An Untapped Mesonet
Crowdsourcing Private Weather Stations

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- MESONET: (1) Weather instrumentation stations "deployed in a network from a few kilometers to tens of kilometers apart to provide baseline data for mesoscale multifaceted observational studies" (2) Weather stations set at a spatial spacing of 2 - 40 km and temporal record spacing of 1 to 15 min. This spacing provides information on mesoscale phenomena. (AMS)

- CROWDSOURCING: the practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people and especially from the online community rather than from traditional employees or suppliers (www.merriam-webster.com)

- INFORMATION: knowledge that you get about someone or something; facts or details about a subject (www.merriam-webster.com)

- DATA: facts or information used usually to calculate, analyze, or plan something (www.merriam-webster.com)

- Weather Station Network Examples/Resources
  - Automated Surface Observing System (ASOS)
  - Community Collaborative Rain, Hail and Snow Network (CoCoRaHS)
  - NOAA/NWS Cooperative Observer Network (COOP)
  - Oklahoma mesonet
  - Springfield, MO mesonet
  - New Orleans Sewerage and Water Board mesonet
  - and many, many more…

  - http://www.eol.ucar.edu/projects/hydrometnet/

- What about other “networks?” For example…
  - WeatherUnderground
    - Precip data use for local analysis of Hurricane Isaac impacts in New Orleans and flash flooding in Springfield, MO and Mobile/Pensacola events
  - Davis Weather Stations and AWS/Weatherbug
    - Collaborated with Davis and AWS to gather data for Mobile/Pensacola flash flooding event

(no preferences are implied in referencing the above networks; others are available and being used)

32 Total

8 PWS

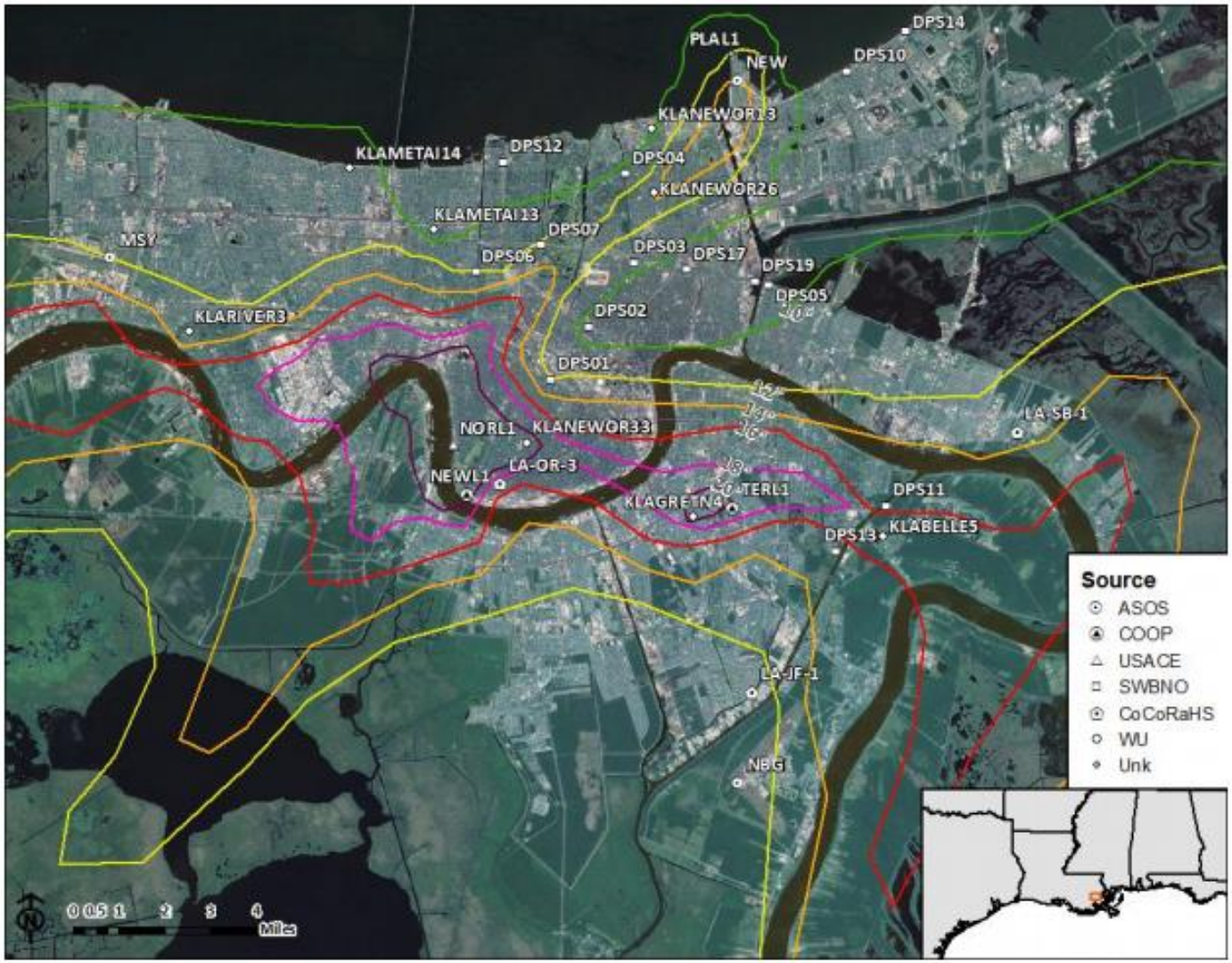


Figure 11. Same as Figure 10 but with site identifiers instead of point totals. Sites with four characters and a number are sites that come in through the HADS network and have an identifier set by local NWS WFOs. Sites with three characters are ASOS/AWOS airport stations. Sites starting with "DPS" are SWBNO pumping stations. Sites with eight characters and two numbers are Weather Underground PWS sites. Sites starting with "LA" followed by two additional characters and a number are CoCoRaHS sites.

Lincoln, W. S., and D. Schlotzhauer. Reconciling New Orleans Pumping Data with Gauge Observations of Isolated Extreme Rainfall Due to Hurricane Isaac; NOAA/NWS/LMRFC Technical Report [http://www.srh.noaa.gov/images/lmrfc/tech/Isaac_pumping.pdf]

46 Total

9 PWS

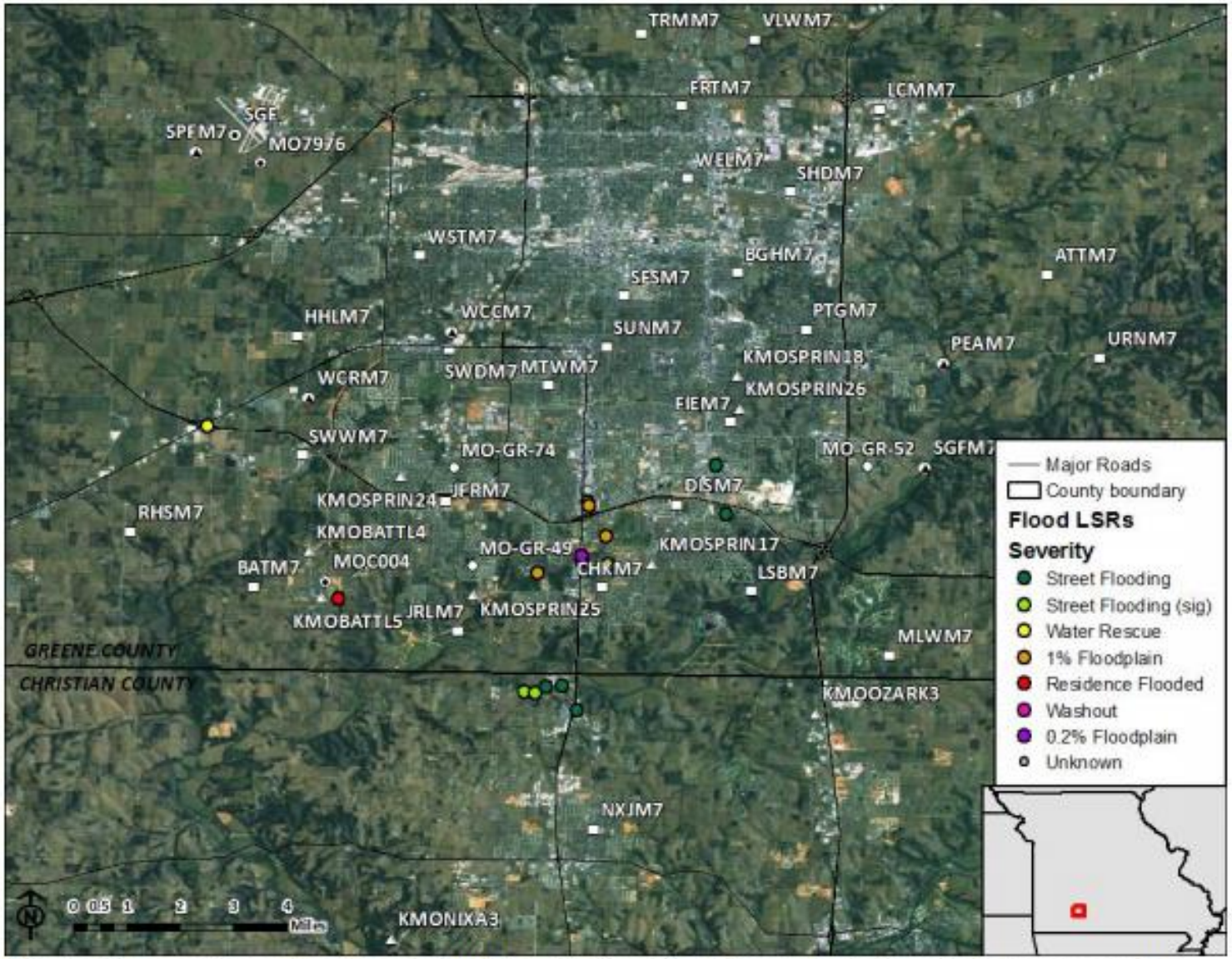
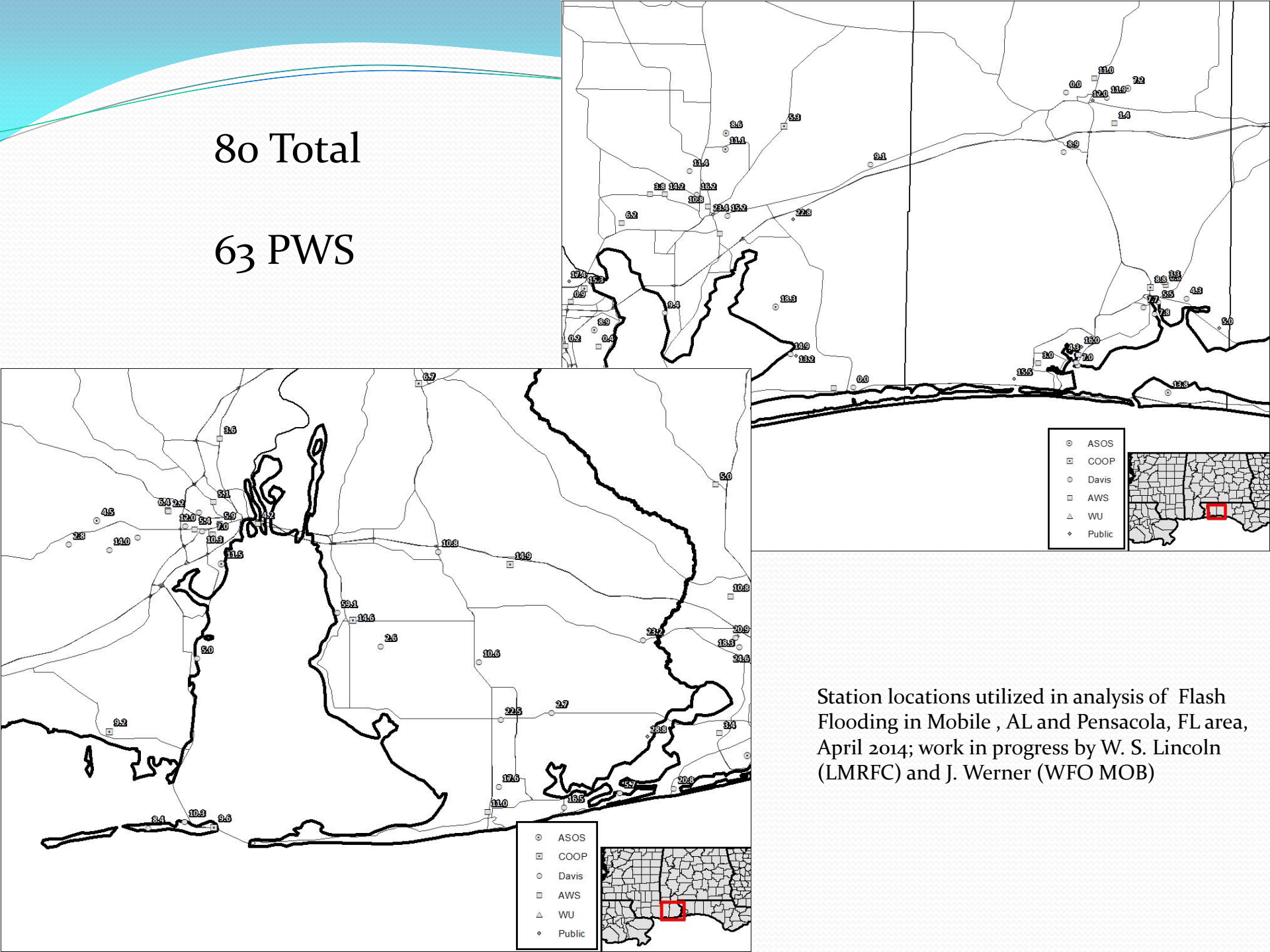


Figure 7. Locations of point rainfall data obtained for this analysis. Symbols represent the different sources of rainfall data. Locations of flooding repored to the NWS and digitized from media photos/video are added as a reference and are colored based upon relative flood severity (greens represent low-severity flooding, orange/red/purple represent high-severity flooding).

Lincoln, W. Scott. "Analysis of the 15 June 2013 Isolated Extreme Rainfall Event in Springfield, Missouri." *Journal of Operational Meteorology* 2.19 (2014).

80 Total

63 PWS



Station locations utilized in analysis of Flash Flooding in Mobile , AL and Pensacola, FL area, April 2014; work in progress by W. S. Lincoln (LMRFC) and J. Werner (WFO MOB)

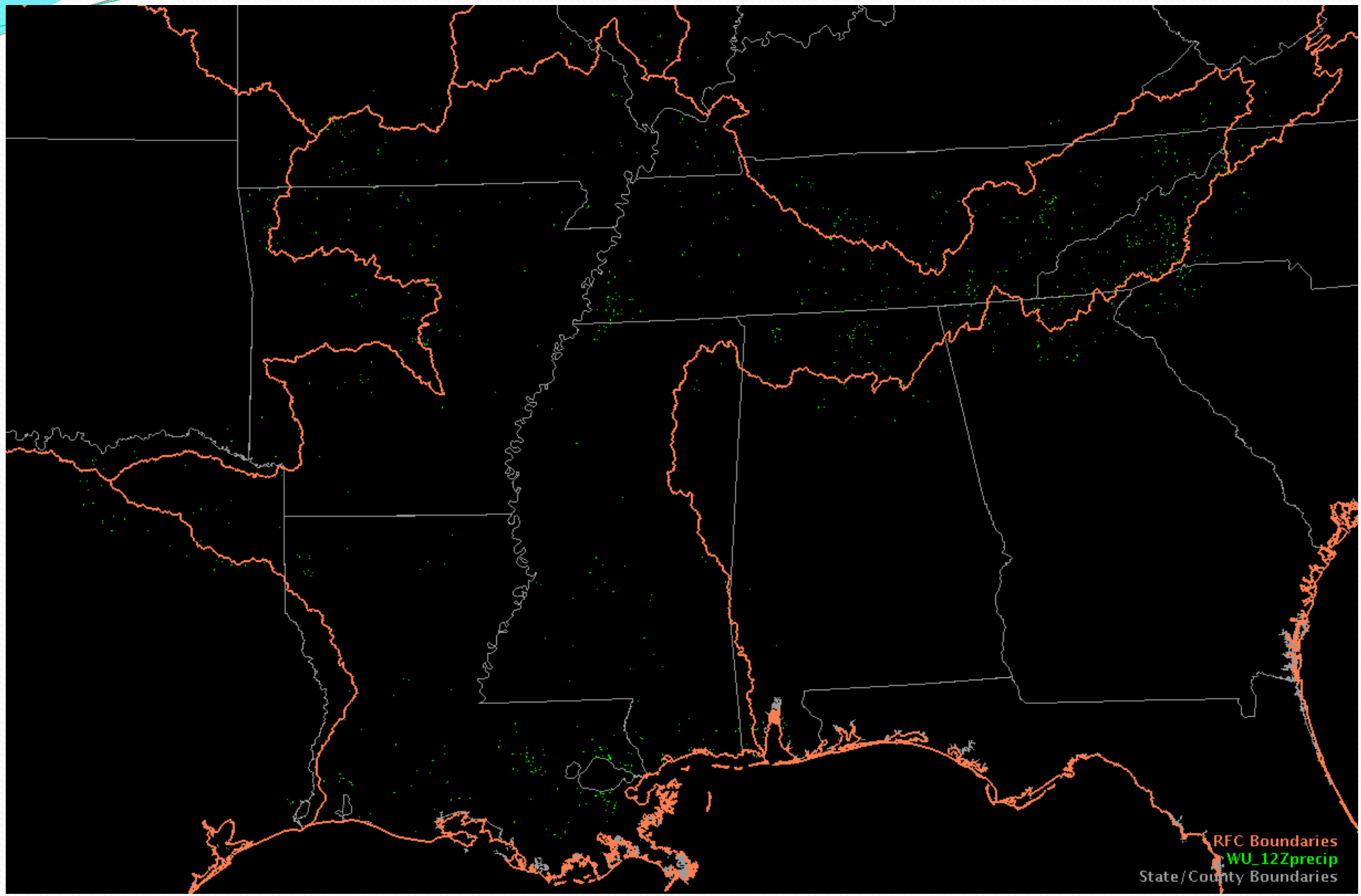
- Benefits of PWS data (for example…)
  - ~16000 stations across CONUS in WU network
  - ~1600 stations in LMRFC AOR
  - Roughly 160 station in any given CWA

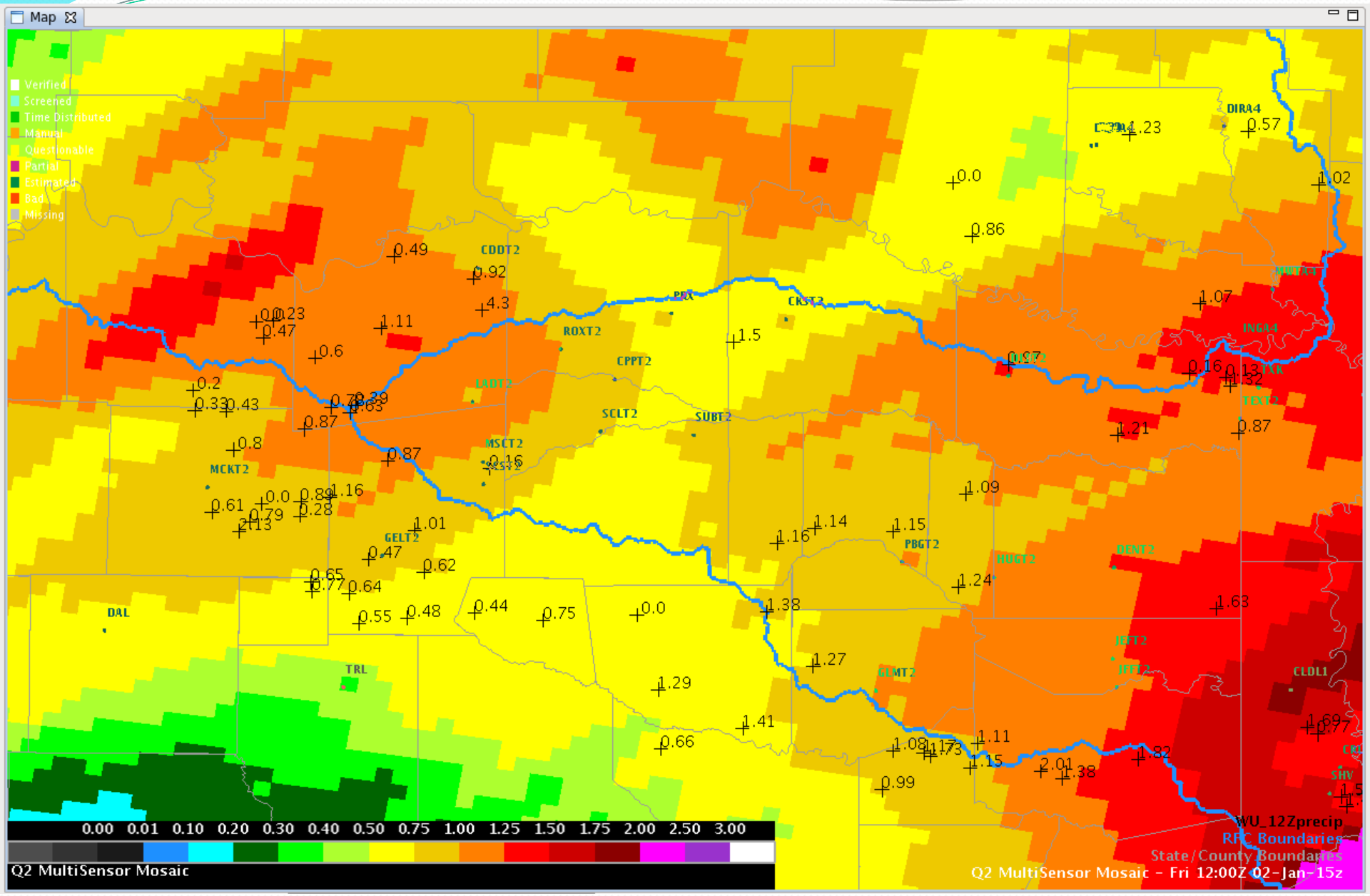
  - Provide secondary, independent data source to NWS data

- PWS websites great for casual browsing of information or obtaining small amounts of data
- Problems/Issues with efficient access of PWS data
  - How do we know exact location for plotting?
  - How do we deal with differing data formats?
  - How do we deal with totalizing varying measurement intervals?
  - How do we gather data from LARGE number of stations in AOR?
  - How do we display data?

  - Answer – Scripting/Programming

- Script Example
  - On regular basis (i.e. weekly or monthly)
    - Gather all WU PWS station names
    - Find Lat/Lon of each station
  - On daily/hourly basis via cron, for each station in AOR
    - Totalize rainfall for each station
    - Create shapefile of rainfall totals
    - Transfer shapefile set to AWIPS2 system
    - Display data for operational use


RFC Boundaries
WU_12Zprecip
State/County Boundaries


Map
Verified
Screened
Time Distributed
Manual
Questionable
Partial
Estimated
Bad
Missing
0.00 0.01 0.10 0.20 0.30 0.40 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.50 3.00
Q2 MultiSensor Mosaic
WU_12Zprecip
RFC Boundaries
State/County Boundaries
Q2 MultiSensor Mosaic - Fri 12:00Z 02-Jan-15z
DIRA4
INGA4
CDDT2
ROXT2
CPPT2
LADT2
SCLT2
SUBT2
MSCT2
MCKT2
GELT2
PBGT2
HUGT2
DENT2
JEFT2
GLMT2
CLDL1
SHV
DAL
TRL

- Other Problems/Issues
  - are stations located properly to collect rain (following NWS COOP/COCORAHS siting rules)?
  - are stations calibrated?
  - are stations maintained?
  - are stations communicating correctly with internet?

- Probably answers are “yes”…these people are serious about their hobby! But how can we be sure?

- Completing development of simple QC process to compare PWS data to official NWS data at same location
  - Statistical comparison of year's data
  - If data sets are statistically same, then PWS data is "good"
  - If not, flag with a warning
  - Also, forecaster judgment

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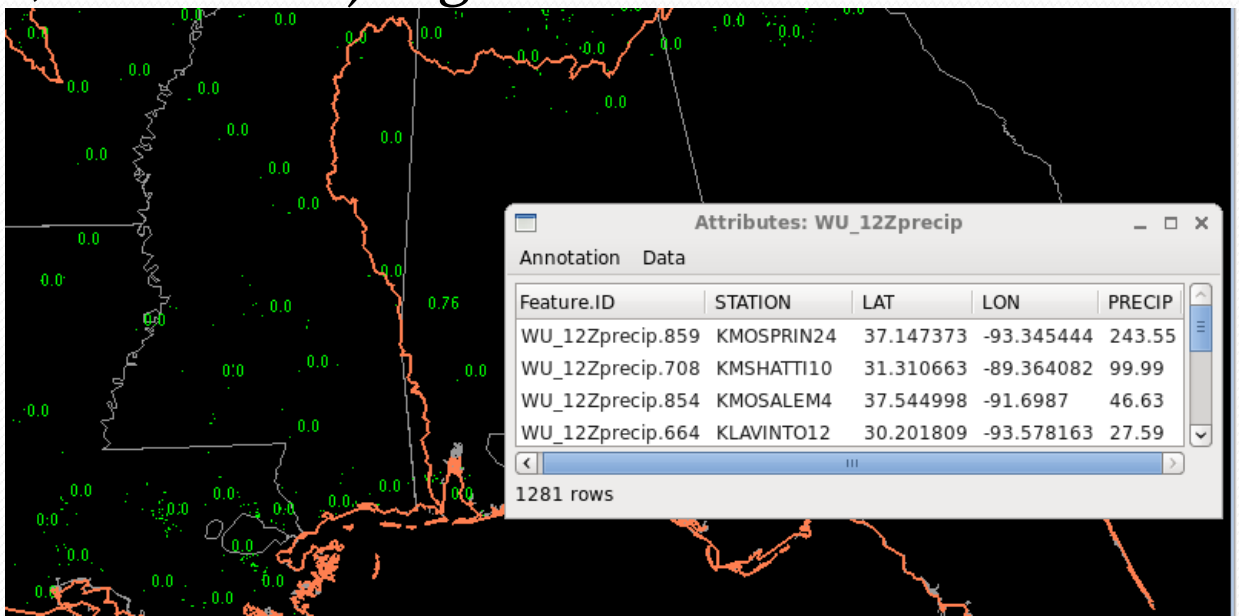

- Key Points
  - LOTS of information collected via Private Weather Stations
  - With automation via scripting/programming, basic QC, and forecaster judgement this information turns into useful data
  - Data from PWSs can be used to confirm or fill gaps in NWS systems, serving as secondary, independent set
  - PWS data is useful in event analysis and operational setting
  - Other parameters can be extracted
  - Useable by other NWS offices, including WFOs

- Acknowledgments
  - W. Scott Lincoln
    - LMRFC Hydrologist
  - Connor Baird
    - Former Student Volunteer
    - Programming and Statistics

QUESTIONS/COMMENTS

(or a nice round of applause?)

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