Canadian Group on Earth Observations (CGEO)

CGEO Workshop on Soil Moisture Monitoring, Analysis and Prediction in Agricultural Landscapes
June 19 - 20, 2007, Saskatoon

In-Situ Soil Moisture and Soil Temperature Networks
Current and Future Plans

C. Bruce Baker
Chief Scientist, U.S. Climate Reference Network
NOAA/NESDIS/NCDC

National Integrated Drought Information System
NIDIS

- **Establish the U.S. Drought Portal (USDP) on an expedited basis to provide user-friendly access to historical and real-time data and products from National Integrated Drought Information System (NIDIS) partners**

- **Install soil moisture and temperature sensors at an accelerated rate at U.S. Climate Reference Network stations, consistent with the U.S. Global Earth Observations Near-Term Opportunity) NIDIS Implementation Plan.**

U.S. Drought Portal

The USDP goals are:

- **Support the ability to graph relevant data and products spatially and temporally, and interactively compose maps**

- **Allow users to arrange and save selected products for a specific geographic area for easy return visits; and support links to specific decision support systems.**

Examples of products to be included in the USDP are:

- **Observed elements at multiple time and spatial scales, as both station and gridded datasets: precipitation, snow pack, stream flows, reservoir levels, ground water, crop moisture, soil moisture, temperature, anomalies, and drought impacts.**

Derived products and indexes:

Palmer Drought Severity Index (PDSI),
Surface Water Supply Index (SWSI),
Vegetation Drought Response Index (VegDRI
Keetch-Bryam Fire Index.

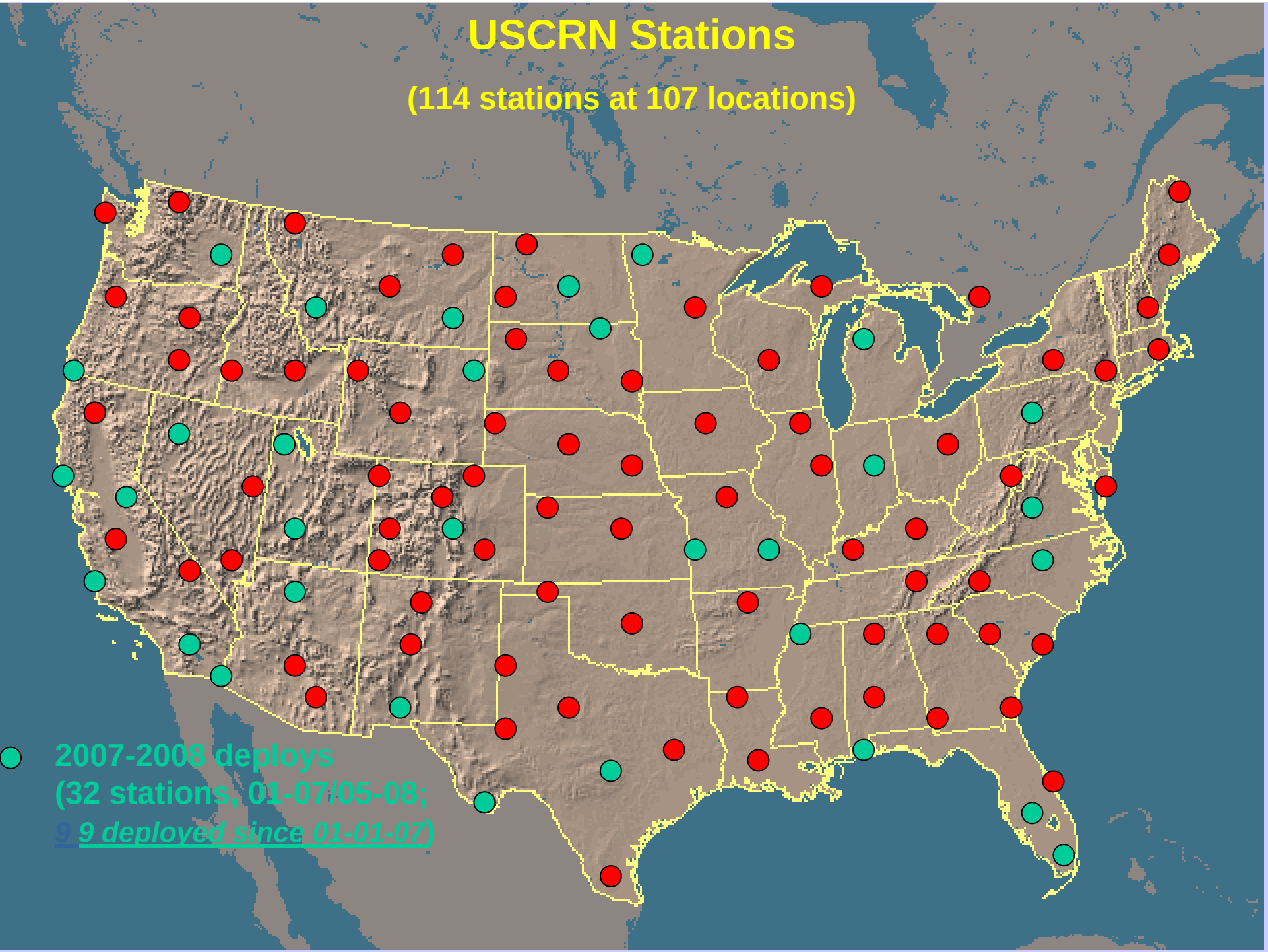
Soil Moisture/Soil Temperature Sensors

Double the number of soil moisture/soil temperature monitoring points across the U.S. FY 08-12

Drought Monitoring
Climate forecasting and modeling.
Reservoir management.
Irrigation scheduling.
Crop yield forecasting.
Contribute to independent verification and validation (IV&V) and calibration of satellite based sensors and measurements.
.

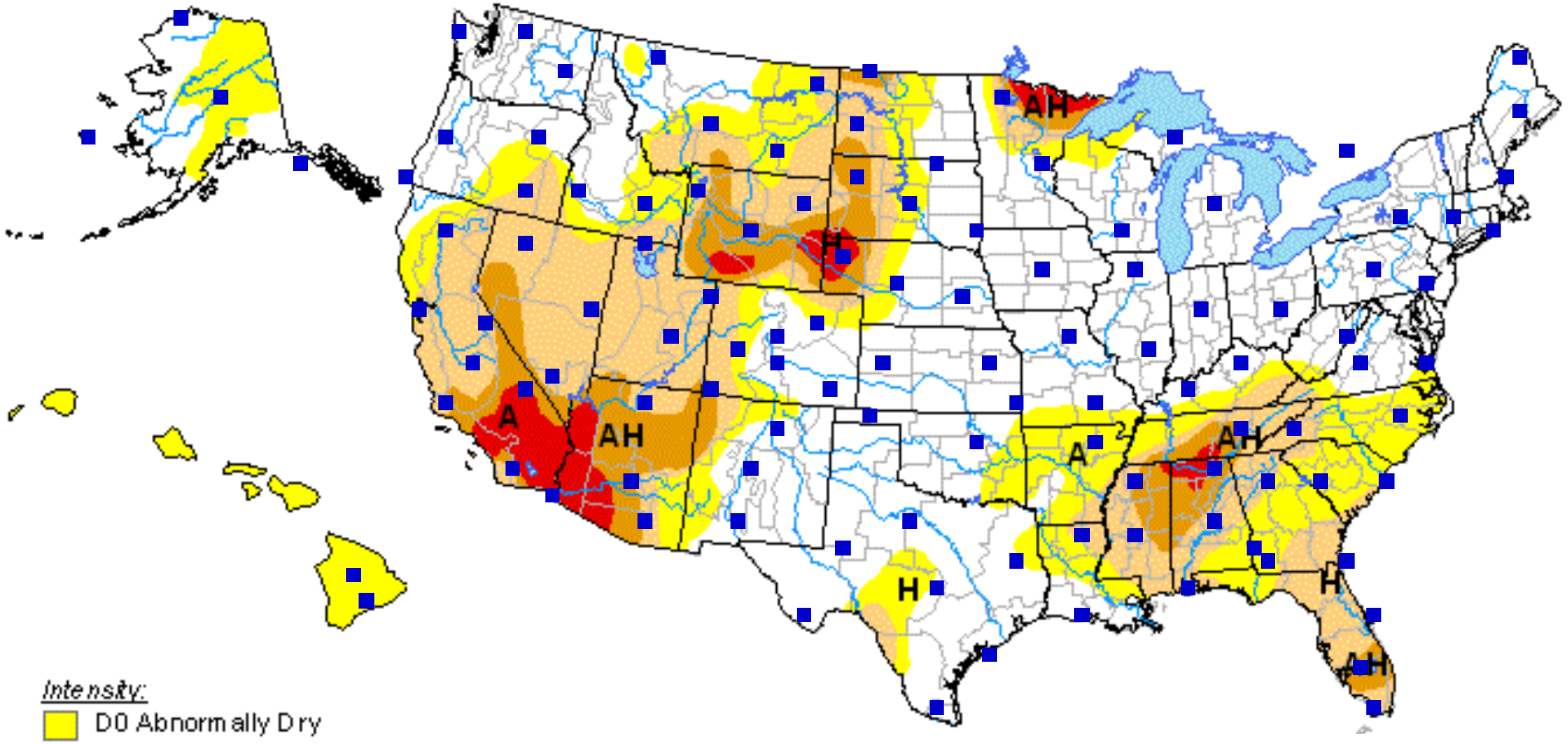

AK Fairbanks 11 NE, NOAA / NESDIS (FCDAS)


SD Sioux Falls 14 NNE, EROS Data Center


USCRN Stations
(114 stations at 107 locations)
2007-2008 deploys
(32 stations, 01-07/05-08;
9 9 deployed since 01-01-07)

U.S. Drought Monitor

April 10, 2007
Valid 7 a.m. EST



Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

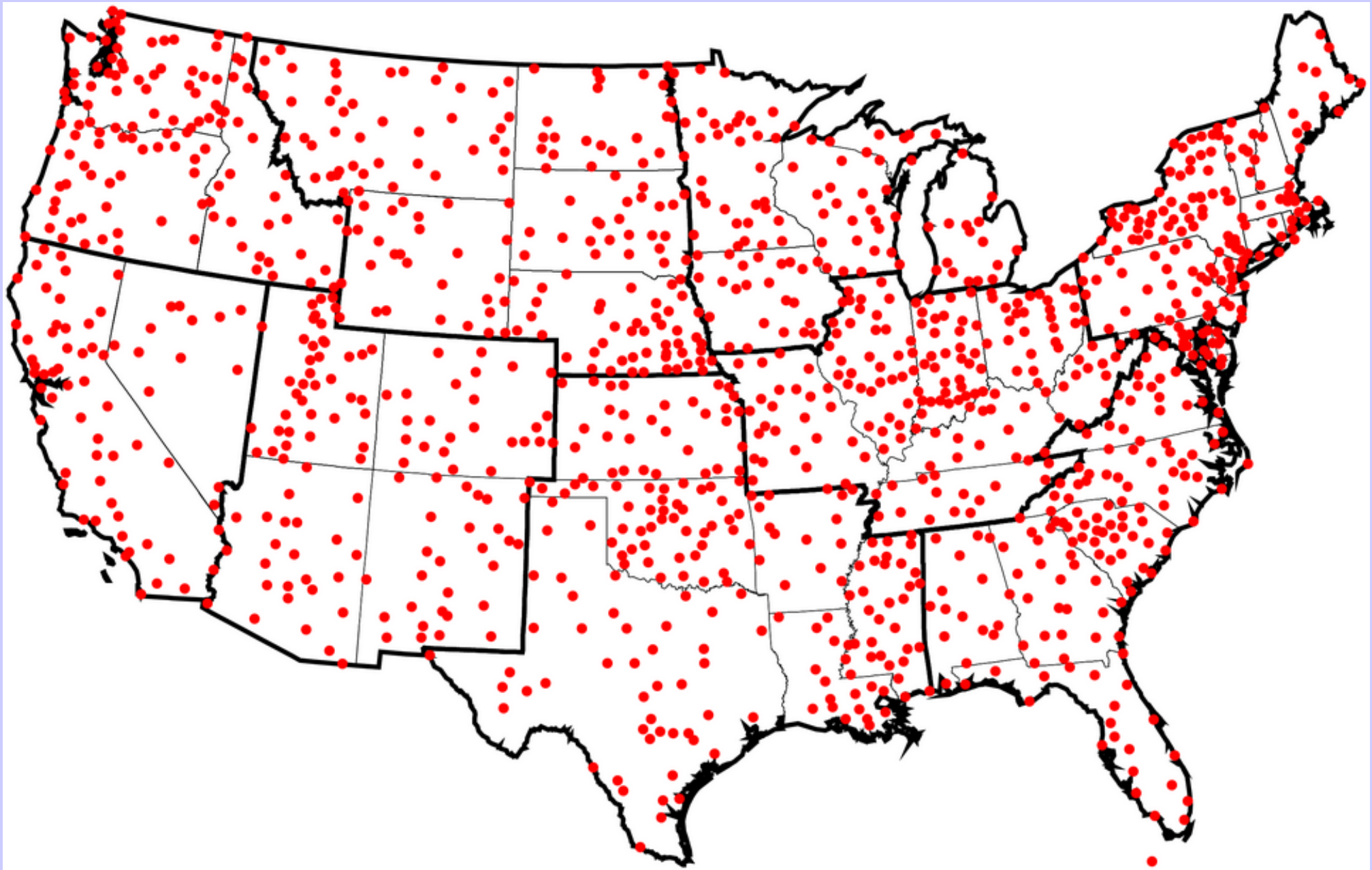
USDA National Drought Mitigation Center

- **Climate Reference Network Station**

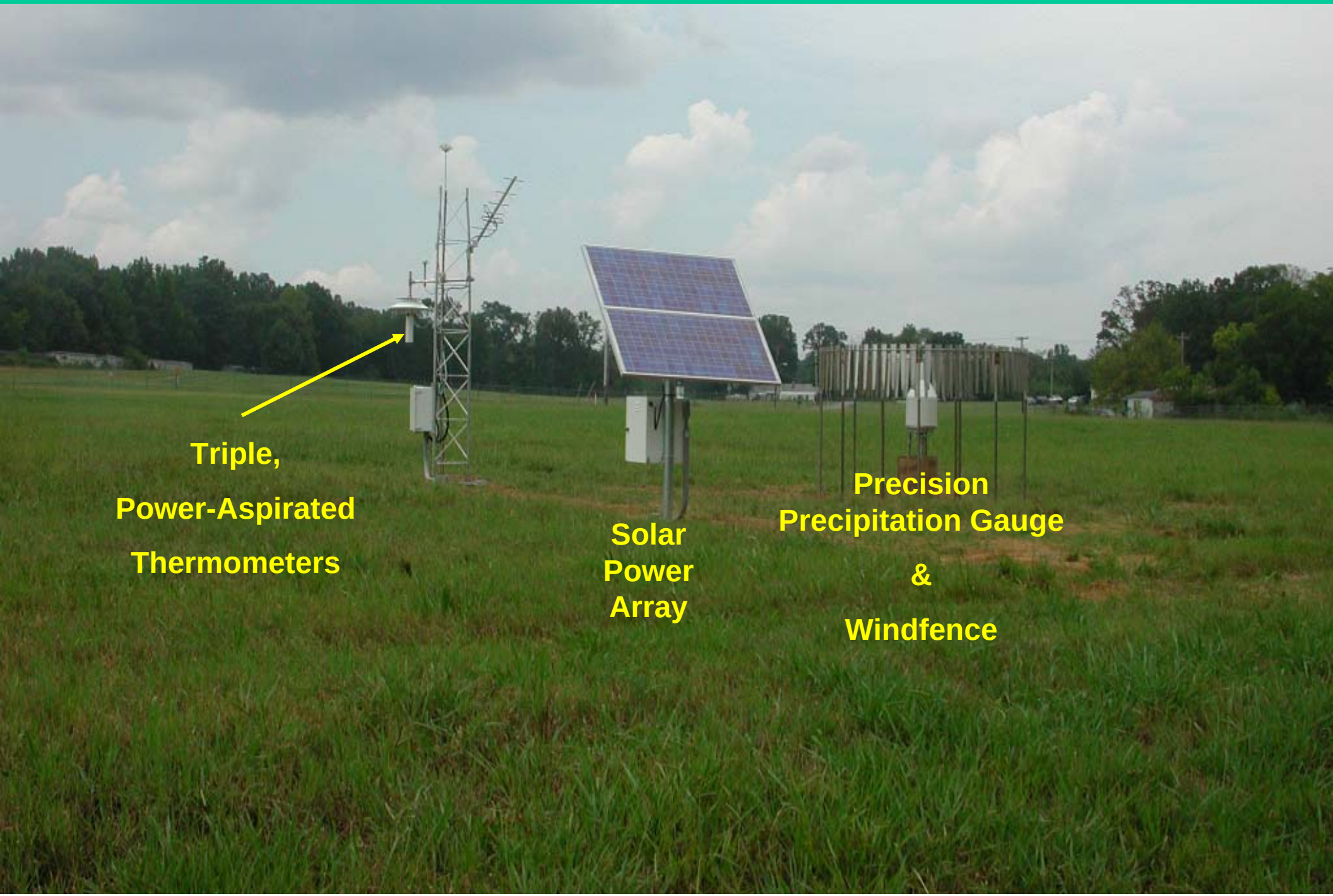
at USCRN buildout (May 2008), mrh

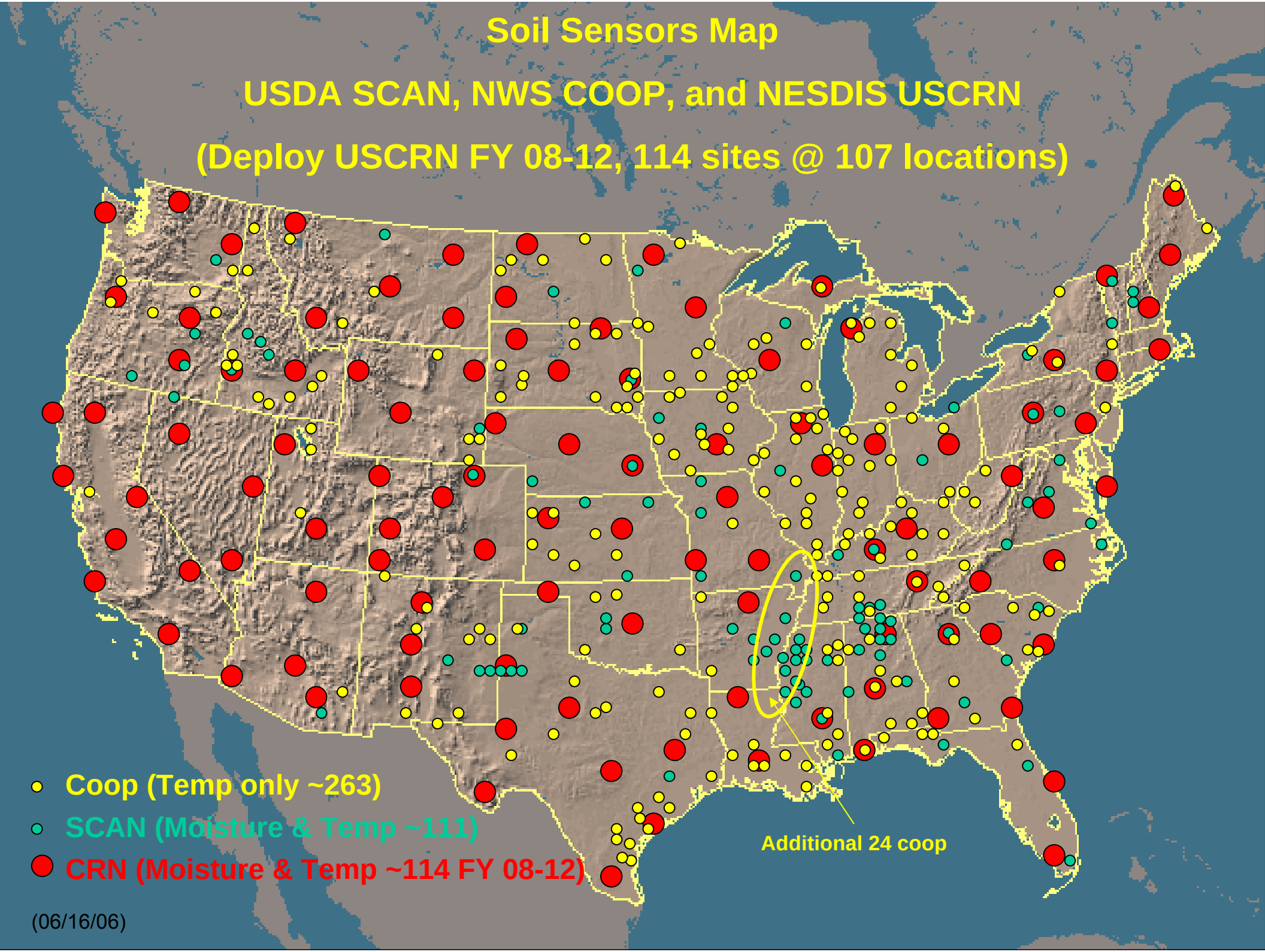
Released Thursday, April 12, 2007
Author: Thomas Heddinghaus, CPC/NOAA

Historical Climatology Network: ~1,200 Sites

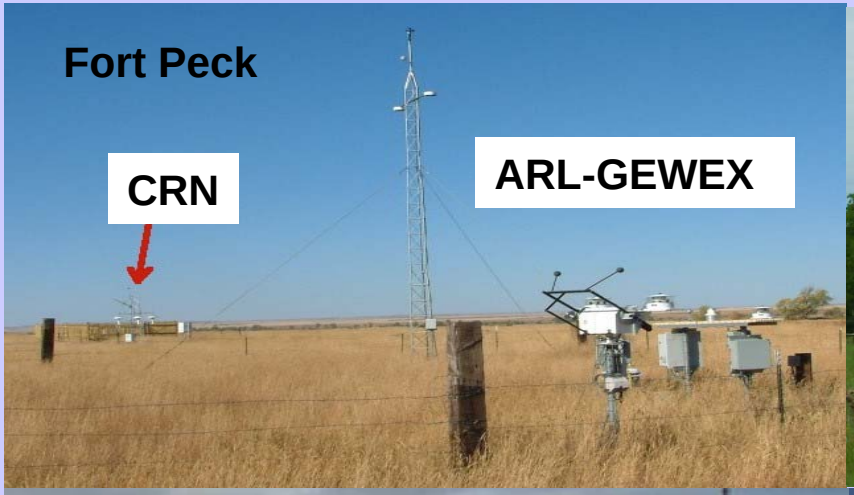


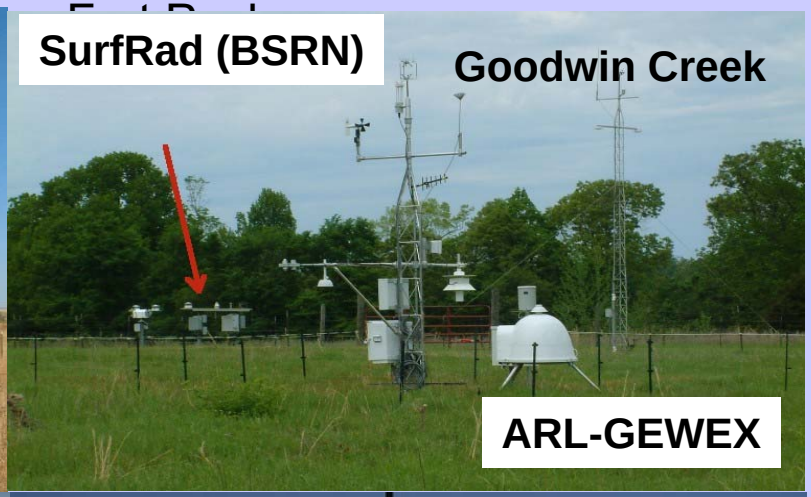
Scottsboro, Alabama, HCN-M Station




Soil Sensors Map
USDA SCAN, NWS COOP, and NESDIS USCRN
(Deploy USCRN FY 08-12, 114 sites @ 107 locations)
Coop (Temp only ~263)
SCAN (Moisture & Temp ~111)
CRN (Moisture & Temp ~114 FY 08-12)
(06/16/06)
Additional 24 coop

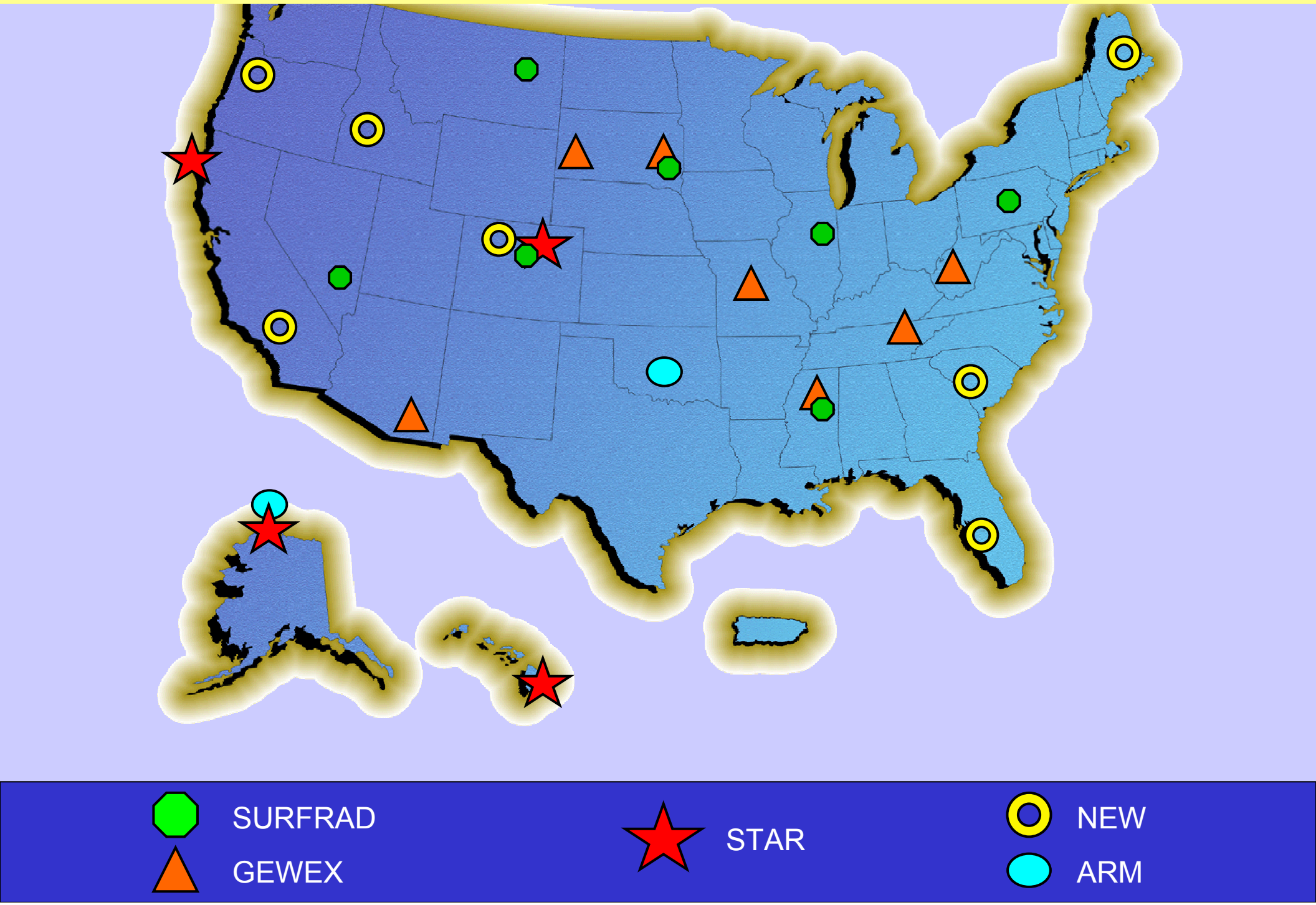
Surface Energy Budget Network
An Integrated Approach





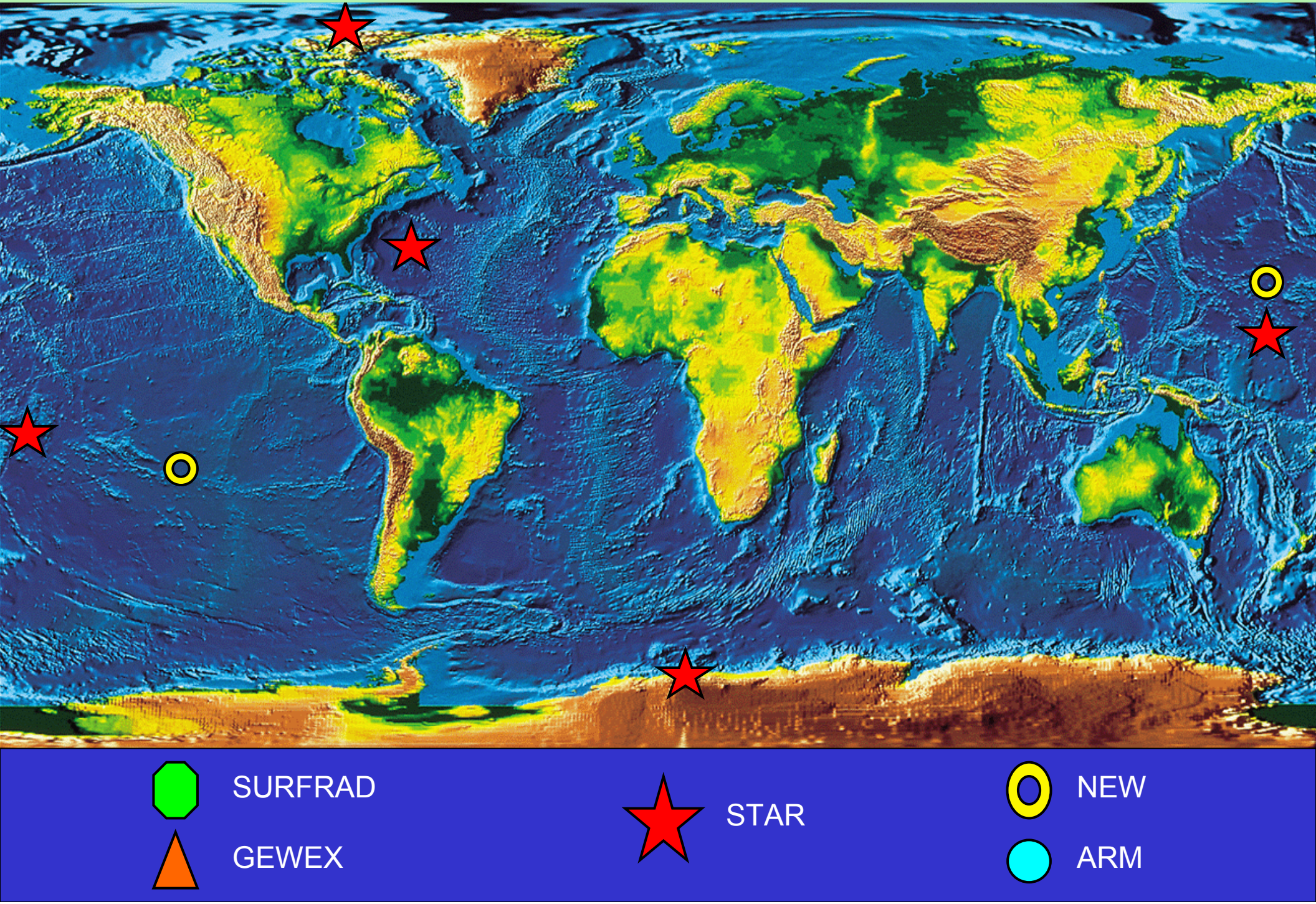
SEBN Candidate Global Sites (U.S.) (10/16/06)

(Current sites to be upgrade to Standard SEBN configuration)



SEBN Candidate Global Sites (non-U.S.) (10/16/06)

(Current sites to be upgrade to Standard SEBN configuration)



U.S. GEWEX
Soil Moisture/Temperature Sensors
Tentative NIDIS Use At
USCRN Stations

- The sensor (Hydra) is same used in USDA/SCAN (Soil Climate and Analysis Network)
- Meets established requirements for measurement of soil moisture and soil temperature
- Peer reviewed publications support operation of the sensor

Hydra Probe by Stevens Water http://stevenswater.com

- Hydra Probe technology has been in use for 10 years in support of NASA for ground truthing of satellite data
- The Hydra II sensor easily interfaces to dataloggers used in USCRN (some are currently deployed in SEBN)

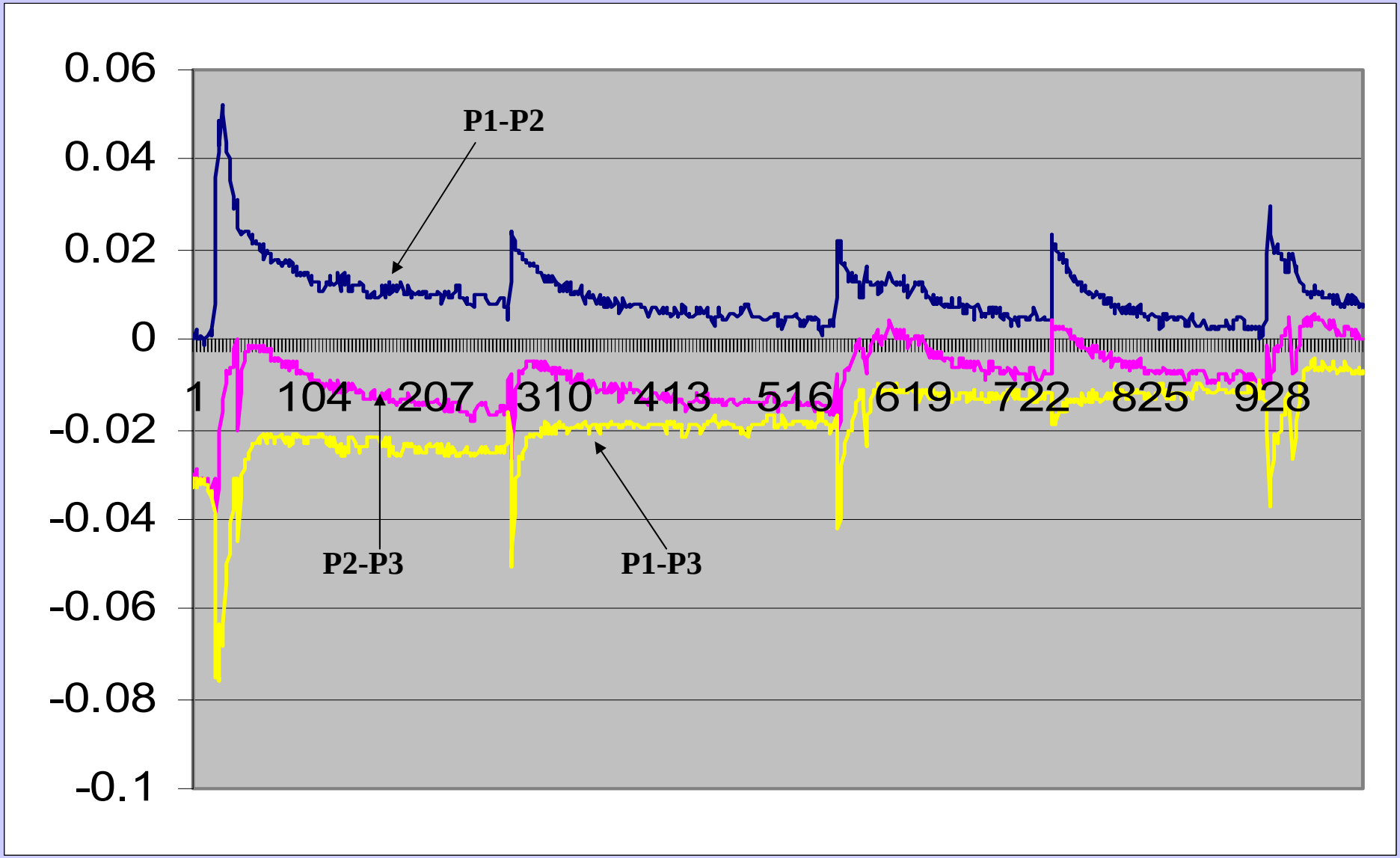
Hydra deployment

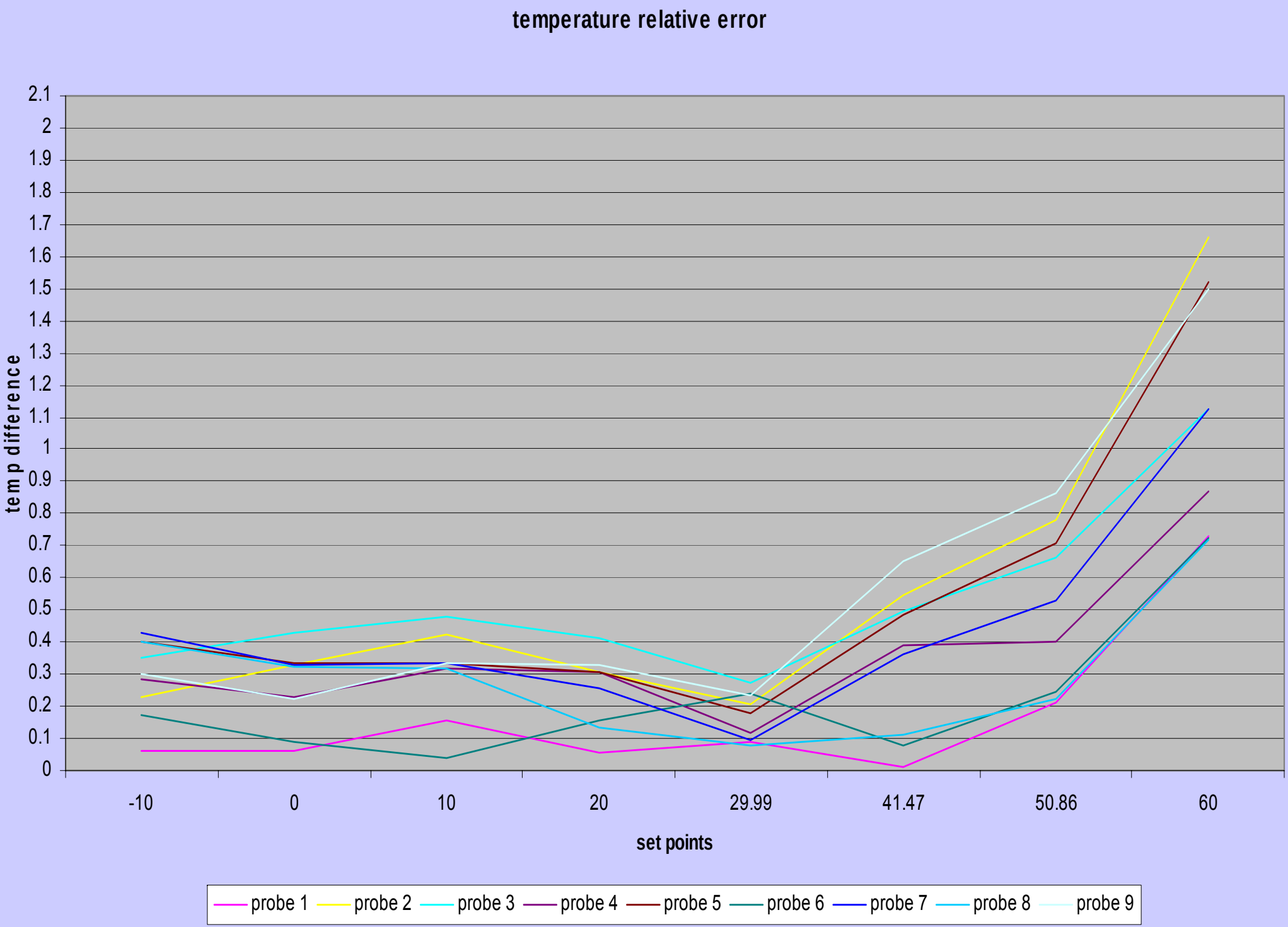
- In USDA/SCAN, 1 sensor is placed at 5,10,20,50, and 100 cm depths for a total of 5 sensors
- In SEBN, sensors are placed at same levels but 3 sensors are placed at 5 and 10 cm, and 2 at 20 cm, for a total of 10 sensors (*replication is needed at upper levels where spatial variability is greater)*
- *Deployment in CRN would be similar to SEBN*

Installation at Fort Peck, MT
August 31, 2006

With replicates


RYOBI


Volumetric Water Content
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
1
104
207
310
413
516
619
722
825
928
P1-P2
P2-P3
P1-P3


temperature relative error
temp difference
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-10
0
10
20
29.99
41.47
50.86
60
set points
probe 1
probe 2
probe 3
probe 4
probe 5
probe 6
probe 7
probe 8
probe 9

CONCLUSIONS

- **Continue Research on the use of replicate measurements**
- **Start examining methods of routinely examining the the water budget with SM/ST, RH, Precipitation**
- **Develop QA/QC procedures for SM/ST**
- **Continued Collaboration with MSC on SM/ST**