CoCoRaHS – An Example of Citizen Science Data Collection in Action

Nolan Doesken
Colorado State University

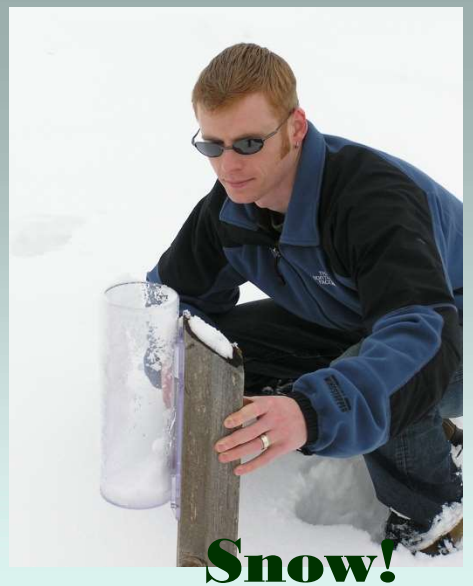
Presented: 9 August 2016

National Environmental Monitoring Conference

Panel on "Organizing and Executing a Citizen Science Project"

Orange County, CA


GoGoRaHS



CoCoRaHS (Community Collaborative Rain, Hail and Snow) network

A simple yet effective way to help scientists track our climate

http://www.cocorahs.org

The Birth of CoCoRaHS –

It came from a local disaster

1997 Fort Collins, CO Flood

CoCoRaHS

Community Collaborative Rain, Hail & Snow Network

Dramatic local variations in rainfall

Radar was way off, rain gauges were few
Flood came as a surprise

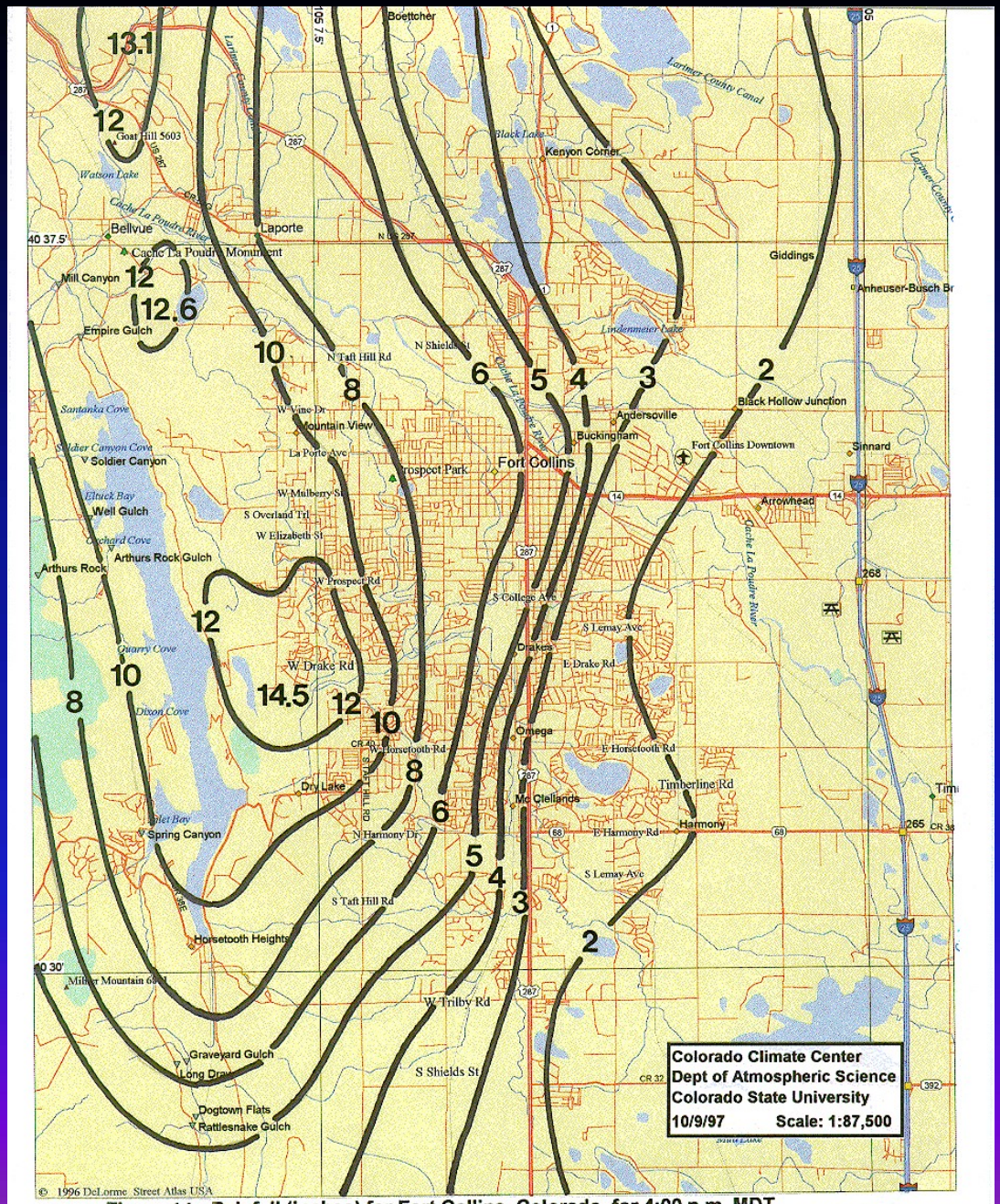


Figure 14. Rainfall (inches) for Fort Collins, Colorado, for 4:00 p.m. MDT July 27, 1997 through 11:00 p.m. MDT for July 28, 1997

Out of the floodwaters arose a community of citizens -- interested, curious, and motivated to help

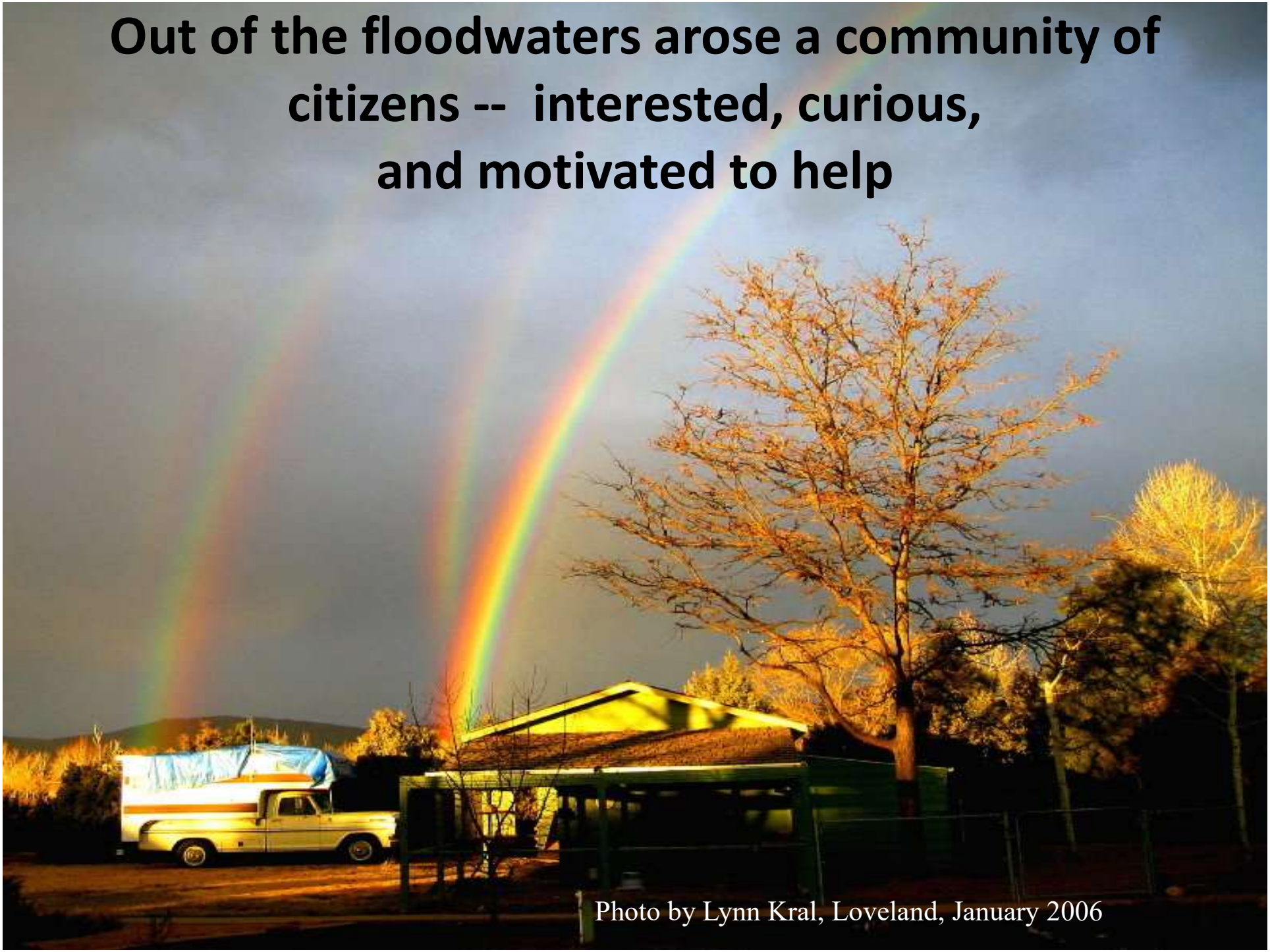
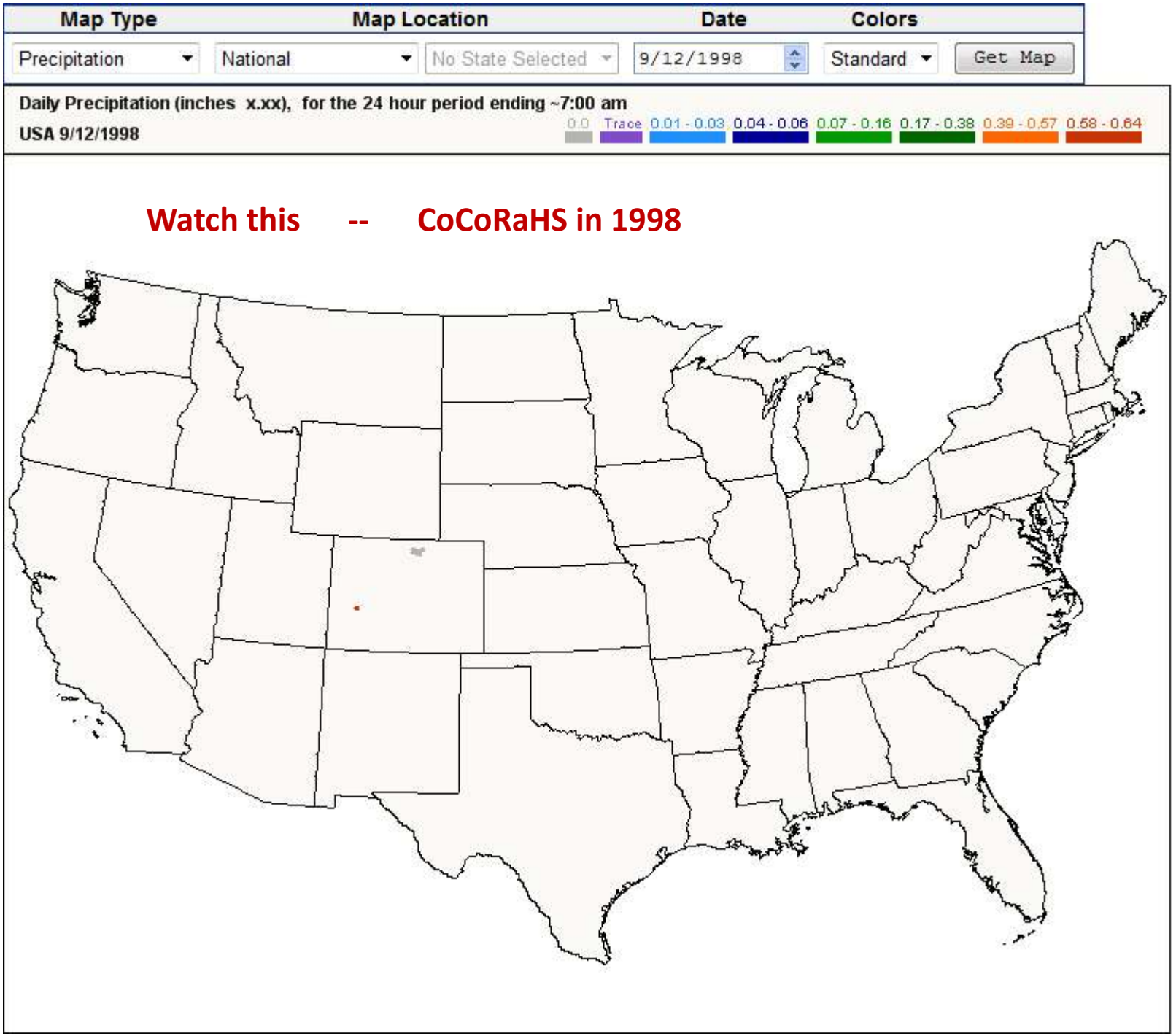


Photo by Lynn Kral, Loveland, January 2006


Map Type
Map Location
Date
Colors
Precipitation
National
No State Selected
9/12/1998
Standard
Get Map
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 9/12/1998
0.0
Trace
0.01 - 0.03
0.04 - 0.06
0.07 - 0.16
0.17 - 0.38
0.39 - 0.57
0.58 - 0.64
Watch this -- CoCoRaHS in 1998

Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/1999	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/1999

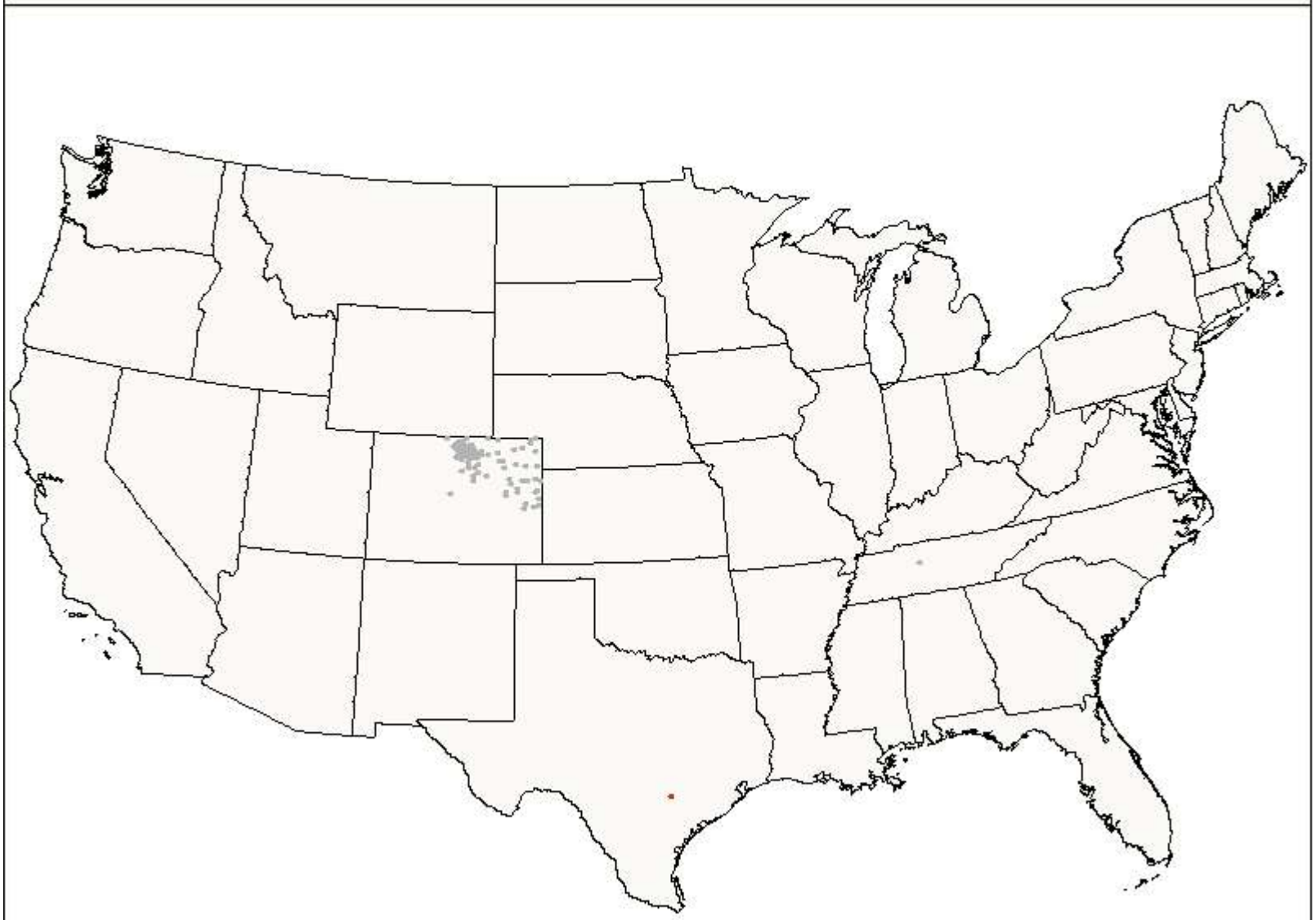
0.0 | Trace | 0.01 - 0.03 | 0.04 - 0.06 | 0.07 - 0.14 | 0.15 - 0.33 | 0.34 - 0.50 | 0.51 - 0.55

Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2000	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2000

0.0 | Trace | 0.01 - 0.02 | 0.03 - 0.04 | 0.05 - 0.10 | 0.11 - 0.24 | 0.25 - 0.36 | 0.37 - 0.40

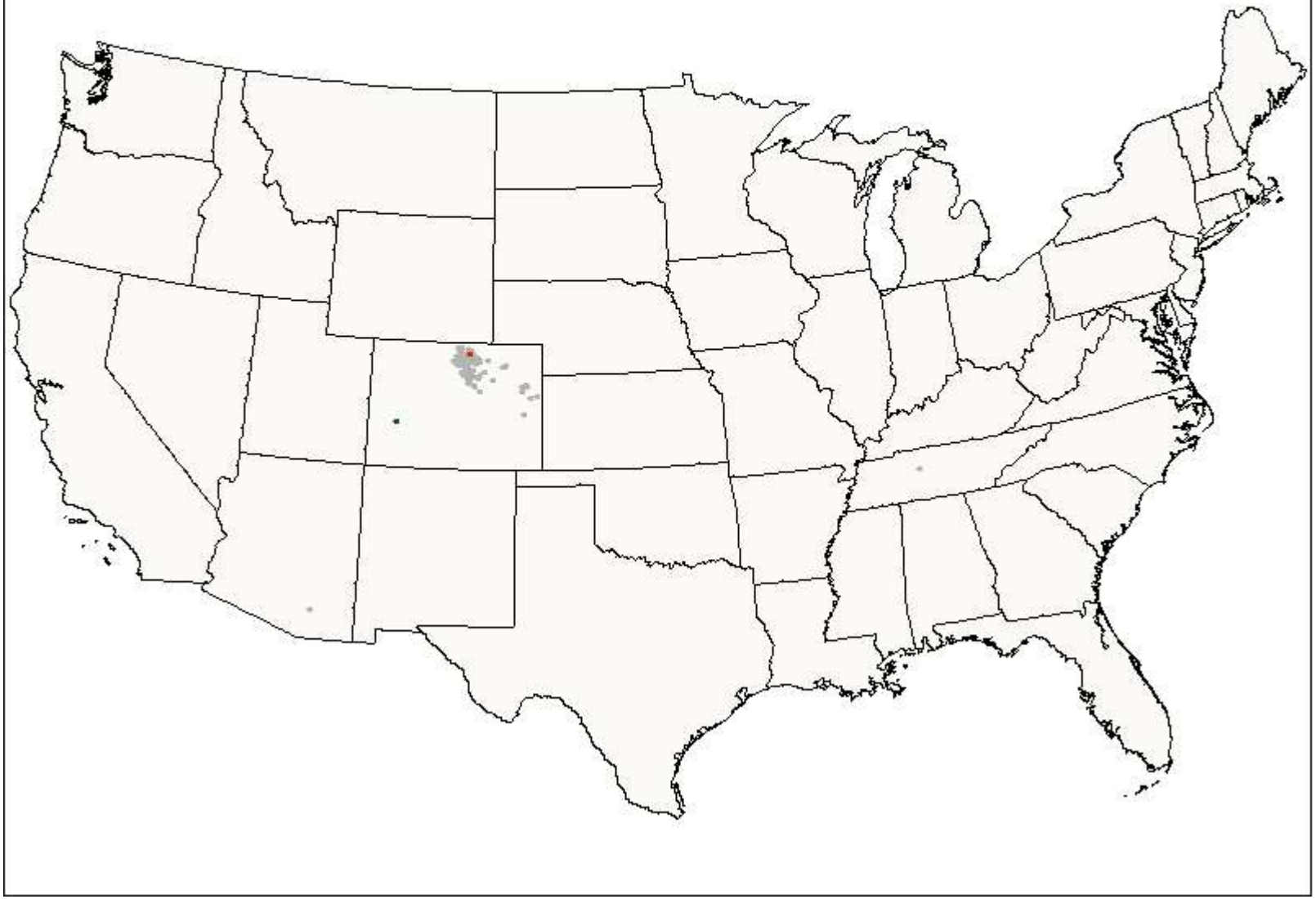


Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2001	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2001

0.0 Trace 0.01 - 0.01 0.02 - 0.02 0.03 - 0.05 0.06 - 0.12 0.13 - 0.18 0.19 - 0.21



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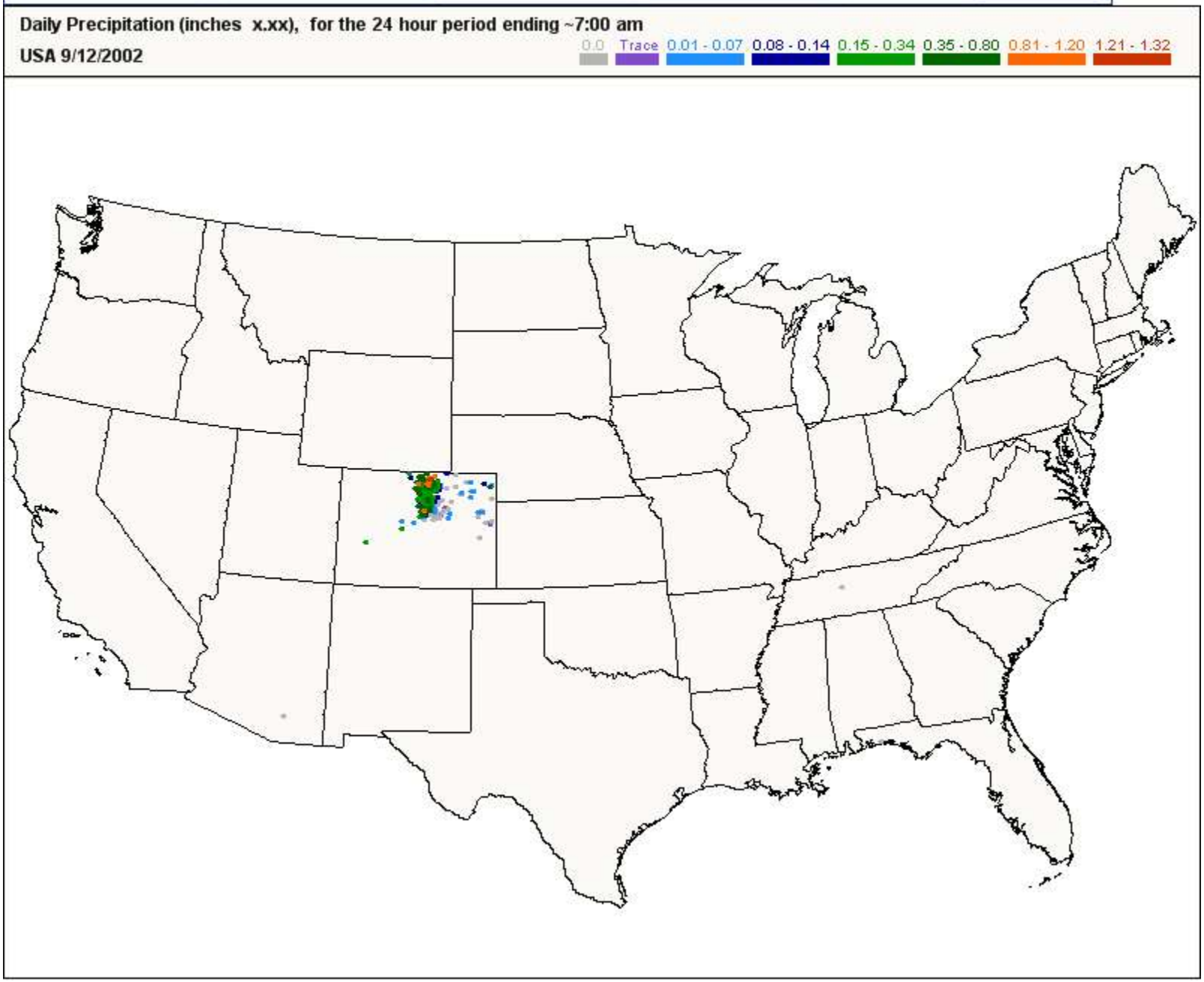

Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2003	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2003

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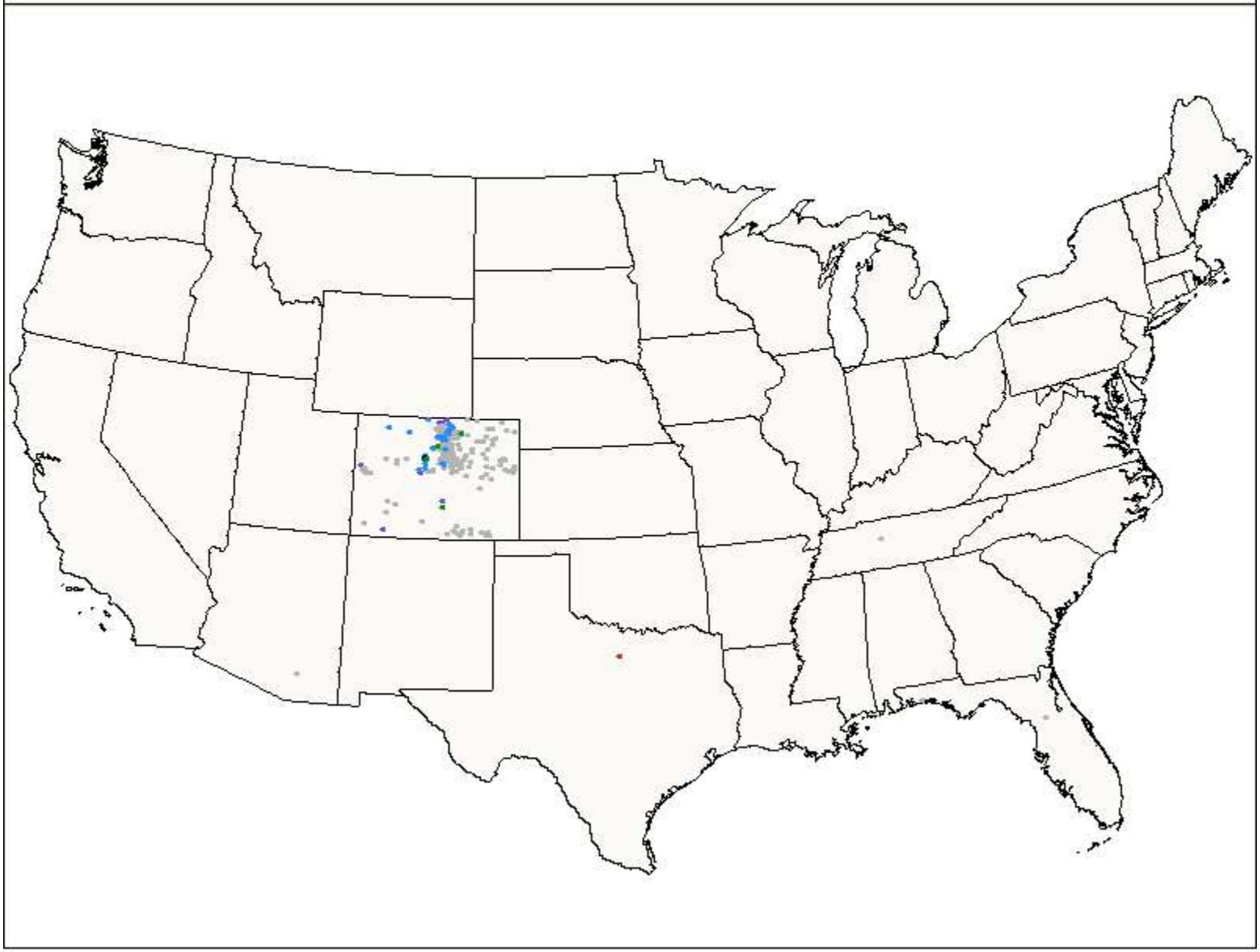
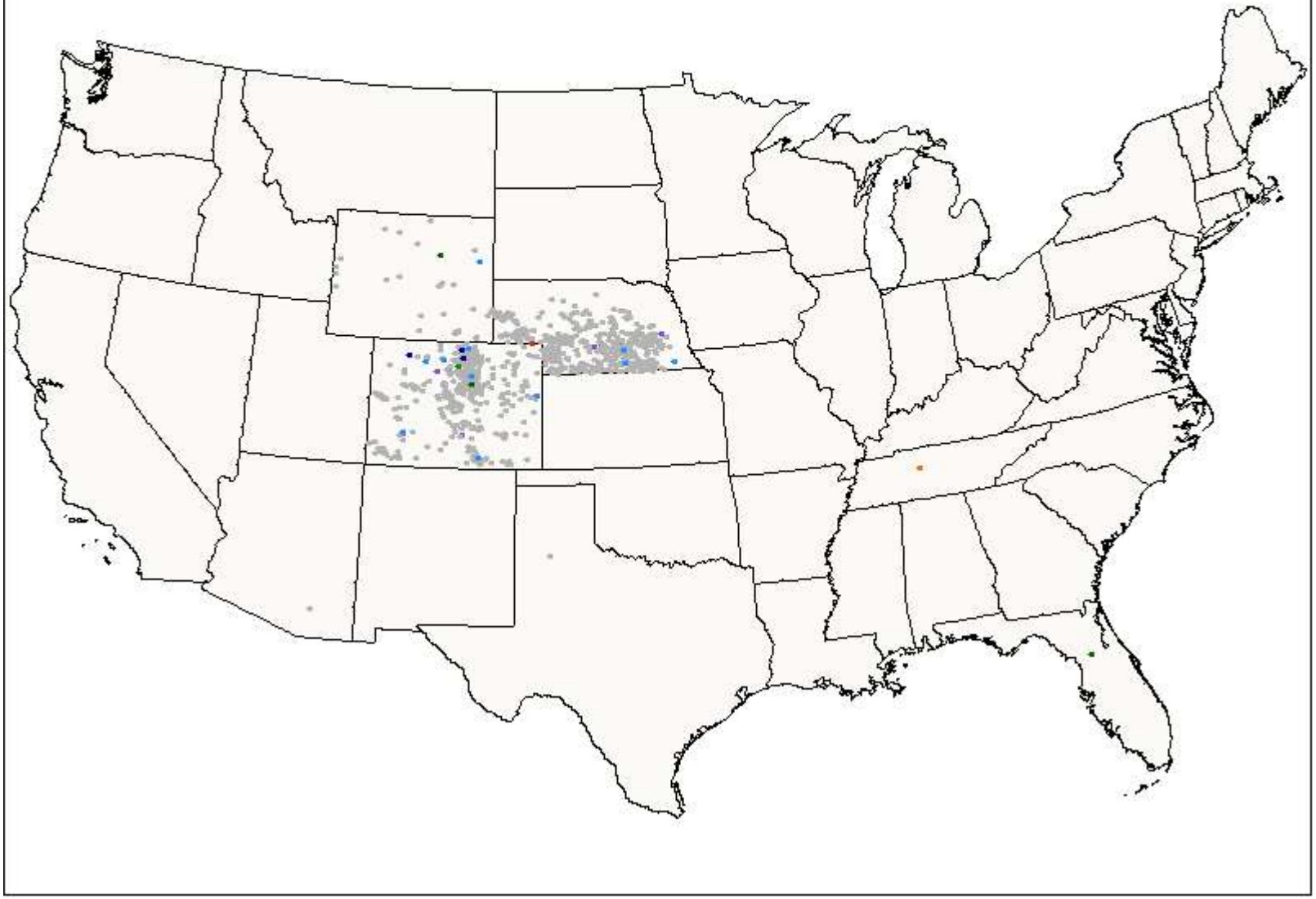


Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2004	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2004

0.0 Trace 0.01 - 0.03 0.04 - 0.06 0.07 - 0.16 0.17 - 0.40 0.41 - 0.60 0.61 - 0.68

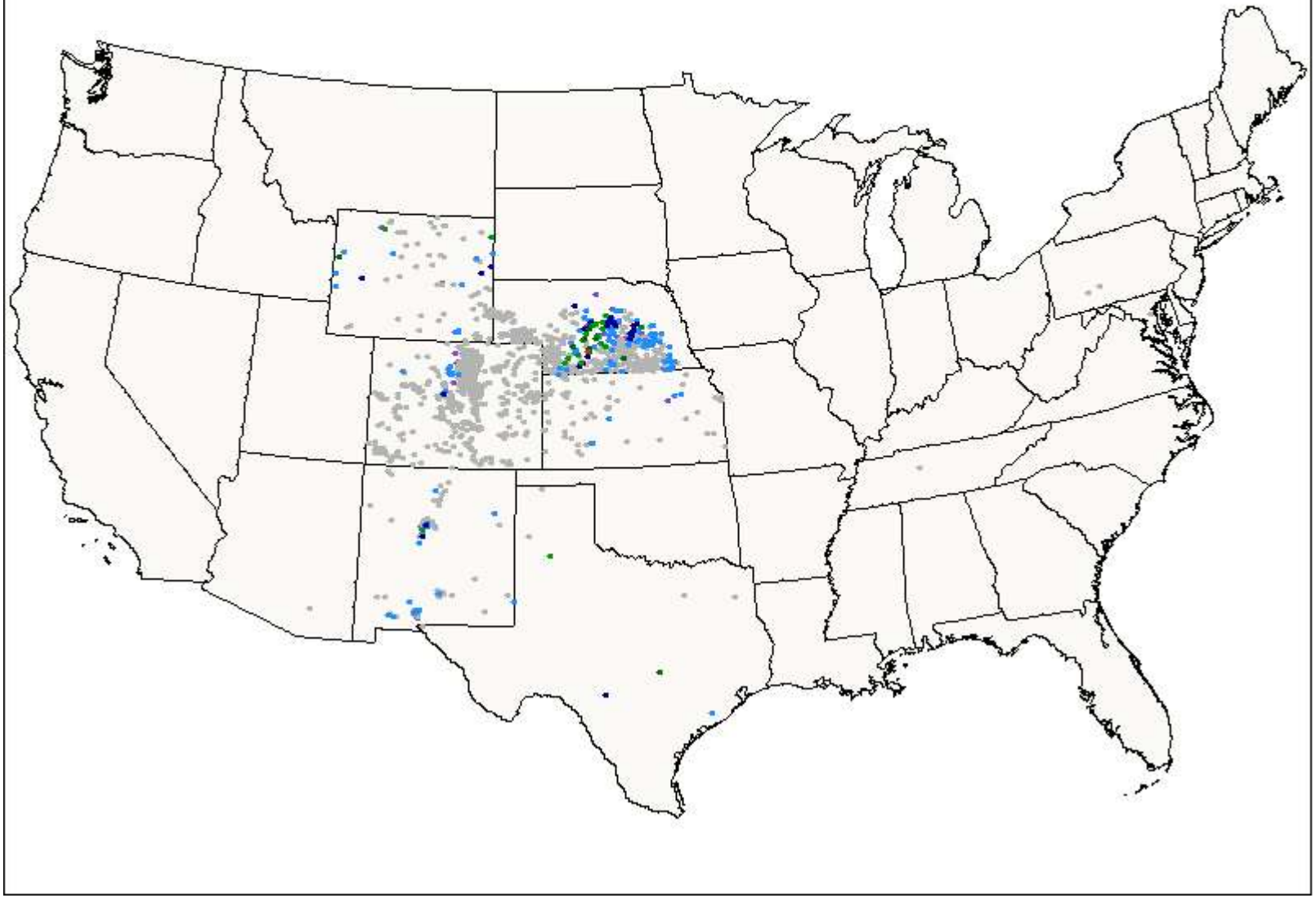


Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2005	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2005

0.0 Trace 0.01 - 0.08 0.09 - 0.16 0.17 - 0.40 0.41 - 0.95 0.96 - 1.42 1.43 - 1.58



Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2006	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2006

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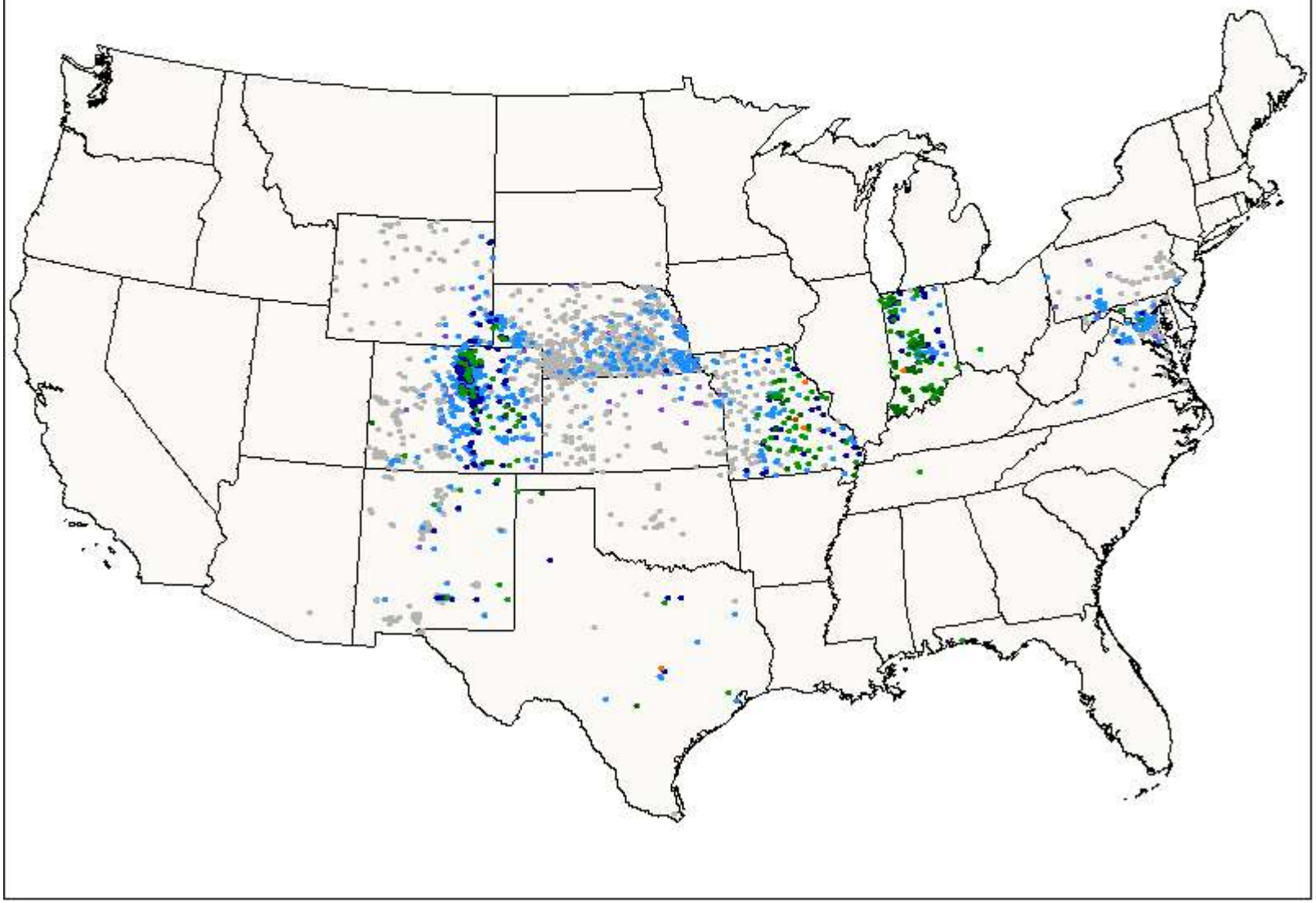

Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2007	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2007

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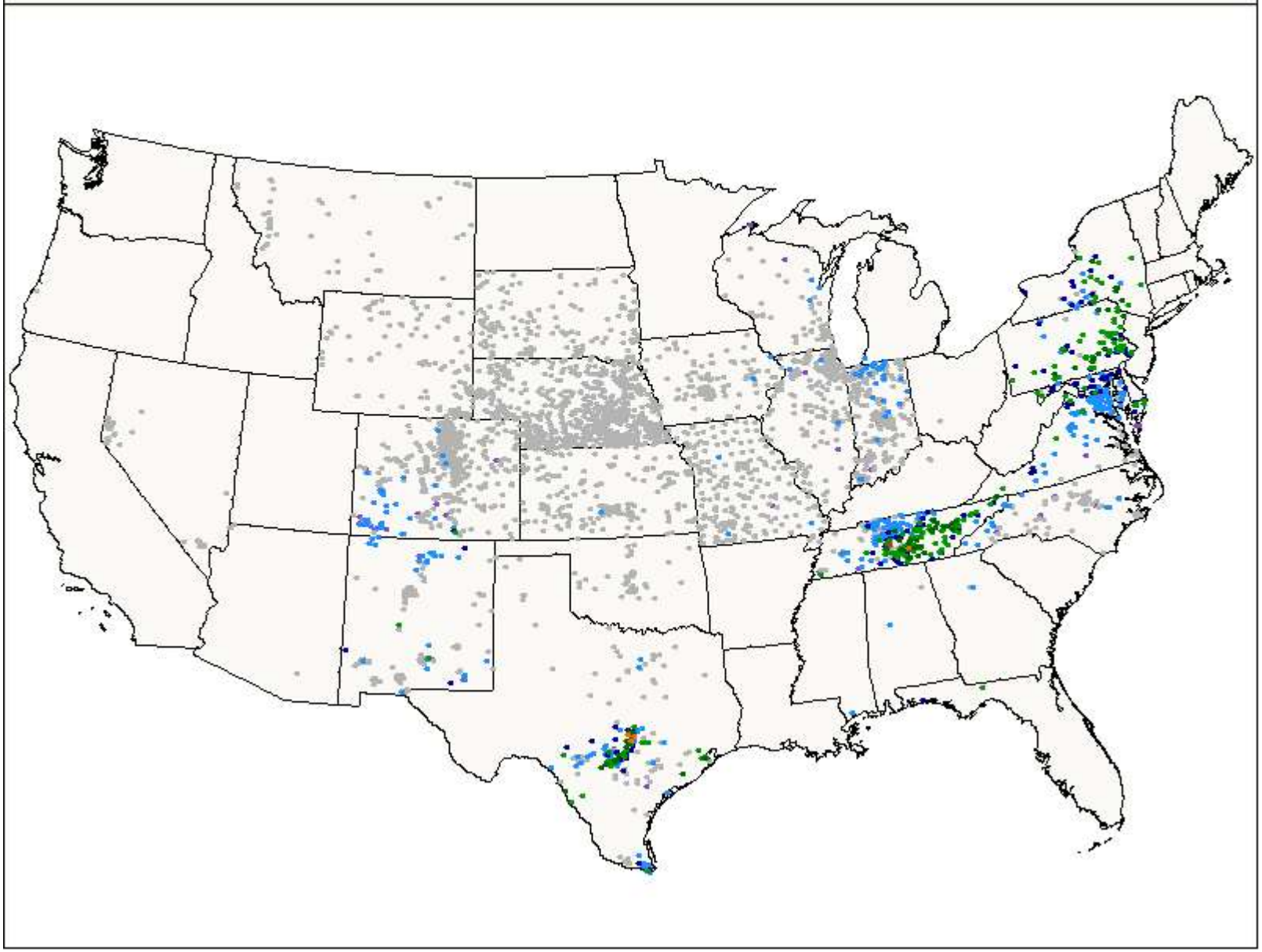
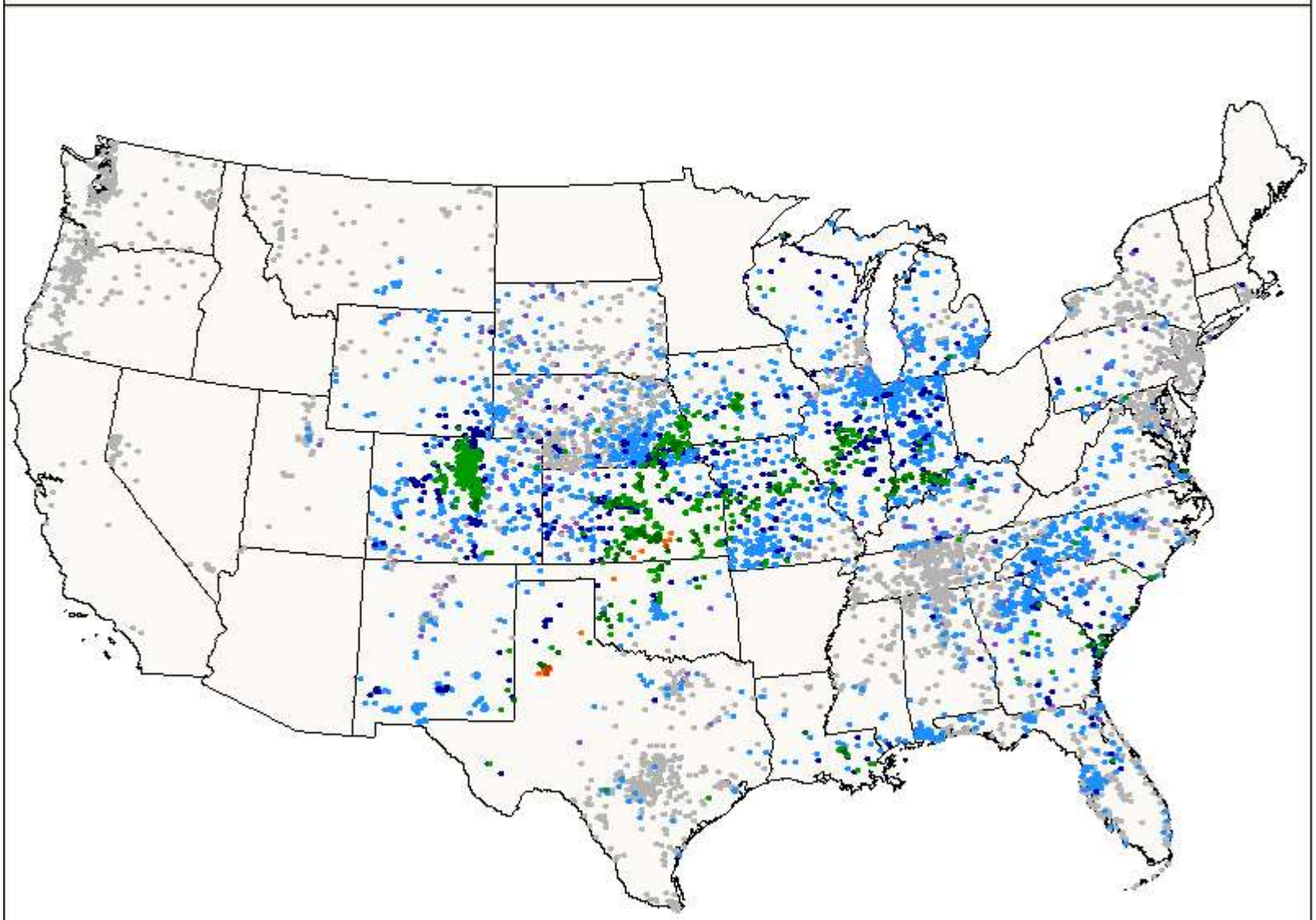


Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2008	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2008

0.0 | Trace | 0.01 - 0.41 | 0.42 - 0.82 | 0.83 - 2.05 | 2.06 - 4.92 | 4.93 - 7.38 | 7.39 - 8.21

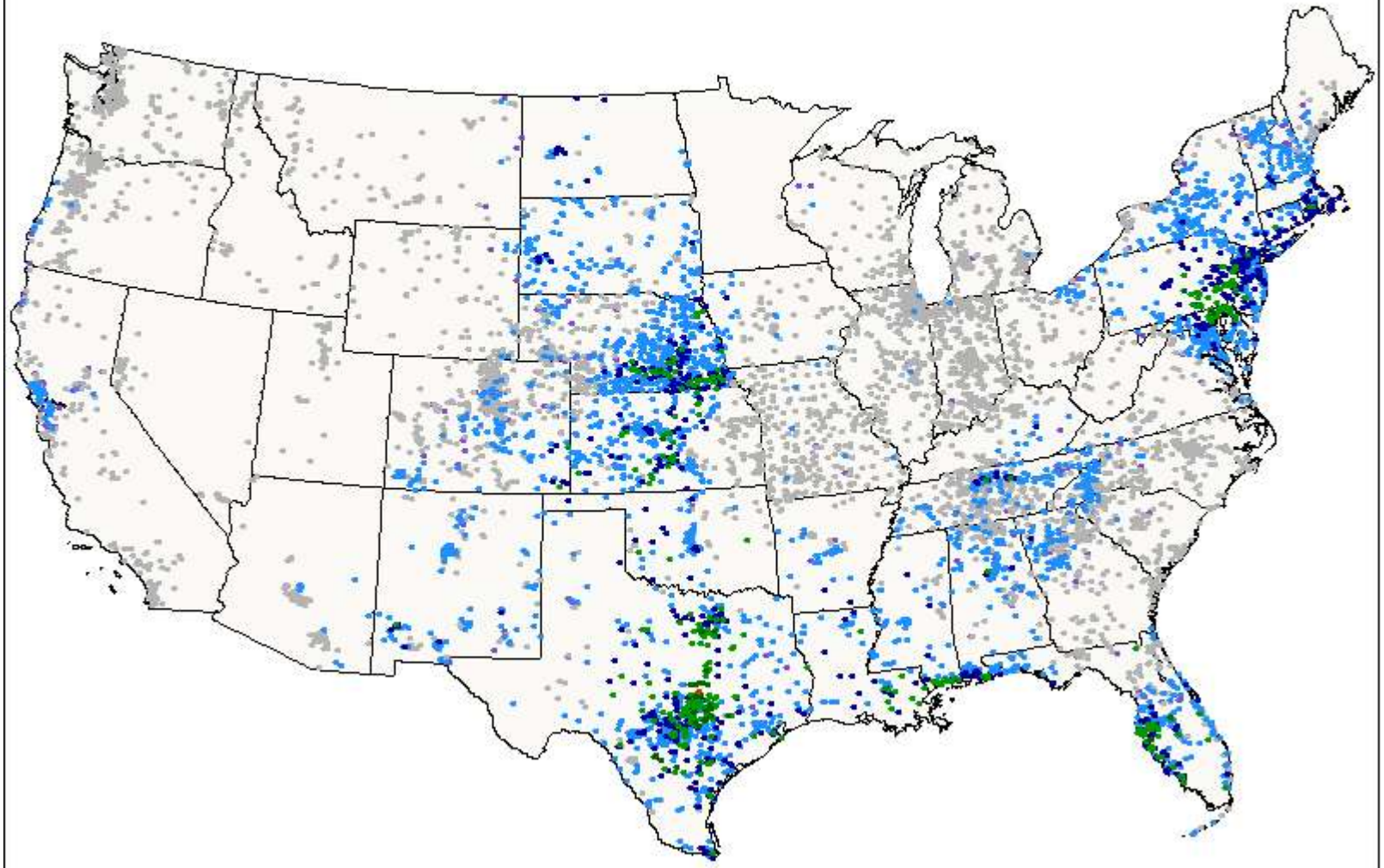


Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2009	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2009

0.0 Trace 0.01 - 0.72 0.73 - 1.44 1.45 - 3.59 3.60 - 8.61 8.62 - 12.91 12.92 - 14.33

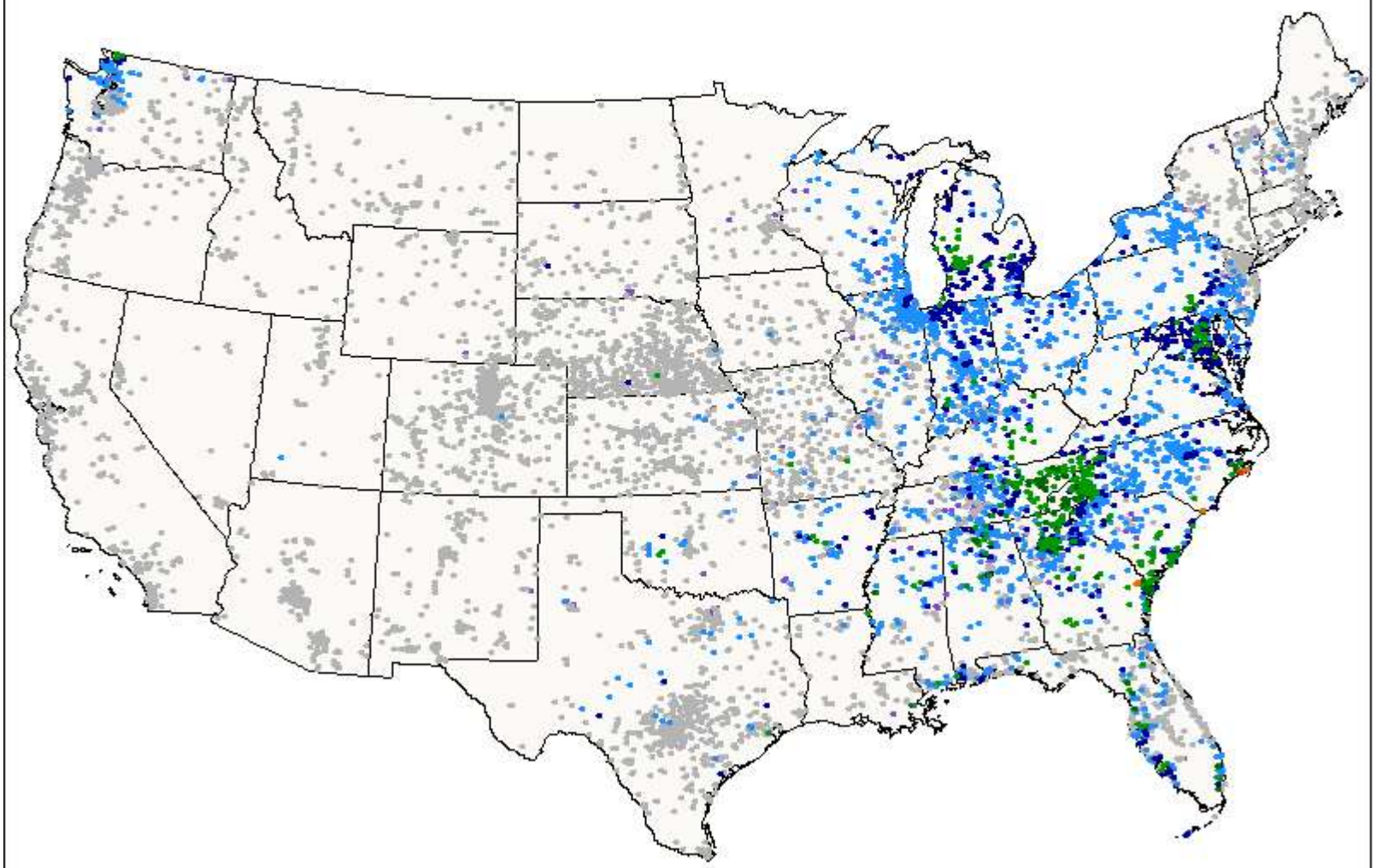


Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2010	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2010

0.0 | Trace | 0.01 - 0.30 | 0.31 - 0.60 | 0.61 - 1.50 | 1.51 - 3.59 | 3.60 - 5.38 | 5.39 - 5.98



Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2011	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2011

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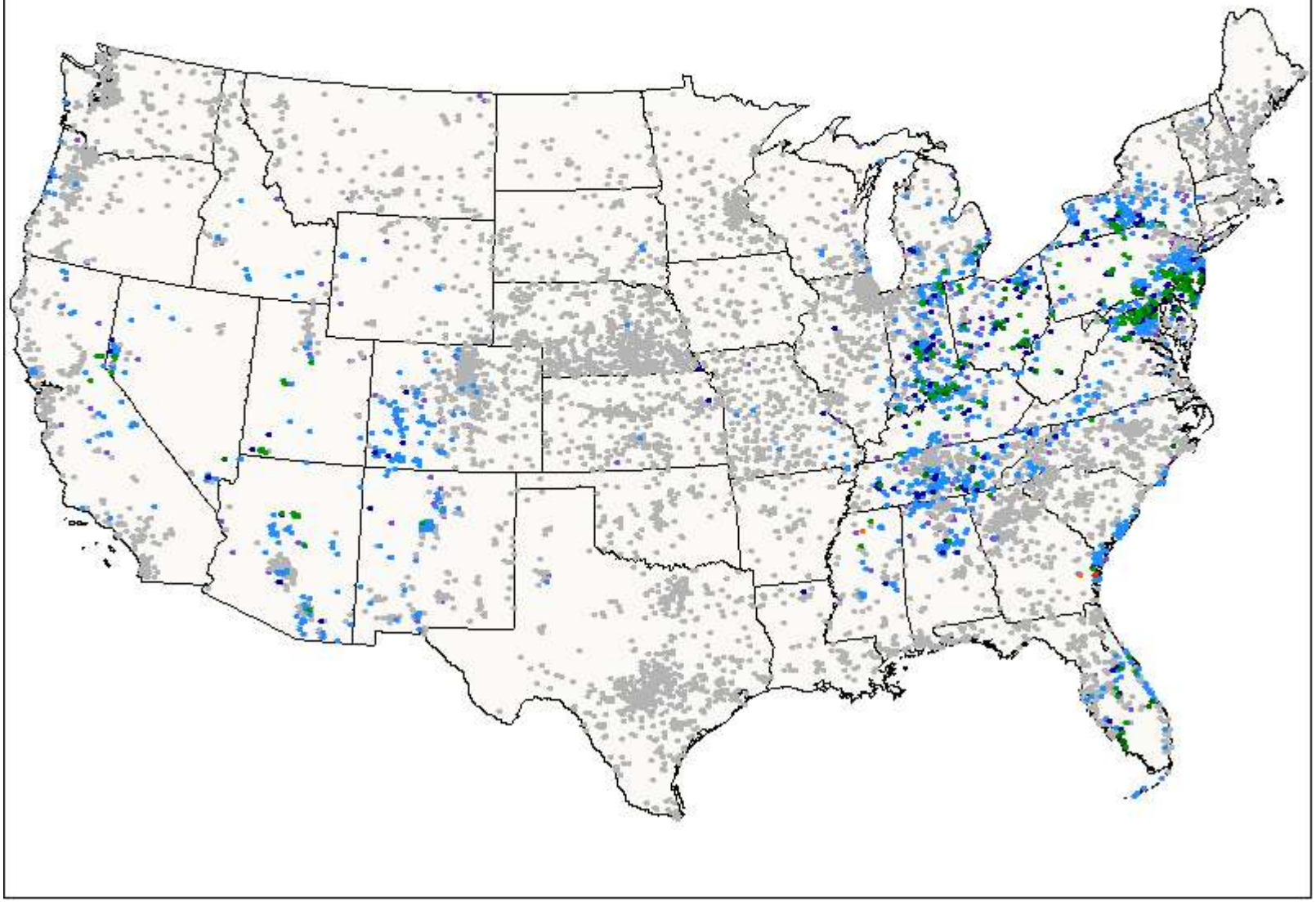

Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2012	Standard	Get Map

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 9/12/2012

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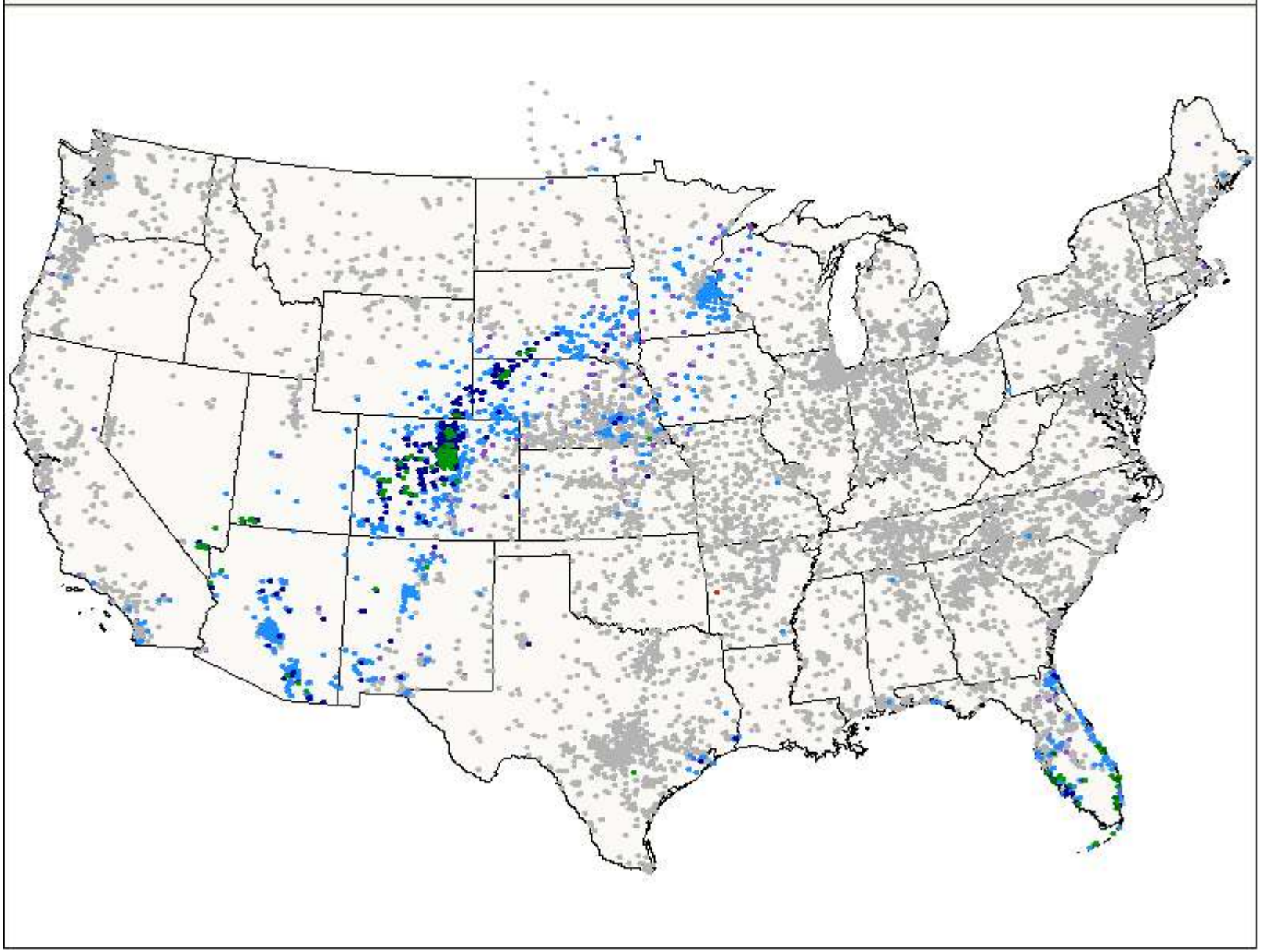
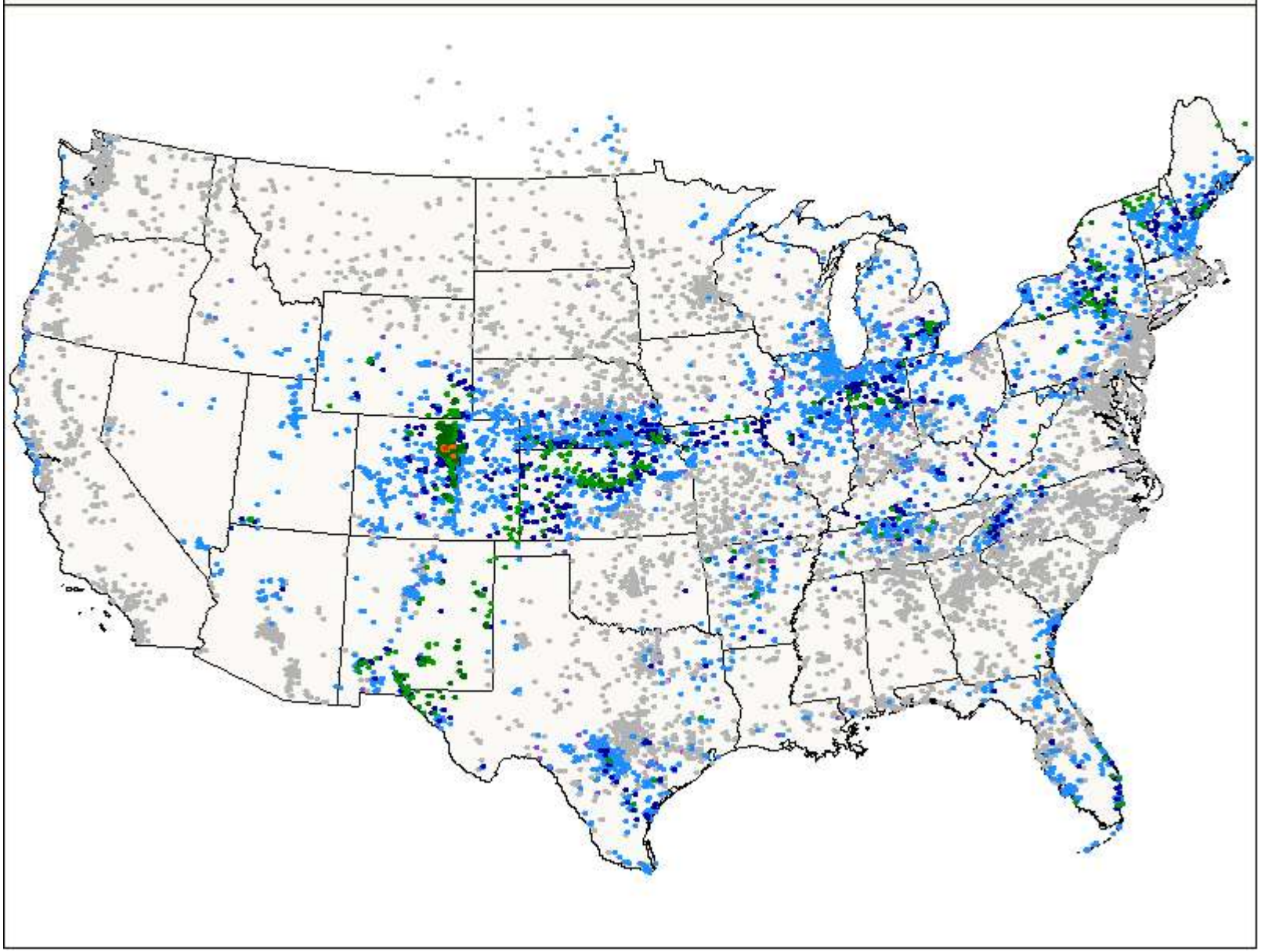


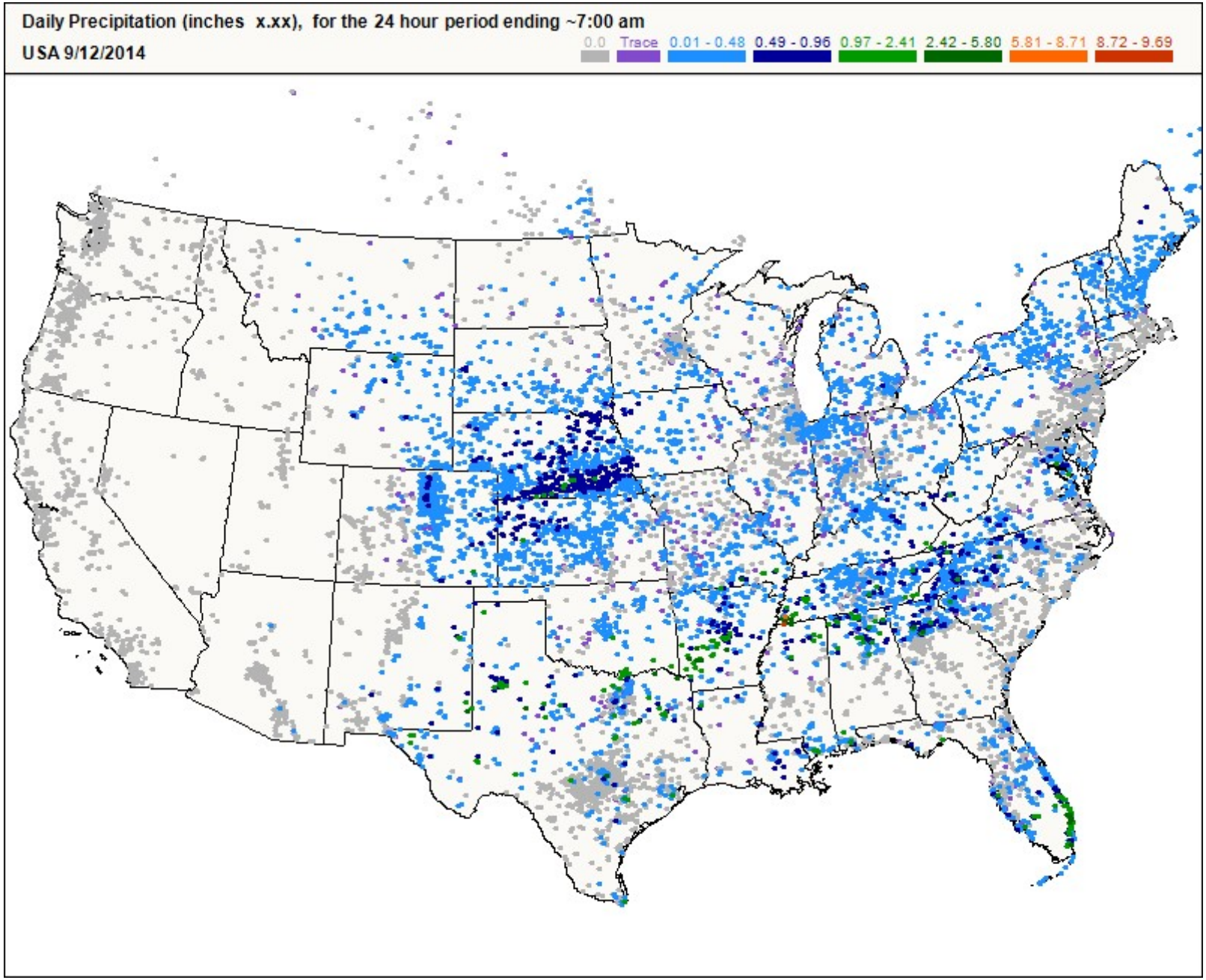
Map Type	Map Location		Date	Colors	
Precipitation	National	No State Selected	9/12/2013	Standard	Get Map

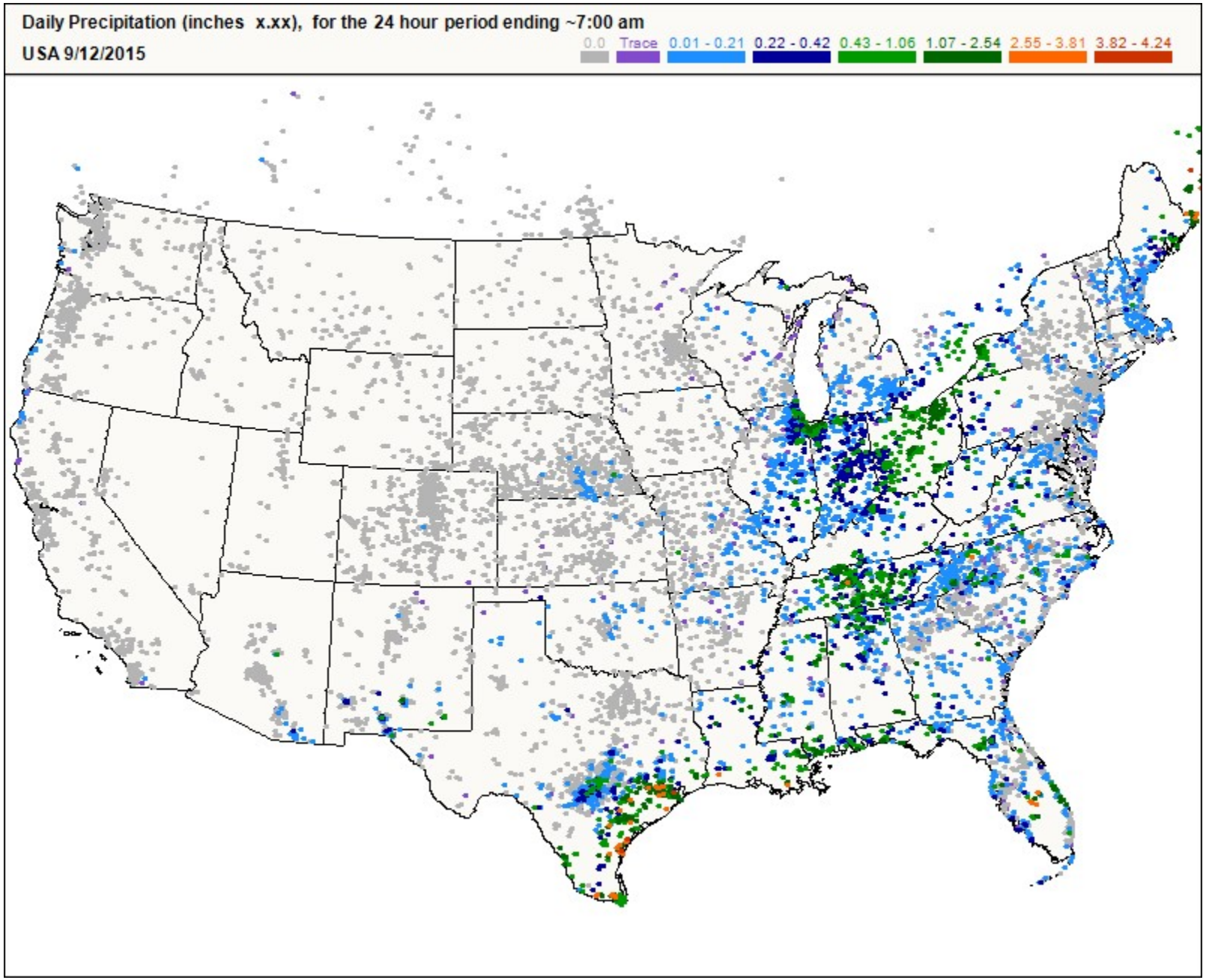
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

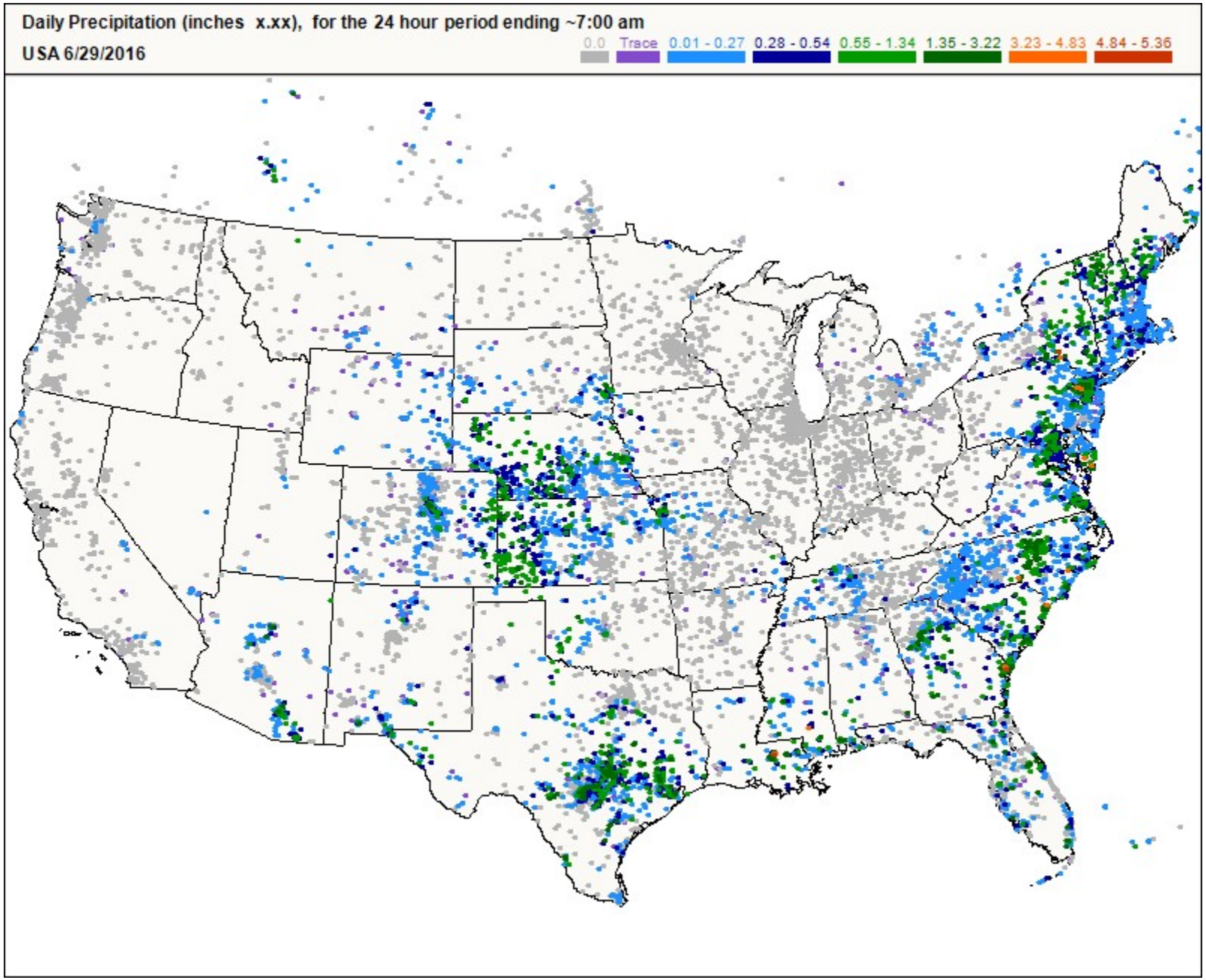
USA 9/12/2013

0.0 Trace 0.01 - 0.50 0.51 - 1.00 1.01 - 2.49 2.50 - 5.97 5.98 - 8.95 8.96 - 9.93




Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 9/12/2014
0.0
Trace
0.01 - 0.48
0.49 - 0.96
0.97 - 2.41
2.42 - 5.80
5.81 - 8.71
8.72 - 9.69


Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 9/12/2015
0.0
Trace
0.01 - 0.21
0.22 - 0.42
0.43 - 1.06
1.07 - 2.54
2.55 - 3.81
3.82 - 4.24


Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 6/29/2016
0.0
Trace
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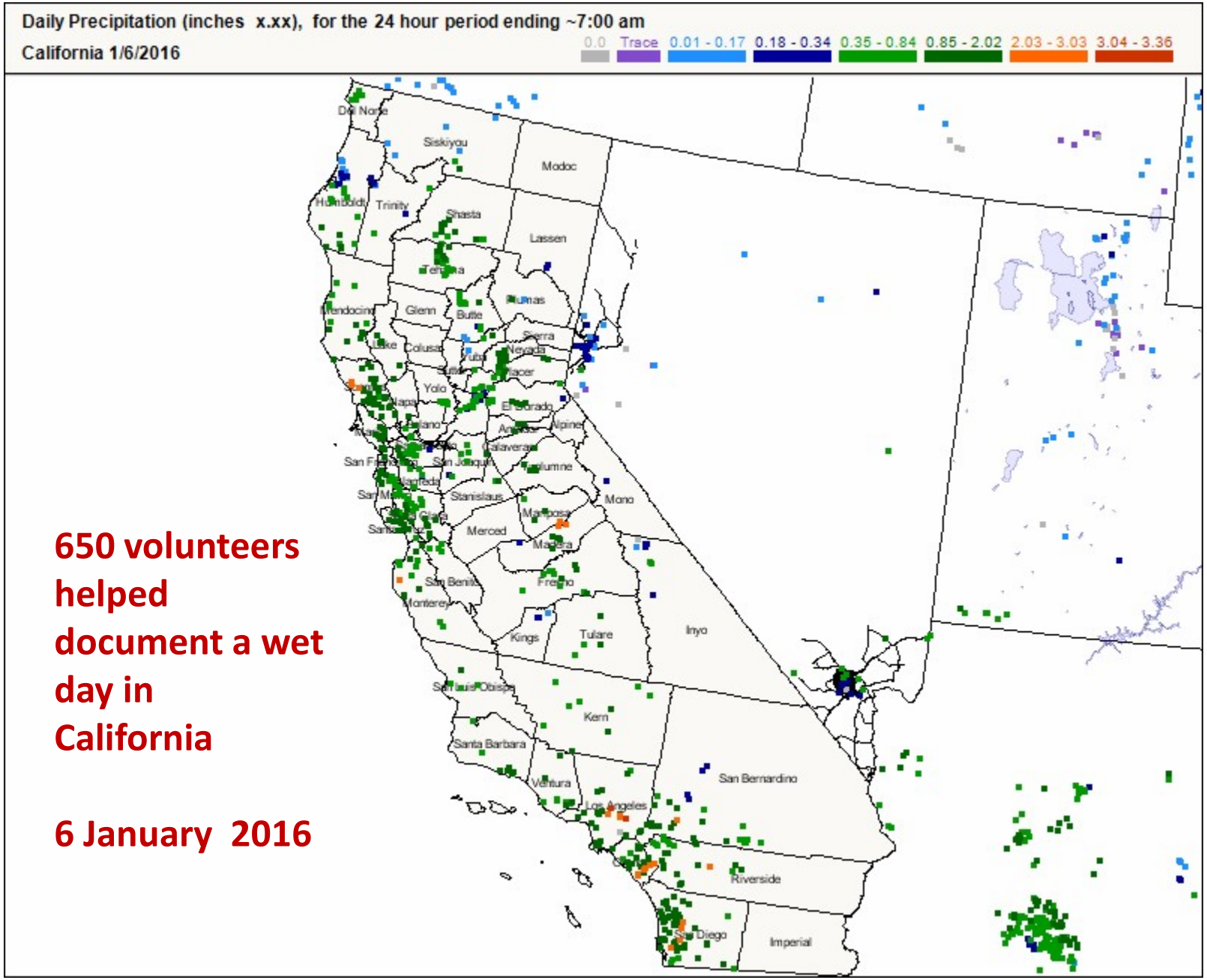
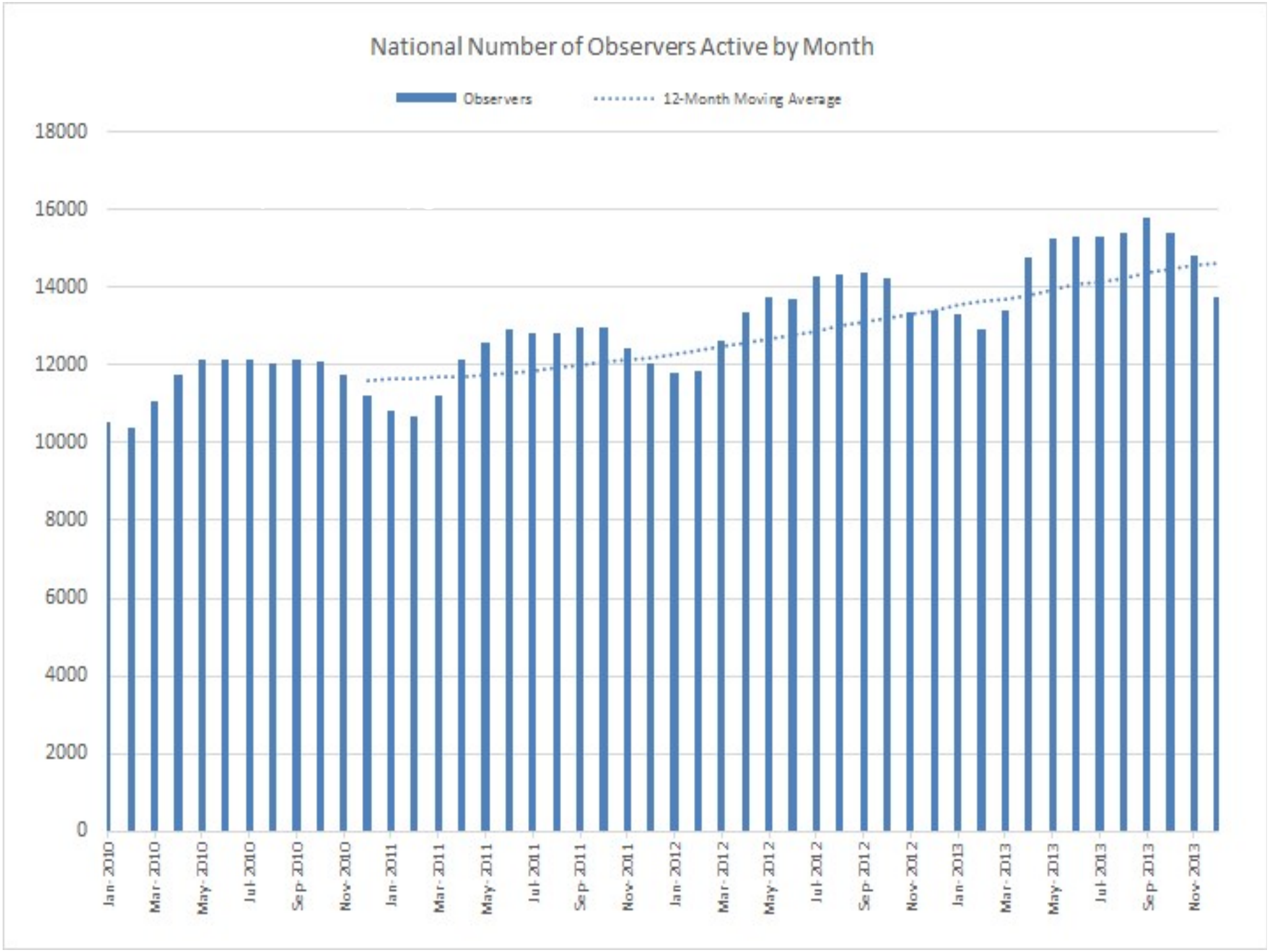
0.28 - 0.54
0.55 - 1.34
1.35 - 3.22
3.23 - 4.83
4.84 - 5.36



650 volunteers helped document a wet day in California

6 January 2016

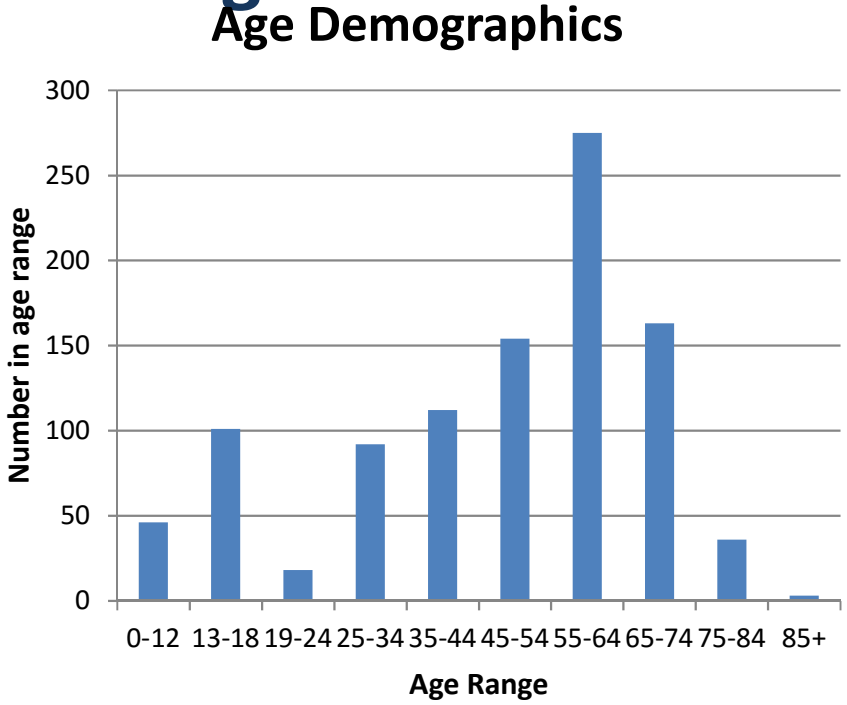

National Number of Observers Active by Month
Observers
12-Month Moving Average
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Jan-2010
Mar-2010
May-2010
Jul-2010
Sep-2010
Nov-2010
Jan-2011
Mar-2011
May-2011
Jul-2011
Sep-2011
Nov-2011
Jan-2012
Mar-2012
May-2012
Jul-2012
Sep-2012
Nov-2012
Jan-2013
Mar-2013
May-2013
Jul-2013
Sep-2013
Nov-2013

DEMOGRAPHICS

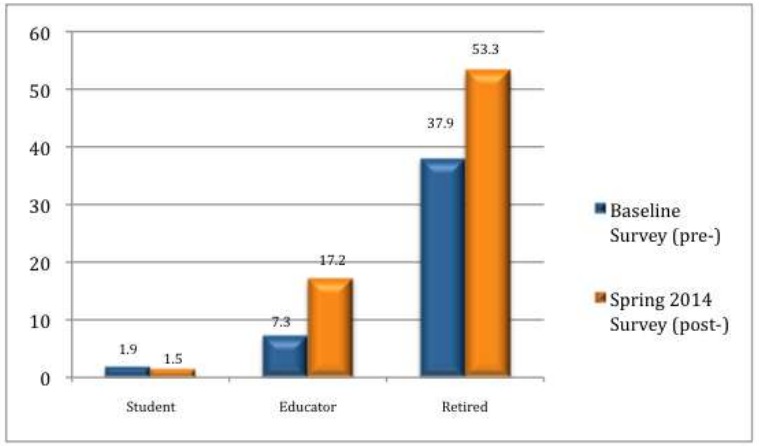
37% - under 45 years

42% - 45 – 65 years

21% - greater than 65



1,000 who registered for program



17% - educators

2% - students

Each point on the map is a person with a purpose

The keys to useful and usable data collection

-- instrumentation that is accurate and easy to use (low cost helps too)

-- understandable protocols, relevant uses

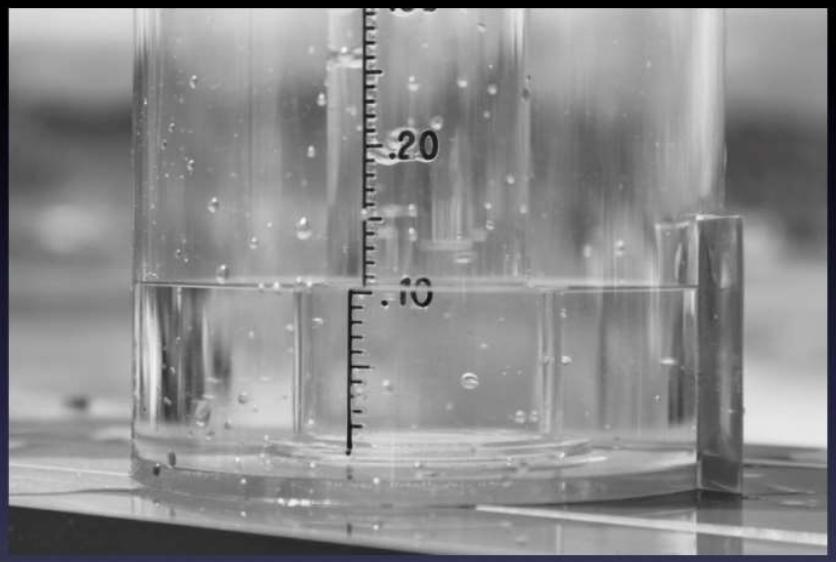
-- effective training

-- easy and satisfying data entry

-- data quickly accessible to view and share

Users that need the data help, too

Who uses CoCoRaHS Observations?



1. Weather Forecasters
2. Hydrologists
3. Water management
4. Researchers
5. Agriculture
6. Climatologists
7. Insurance Industry
8. Engineering
9. Recreation
10. Many others

*"CoCoRaHS is **CRITICAL** (my emphasis) to hazardous weather operations at the NWS Austin-San Antonio Weather Forecast Office. We utilize the daily precipitation reports to produce maps such as the one attached, which are used extensively by the media (directly shown on TV broadcasts), our emergency management partners (for briefing officials and planning search and recovery operations), and the general public."*

Jon Zeitler – *NWS Austin-San Antonio Weather Forecast Office*

CoCoRaHS Emphasizes Training

-- in person face-to-face when possible

-- versatile options for on-line training, too

Training Animations

CoCoRaHS Training Videos

Getting Started with CoCoRaHS - The Basics of ...

Measuring Hail

CoCoRaHS HQ

How to Measure Extreme Rainfall

Training Slide Shows

Click on one of the CoCoRaHS Training Slide-Shows below to view as HTML or download as PDF.

HTML PDF

HTML PDF

HTML PDF

HTML PDF

HTML PDF

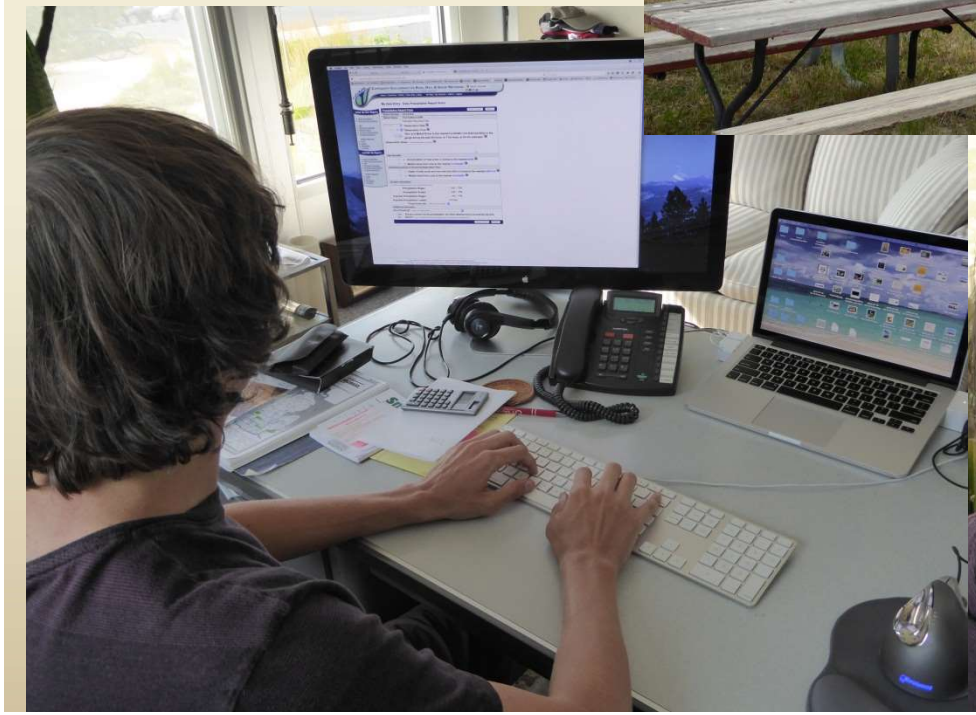
+ Live and archived Webinars


CoCoRaHS
Community Collaborative Rain, Hail & Snow Network

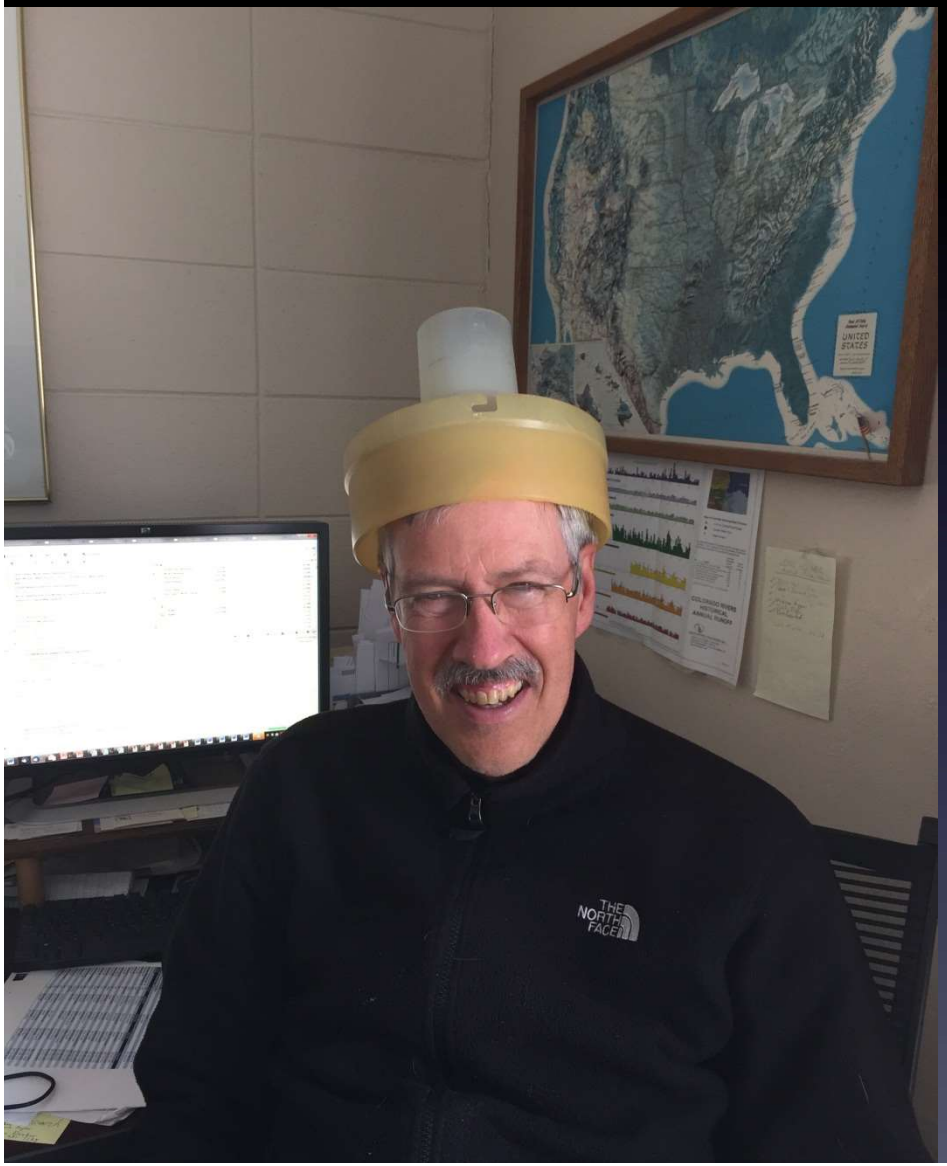
The Process:

-- Observe
-- Report
-- Review
-- Assess

-- Repeat



Staying on Top of our Data Collection



We Make Use of:

- Daily reminder messages
- Social Media
- Regular e-mail updates
- Wide dissemination of data and products
- A friendly “help desk”

Message of the Day

Message of the Day: CoCoRaHS Blog | Go to end of message

How is your garden growing this summer? Check out the CoCoRaHS "Climate Resources Guide for Master Gardeners"!

CoCoRaHS has an on-line guide for our master gardeners out there, but you don't have to be a Master Gardener to learn some great info about climate and gardening. The HTML version of this **guide**, introduces elements of large scale and local climate important to gardeners. An overview of climate patterns and differences are shown. Links to local climate information are provided. Topics include: Climate & Gardening, Sunshine, Temperature, Humidity and Dew Point, Precipitation, Wind, Evapotranspiration, Climate Resources, Climate Change and CoCoRaHS.

We hope that you'll take a look at it, use it for your own gardening needs and pass along the URL link to other gardeners you know who may be interested in gaining a better understanding of climate and how climate might effect their local gardening efforts . . . and when you have a few ripe tomatoes on the vine, send Nolan an email and he'll be right over to try them out!

The Catch

NOLAN DOESKEN'S MONTHLY COCORAHS E-MAIL MESSAGE

CoCoRaHS -- Summertime When the...Weather is Easy?

Fort Collins, Colorado -- July 1st, 2016

Greetings and happy summer to you all,

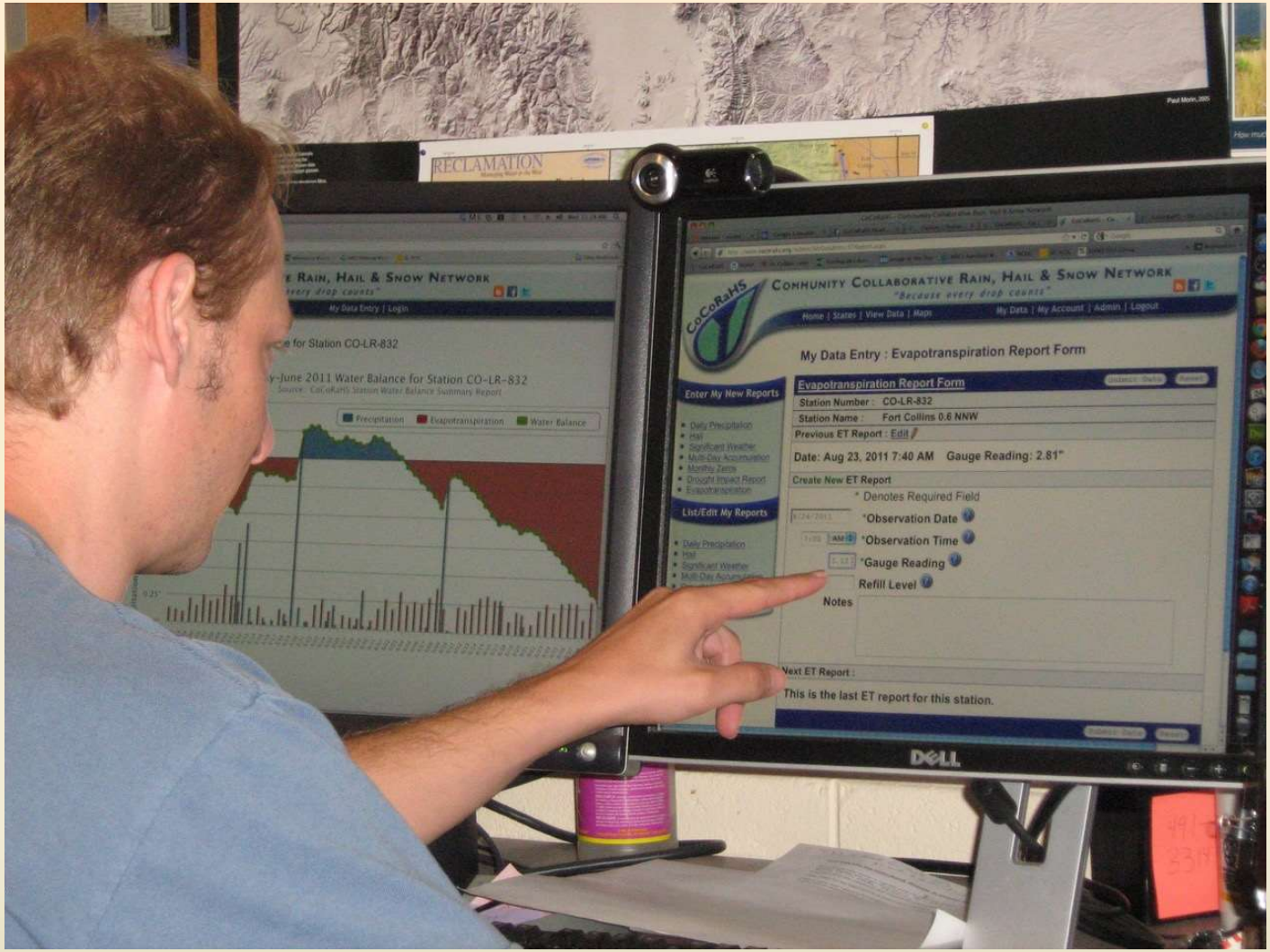
Happy July, everyone! As we move into mid summer, we are in the time of year where, with the exception of much of California and some of the Pacific NW, thunderstorm downpours are most prolific. It is also the time where rainfall can be most dramatically localized -- with flash flooding in one part of town and possibly dry elsewhere. As I mentioned in my note two weeks ago, this was the situation that motivated CoCoRaHS to be born -- out of an extreme, but highly localized flash flood here in Colorado in the late 1990's.

Why We Do CoCoRaHS

It is now that time of year, so I ask you to be on your toes. Situations like that are repeated every summer. These next several weeks are the time of year when the atmosphere can carry more water vapor than any other time of year. This is because "precipitable water" -- the total depth of water that could be condensed out of a column of air directly overhead -- is limited by temperature. The warmer it is, the more water the atmosphere can hold, and this is non linear. Increasing the temperature of the air 2 degrees F increases the moisture-holding capacity by about 7%. Ocean waters also continue to warm so that vast water vapor resources lurk nearby over the warm waters of the Gulf of Mexico and the warming Atlantic. (Remember, the dry summers on

Social Media

facebook



Noah -- a friendly face and cheerful voice to personally answer questions

We take data quality very seriously

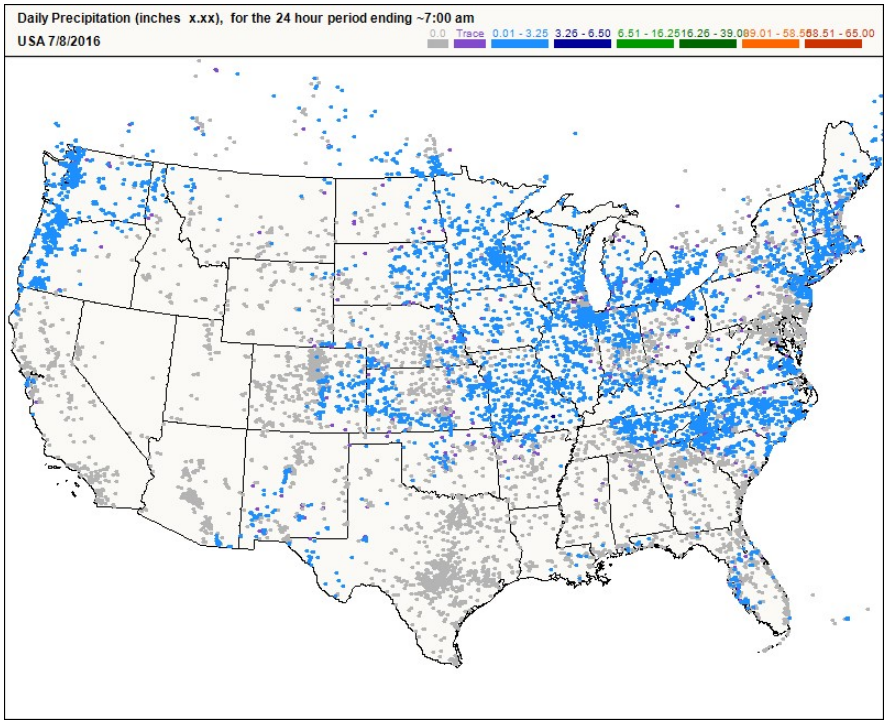
- But we also accept new volunteers every day – some who are 8 years old or younger, or 90 and older -- so mistakes are made
- Then we make a game

out of catching and

fixing them

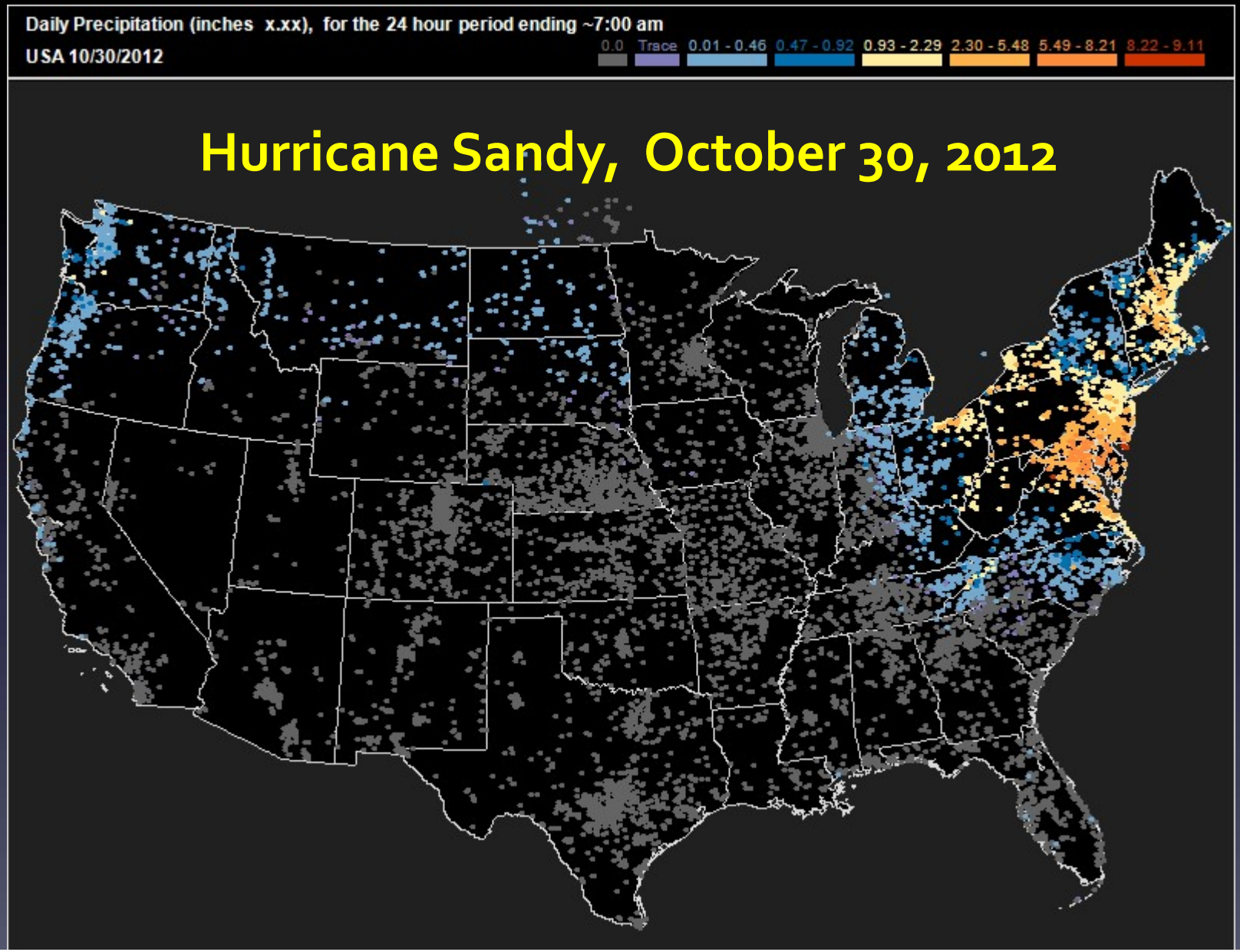
-- We also hire a

“QC Intern”




Some of our team of State CoCoRaHS Volunteer Coordinators

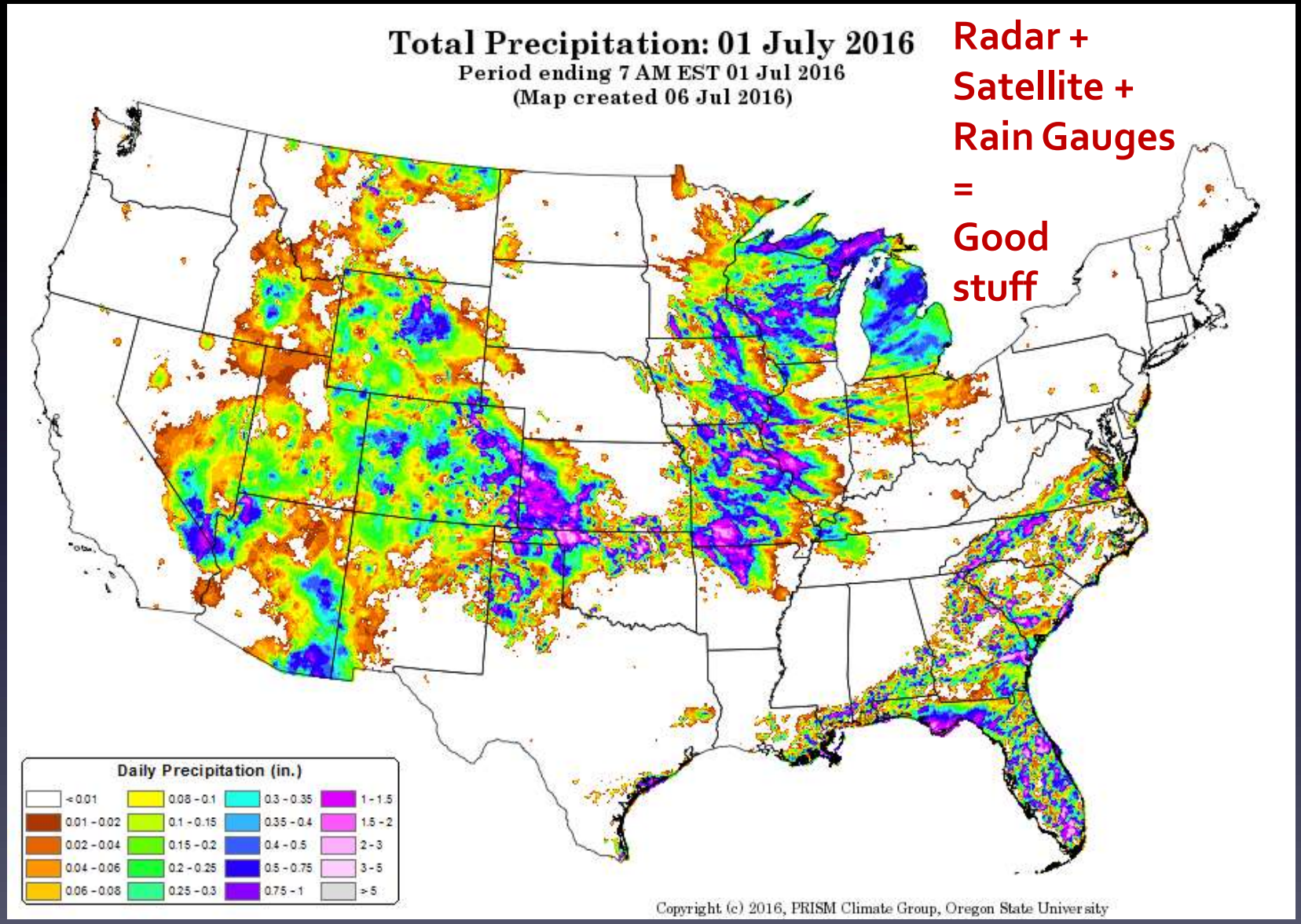
It's work, but it's worth it



Each measurement alone may or may not be interesting, but together they paint a picture that is new, different and valuable every day

Missouri River Flood spring 2011

Integration with Technology



And then there is snow

To Grill or not to Grill,

That is the question

- Maybe not a good time


Where’s the Weber ?

Nice to look at, but hard to measure

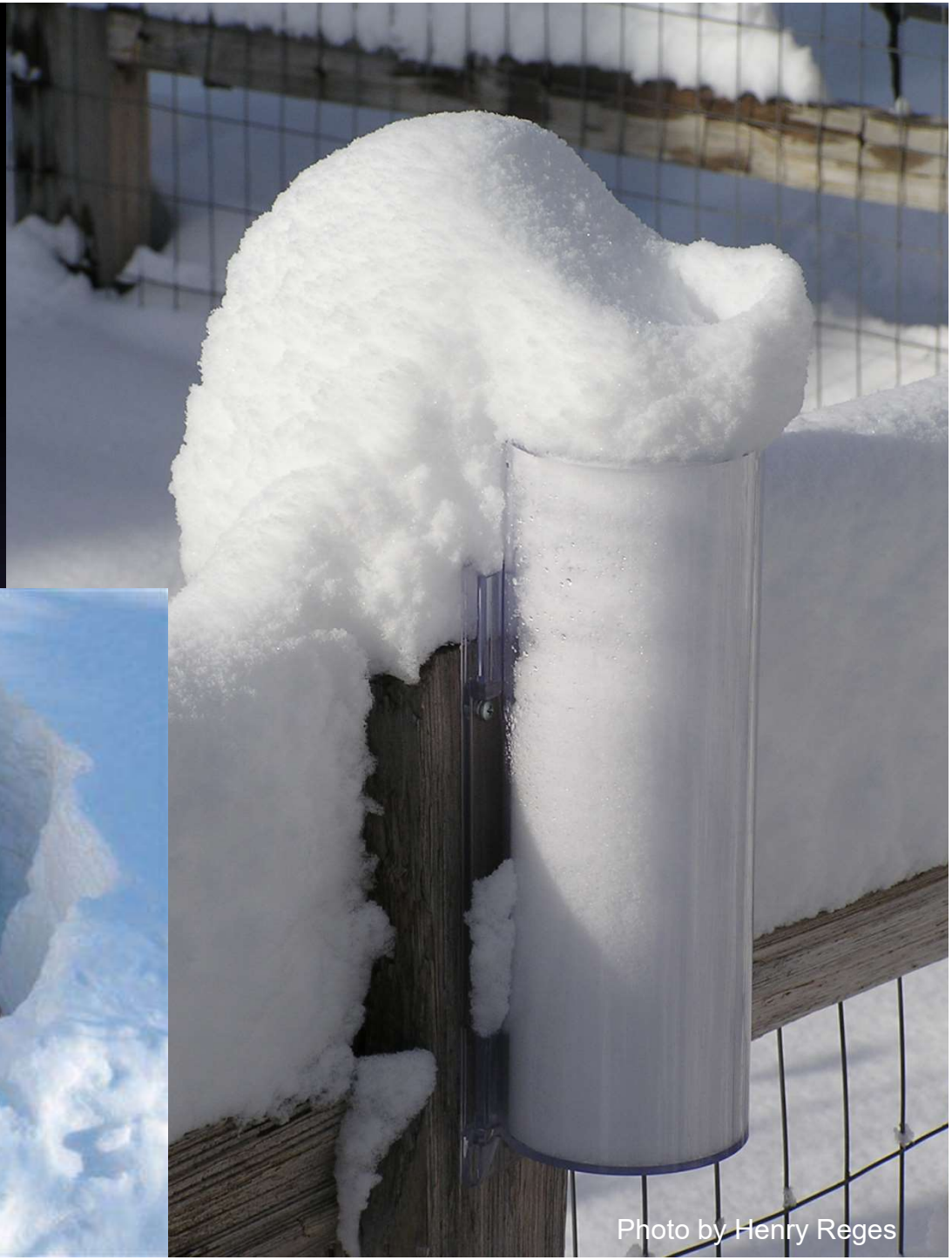
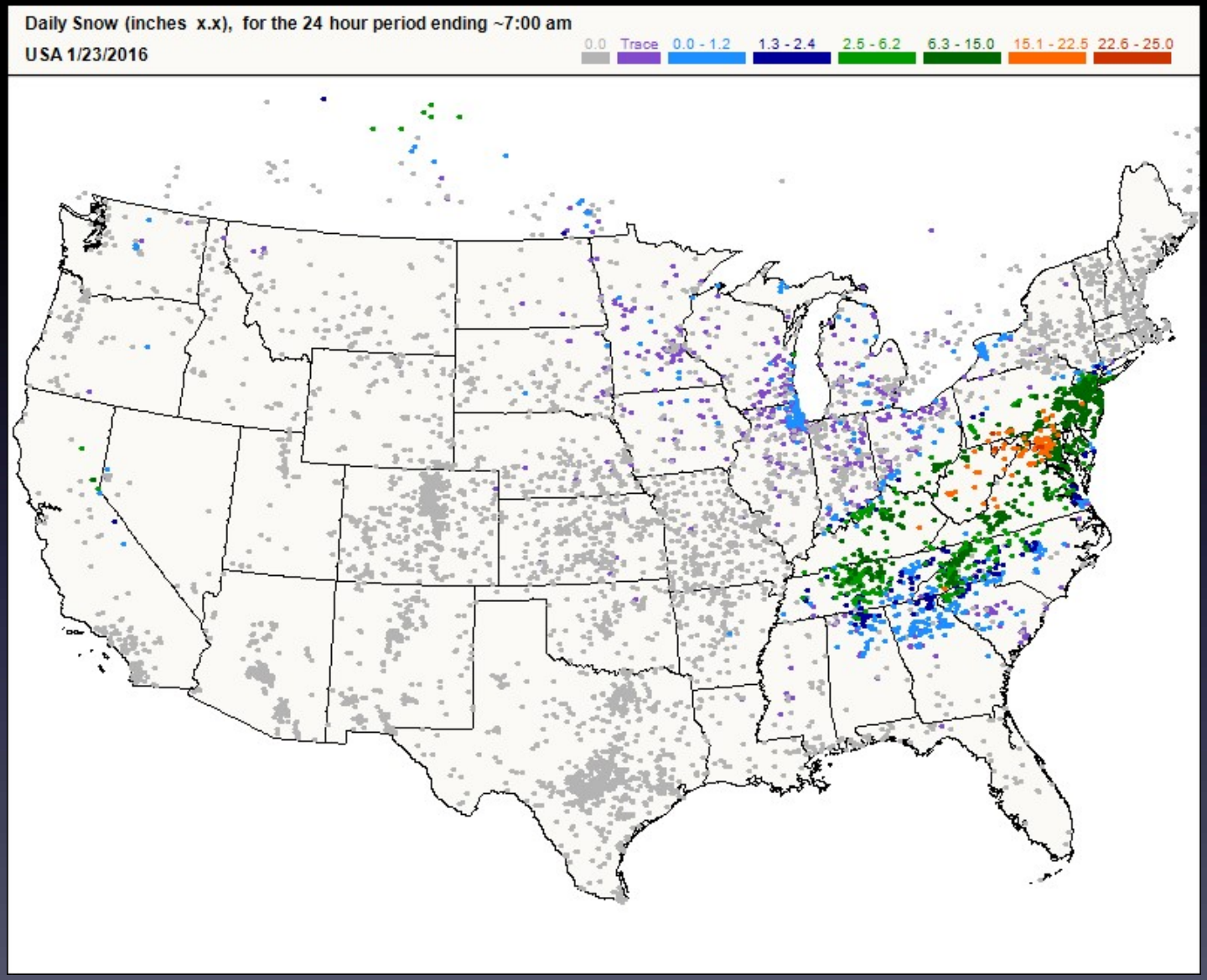


Photo by Henry Reges

CoCo RaHS Gauge
March 2003 Snowstorm

Arapahoe County CoCo RaHS observer near Cherry Creek, Colorado

The Big DC snowstorm of January 23, 2016



CoCoRaHS Comradery

- Here is my outline for our August panel at the 2016 National Environmental Monitoring Conference (NEMC)
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- 1) Short intro to CoCoRaHS -- a local flood disaster in 1997 showed the limitations of technology and the opportunities for citizen participation to help map, track and forecast storms -- How CoCoRaHS was born
- 2) When and how we grew to become an international project (Will simply show one daily precipitation map for the same date each year from 1998 - 2016 to show the growth (this will only take a minute or two to show the evolution -- as I do, I'll describe the behind the scenes actions and financial support that made the growth possible.
- 3) Maybe a graph of our participant numbers and age demographics of our active volunteers
- 4) A picture of some of our volunteers and their rain gauges in action
- 5) Training our volunteers (will show photo of classroom training, and then show screen shots of some of our online training materials -- but will end with, if possible, an example of one of our 2-minute training cartoon animations that we heavily rely on.)
- 6) Short sequence of data collection in action -- a volunteer checking their rain gauge, then entering their report, then looking at their data on the CoCoRaHS maps and reports
- 7) How we keep on top of this data collection effort
  -- always training, always communicating.
- -- daily reminders "Message of the Day"
- -- monthly e-newsletters "The Catch"
- -- social media
- -- The CoCoRaHS help desk investment
- -- Data Quality Control (part time meteorological intern that spends several hours each day looking for errors, confirming/editing, communcating) Our data are used because our data are good, Our data are good, because our data are used.
- -- our amazing team of "volunteer coordinators" (Show pictures of WERA 1012 attendees)
- -- funding
-
- 8) Why is it worth it?
- -- accurate measurements of precipitation, especially winter precipitation, are surprisingly lacking. Automation is rampant and automated data available, but the accuracy and reliability of these data, including much of our federally collected data, is inferior.
- -- Integration with technology (Where the rubber meats the road) Show maps of national precip from PRISM and from MSPE
- -- Wonderful relationship (friends wherever we go -- both public and professional) -- include photos from volunteers in Canada, Bahamas
-
- 9) End with a few good photos and examples.
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Join Us! Tell others!

We need many more observers

http://www.cocorahs.org

Support for this project provided by NSF, NOAA Environmental Literacy Program and *many* local charter sponsors.