

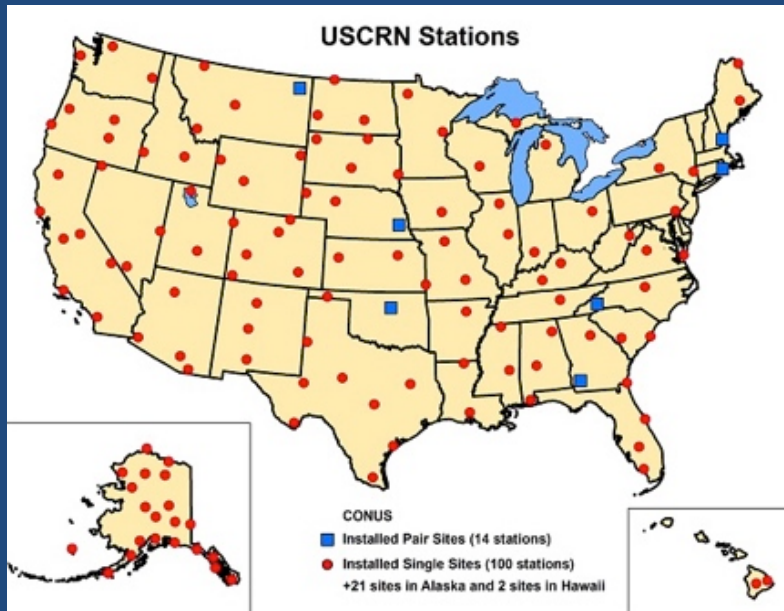
Using CRN data in the development of a gridded nationwide soil moisture product



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Background



- Long-term high-quality observations ~ 114 stations
- Currently ~7 years of soil moisture observations

- Develop a technique to use CRN stations as “anchor points” to characterize soil moisture conditions as a function of soil properties and atmospheric conditions.



Soil moisture products

Requirements:

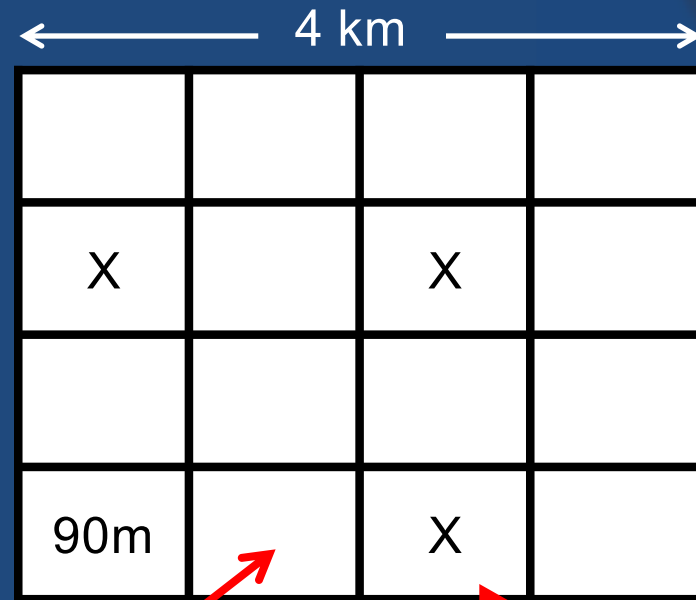
- ◆ Temporal scales: Weekly, monthly, daily
- ◆ Spatial scales: Hydrologic Unit Code, census, state/county
- ◆ In situ Depths (cm): 2, 5, 10, 20, 50, 100
- ◆ Surrogate data: **National Cooperative Soil Survey and its Soil Survey Geographic Database (SSURGO) and State Soil Geographic Database (STATSGO) points, land cover, bench mark soils**
- ◆ All raw data behind maps should be available: time series, water year

Monitoring and Forecast Products:

- ◆ Volumetric water content
- ◆ Percent saturation
- ◆ Soil temperature daily average max, min

CRN-soil property comparison

- A 4.05 km analysis grid is produced, which corresponds with available daily precip/ET grids
- For every ~4 km grid box there are $45 \times 45 = 2025$ 90m subgrid-scale soil property boxes
- If the SSURGO/STATSGO analysis of each of these soil constituents are within 5% of the soil characteristics of a CRN station, it is considered a “match”.



%	CRN	ST/SU
Sand	10	8
Silt	60	66
Clay	30	26

match

%	CRN	ST/SU
Sand	10	8
Silt	60	64
Clay	30	28

CRN-soil percentages

- For each 4-km analysis grid box, the number of matches are counted

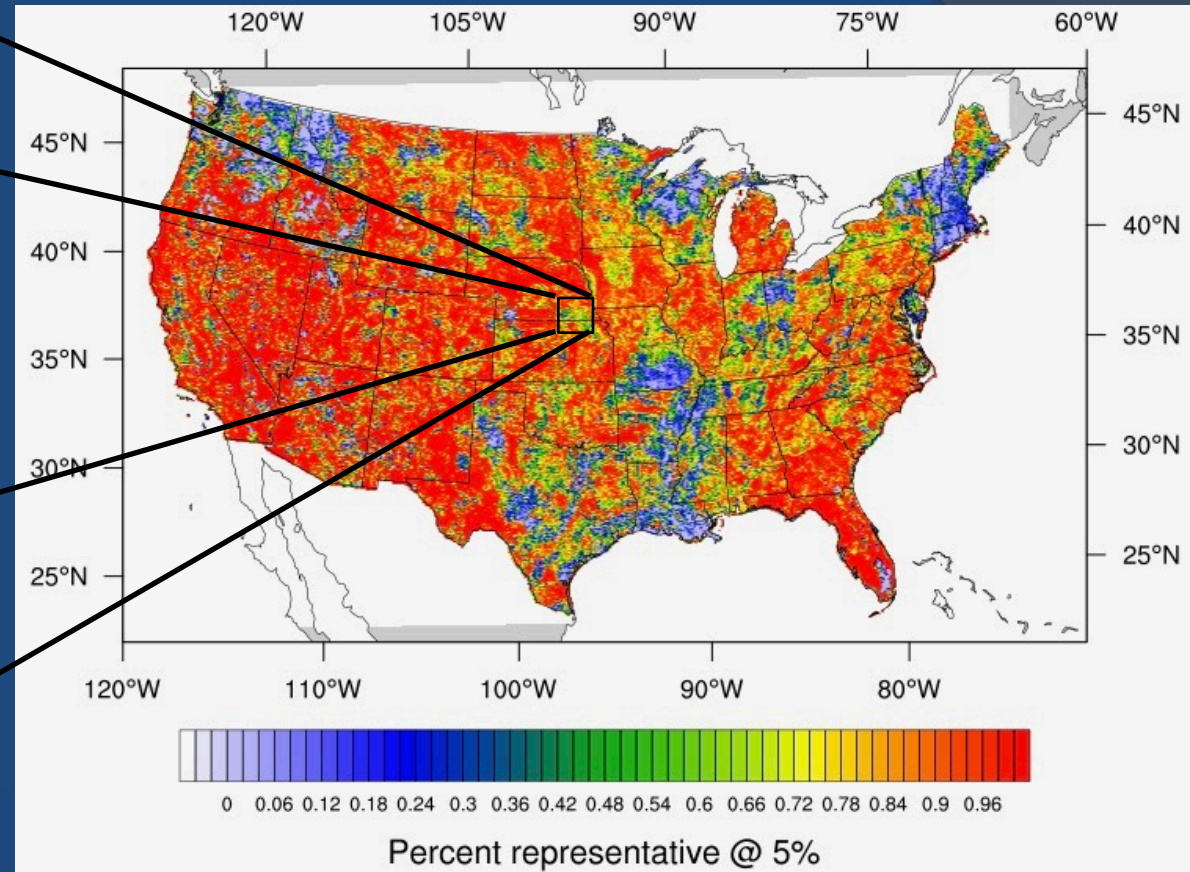
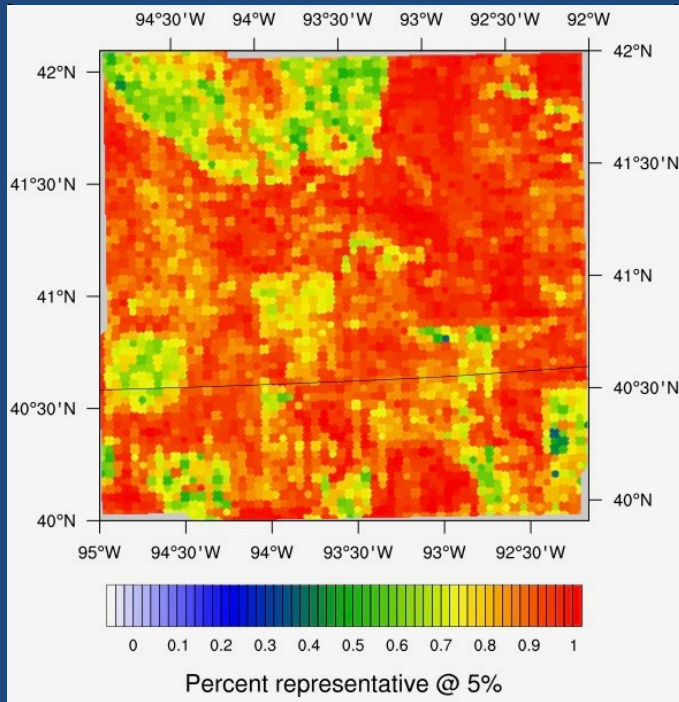
X	X	X	X
X	X	X	
X	X		X
90m		X	X

	X		
X		X	
90m		X	

$$4/16 = 25\%$$

$$12/16 = 75\%$$

CRN-soil property comparison



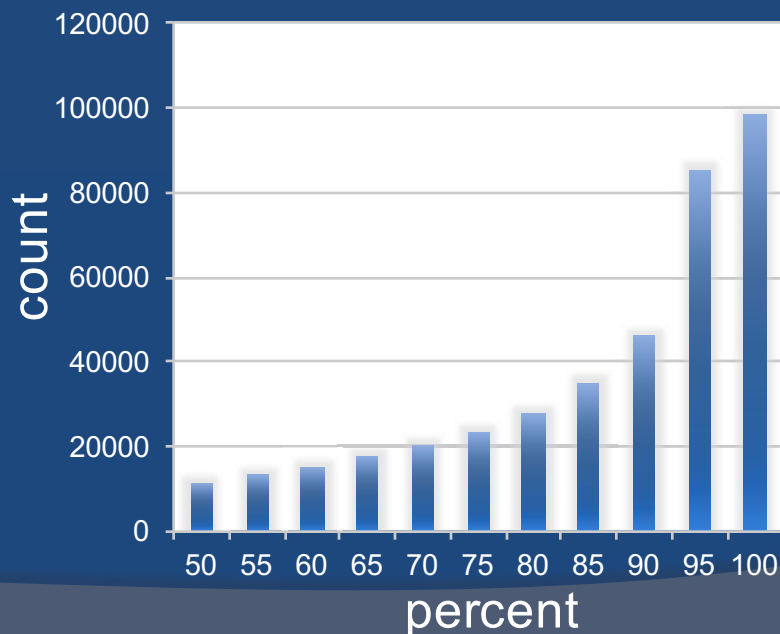
- On this 4-km grid, the % of 90 m analyses that match at least one CRN station measurement are plotted. Note the majority of the US is highly represented by the CRN measurements

Varying statistics

- Different thresholds can be used to determine if a 90 m soil analysis is considered a “hit” with a CRN station measurement.

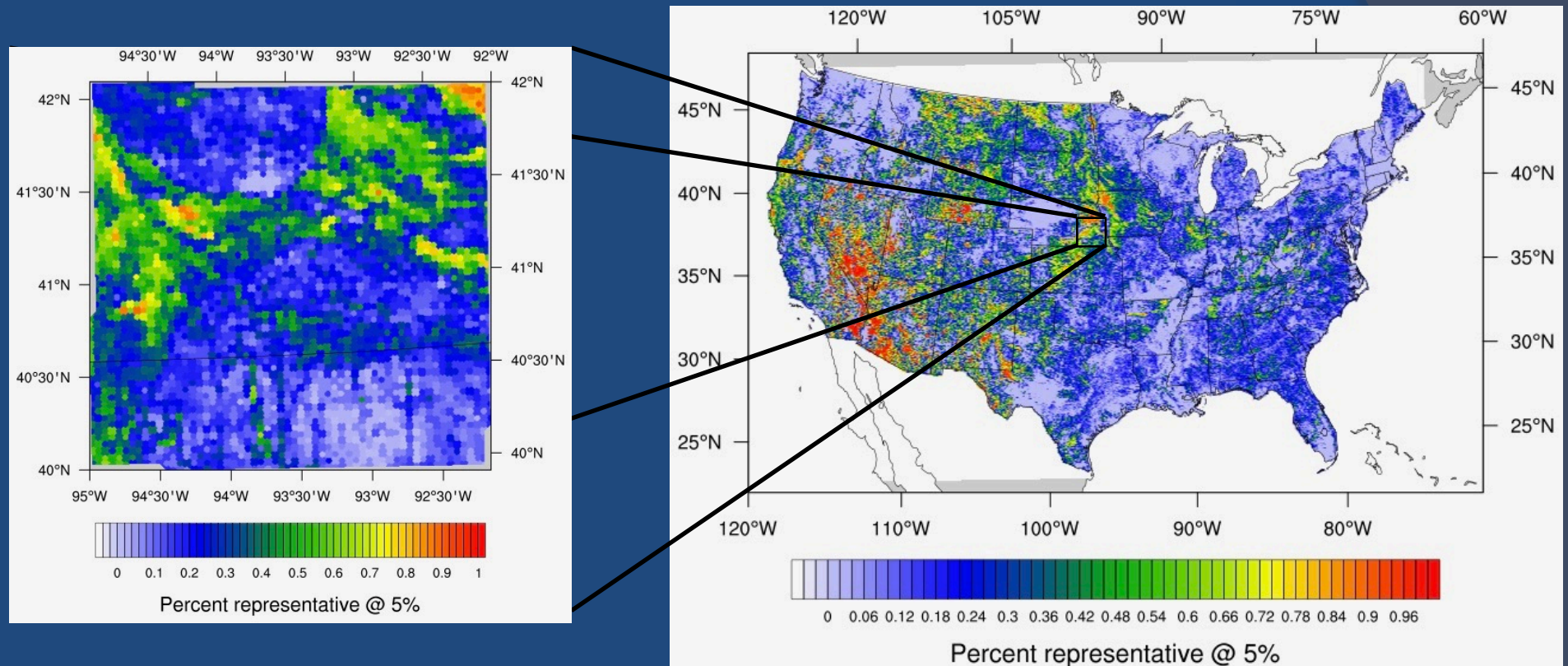
Threshold	100% of 90 m tiles covered in 4 km box	90% of 90 m tiles covered in 4 km box	50% of 90 m tiles covered in 4 km box
20%	91.7	96.9	99.9
10%	71.6	87.7	97.4
5%	20.6	48.2	82.6
2%	1.0	3.0	17.7

- At different thresholds, various % of the US is represented by a 4-km grid box containing a certain % of hits, and this % increases with widening threshold window.



- Even using a 5 percent threshold, the % of 90 m analysis points within a given 4-km box peaks at 100% then decreases

Soil property-vegetation thresholds



- After matching the 90 m SSURGO/STATSGO and CRN measurement datasets, the 90 m vegetation types from the National Land Cover Dataset (NLCD) was applied.
- After applying the vegetation threshold there are percent of matches decreases, however almost all 4-km grid boxes have some matches

Next Steps

- The large areal extent of representativeness suggests that this technique can be adequately applied over much of the US, and thus has the potential to improve soil moisture products
- We will develop a transfer function using the 4km gridded products for ET (ALEXI) and precipitation (PRISM) as forcing functions to see how the measured soil moisture and temperature respond for a given soil and vegetation type for each of the CRN anchor points.
- The transfer functions will be applied to all of the surrogate 90 m subgrid-scale data points that match a particular CRN “anchor point” with the same soil characteristics and vegetation type, thus allowing for a derived soil moisture value at each point.
- The resulting distribution of soil moisture from the 90 m data points will be used to statistically define the soil moisture on the 4-km grid via weighting functions.