SWATS
Present and Future

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SWATS Status

1) Several systems have failed sensors presently.

2) Failures primarily from aging.

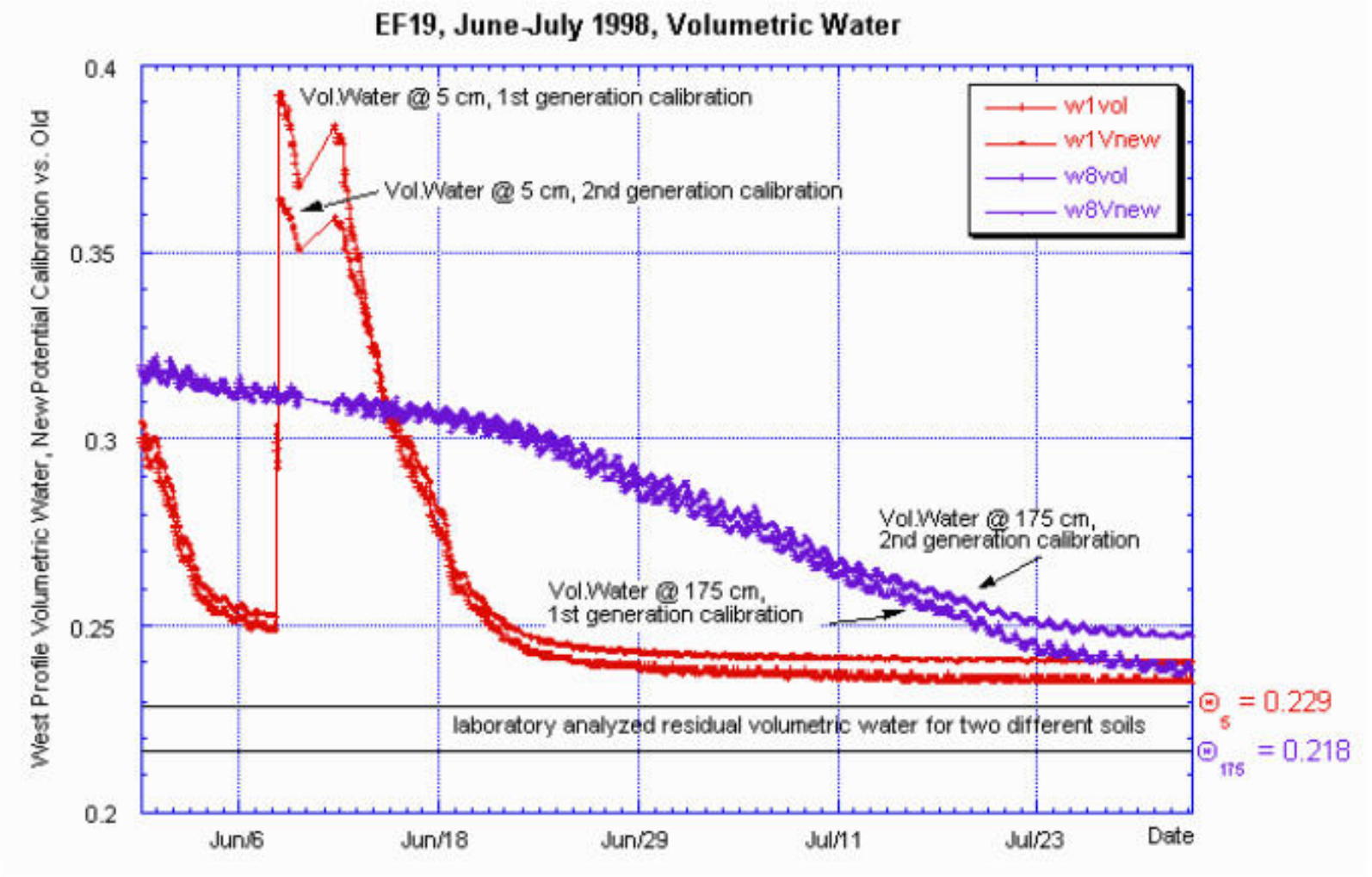
3) Lack of sensitivity to low soil moisture.

4) Sensor (CS229-L) same as used in OK Mesonet.

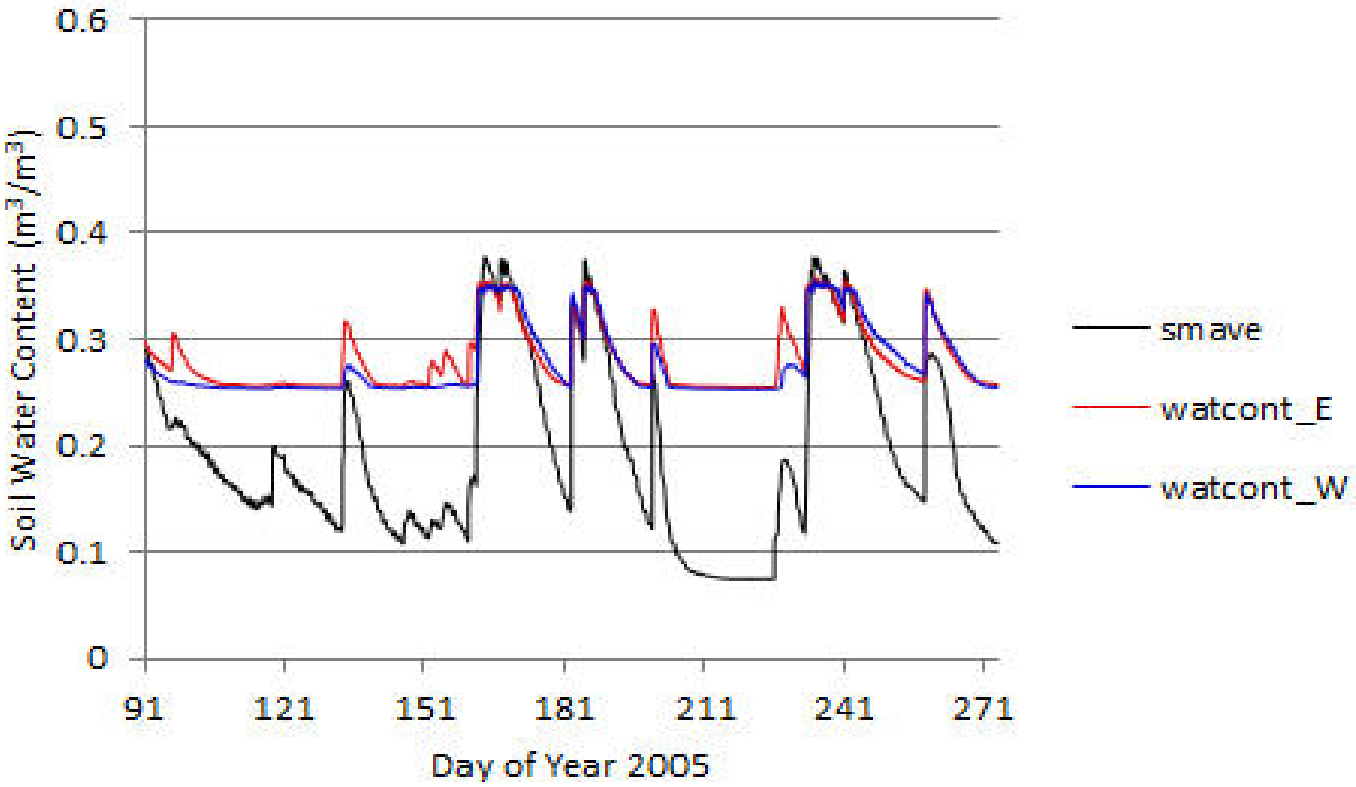
5) EF13, EF19, EF20 sensors replaced May 2006.

6) 2nd generation calibrations applied 12 Sep 2008 at EFs 13, 19, 20; 1 December 2008 at other EFs.

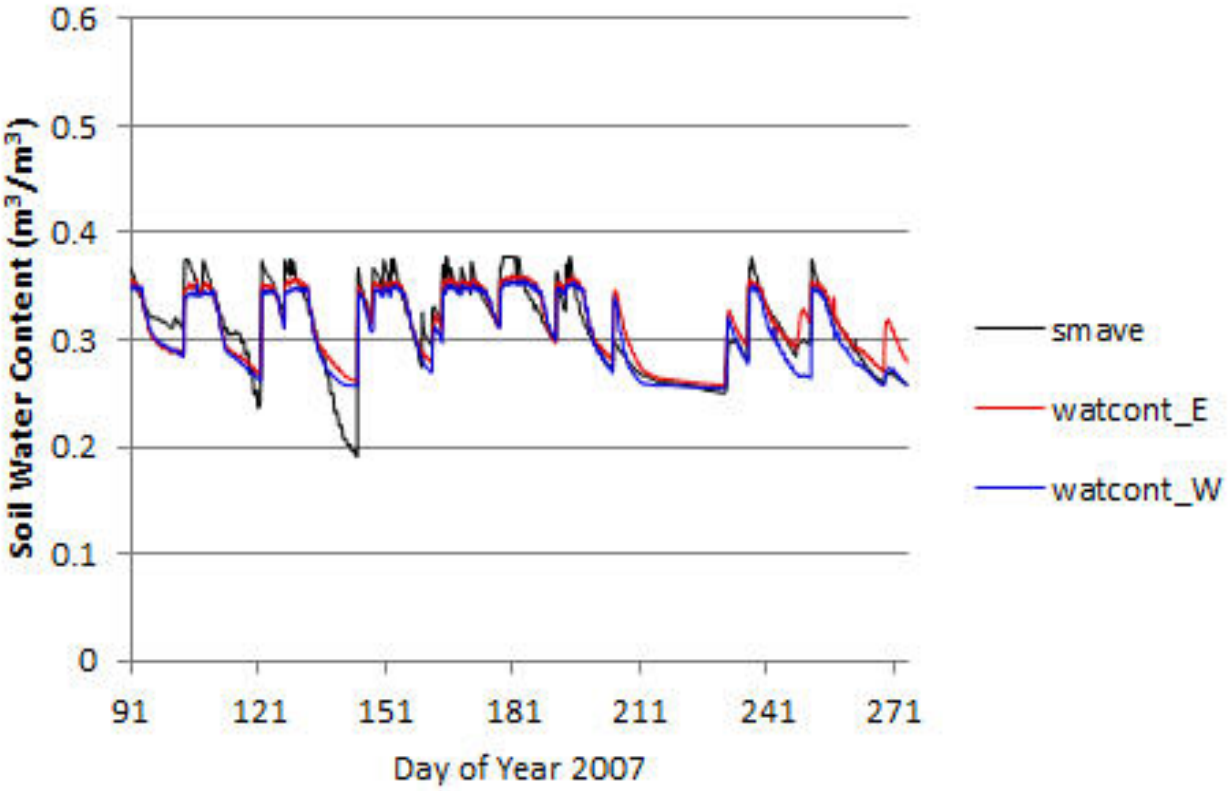
2nd Generation Calibration Reduces Range



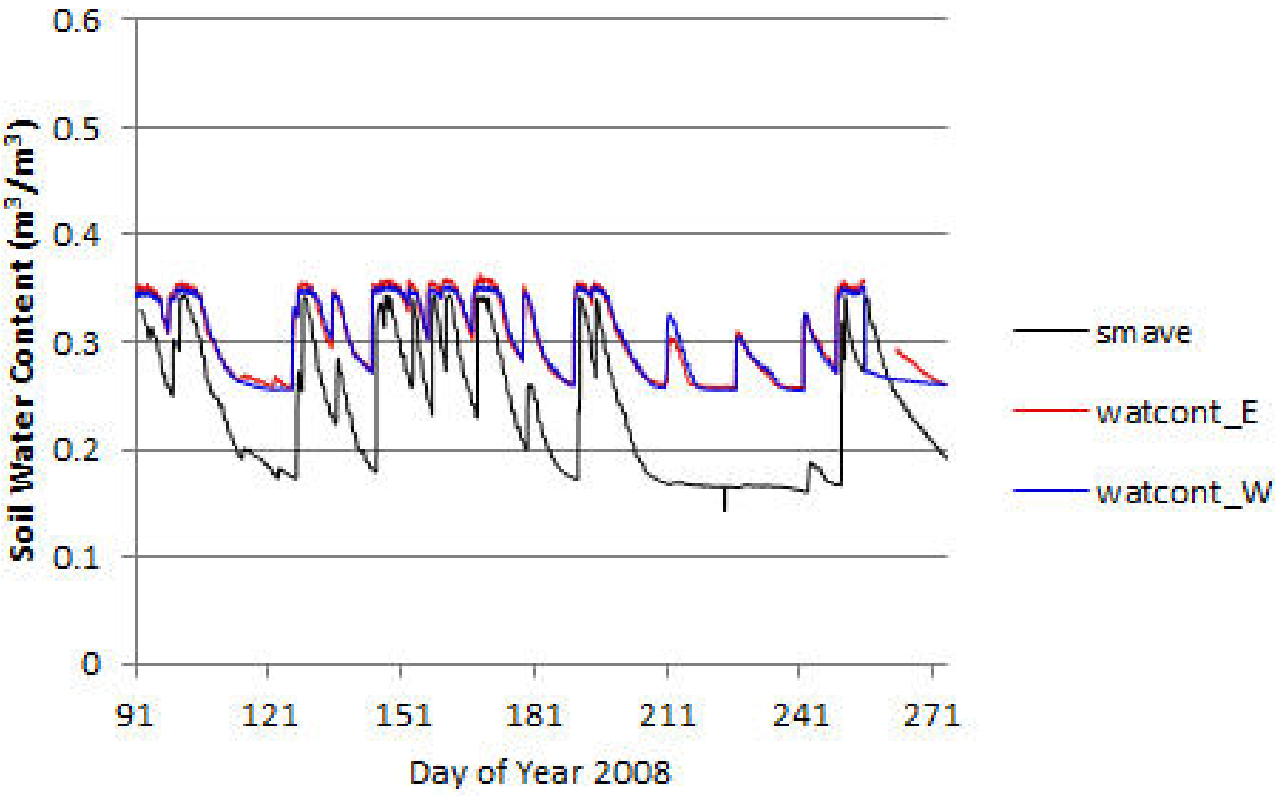
Soil Water Content - SWATS 5 cm, EBBR 2.5 cm 2005 – dry year



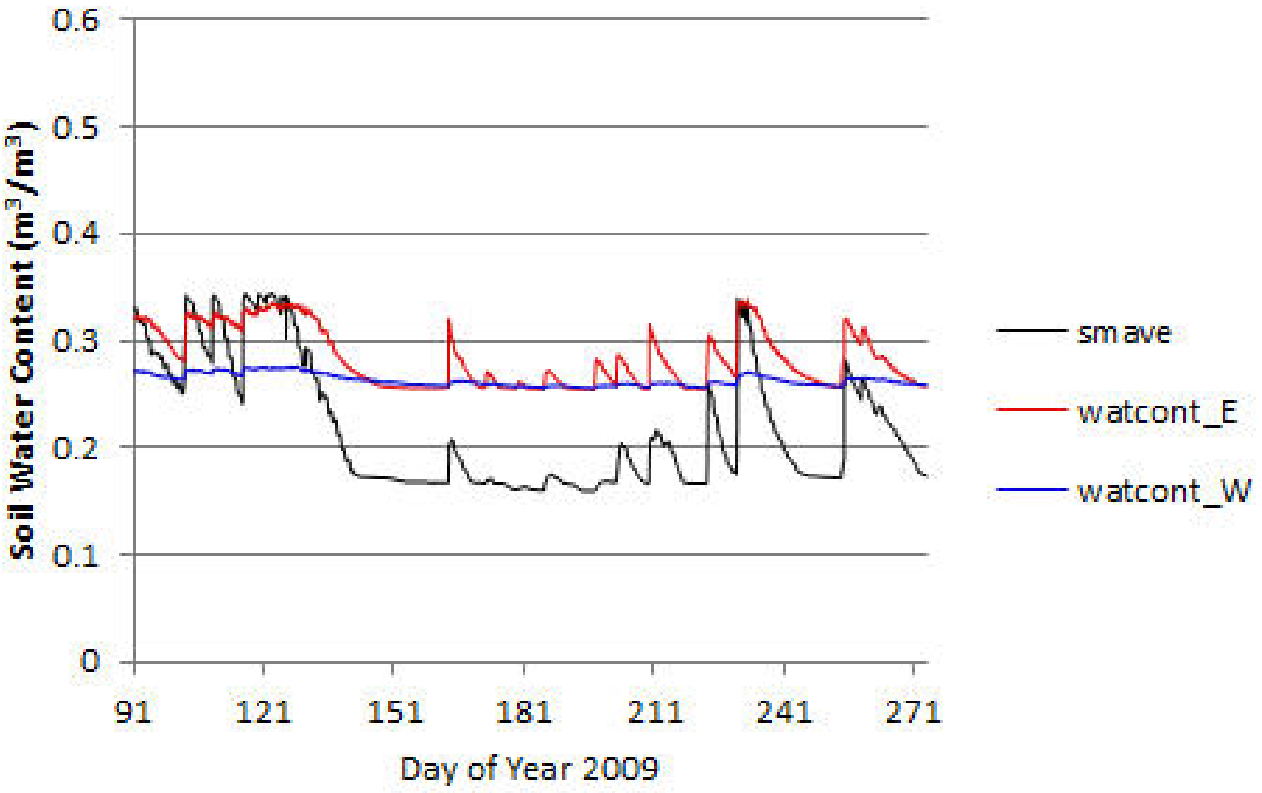
Soil Water Content – SWATS 5 cm, EBBR 2.5 cm 2007 – wet year



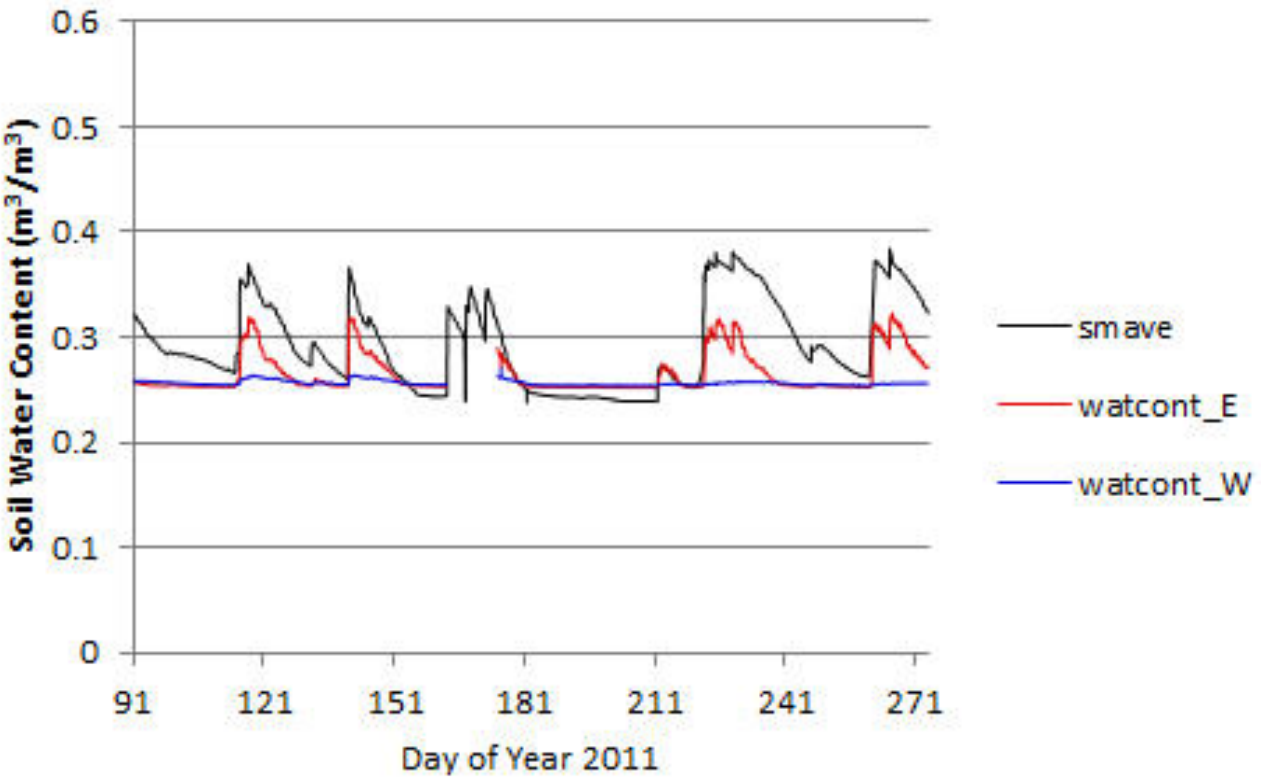
Soil Water Content – SWATS 5 cm, EBBR 2.5 cm
2008 – average year



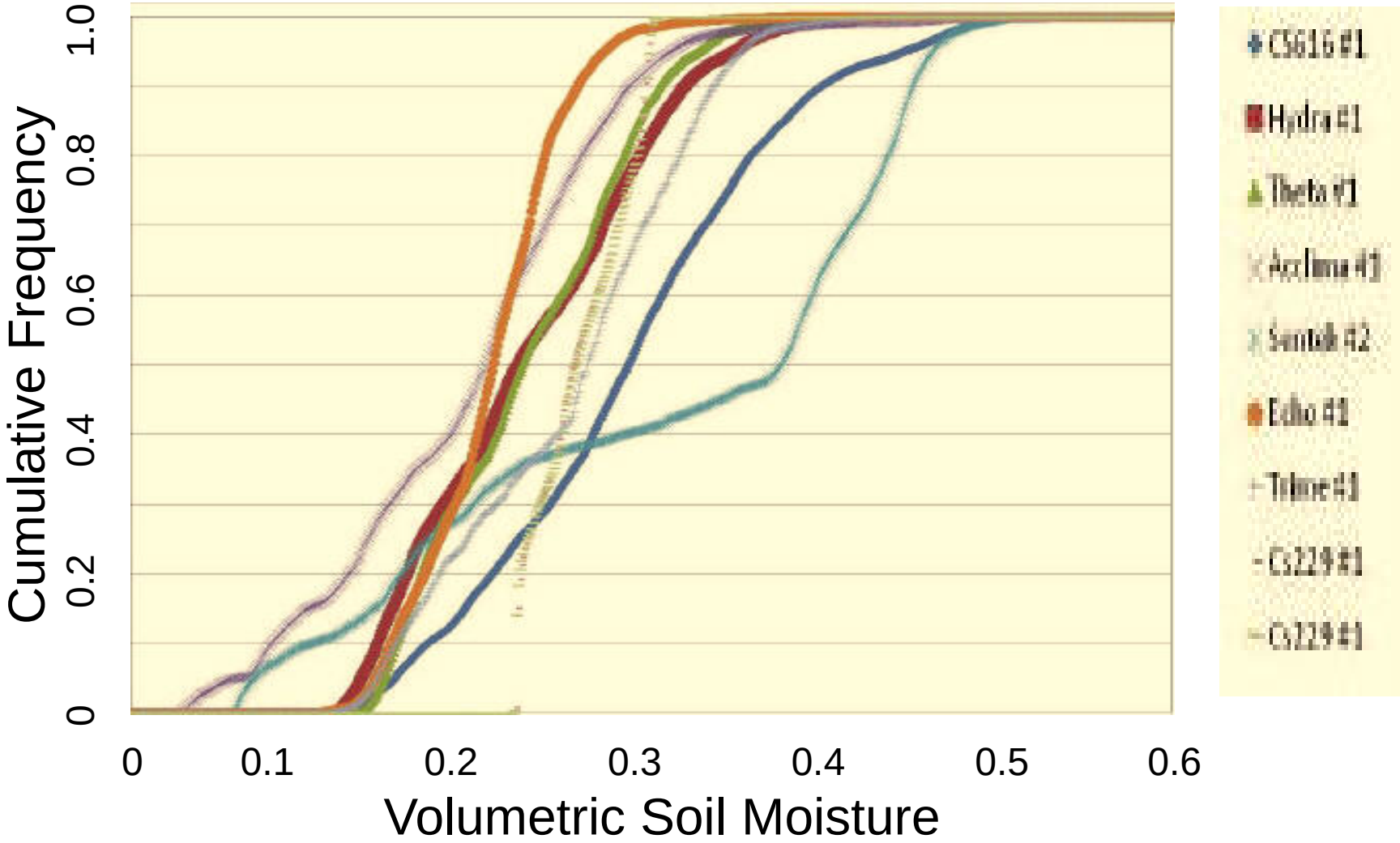
Soil Water Content – SWATS 5 cm, EBBR 2.5 cm 2009 –reduced max, west bad



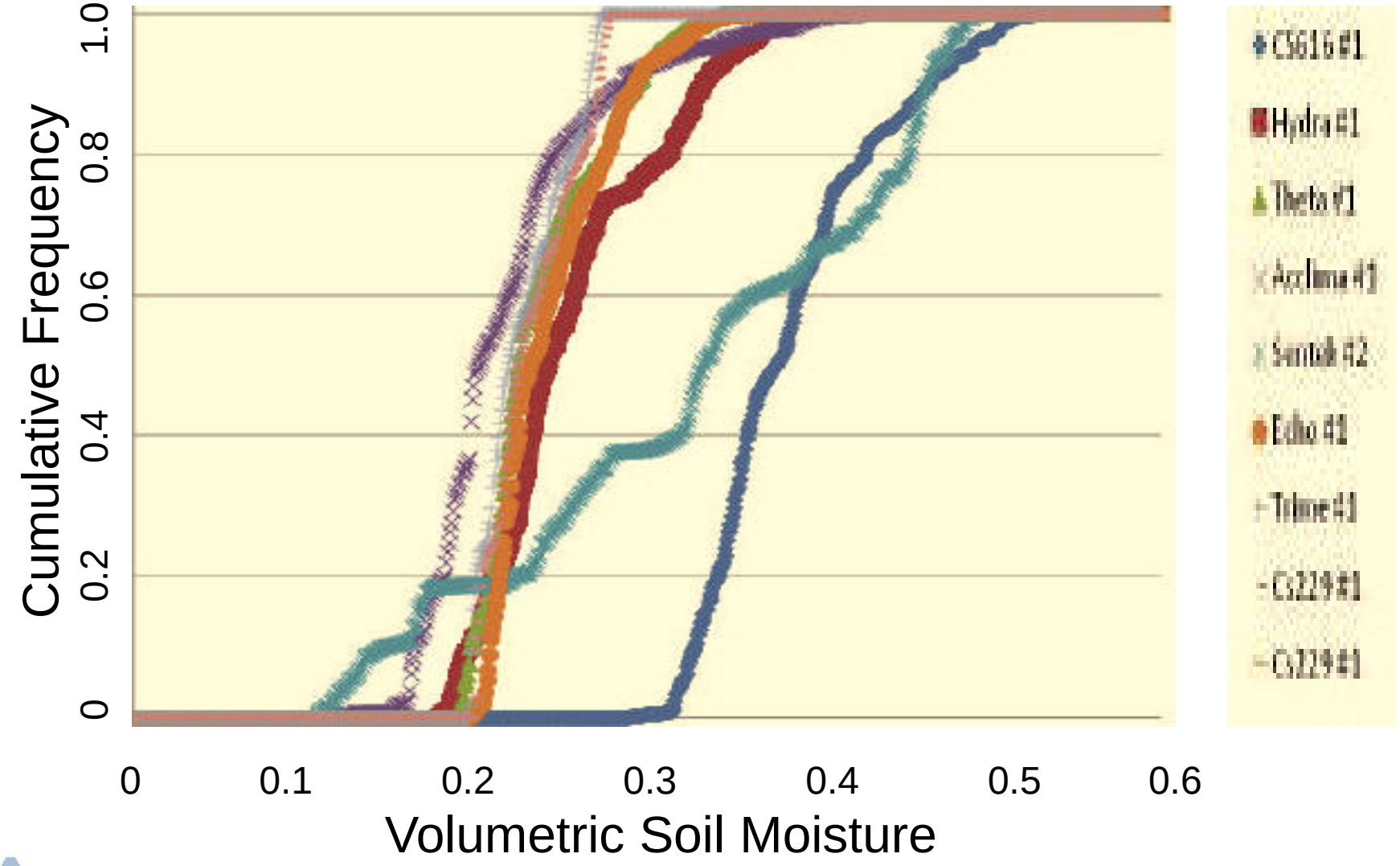
Soil Water Content – SWATS 5 cm, EBBR 2.5 cm 2011 – east starting to fail



Soil Moisture Probe Comparisons at SMAP Testbed - Marena, OK for 5 cm soil

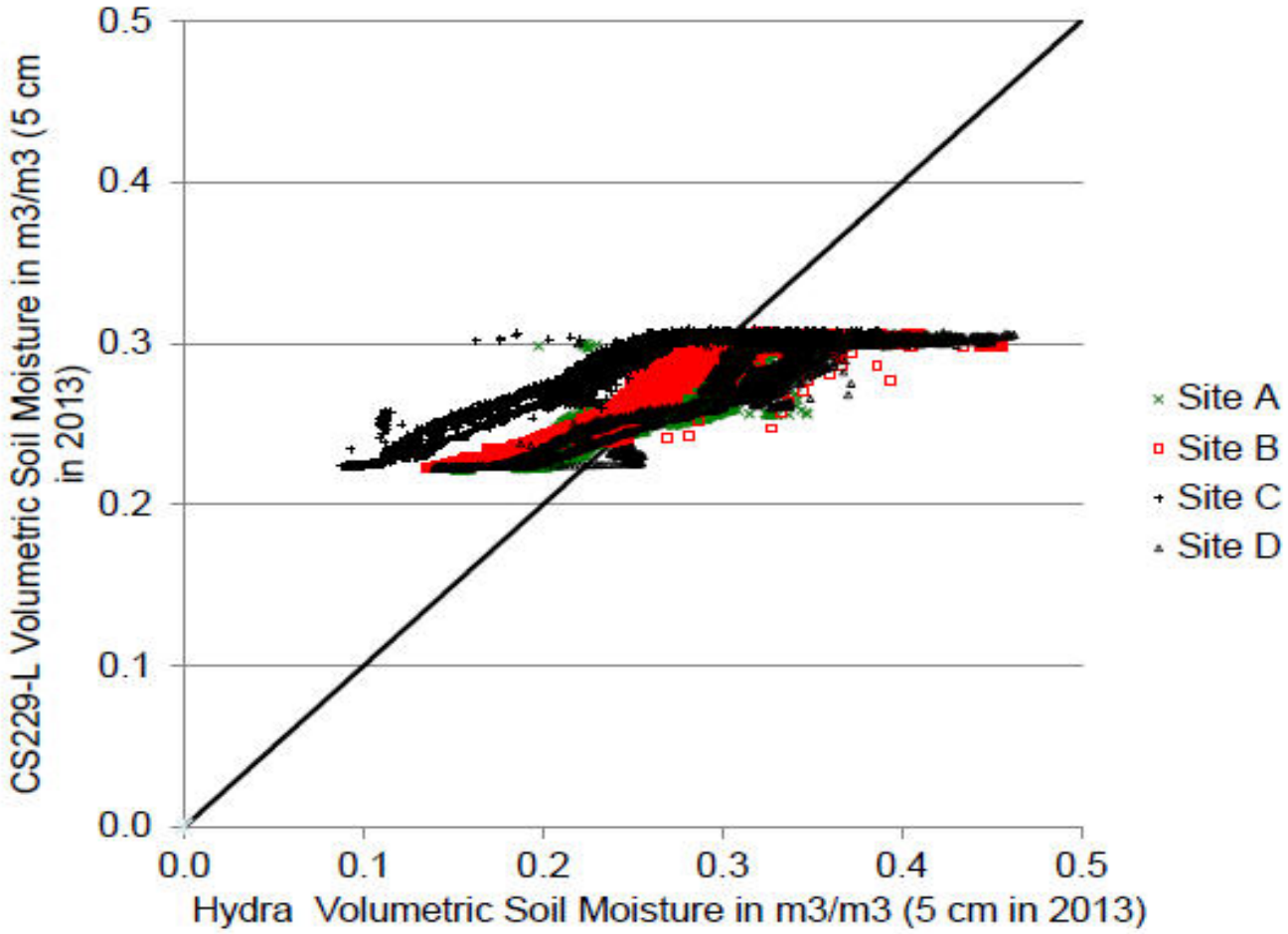


Soil Moisture Probe Comparisons at SMAP Testbed - Marena, OK for 50 cm soil



Hydra Probe II, CS229-L Comparison

SMAP Marena Oklahoma In Situ Sensor Testbed
Sensor to Sensor Average Comparison



SMAP Testbed Failure Rates

SMAP Marena Oklahoma In Situ Sensor Testbed
Calibration Accuracy

Sensor	RMSE Factory Calibration	RMSE Site Calibration	Failure Rate
Theta	0.0300	0.0276	0% (0/20)
Hydra	0.0401	0.0299	0% (0/24)
ECTM(Echo)	0.0811	0.0361	35% (7/20)
CS616	0.0726	0.0626	5% (1/20)
Acclima	0.0796	0.0253	55% (11/20)
Trime	0.0422	0.0233	12.5% (1/6)
CS229	-	-	15% (3/20)
EnviroSMART/Sentek	-	-	0% (0/16)

RMSE in m^3/m^3

Preferences

- **Measurements of prime importance:** soil temperature and soil moisture;
  secondary: matric potential, thermal conductivity

- **Measurement depths:** near surface (2.5, 5, 10 cm) and root depth (100-175 cm)

- **Location:**
  co-locate soil and surface flux measurements within the same vegetation type
  (logistically, this appears to not be possible)
  co-locate with AERI, Raman Lidar, Doppler Lidar, Wind Profiler (BL depth)
  include representative forest (not Okmulgee; very shallow soil)

- **Frequency of measurement:** half-hourly or hourly

- **Ancillary measurements:** site vegetation type and height, dominant land cover type and height (the first is presently done, the second is not)

We Propose To:

- replace the present SWATS system with new Campbell Scientific, Inc. data logger equipment and with either CS650/CS655 Soil Water Content Reflectometers (same technology as the CS616) or Hydra Probe II probes. The Hydra Probe II has the advantages of being more robust and having calibrations already determined for all soil types within the ARM domain. Fractional Water Index and Matric potential could be calculated.
- re-use the trenches dug for the SWATS; take advantage of known soil type from previous soil sampling studies.
- re-use the present SWATS enclosures and conduit, if possible.
- use duplicate probe profiles again.
- install revised SWATS systems at the new EF39 (Morrison) and EF40 (Pawnee) sites first.
- possibly install a new SWATS near the present CF system for a year-long comparison study.
- possibly produce a Soil Moisture and Temperature VAP that combines SWATS/EBBR/CO2FLX measurements.

Reference

Michael Cosh, Tyson Ochsner, and Lynn McKee, “Early Conclusions of the Soil Moisture Active Passive Marena Oklahoma In Situ Sensor Testbed (SMAP-MOISST),” presentation.