Design of soil moisture sampling networks for validation of passive microwave remote sensing missions

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Establishing a Soil Moisture Observatory for Validation of SMOS

- Project Overview
- Soil Moisture Data Required/Produced
- Soil Moisture Needs (accuracy, temporal, horizontal resolution, sampling protocol)
- What is lacking/ where should we be going in monitoring/research
- Implications of data gaps or missing data
- Common data access portals

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Project Overview

- Validation of soil moisture from the SMOS mission over Canadian agricultural regions (Magagi et al.)
- Establish paired soil moisture monitoring networks
- Sites will focus on agricultural regions in Western and Eastern Canada.

Soil Moisture Data Produced

- Two soil moisture monitoring networks
- Sampling at 5, 20 and 50cm depths

Temporal Frequency :

Hourly

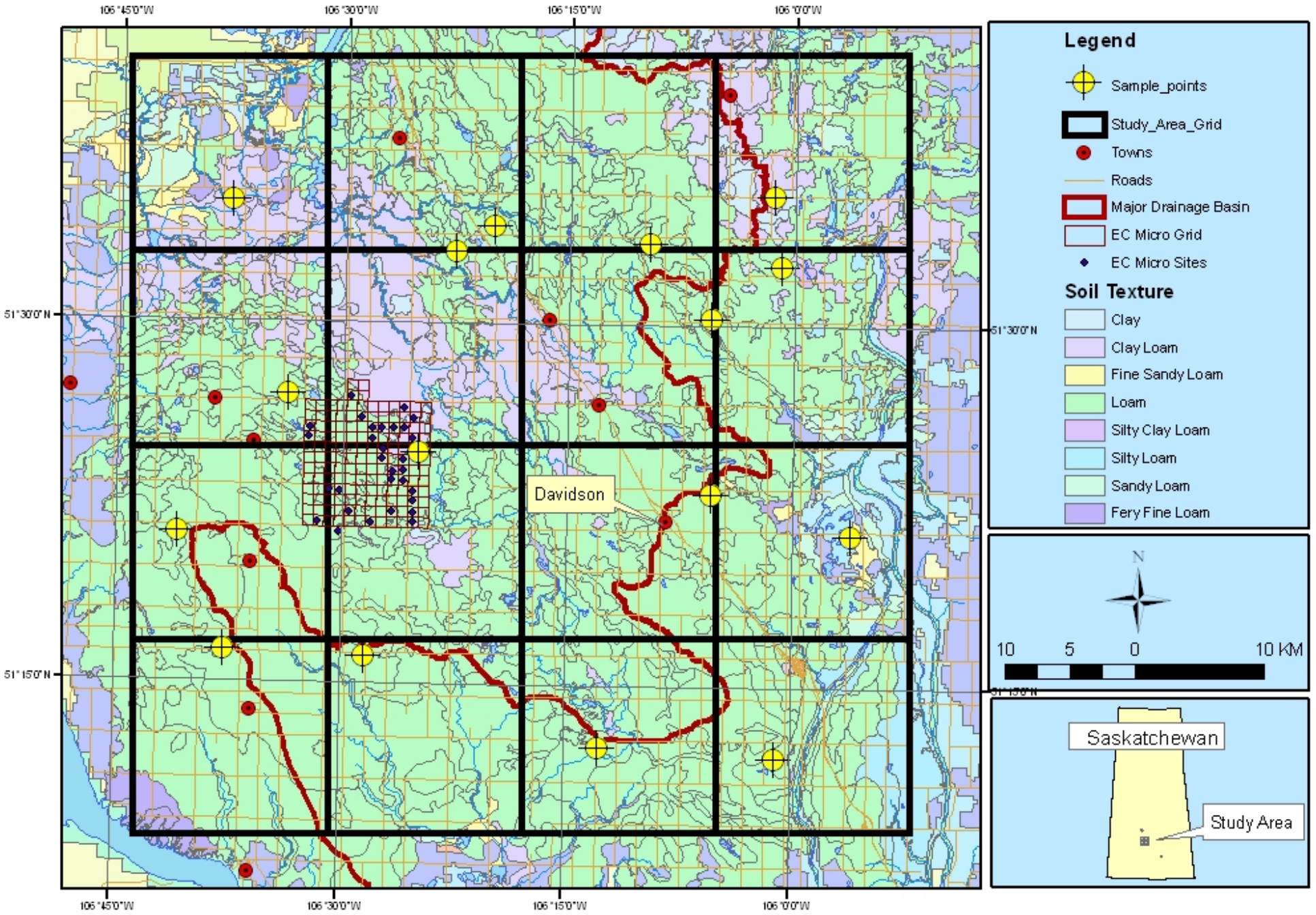
Variables Observed:

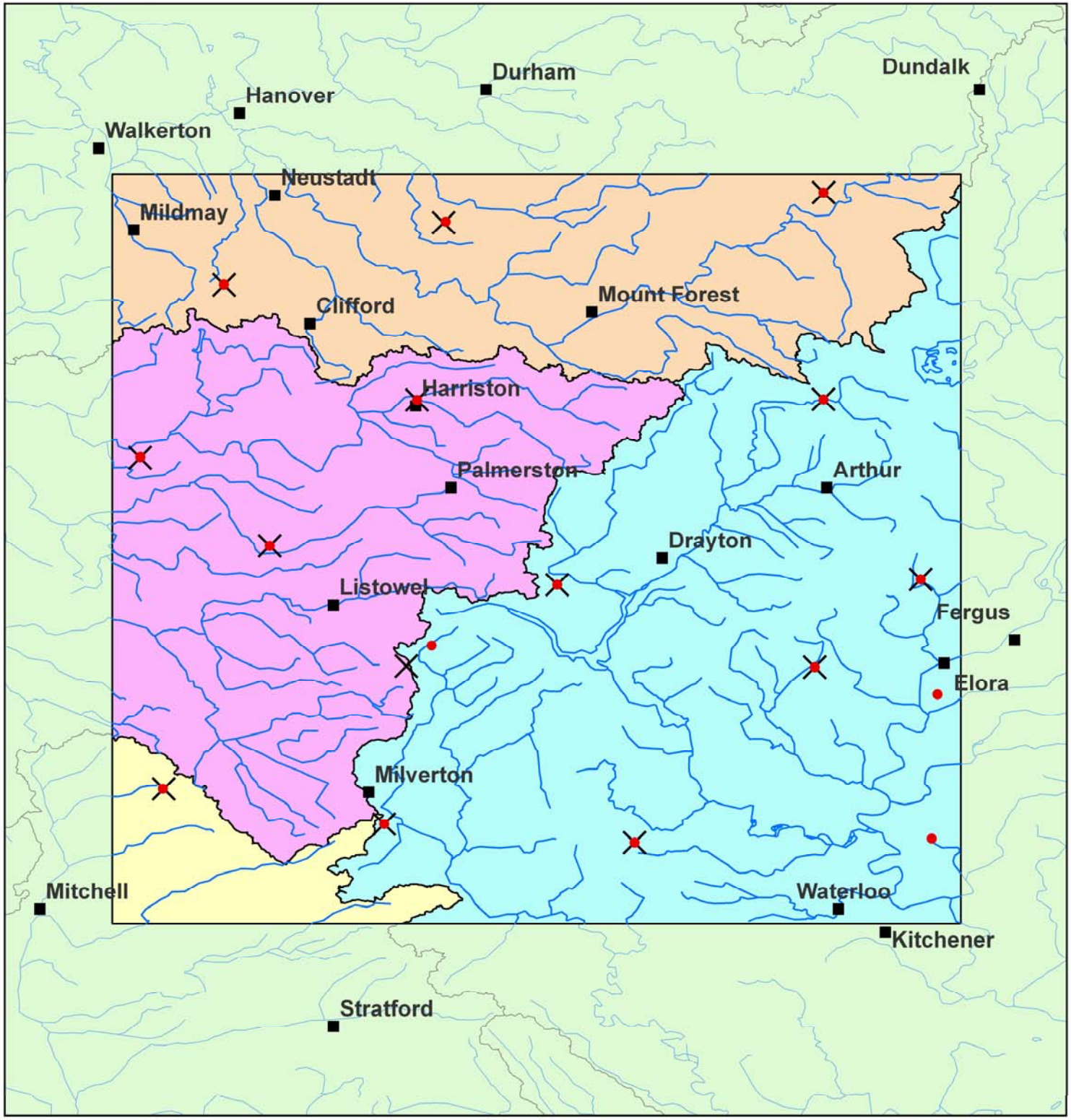
Soil temperature

Soil Volumetric Content

Precipitation

Outlook/Davidson Soil Moisture Network





STUDY AREA AND INSTRUMENTATION SITES

N

1:500,000

0 2.5 5 10 15 20 25 Kilometers

Legend

- Study Sites
- Agricorp Rain Gauges
- Cities/Towns
- Rivers

Watersheds

- Saugeen River
- Grand River
- Maitland River
- Thames River

KEY MAP OF SOUTHERN ONTARIO

Data Sources:

Agricorp (2006)
Ontario Ministry of Natural Resources (2005)
Ontario Ministry of Agriculture, Food and Rural Affairs (2004)

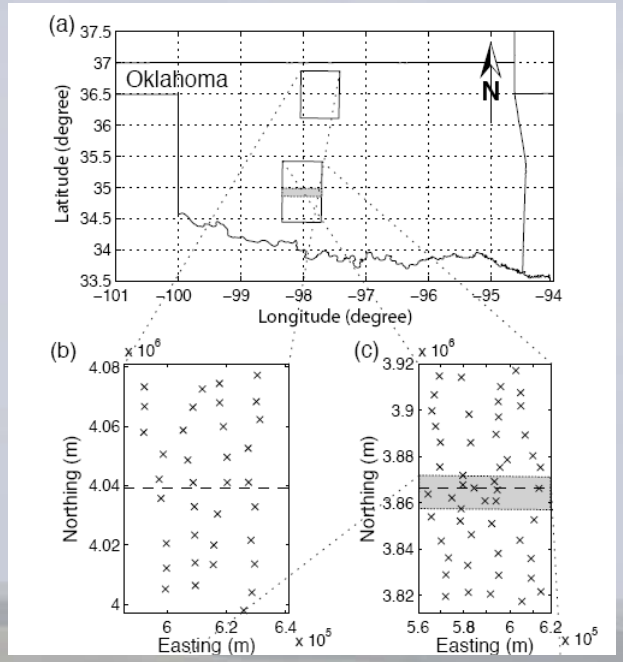
Soil Moisture Needs: Accuracy, Temporal and Horizontal Resolution

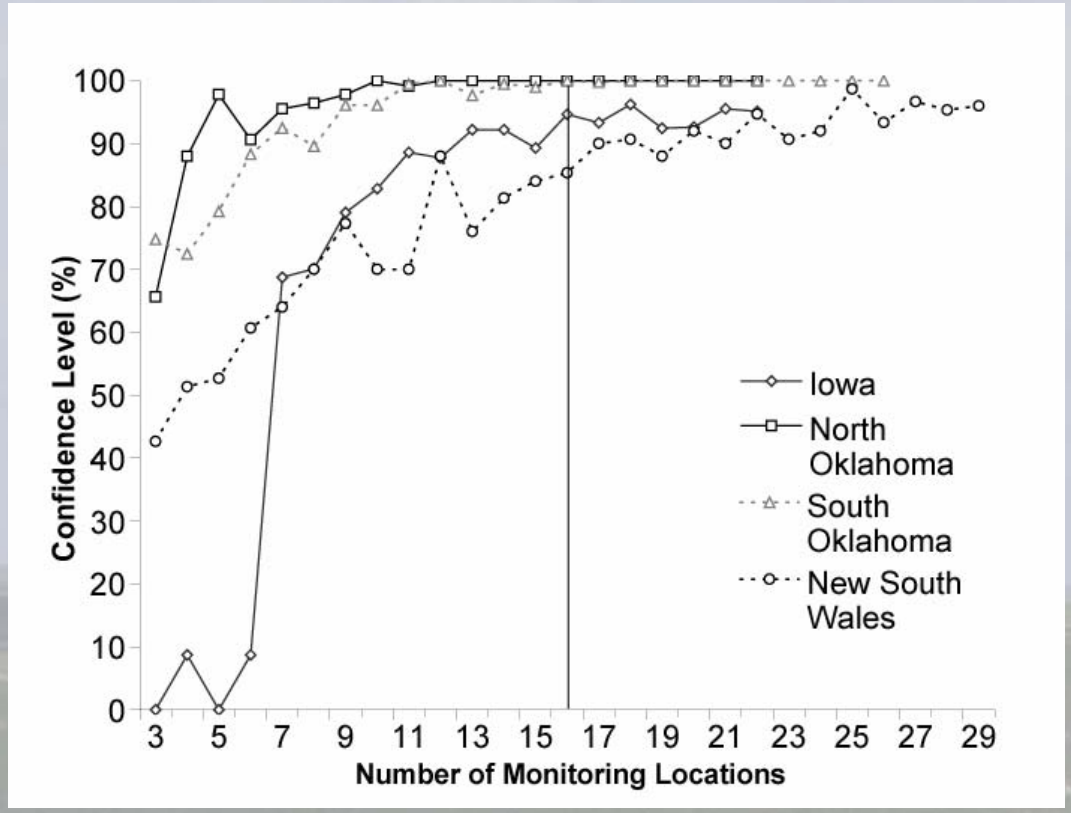
- Soil moisture for validation of passive microwave (development of data assimilation approaches) is different from climate networks
- Accuracy – better than 4%
- Temporal resolution – must coincide with satellite overpass (6am & 6pm – SMOS)
- Horizontal Resolution?

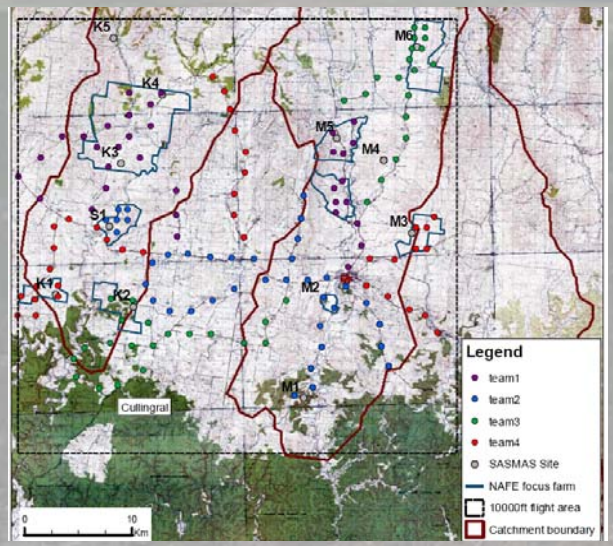
Establishing a Soil Moisture Observatory: Design Issues

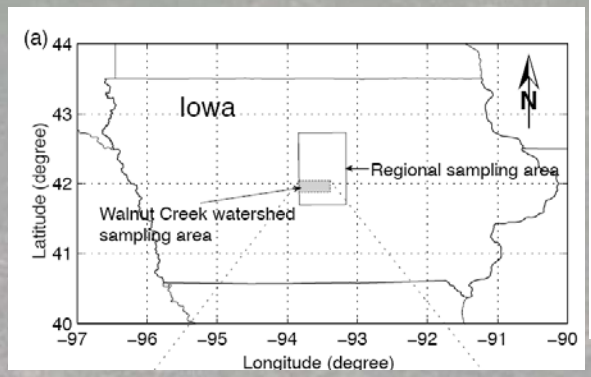
- How many samples are needed?
- How should we sample?
- Impacts of Land Use Practices?
- Other applications of the soil moisture sampling array

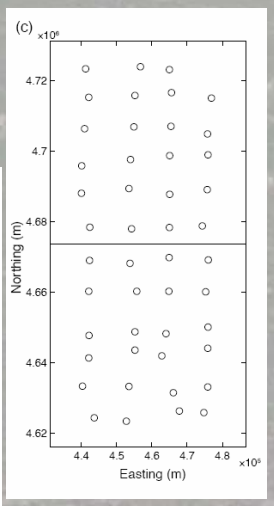
What is a representative network at the satellite pixel scale?



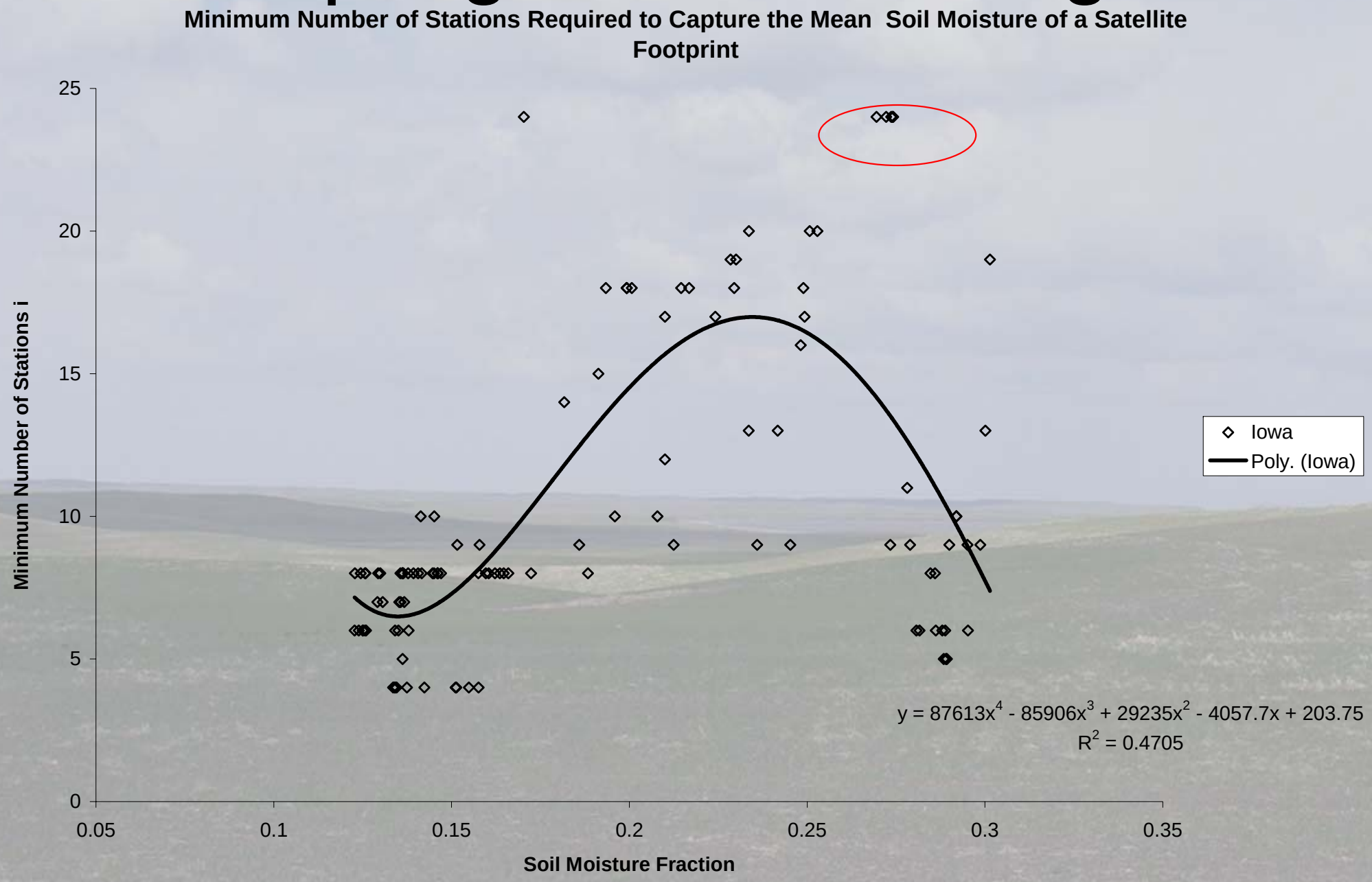




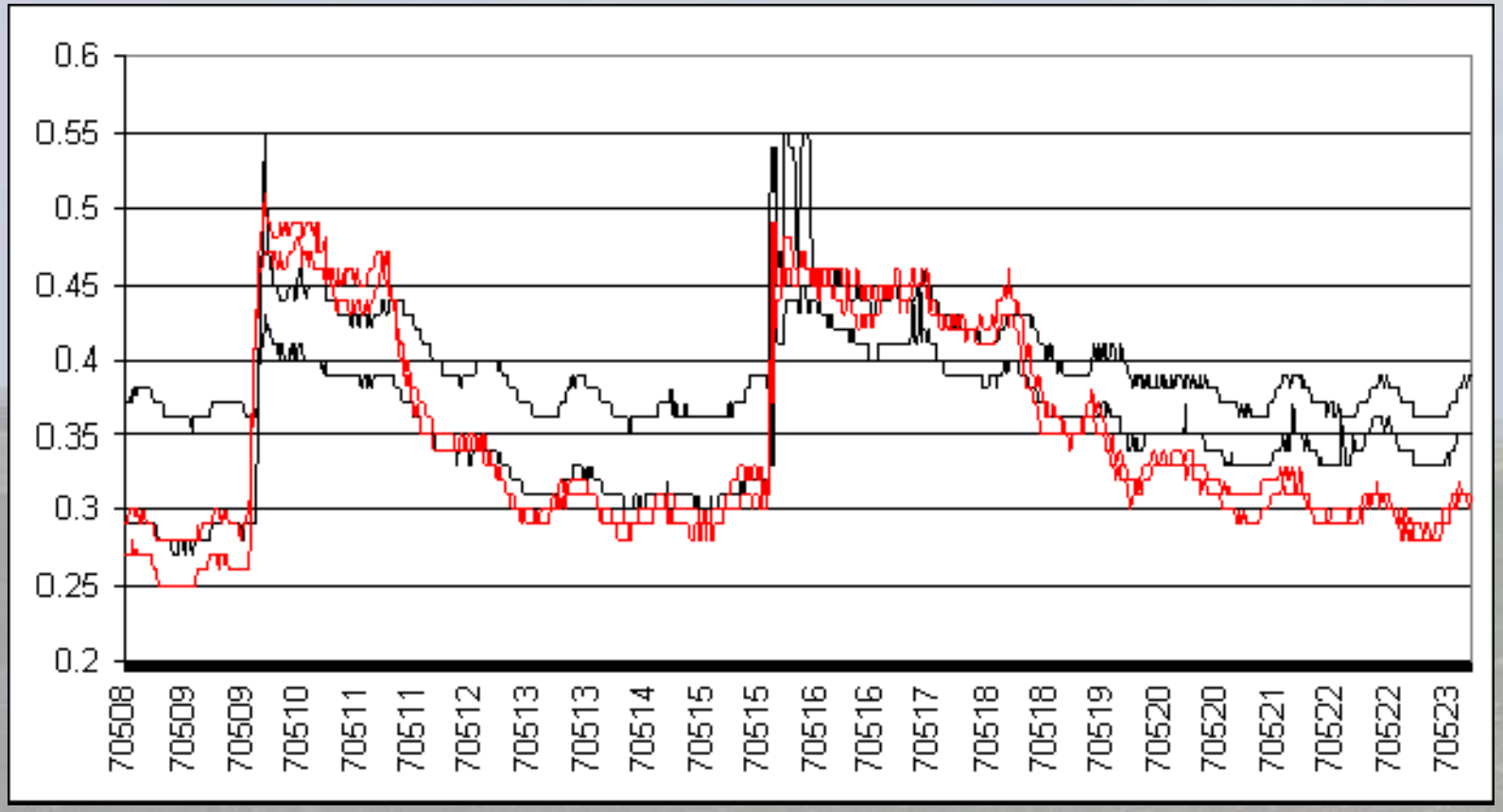




Sampling Network Design

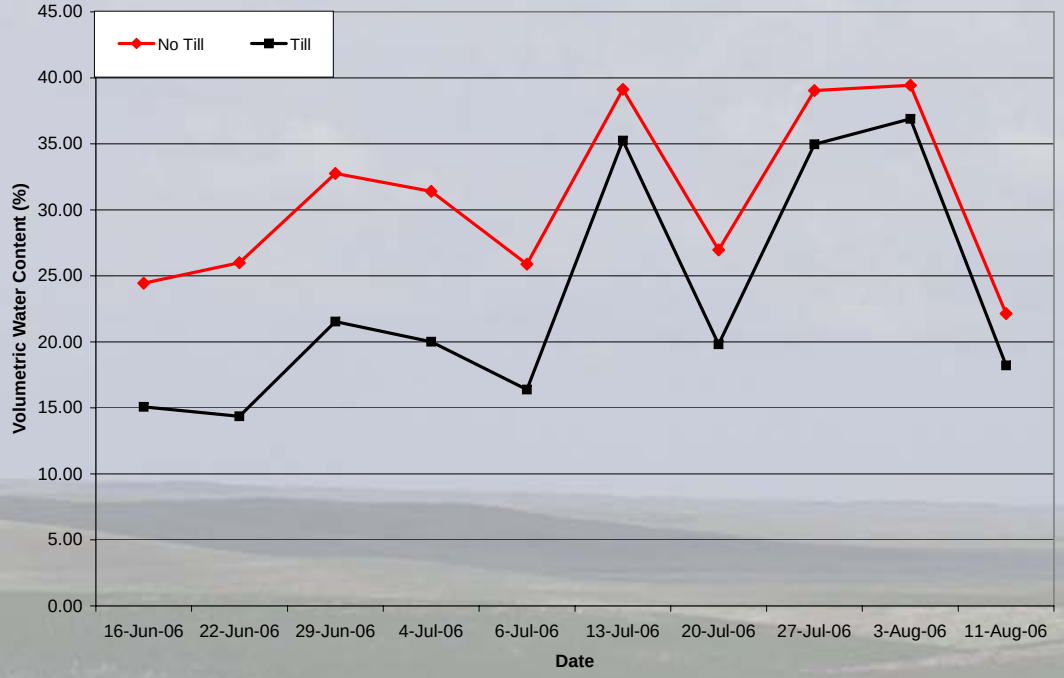


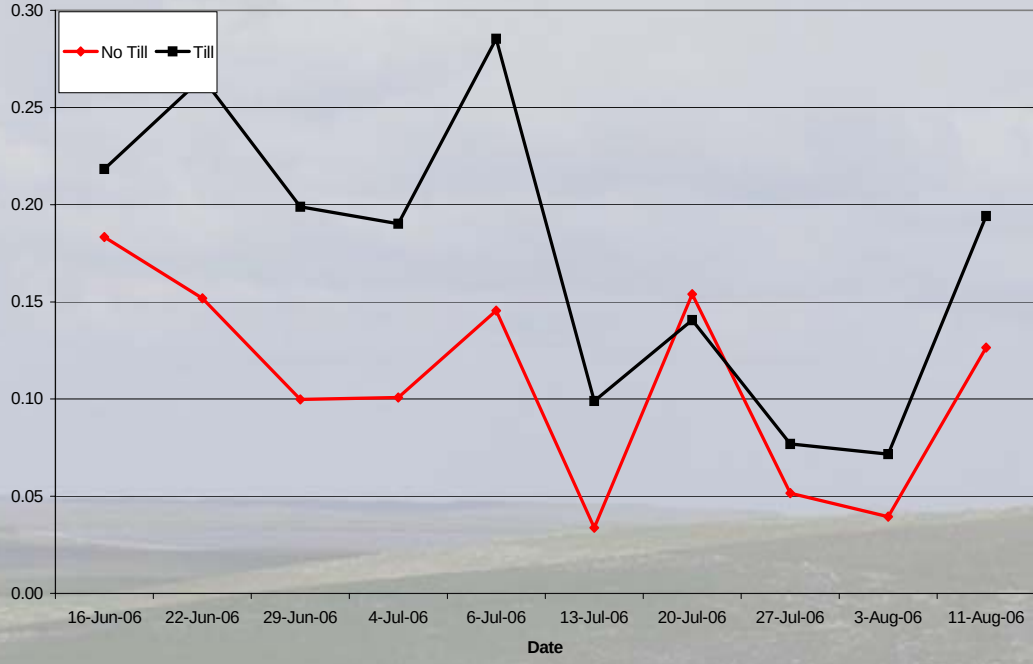
What is a representative measurement?



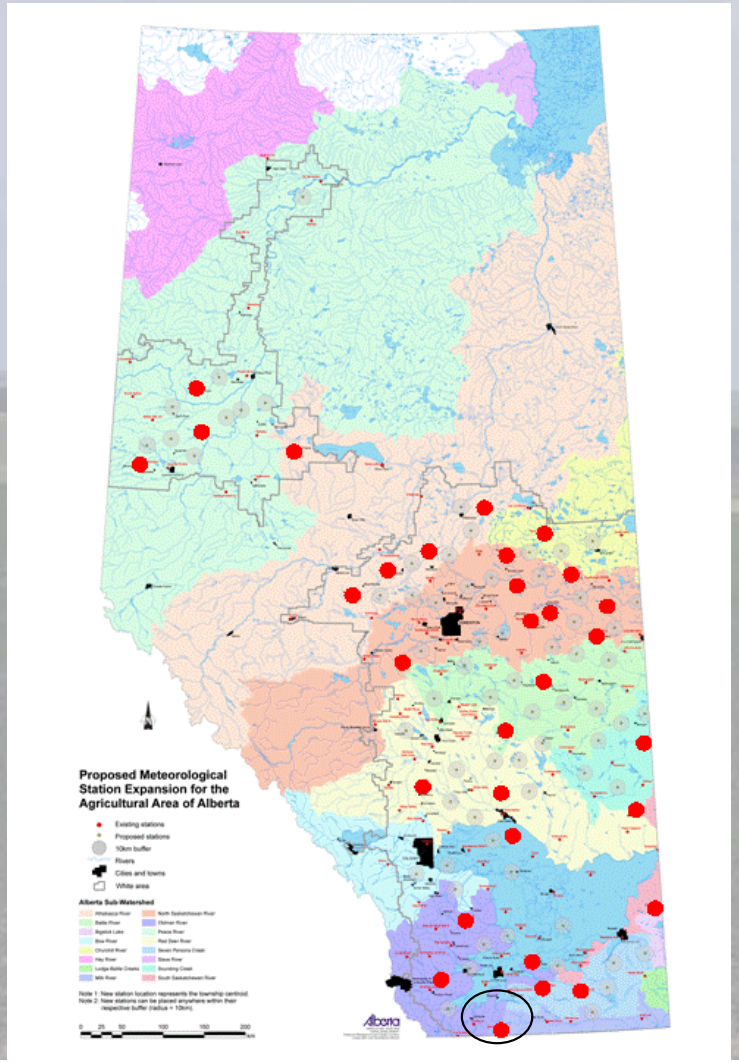
Hourly Soil Moisture and Soil Temperature Collected Vertically (Red) and Horizontally (Black)

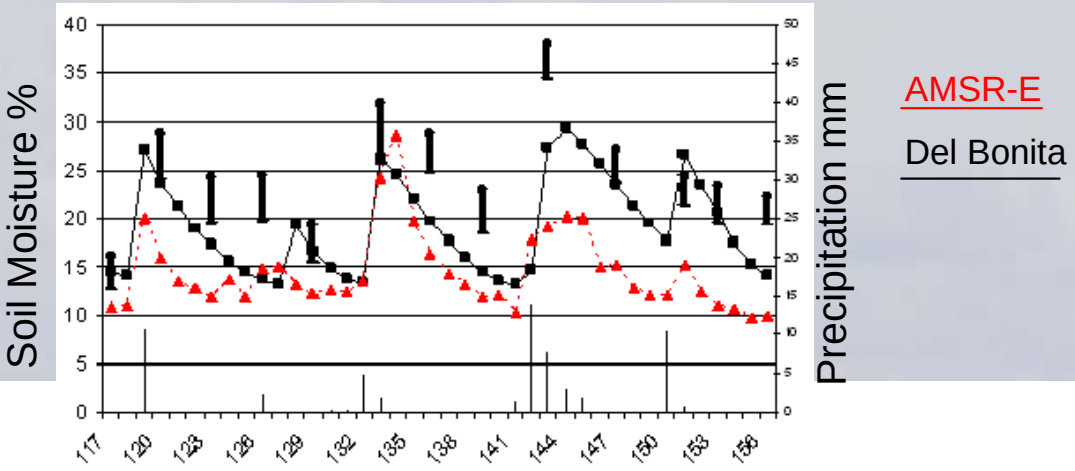
Impacts of land-use practices on measurement

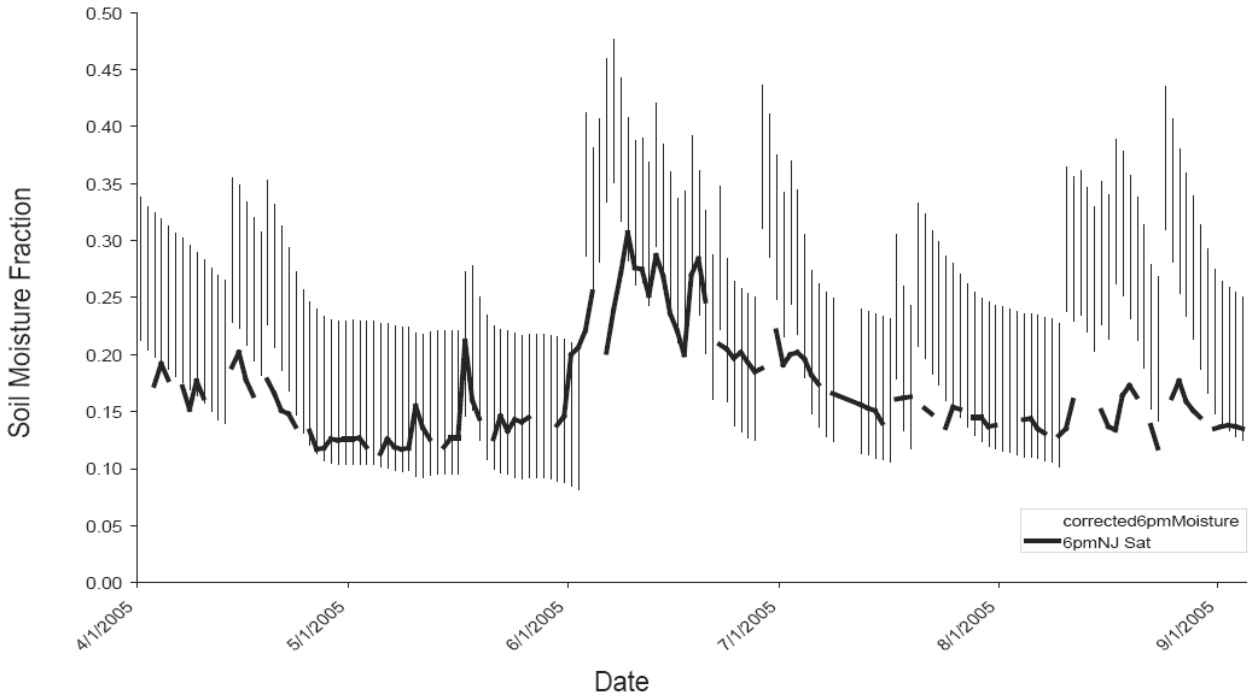




Using existing SM networks for AMSR-E validation

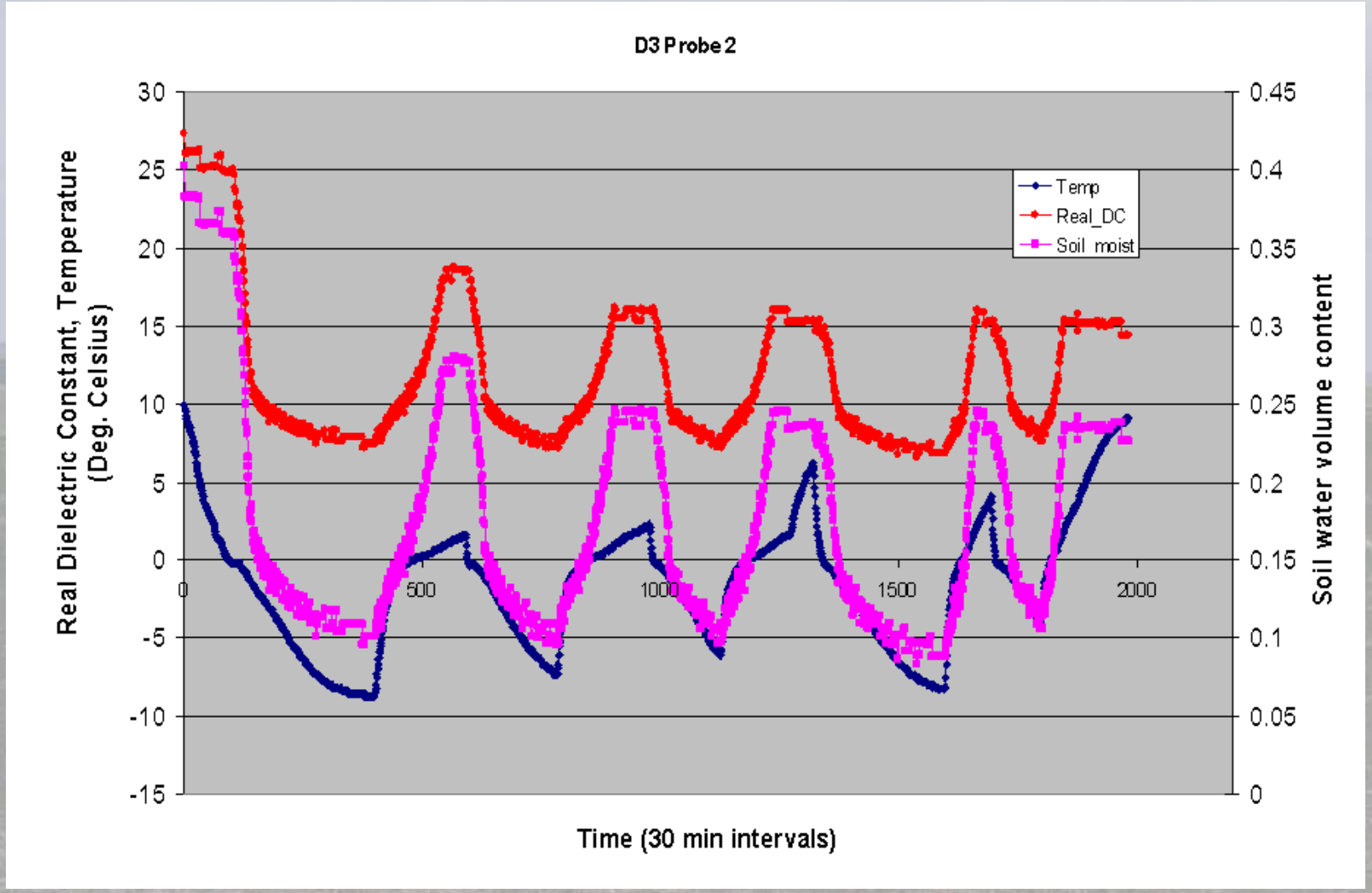






Opportunities

- Representation and validation of freeze thaw states



Conclusions

- Soil water sampling needs for passive microwave validation/calibration are different from those of climatology
- Paired soil water sampling networks are currently underway
- Sampling design and protocol issues that should be considered when establishing a national network