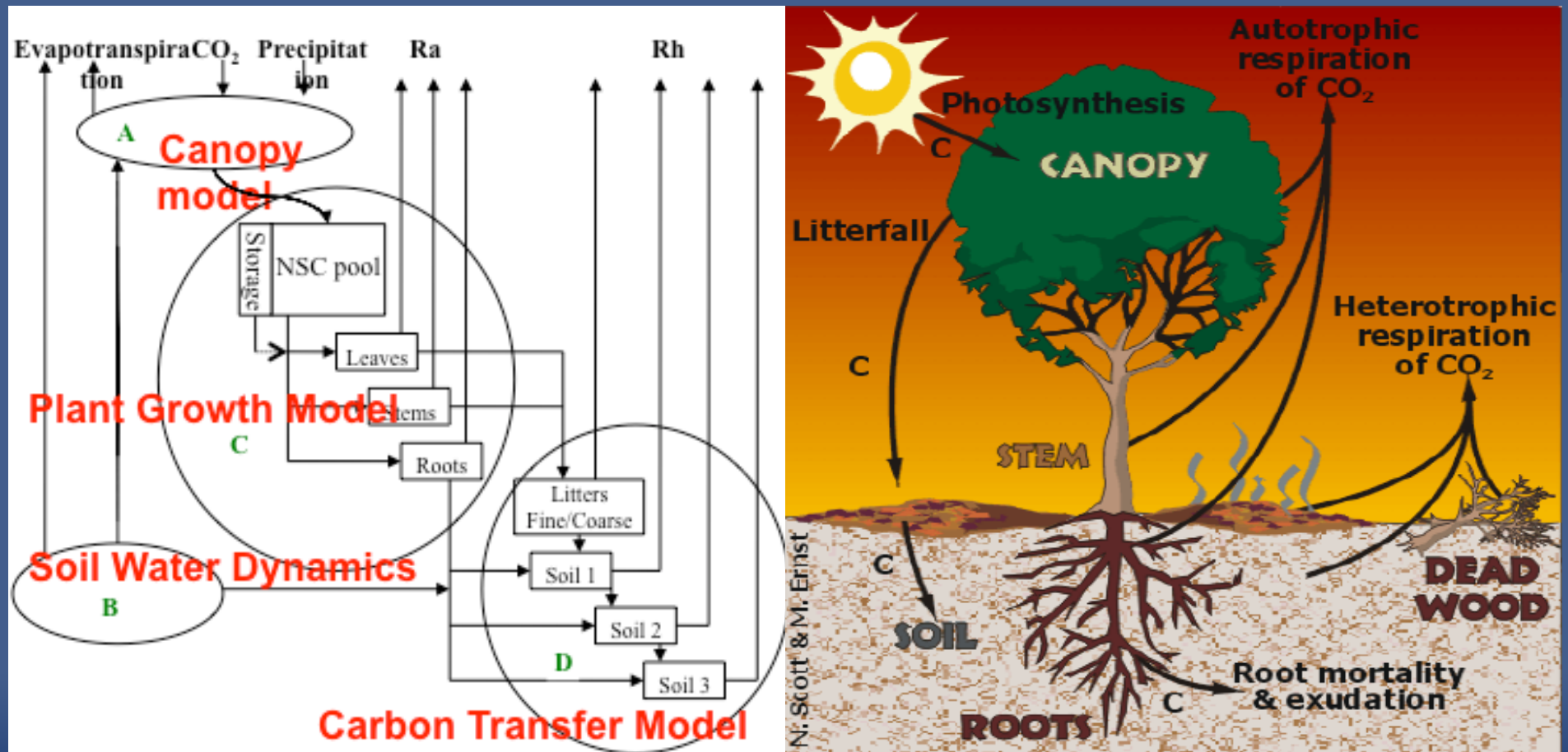
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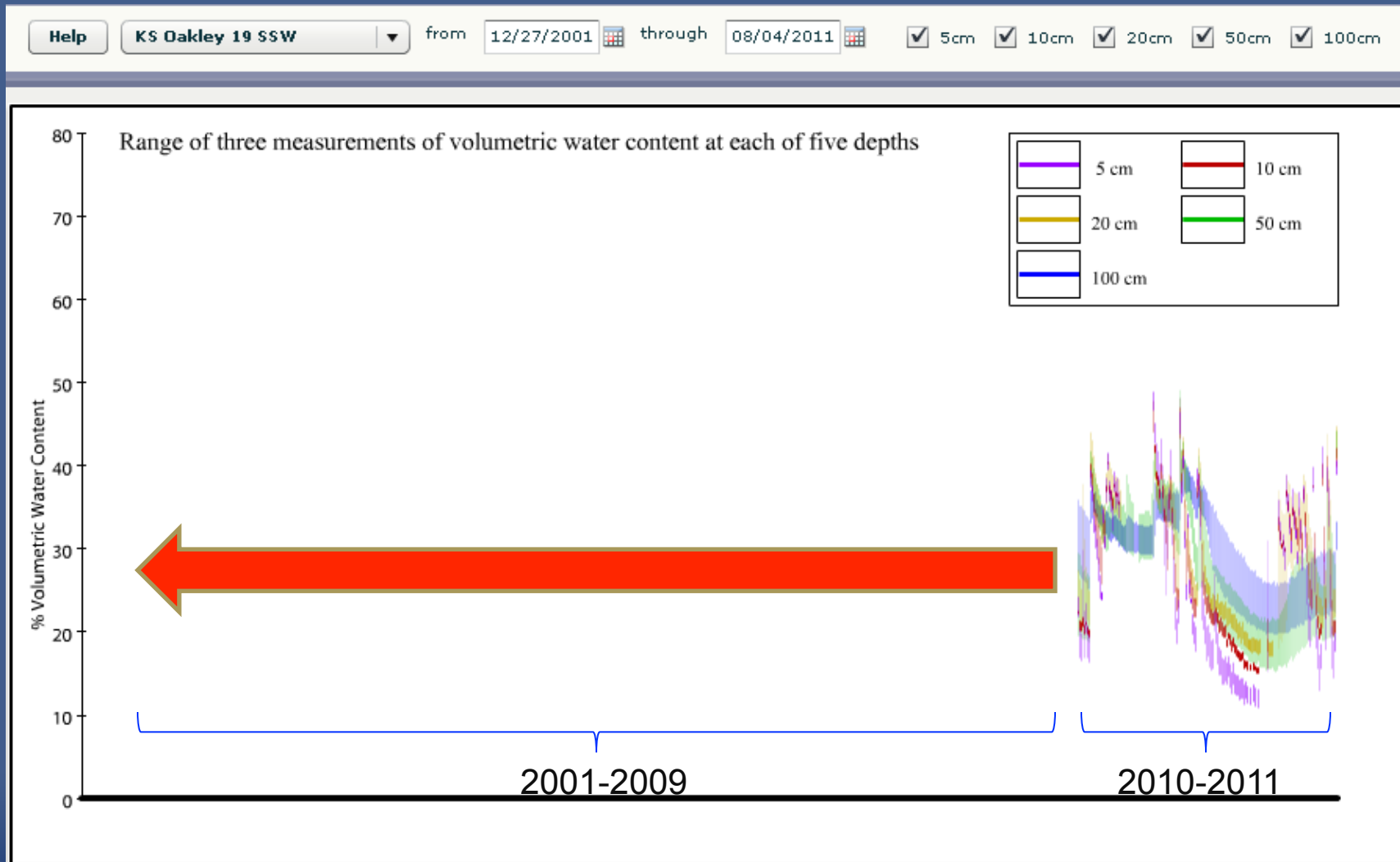
Soil Moisture

- Only 3 years of data
- No other ecosystem measurements
 - Photosynthesis, ET, carbon cycle, water balance, etc.
- How to increase the value of measurements?

Diagram of Terrestrial Ecosystem Model



Artificial Historical Soil Moisture Record

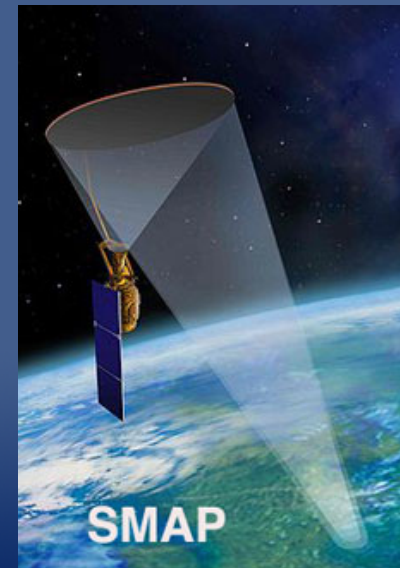


Products

- Artificial soil moisture record will improve product development
 - Monitor historical change in soil moisture
 - Drought
- Climatology of soil
- Look at changes in ecosystem properties and future changes to ecosystem

Future Work

- Finish the analysis of growing season and soil temperature
- Connect model to USCRN
- SMAP
- Soil Moisture Variability and Quality Control



Acknowledgements

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Thank you!

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