Coordinated National Soil Moisture Network Pilot

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Western States Drought Coordinators & Emergency Managers Meeting
July 20, 2015

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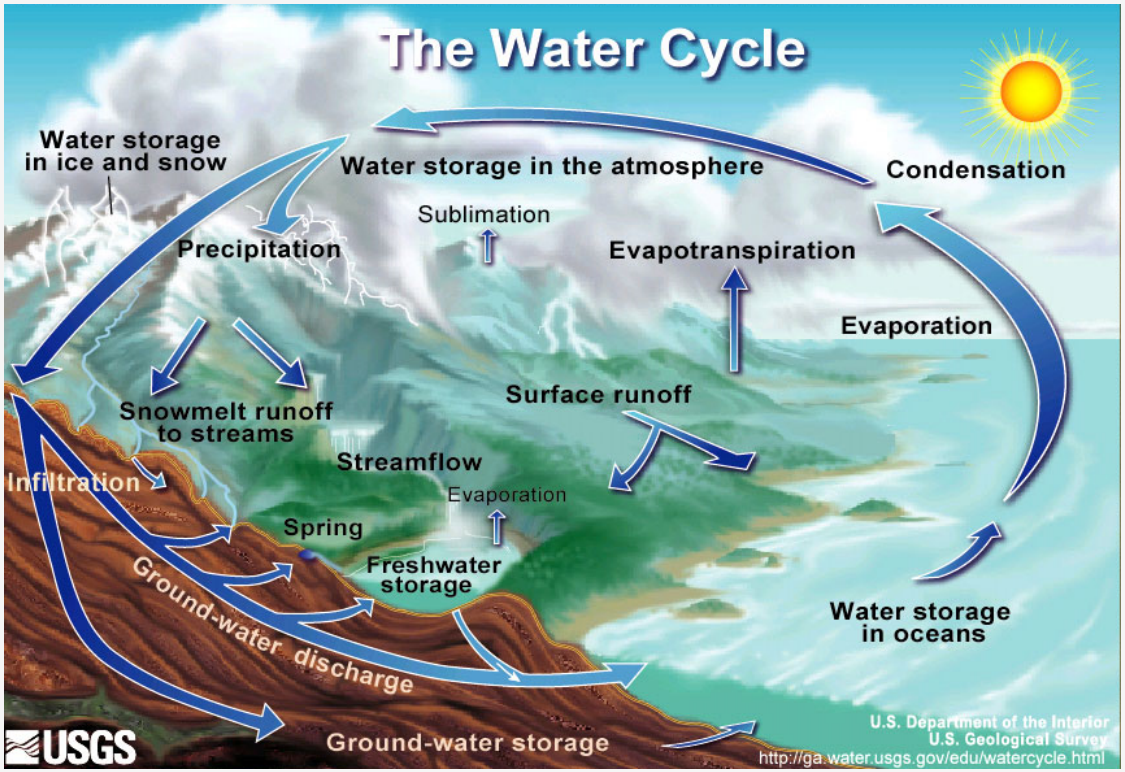
Motivation

- President's Climate Action Plan
- Open Water Data Initiative
- Missing piece of hydrologic observational data



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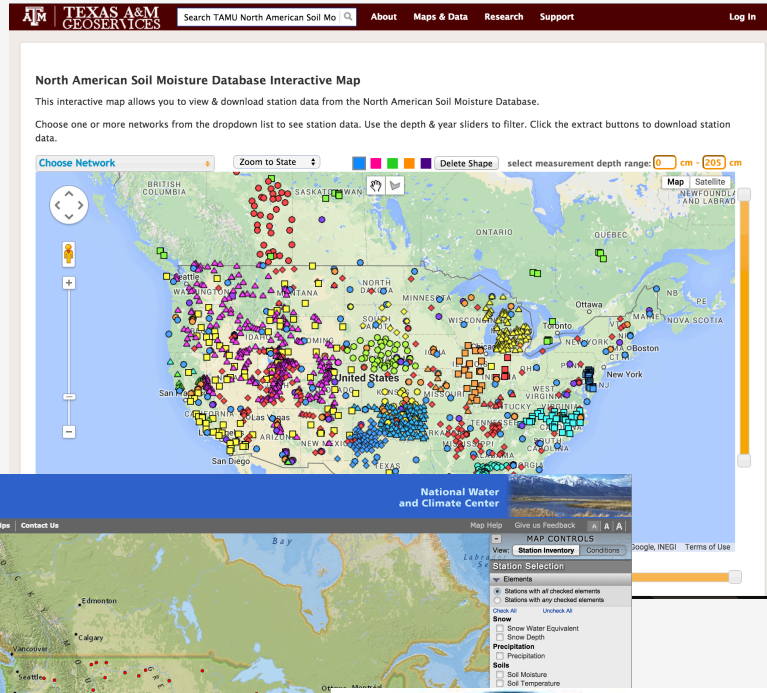
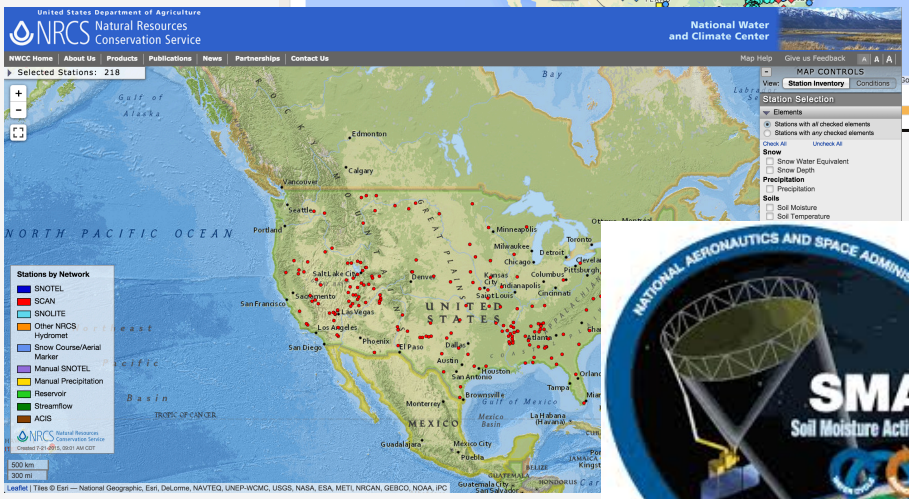
Current Soil Moisture Data Sources

- SCAN & CRN
  - In-Situ
  - National coverage
  - Real-time & historical
  - Limited web service access
  - Multiple depths
- NASMD
  - In-Situ
  - Historical
  - National coverage
  - Multiple depths
- SMOS, NLDAS, SMAP
  - Satellite derived
  - National coverage
  - Near real-time
  - Near surface data





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SCAN: Soil Climate Analysis Network
CRN: Climate Reference Network
NASMD: North American Soil Moisture Database
SMOS: Soil Moisture and Ocean Salinity
NLDAS: North American Land Data Assimilation System
SMAP: Soil Moisture Active Passive

Top: http://soilmoisture.tamu.edu/Data/Map/
Middle: http://www.wcc.nrcs.usda.gov/webmap/index.html
Bottom: http://spaceflightnow.com/2015/01/25/preview-story-launch-of-delta-2-rocket-with-nasa-probe-thursday/

Pilot Use Cases

1. Operational Drought Monitoring: NOAA, U.S. Drought Monitor
2. Experimental Land Surface Modeling: NOAA/ NOHRSC, Snow Modeling
3. Operational Hydrological Modeling: NOAA RFCs

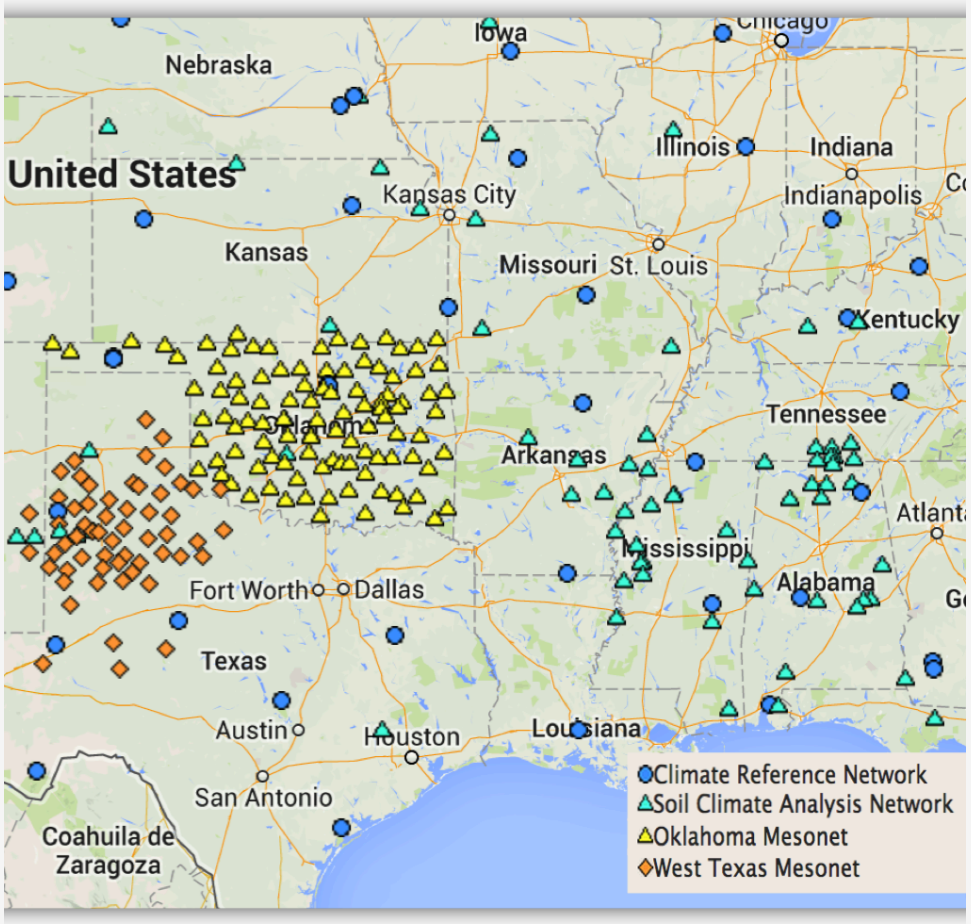
Goal

As a U.S. Drought Monitor Author I want to see a map of percentile ranking of current volumetric water content (VWC) at discrete and common depths, related to 30 yr record, for sites colored using the drought monitor legend so that I can determine the necessary changes to be made to this week's DM map.

(in context of use case #1)

Pilot Data Sets

- In-Situ:
  - US CRN
  - SCAN
  - Oklahoma Mesonet
  - West Texas Mesonet
- Modeled:
  - NLDAS-2 model-derived soil moisture from: Noah, Mosaic, SAC and VIC



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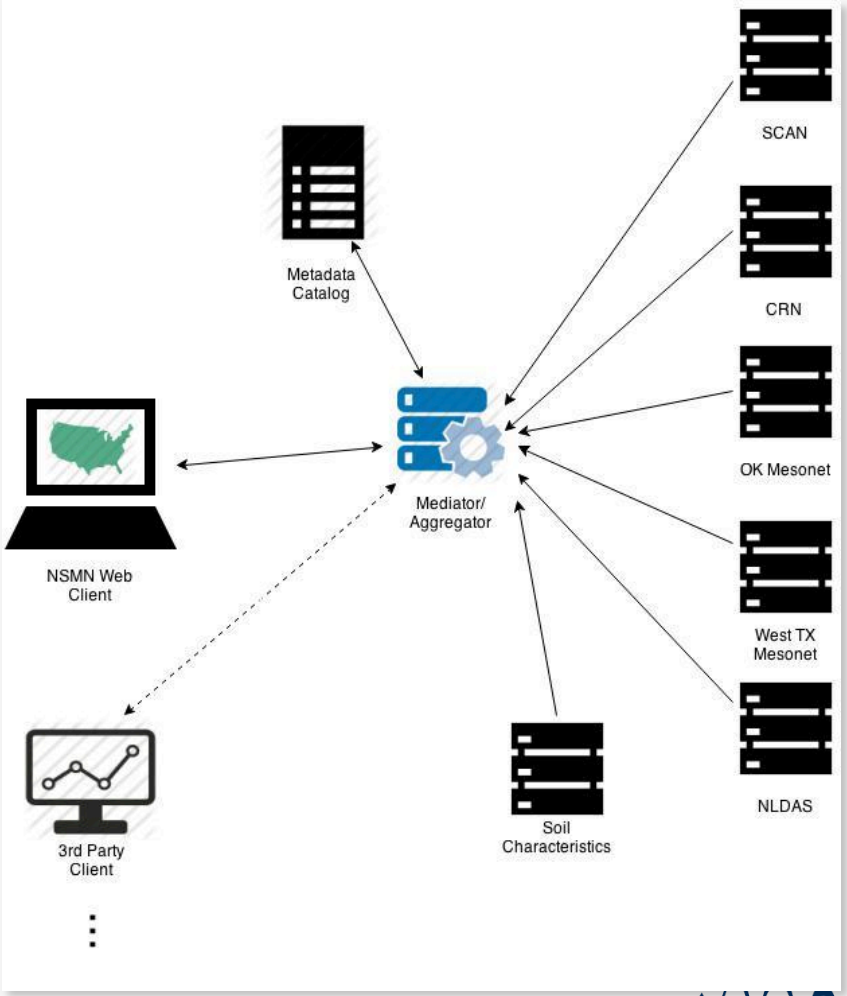
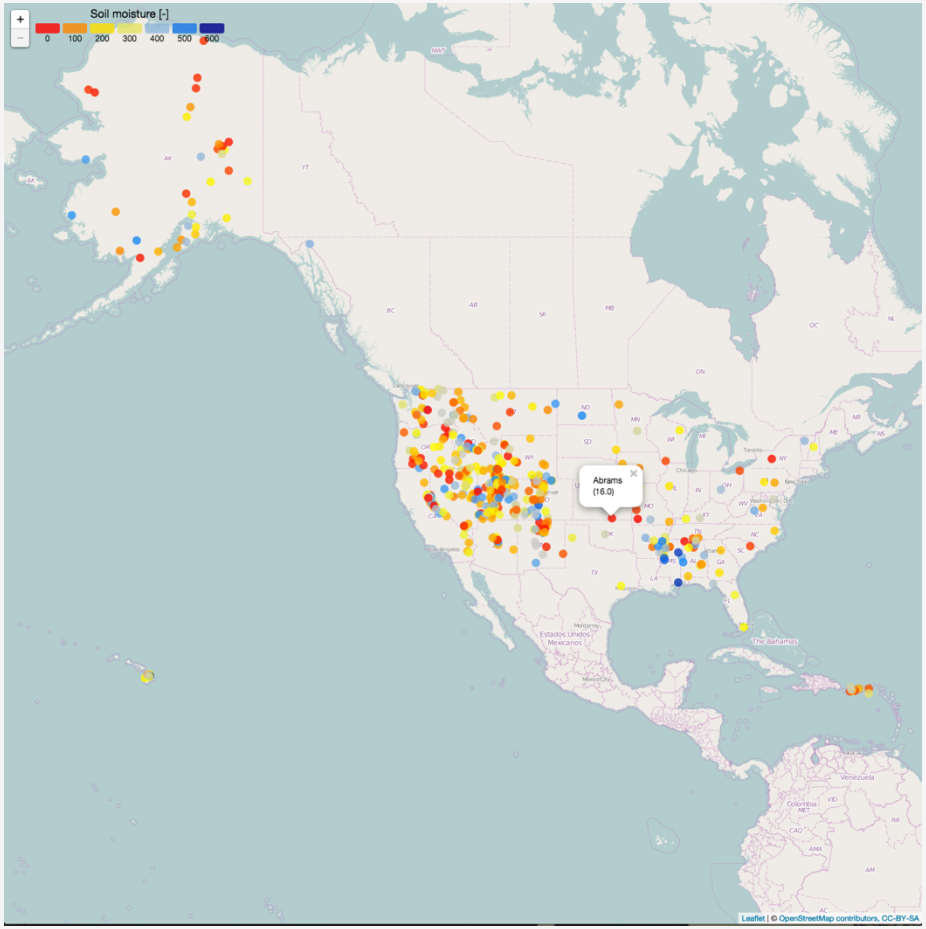
System Components

- Site metadata and soil characteristics web service - Re-factor NASMD
- Catalog of data sets and service metadata
- CRN web service - NCDC ArcServer (does not include soil moisture)
- SCAN web service - AWDB SOAP
- OK Mesonet web service
- West TX Mesonet web service
- NLDAS web service - USGS Geo Data Portal
- Algorithm development for calculating percentiles, aggregating datasets
- Service mediator/aggregator
- Map-based visualization web tools

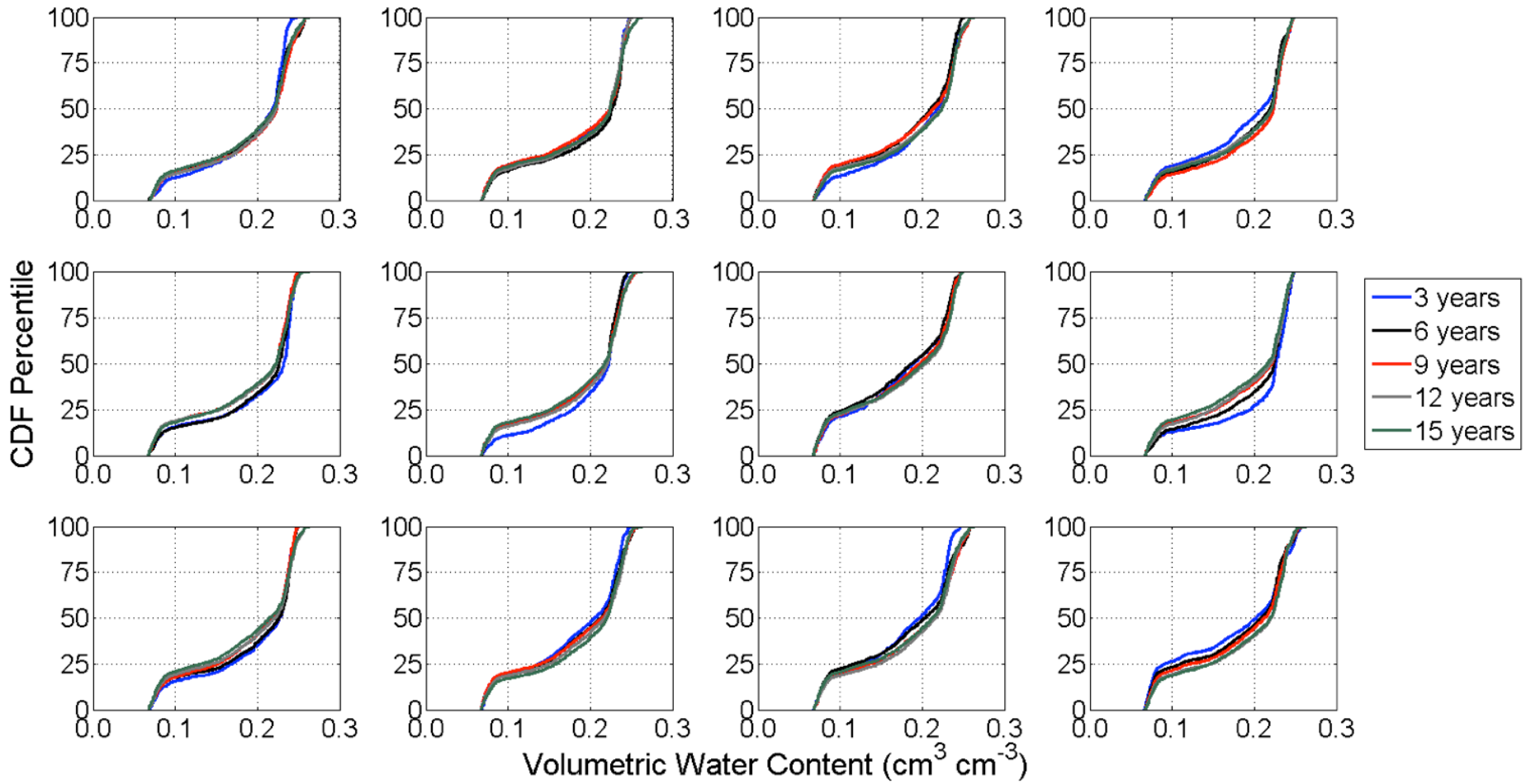


Progress

- Gathering & QA/QC of station metadata
- Web services established for West TX, OK Mesonets and TAMU proxy for CRN data (temporary for pilot)
- Started service development talks with West TX and OK Mesonets
- Mediator coded to access and process SCAN, TX and OK data (CRN in process)
- Interactive map display prototype of VWC values
- Analysis of historical record needed for representative SM percentiles using cumulative distribution functions (CDF)
- Developed of an SOS service for aggregated VWC data

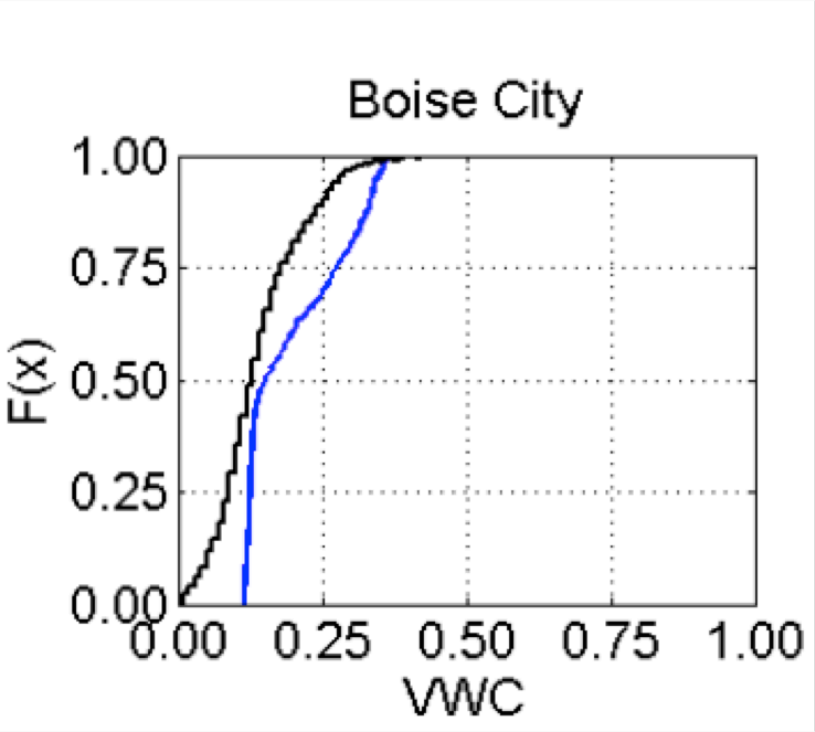


Generating percentiles

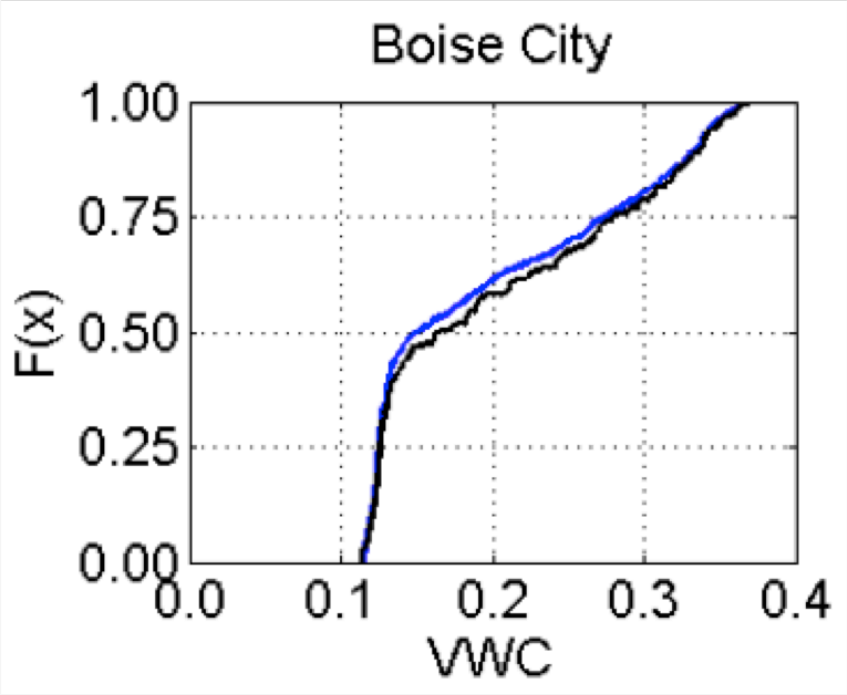


CDF Matching

Before CDF Matching



After CDF Matching



Pilot Products

1. Map Visualization

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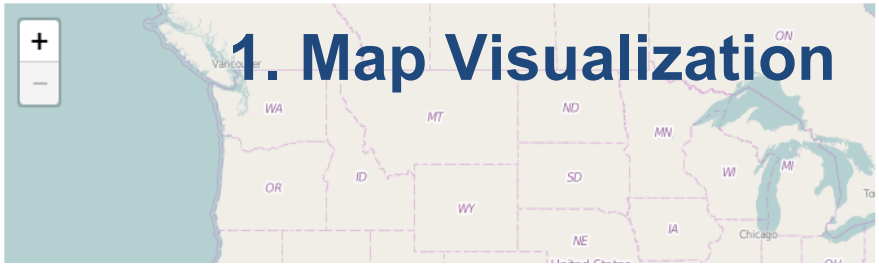
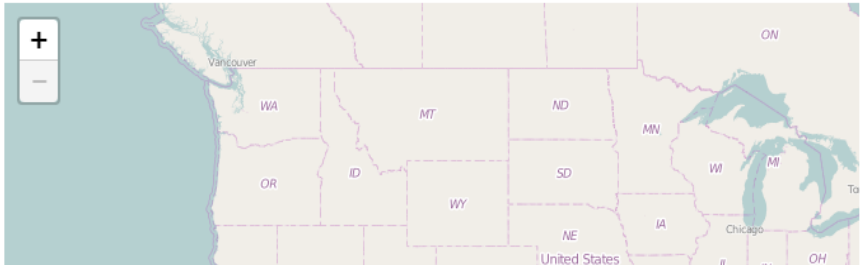
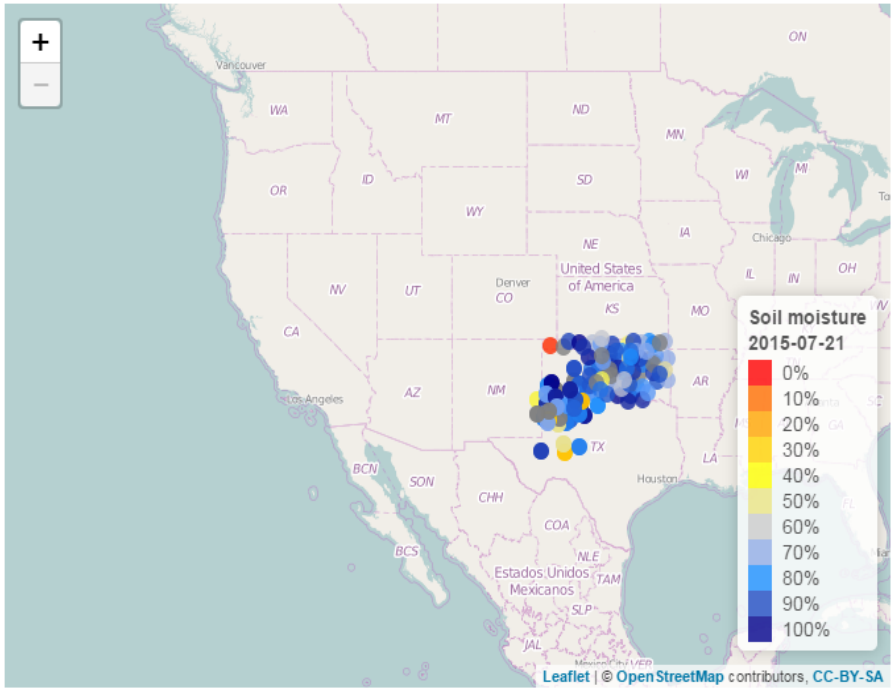


10-30cm



30-100 cm



2. SOS Web Service

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Lessons Learned

- Most major in-situ networks do not currently serve soil moisture via web services
- Existing services often have little or no documentation (perhaps suggests that they are not widely used?)
- Station metadata is not available via services (soil parameters, sensor info, etc.)
- CRN does not serve soil moisture data via services (FTP only)
- A wide range sensor depths are used
- Sites can be added or removed
- Although period of record is relatively short, stable percentiles can be estimated for most stations

Remaining Challenges

- Integrating in-situ data (points) with satellite derived data (coverage)
- Coordinating data sharing efforts with regional and state mesonets
- Providing both real-time and historical data
- Performing on-the-fly QA/QC checks on integrated datasets
- Scaling up network infrastructure

Next Steps

- Build-out system infrastructure
- Survey federal, state and local agencies to identify soil moisture data sources and new use cases
- Incorporate additional data providers
- Integrate SMAP and NLDAS-2 data
- Develop industry partnerships
- Collaborate with the international soil science informatics community by participating in the OGC ADWG SoilIE
- Develop new tools, visualizations and data products

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