

Climate Monitoring, Climate Research, and Climate Services for Colorado

Russ Schumacher

Colorado State Climatologist

Colorado Climate Center

Department of Atmospheric Science, Colorado State University

Along with: Becky Bolinger, Noah Newman, Zach Schwalbe, Julian Turner, Peter Goble,
Henry Reges, Dani Talmadge, and Nolan Doesken



ATMOSPHERIC SCIENCE
COLORADO STATE UNIVERSITY



COLORADO CLIMATE CENTER

Providing information and expertise on Colorado's complex climate

Denver-Boulder AMS meeting
28 February 2019



Colorado State University

Brief history of the CCC

- Until 1973, the federal government operated a “state climatologist” program – but in 1973 this was abolished
- Later that same year, Colorado established the Colorado Climate Center at CSU with support through the Colorado Agricultural Experiment Station





Previous state climatologists

Tom McKee, 1974-2000

Nolan Doesken, 2006-2017
(Assistant State Climatologist, 1977-2006)



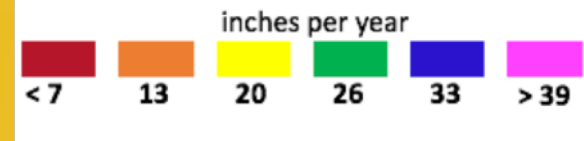
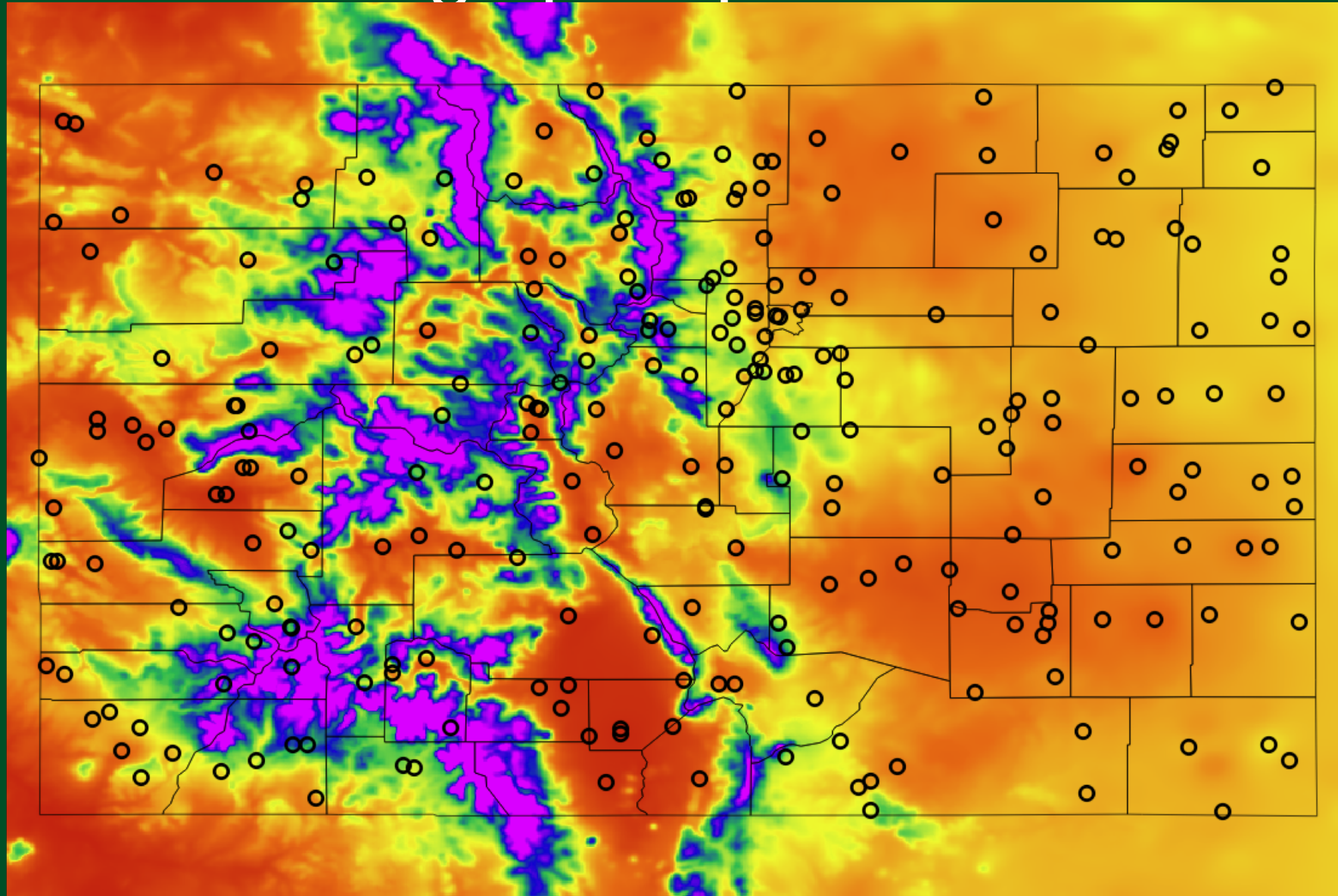
Roger Pielke, Sr, 2000-2006



https://www.atmos.colostate.edu/wp-content/uploads/2017/08/8.9.17_Nolan_retirement.jpg



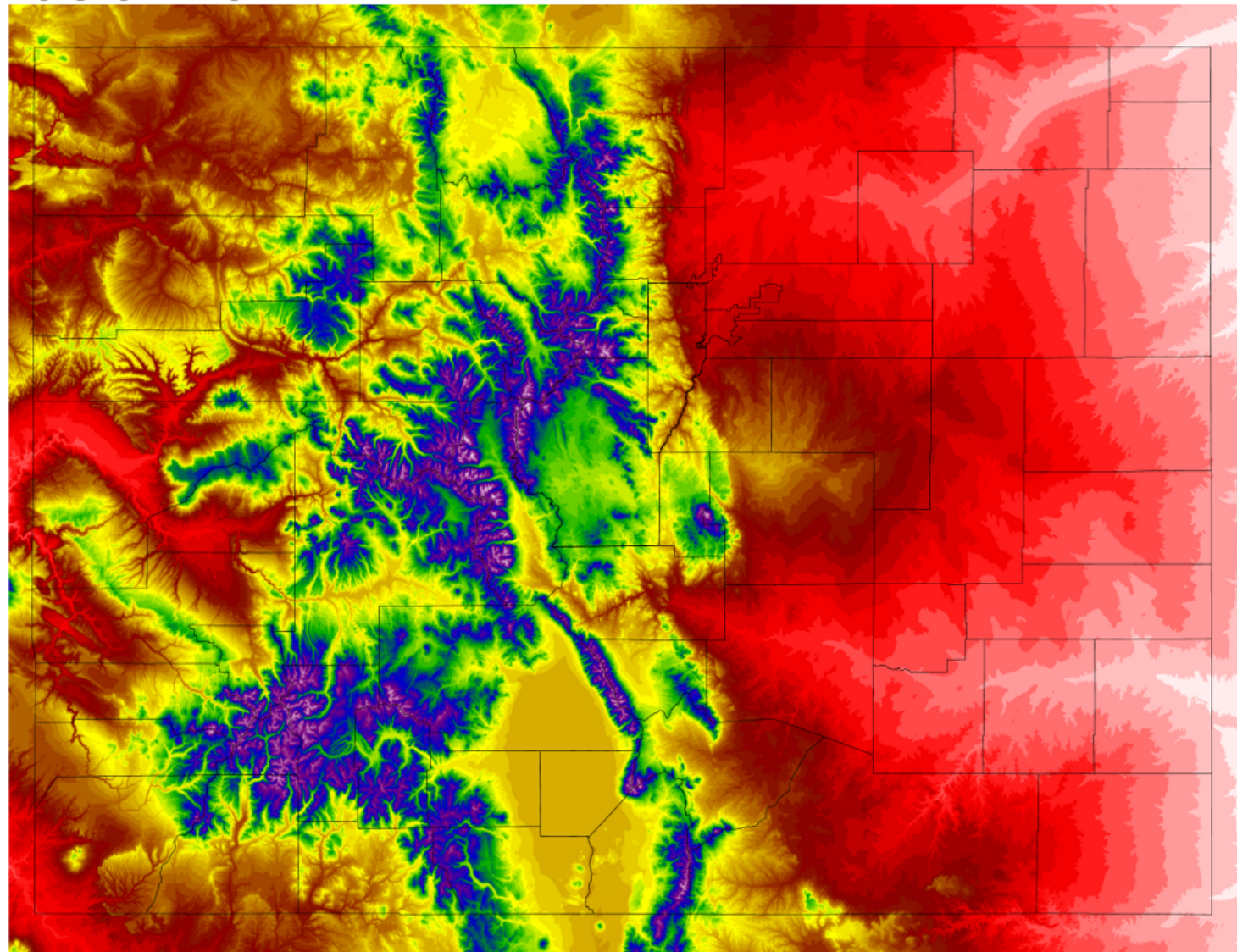
Annual average precipitation



Data: PRISM climate group
prism.oregonstate.edu



Topographic Map of Colorado



Created by Joe Grim (joeandfrede.com) from the USGS National Elevation Dataset (ned.usgs.gov), 10 arc-second resolution



http://www.joeandfrede.com/colorado/misc_trip_reports/colorado_topo_med_res.png

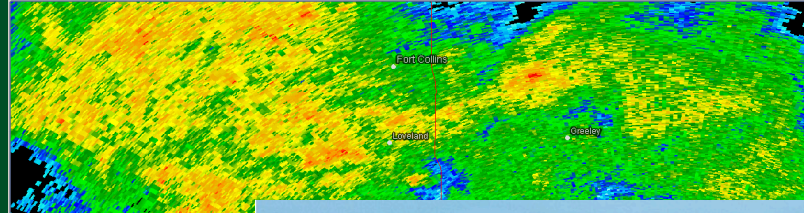
COLORADO CLIMATE CENTER



Colorado's weather and climate extremes

High Park Fire, June 2012 (from the dept)

“Great Colorado Flood of September 2013”



NEXRAD LEVEL-II
KFTG - DENVER, CO
09/12/2013 05:07:11 GMT
LAT: 39/47/11 N

Photo courtesy of Noel Bryan



Nederland, March 2003
From Wesley et al. (2013)

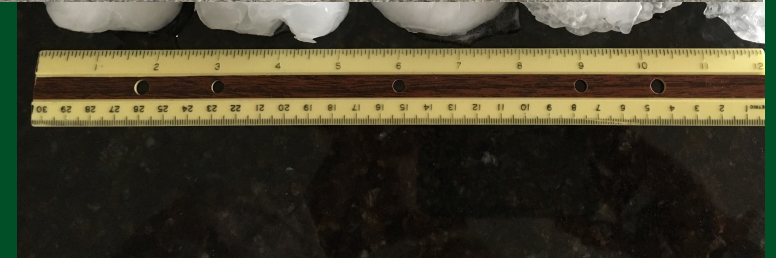


Otero County, May 2018

D.I.A. CO | 2018-06-19 14



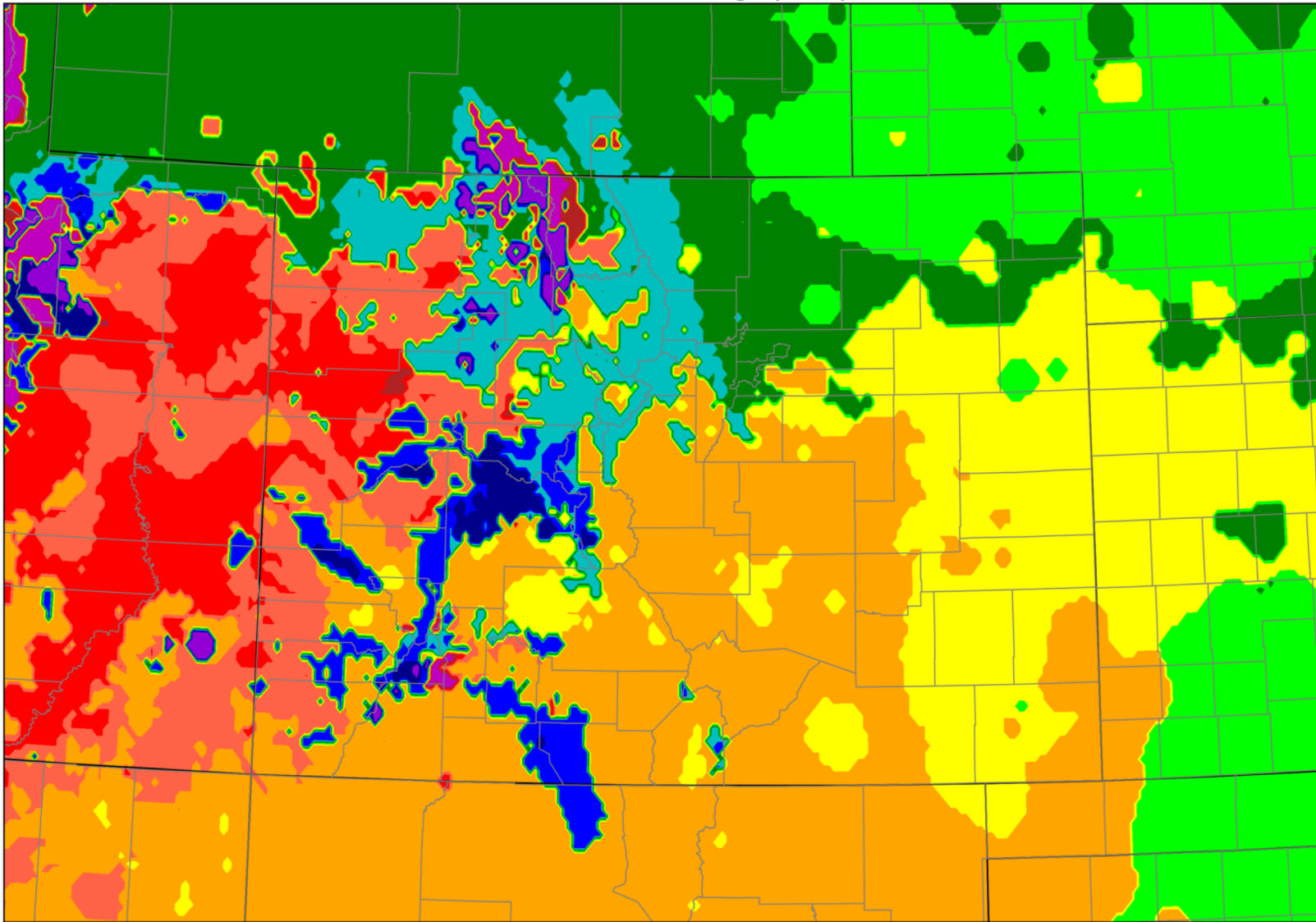
Fountain, August 2018
Photo from Jennifer Stark, NWS Pueblo



<https://twitter.com/ViaeroWXCams/status/1009168644415328258>



month of maximum average precipitation



Analyzing climate
data: both useful
and fun!

Month of maximum average precip
Data: PRISM Climate Group,
prism.oregonstate.edu

Figure: Russ Schumacher/Colorado Climate Center
Data: PRISM climate group (prism.oregonstate.edu)

Read the latest monthly summary from the Fort Collins Campus Weather Station:

August 2018 Summary



Previous | Next

Current Conditions

Fort Collins, CO



68.5°F

Last Updated on September 26, 5:43 PM MDT

Wind: Calm

Dewpoint: 33°F

Humidity: 27%

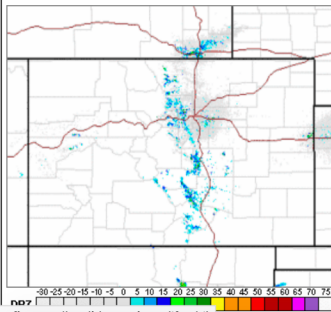


Zip Code

Local Conditions

Fort Collins Weather Station
Current conditions

Colorado Radar



CCC News Feed

As fall is nigh, drought persists

September 21, 2018

The Grand Junction Daily Sentinel talked with Becky Bolinger about recent drought expansion in western CO and the "wait and see" mode for what the next snow season will bring.

Record-breaking heat, dry weather increase fire danger, worsen drought conditions across Colorado



September 17, 2018

Colorado Springs Gazette interviewed Russ Schumacher to learn more about the recent hot weather and how it's contributing to drought conditions.

Most weather signs are pointing to an El Niño weather pattern this fall and winter August 31, 2018

Becky Bolinger shares with The Fence Post what an El Niño winter could mean for Colorado.

Social Media

Colorado Climate Ce...
Liked 963 likes

Colorado Climate Center
on Monday

"Here in Colorado, over 20 percent of severe hail reports through the beginning of September have been at least 2 inches. Three percent have been at least 3 inches – bigger than a standard 2.75-inch baseball. These are the highest such percentages in state history. Moreover, Colorado saw a new record, with hail greater than 3 inches in diameter reported 10 times, over seven different days."

Tweets by @ColoradoClimate

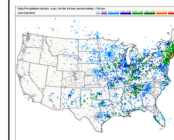
ColoClimateCenter Retweeted
NWS Pueblo @NWSPueblo
The high temperature through 300 PM today in Colorado Springs has been 87 degrees, This breaks the previous record high for today of 86 degrees, which was set in 2003 and 1924. #cowx

Quick Links



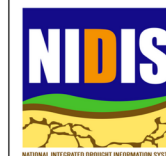
CoAgMET

The Colorado Agricultural Meteorological nETwork provides live-updated meteorological conditions at agriculture sites across Colorado.



CoCoRaHS

The Community Collaborative Rain Fall and Snow network provides daily precipitation data from around the country, recorded by citizens.



Drought

View our weekly updated drought summary for the NIDIS Intermountain West Region's Drought Early Warning System.



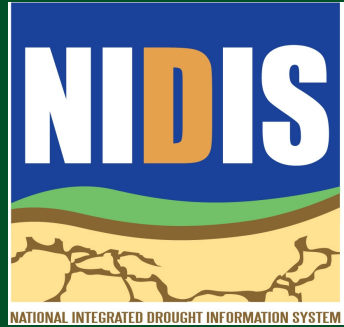
Our mission

The Colorado Climate Center at CSU provides valuable climate expertise to the residents of the state through its threefold program of:

- 1) ***Climate Monitoring*** (data acquisition, analysis, and archiving)
- 2) ***Climate Research***
- 3) ***Climate Services*** (providing data, analysis, climate expertise, education and outreach)



A small selection of our partners and stakeholders



Our primary activities

- Drought monitoring and early warning
- Community Collaborative Rain, Hail, and Snow network (CoCoRaHS)
- The Colorado Agricultural Meteorological Network (CoAgMET, “Colorado’s Mesonet”)
- Other CCC projects and activities



National Integrated Drought Information System

Intermountain West Drought Early Warning System

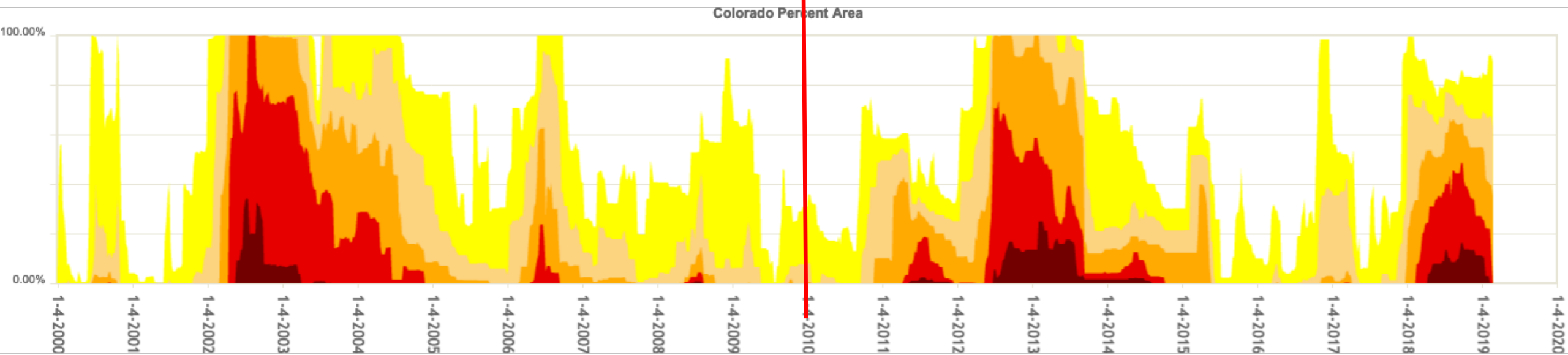
Becky Bolinger, Assistant State Climatologist



**Peter Goble,
Climatologist and drought specialist**



Colorado State University



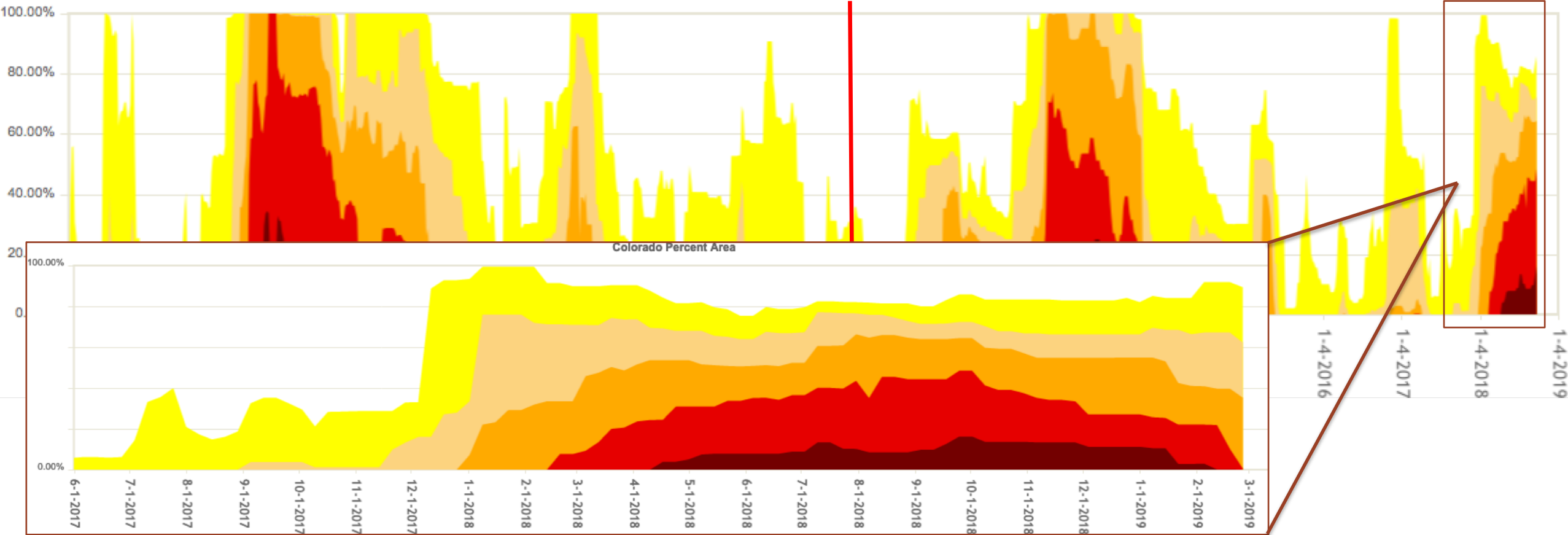
Implementation of weekly monitoring operations in 2010 led to more timely detection of the 2012 drought.

Yes! Drought can happen in the winter!!

improved monitoring = improved drought depiction



Colorado Percent Area

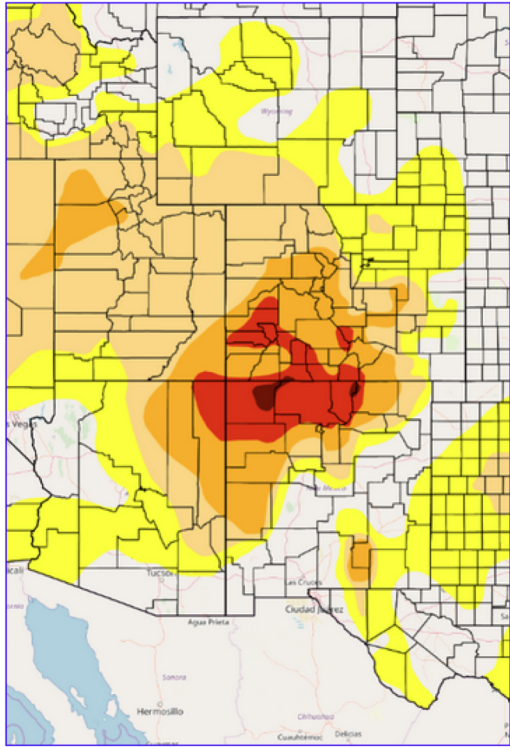


improved monitoring = improved drought depiction

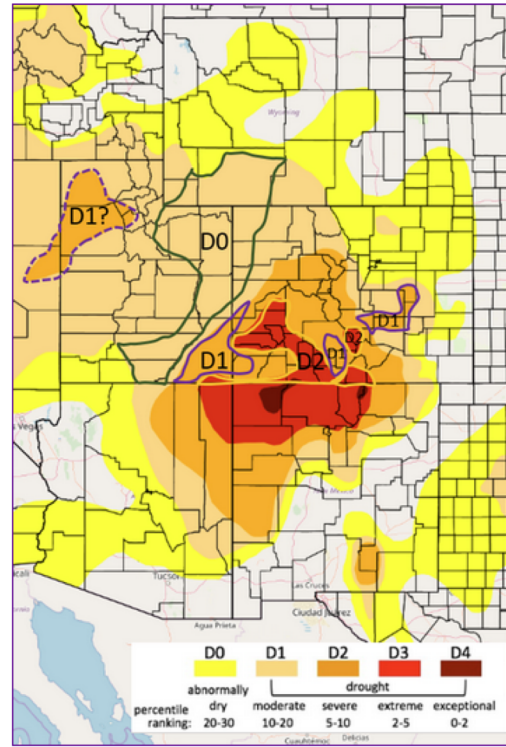




NIDIS Intermountain West
Drought Early Warning System
February 26, 2019



Current U.S. Drought Monitor Depiction ⓘ



Recommended Changes ⓘ

Summary: February 26, 2019

We've reached the point in our orbit where days begin to last noticeably longer, and temperatures start slowly but surely to tick upward. That said, winter 2019 will not be going anywhere without a fight. The entire western United States saw below average temperatures over the past week. The Intermountain West was anywhere from five degrees below normal in the central Colorado Rockies to 25 degrees below normal east of the Bighorns in Wyoming.

Some parts of the Intermountain West (IMW) received major snowfall too. Payson, AZ recorded 31.8" of snow in 48 hours. Totals in the Colorado San Juans were impressive. CoCoRaHS stations in the Durango area recorded as much as 23" in 24 hours. The Wolf Creek Ski area recorded 86" of snowfall in a seven-day period. That's an average of over one foot/day. While these are extreme examples, Pacific Moisture did grace a large portion of the region.

Weekly Drought Monitoring

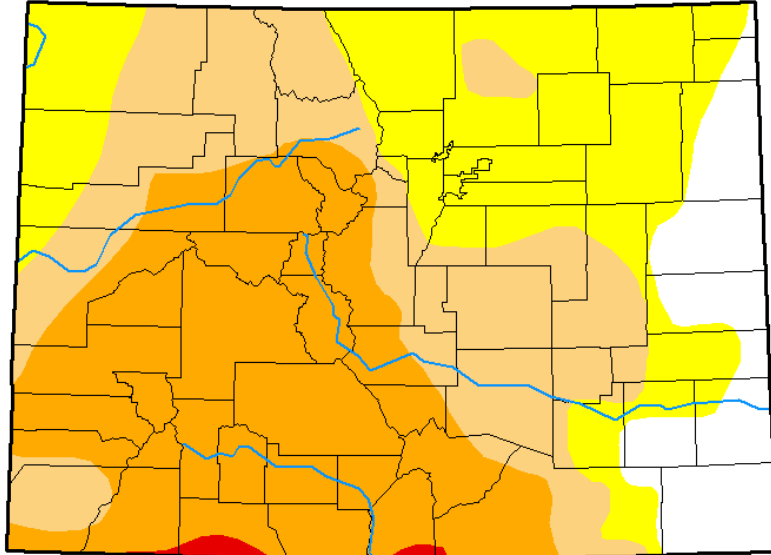
climate.colostate.edu/~drought

- ☐ Conditions
 - ☐ Precipitation, snow
 - ☐ Evaporative Demand
 - ☐ Streams, soils, vegetation
- ☐ Impacts Reports
- ☐ Outlooks
- ☐ Recommendation to USDM



U.S. Drought Monitor Colorado

February 26, 2019
(Released Thursday, Feb. 28, 2019)
Valid 7 a.m. EST



Intensity:

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

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

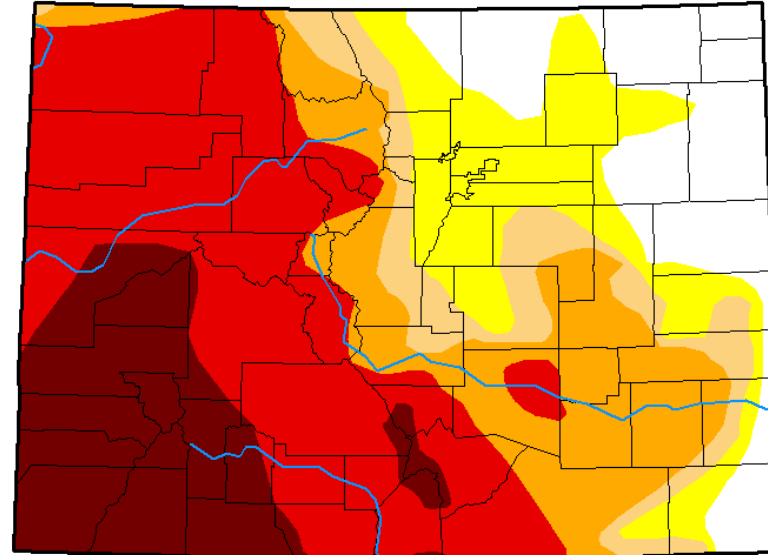
Brad Rippey
U.S. Department of Agriculture



<http://droughtmonitor.unl.edu/>

U.S. Drought Monitor Colorado

October 2, 2018
(Released Thursday, Oct. 4, 2018)
Valid 8 a.m. EDT



Intensity:

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

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

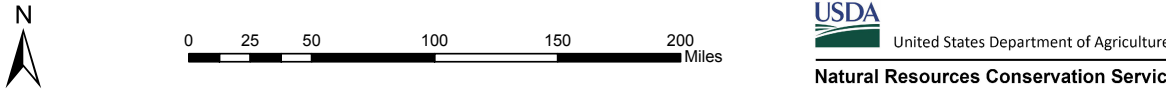
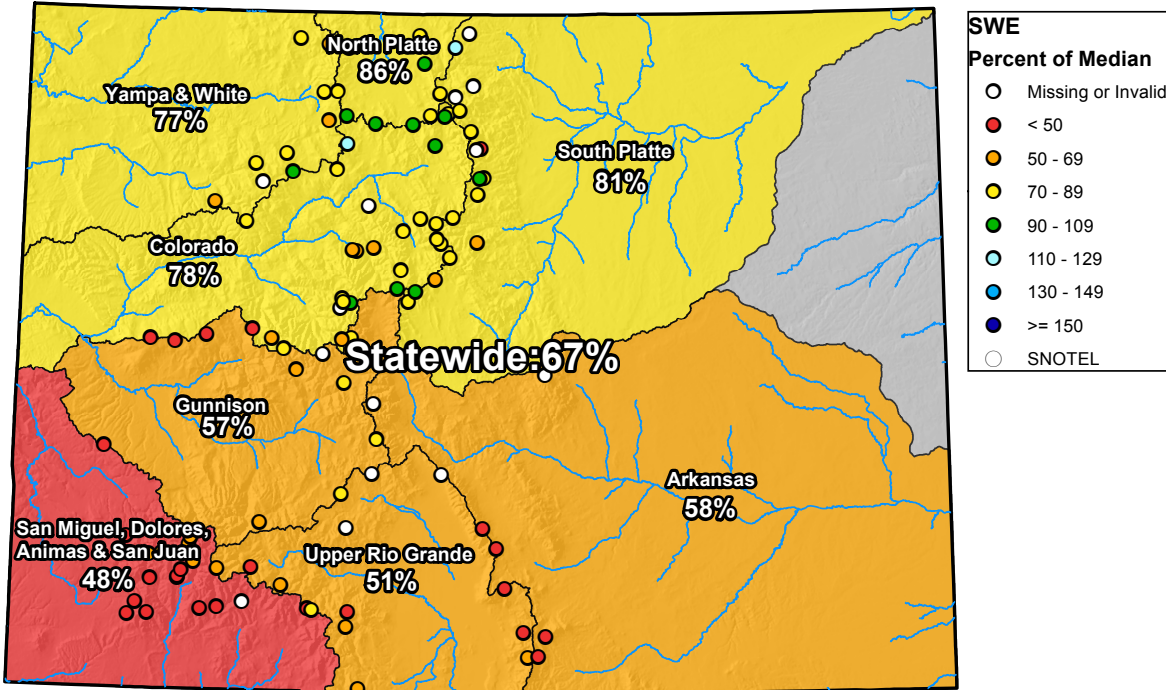
David Miskus
NOAA/NWS/NCEP/CPC



<http://droughtmonitor.unl.edu/>

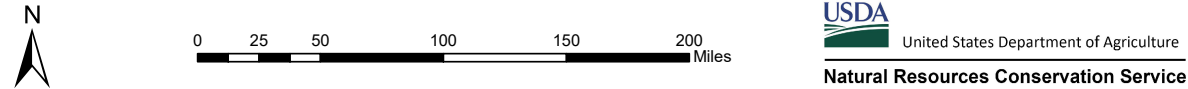
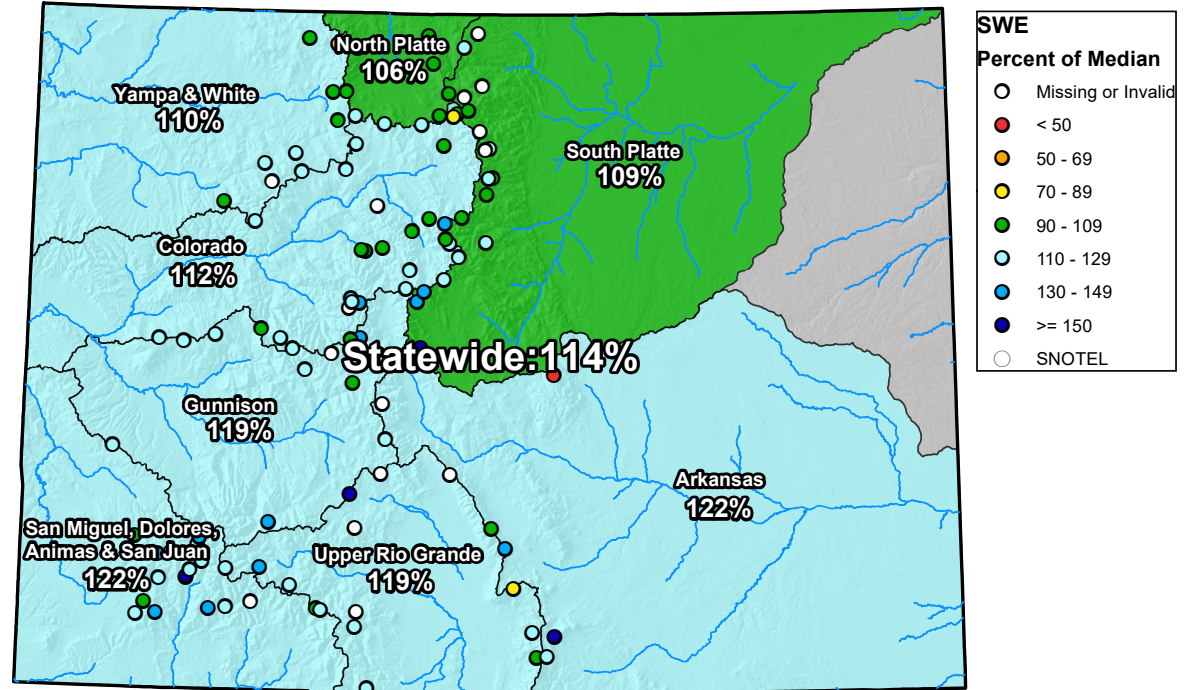
Colorado SNOTEL Snow Water Equivalent (SWE) Update Map with Site Data

Current as of Mar 14, 2018



Colorado SNOTEL Snow Water Equivalent (SWE) Update Map with Site Data

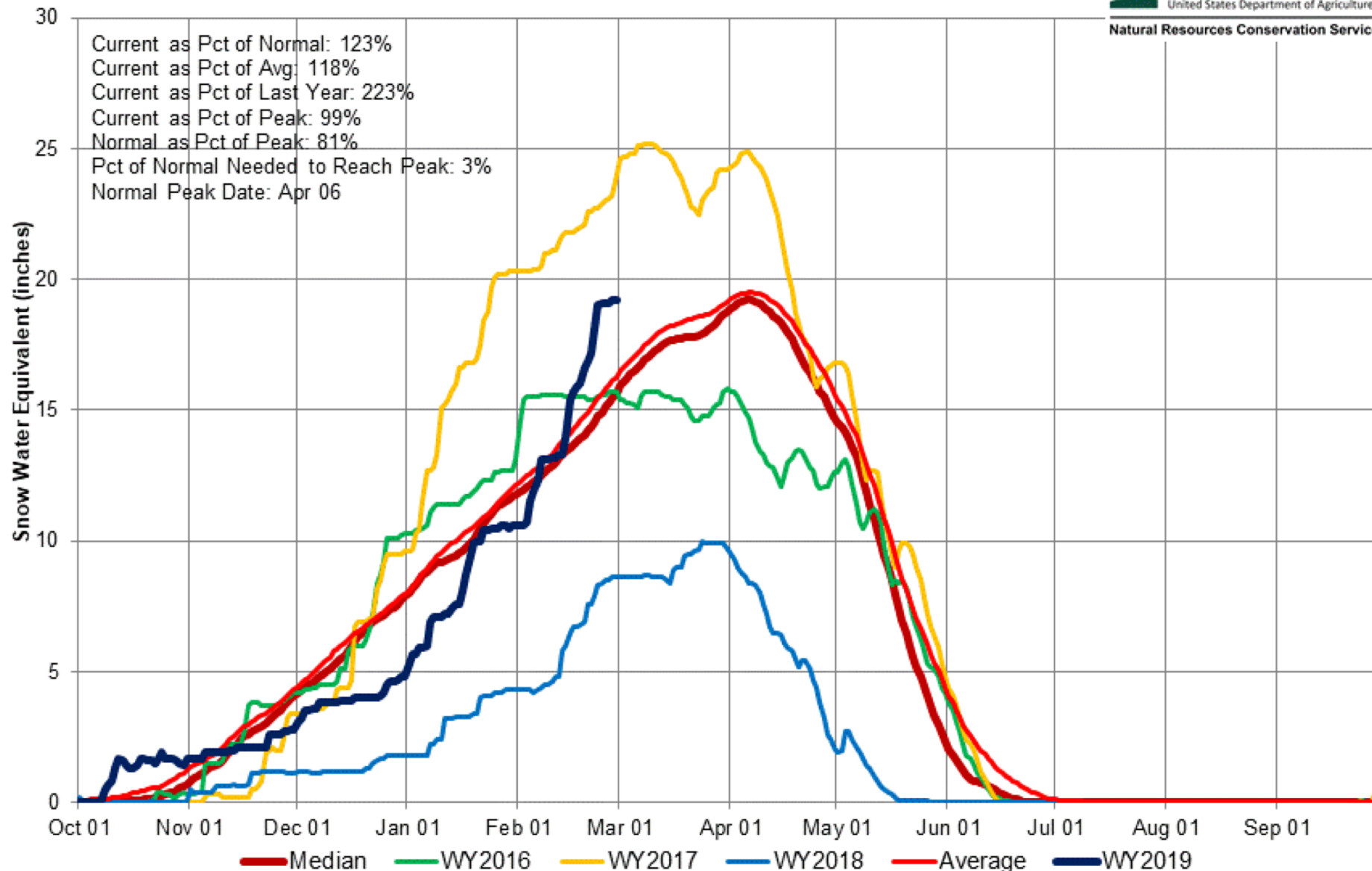
Current as of Feb 28, 2019



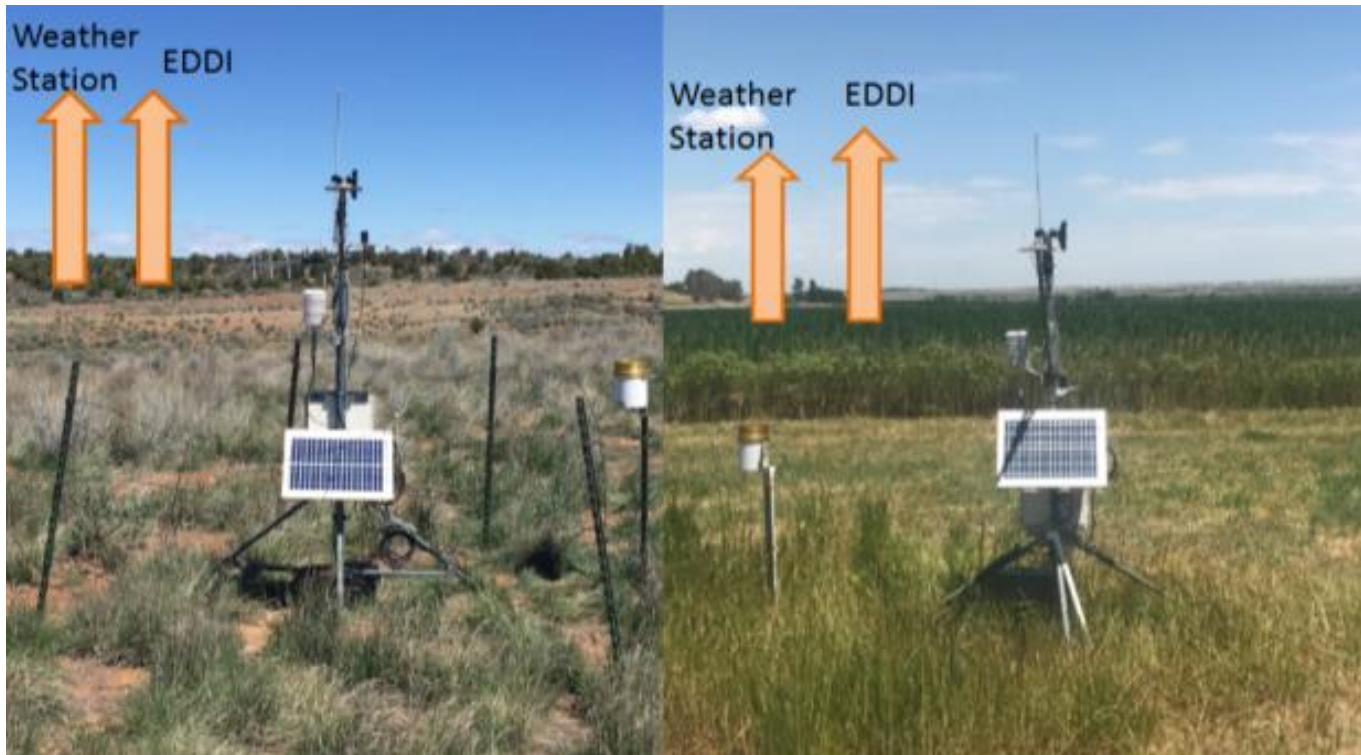
San Miguel, Dolores, Animas & San Juan River Basins Time Series Snowpack Summary

Based on Provisional SNOTEL data as of Feb 28, 2019

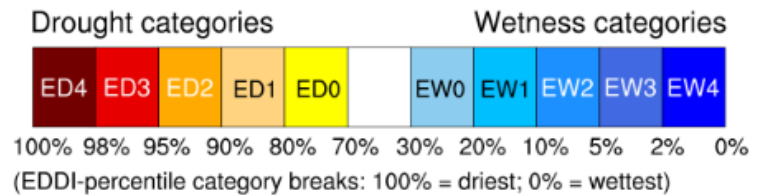
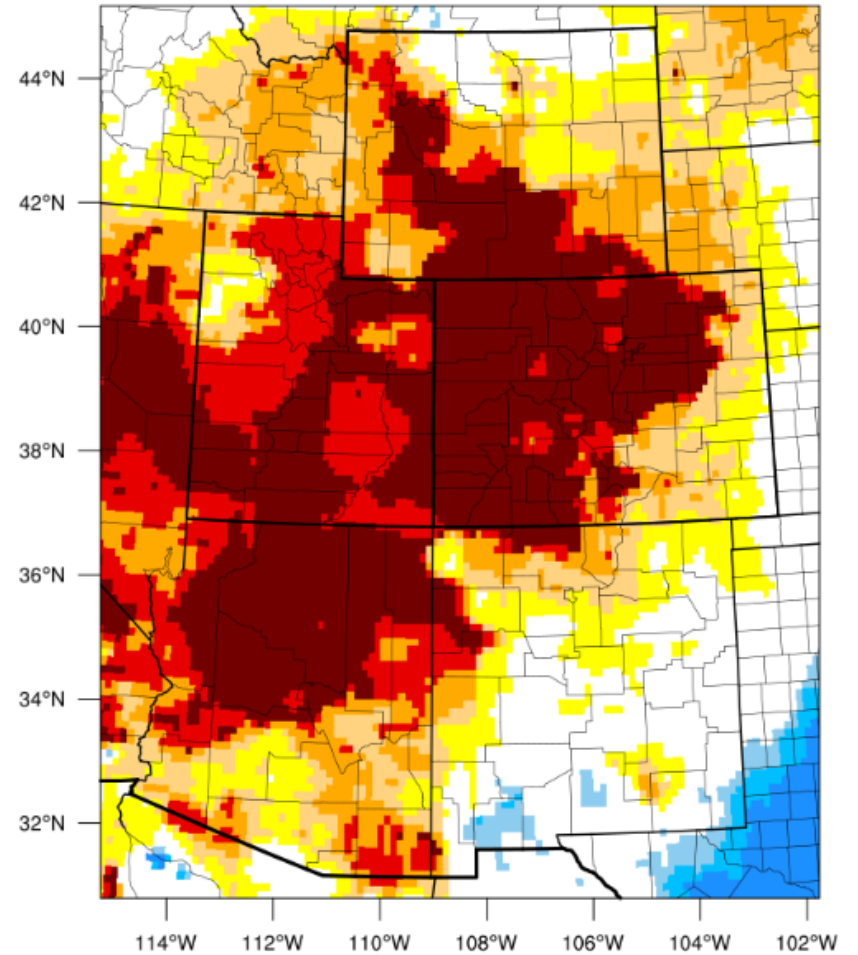
USDA
United States Department of Agriculture
Natural Resources Conservation Service



Ground validation of the Evaporative Demand Drought Index (EDDI) product using CoAgMET data.



1-week EDDI categories for September 14, 2018



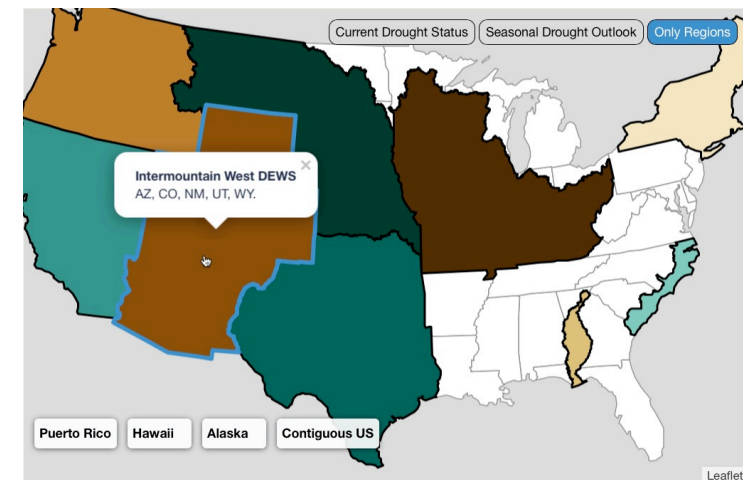
Generated by NOAA/ESRL/Physical Sciences Division





Our Current NIDIS Objectives

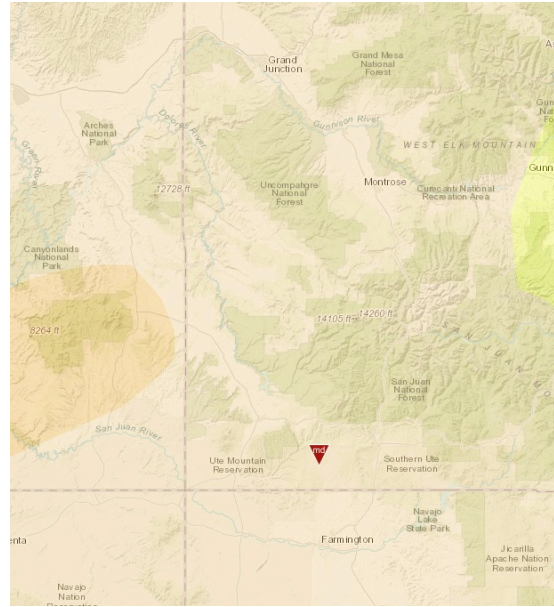
- ✓ enhancing engagement and interaction
- ✓ communication and dissemination
- ✓ value added information and products



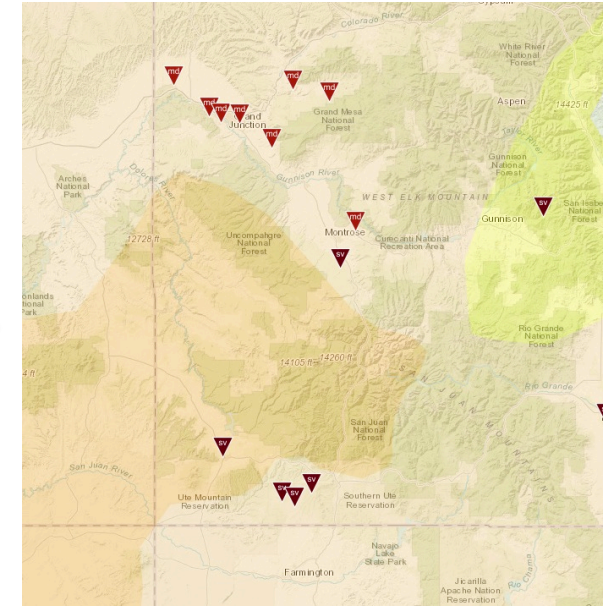
enhancing engagement and interaction



works for Durango-Silverton Railroad
(suspected cause of the 416 Fire)



one
week
later



Soliciting Condition Monitoring reports from CoCoRaHS observers in D2 counties

Rizza, John

February 20, 2018 at 4:48 PM

To: Bolinger, Becky

Re: Conditions in west and southwest CO



I think this is a good approach, plan for the worst and hope for the best rather than be behind the eight ball.

Thank you for your efforts. Maybe this is a good time to revisit the conversation about the short webinars directed towards producers? I can follow up on that email from the other week and Maybe we can set something up for a week or two away?

working with CSU Extension to keep engaged with the ag community



communication and dissemination

webinars and videos

presentations

ColoClimateCenter
@ColoradoClimate

Following

SPEI shows the combined effects of precipitation and temperature anomalies. This summer, western CO's record warmth and very dry conditions have combined forces to make #drought more severe. #cowx

5:36 PM - 4 Sep 2018

8 Retweets 9 Likes

social media

Ranching in Drought

A Workshop by USDA & CSU Extension Range School

Thursday, August 9th
10 am - 3 pm, lunch provided!

Otero Junior College
Student Center (Rm 116), 1802 Colorado Ave, La Junta, CO

- ◆ Discuss drought issues & ideas with other ranchers from the area
- ◆ Latest weather & climate outlooks
- ◆ Flexible grazing strategies
- ◆ Animal health concerns in drought
- ◆ Drought assistance programs
- ◆ Drought planning & goal-setting

promotional materials

website updates

media interviews

September 17, 2018

Colorado Springs Gazette interviewed Russ Schumacher to learn more about the recent hot weather and how it's contributing to drought conditions.

Most weather signs are pointing to an El Niño weather pattern this fall and winter

August 31, 2018

Becky Bolinger shares with The Fence Post what an El Niño winter could mean for Colorado.

We're In Drought. So Why Can We Still Water Our Lawns?

July 24, 2018

Russ Schumacher and Regan Waskom interview with KRCC - Southern Colorado's NPR station - about the water restrictions and drought.

A new monthly precipitation record

July 18, 2018

a record breaking day...

Rank	Value	Setting Date
1	3.87	1997-08-18
2	3.57	2012-07-02
3	3.10	1915-07-28
4	2.88	1989-07-19
5	2.88	1980-07-18
6	2.43	1975-05-08
7	2.39	1988-06-18
8	2.28	1982-06-18
9	2.22	1987-06-04
10	2.17	2008-07-28

On the afternoon of July 5, radar detected a heavy thunderstorm headed toward Cheesman Reservoir in the mountains east of South Park. National Weather Service issued a Flash Flood Warning for the area.

The July 6 precipitation report from the CHEESMAN COOP station reported a 24-hour rainfall total of 3.87 inches. This broke their old July record of 2.70 inches, and it's the 2nd highest accumulation in the station's entire record.

Colorado's Hot Temps Make June the Third Warmest on Record

July 10, 2018

Becky Bolinger talks with Colorado Public Radio about the warmer than average summer Colorado has been experiencing.

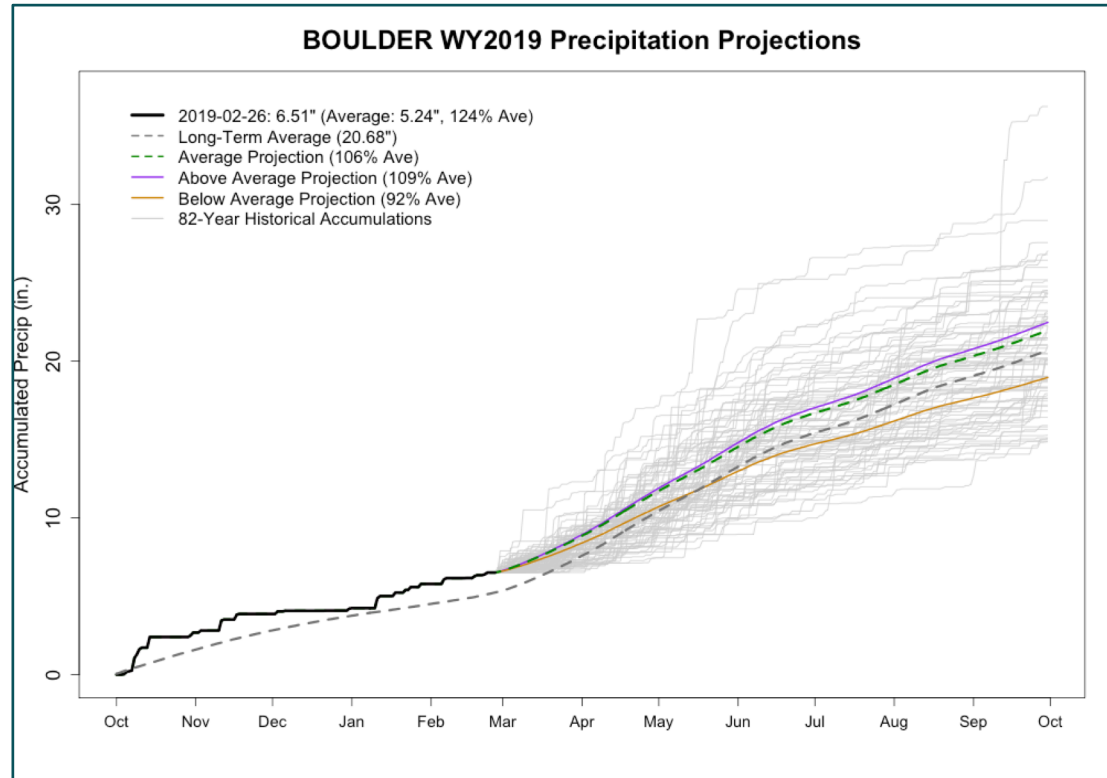
Colorado's worsening drought could make 200,000-acre wildfire seasons more commonplace

July 6, 2018

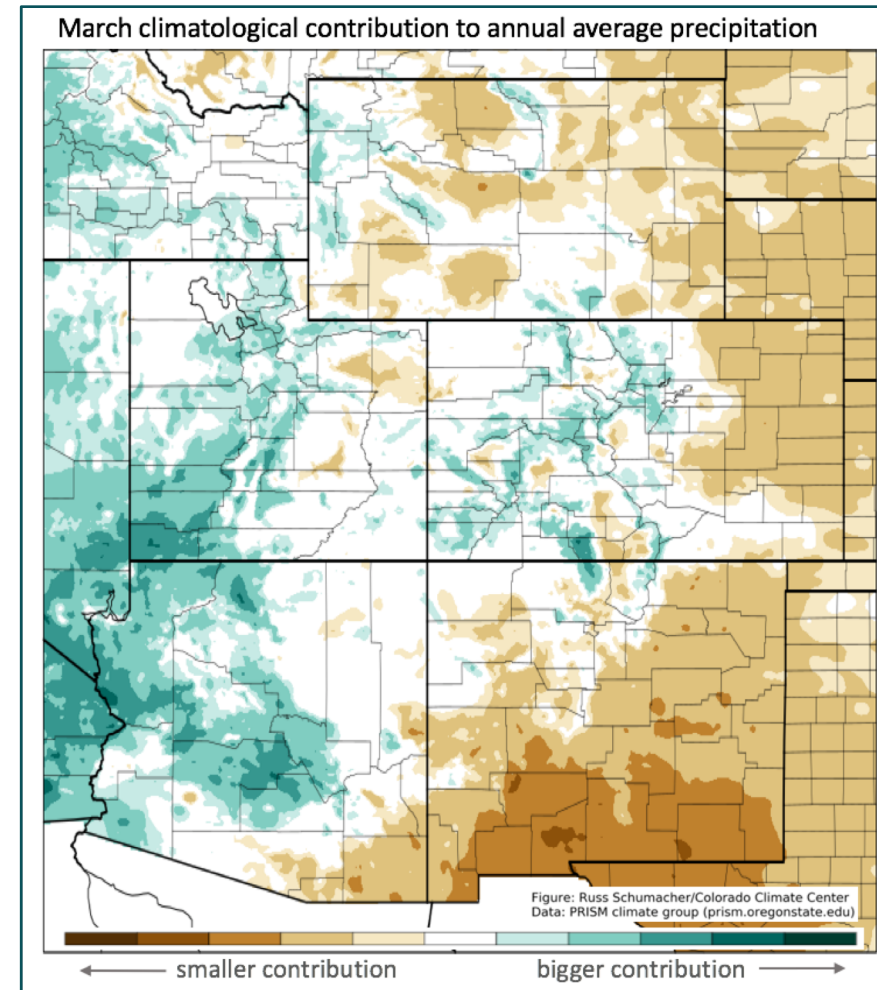
The Denver Post interviews Peter Goble about



value added information and products



What's the likelihood of staying above normal?

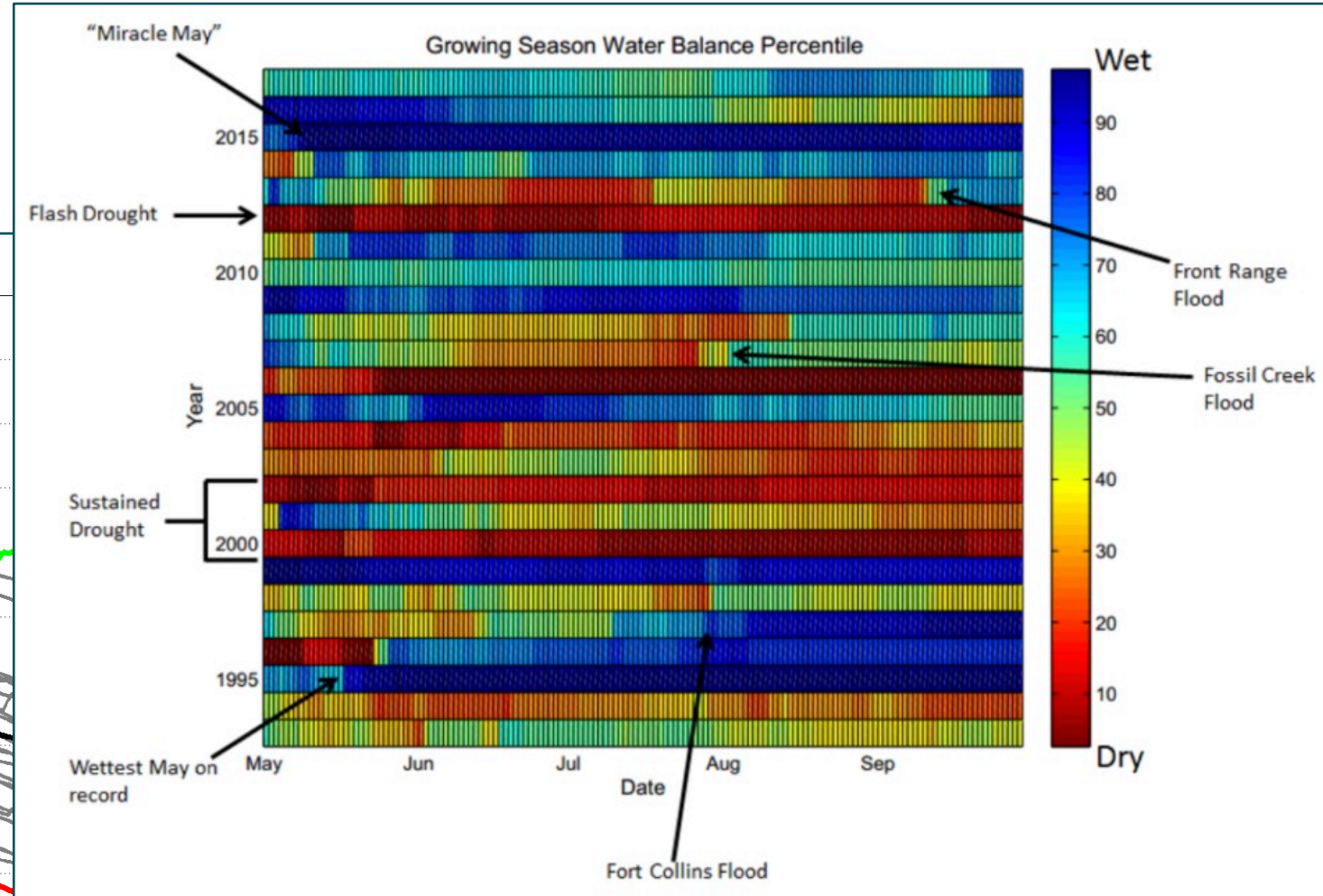
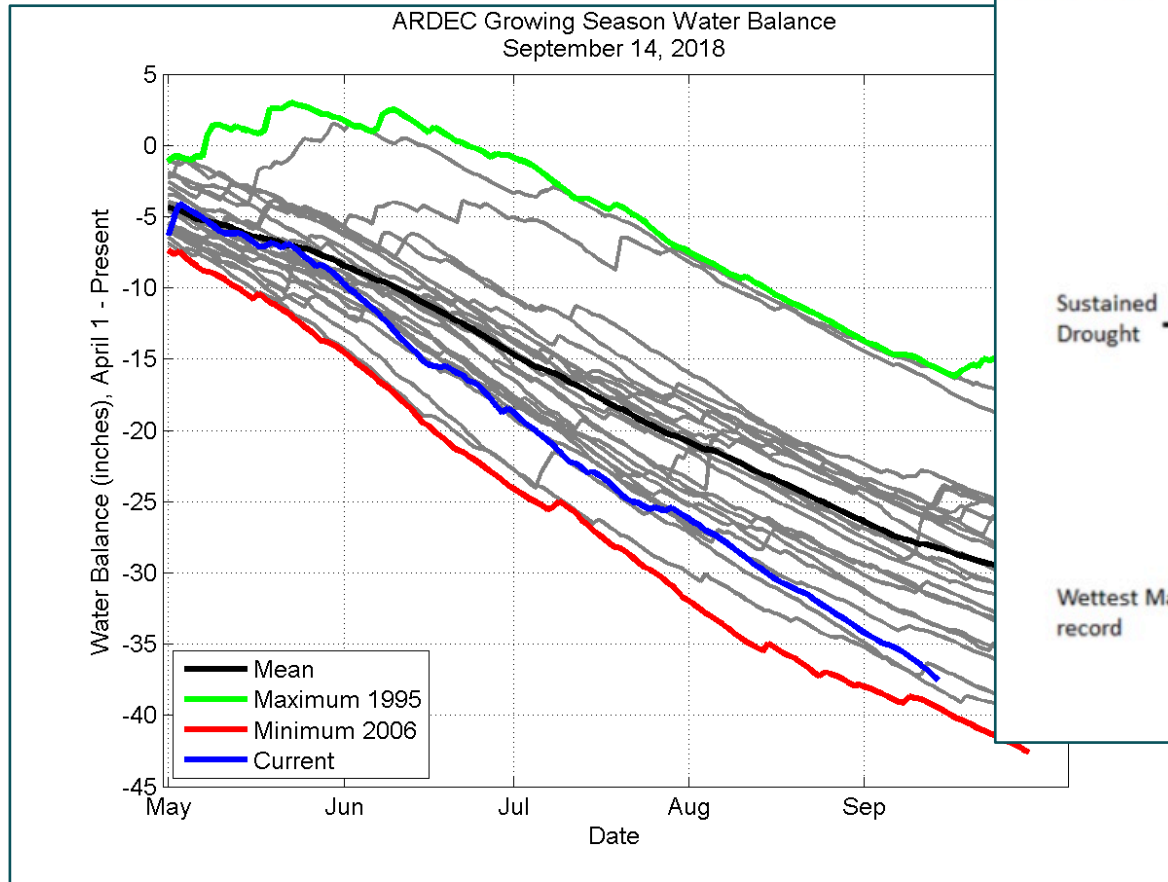


how "important" is each month to the annual contribution of precipitation?



value added information and products

understanding the relationship between precipitation and evaporation and how the drought responds to water balance



A large, round snowball is the central focus of the image. The letters 'COCORAHS' are carved into the snow in a simple, blocky font. The background shows a snowy landscape with some dry grass and bare branches visible at the top and right edges. The entire image has a blue color cast.

COCORAHS

**The Community Collaborative Rain, Hail
and Snow Network**

<https://www.cocorahs.org>

CoCoRaHS headquarters team



CoCoRaHS was born in response to the 1997 Fort Collins, Colorado Flood



STORM TOLL

Deaths - 5 confirmed
Injuries - 40
Missing - 16
Rescued - 160
Damages - Tens of millions of dollars at Colorado State University, \$1.5 million to \$2 million to city roads and bridges; \$1 million to city parks and trails; no estimate for private property.

Source: Emergency Officials
All information as of 1 a.m. today

Wednesday

FORT COLLINS
COLORADOAN

City death toll at 5; damage in millions



I thought I was dead a few times

FLOOD
OF '97

CSU's book losses speak volumes



Rainfall breaks 20-year record



July 30th 1997



Simple low-cost measurement tools



4-inch diameter
High capacity rain gauges



Aluminum foil-wrapped
Styrofoam hail pads



Snow rulers marked
in tenths of an inch

Easy Training

Things to know about...

Rain

- [Overview](#)
- [Weather Radar](#)
- [Measuring Rain](#)

Hail

- [Overview](#)
- [Hail Facts](#)
- [Hail Figures](#)
- [CoCoRaHS & Hail](#)
- [Hail Pad Examples](#)
- [Measuring Hail](#)

Snow

- [Overview](#)
- [Measuring Snow](#)

Training Slide Shows

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



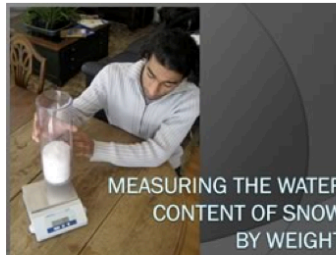
[HTML](#) [PDF](#)



[HTML](#) [PDF](#)



[HTML](#) [PDF](#)



[HTML](#) [PDF](#)



CoCoRaHS Tutorial - How the rain gauge works



Getting Started with CoCoRaHS - The Basics of



The Water Cycle

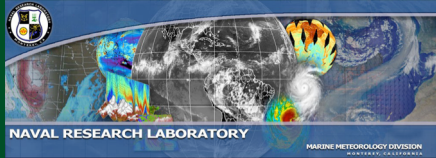
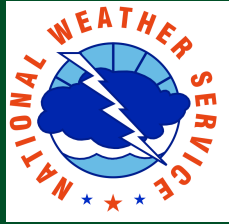
Written Instructions

Slide Shows

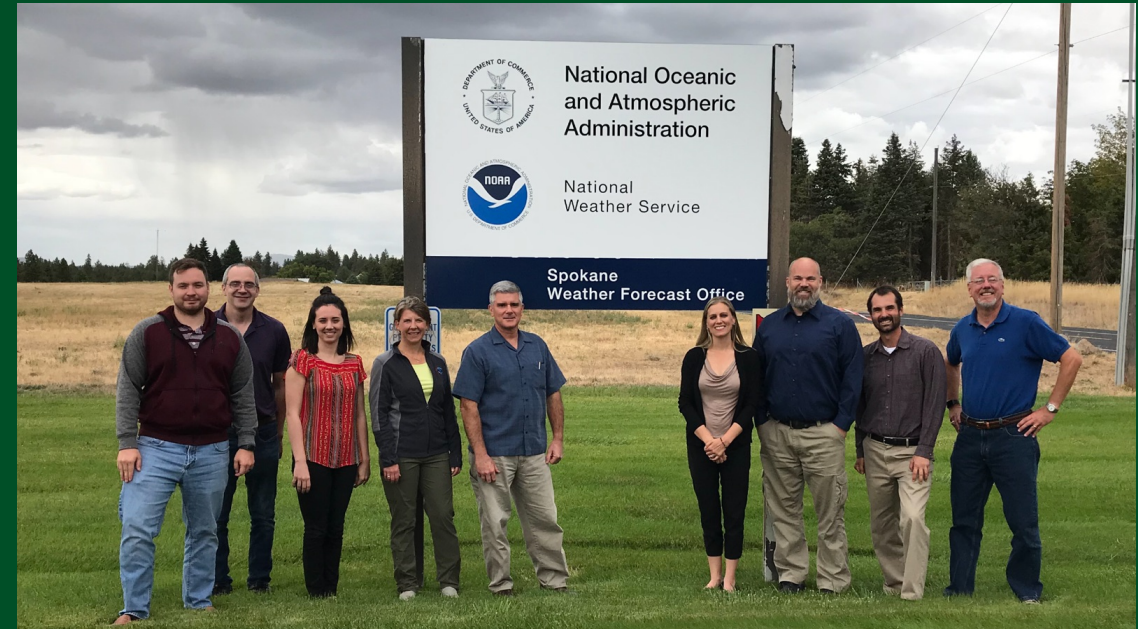
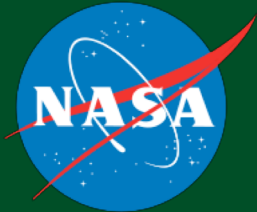
Videos and Animations



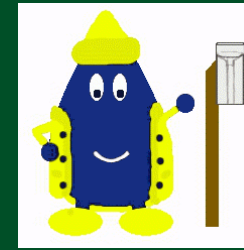
Data used by national entities



National Weather Service
National Hurricane Center



CoCoRaHS For Schools



- All 50 states
 - Colorado, Florida, Maine Coastal Islands, Hawaii school network, and more
- Connections with Scientists
 - UNC Chapel Hill and schools in Washington isotope analysis
- “Rain Gauge Week” bi-annual campaign

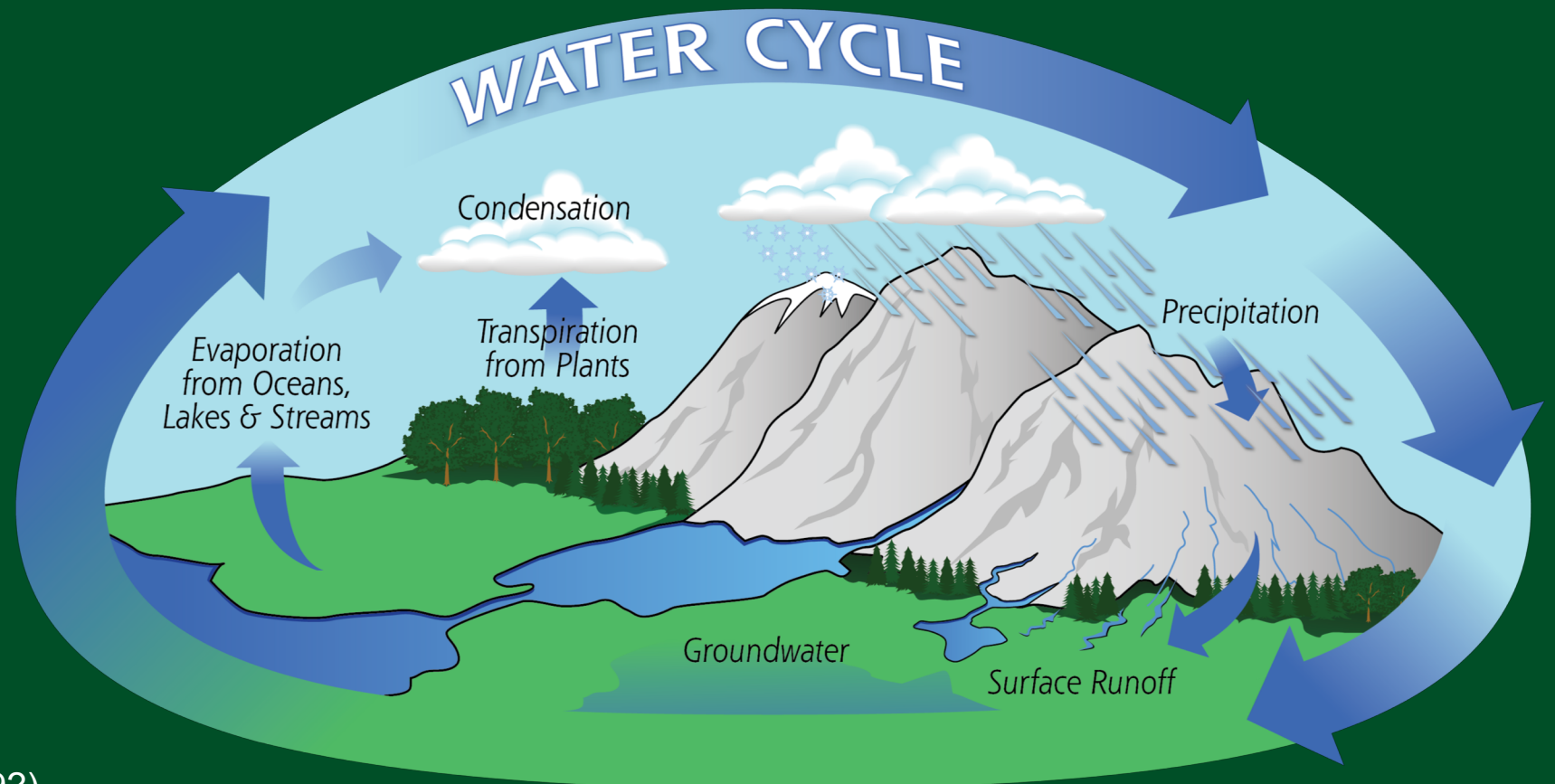


Rockies Weather and Science Day, Coors Field



CoCoRaHS Observation Protocols


- Daily Precipitation
- Multi-day Precipitation
- Hail
- Significant Weather
- Condition Monitoring
- Soil Moisture
- Evapotranspiration
- Frost
- Optics
- Snowflake
- Thunder
- Ice Accretion (Coming 2019?)



https://pmm.nasa.gov/education/sites/default/files/article_images/Water-Cycle-Art2A.png



Precipitation Reports Make Up the Bulk of the Observations



COMMUNITY COLLABORATIVE RAIN, HAIL & SNOW NETWORK
"Because every drop counts"

Select Language ▼

[Home](#) | [Countries](#) | [States](#) | [View Data](#) | [Maps](#) | [My Data](#) | [My Account](#) | [Admin](#) | [Logout](#)

My Data Entry : Daily Precipitation Report Form

For observations spanning more than 24 hours, please use the [multiple day accumulation report](#).

[Français](#)

Precipitation Report Form
Submit Reset

Station Number : CO-LR-607

Station Name : Fort Collins 3.8 SSW

* Denotes Required Field

9/26/2018 *Observation Date ?

7:00 AM *Observation Time ?

0.00 in. *Rain and Melted Snow to the nearest hundredth inch that has fallen in the gauge during the past 24 hours, or T for trace, or NA for unknown. ?

Observation Notes: (This will be available to the public) ?

New Snowfall

NA in. **Accumulation of new snow in inches to the nearest tenth** ?

NA in. **Melted value from core to the nearest hundredth** ?

Total Snow and Ice on Ground at Observation Time

NA in. **Depth of total snow and ice (new and old) in inches to the nearest half inch** ?

NA in. **Melted value from core to the nearest hundredth** ?

Duration Information

If a time is unknown or the storm has not ended leave it blank.

Precipitation Began AM PM

Precipitation Ended AM PM

Heaviest Precipitation Began AM PM

Heaviest Precipitation Lasted minutes

These times are: Select Time Accuracy ▼

Additional Information

Any Flooding? Select a Flooding Value ▼

Yes **Did you record hourly precipitation (or other detailed time increments) for this storm?**

No If yes, CoCoRaHS personnel may request a copy of this data later, so please save it.

Submit Data
Reset

Multiple Day Accumulation Form
Submit Data Reset

Station Number : CO-LR-607

Station Name : Fort Collins 3.8 SSW

9/25/2018 First day of accumulation period. This day should be one day after your last daily report or one day after the End Date of the last multi-day report.

9/26/2018 Date the rain gauge was emptied.

7:00 AM Time the rain gauge was emptied.

Yes No Report was taken at registered location?

in. Multi-Day Precipitation (rain and melted snow, to the nearest hundredth of an inch), or T for trace, or NA for unknown. Information about snowfall should be included in the comments.

in. Total Depth of Snow on Ground (to the nearest tenth of an inch)

in. Water content of core sample (The amount of water present in a core sample of the total depth of snow on the ground, to the nearest hundredth of an inch)

Notes

Submit Data
Reset

Significant Weather and Hail Reports are sent to the NWS in Real-time

Hail Report Form		Submit Data	Reset
Station Number : CO-LR-607			
Station Name : Fort Collins 3.8 SSW			
* Denotes Required Field			
9/26/2018		*Date of Hail Storm	
PM		*Time Hail Storm Began	
<input type="radio"/> Yes <input type="radio"/> No Report was taken at registered location?			
Size of hailstones			
Smallest: Not Selected			
Average: Not Selected			
Largest: Not Selected			
Hail Lasted			
Minutes		This time is accurate within	
Select Accuracy			
Hailfall was: <input type="radio"/> Continuous <input type="radio"/> Intermittent			
Hailstones were:			
(Check all that apply)			
<input type="checkbox"/> Hard <input type="checkbox"/> Soft <input type="checkbox"/> Mixed (Hard & Soft) <input type="checkbox"/> Clear Ice <input type="checkbox"/> White Ice			
Was there more rain than hail? <input type="radio"/> Yes <input type="radio"/> No			
Hail Started:			
<input type="radio"/> Before rain <input type="radio"/> After rain <input type="radio"/> Same time as rain			
Largest Hail Started			
<input type="radio"/> Before smaller hail <input type="radio"/> After smaller hail <input type="radio"/> Same time as smaller hail			
Damage?			
If the storm caused damage, please specify. (Check all that apply)			
<input type="checkbox"/> no damage			
<input type="checkbox"/> minor leaf damage			
<input type="checkbox"/> shredded leaves			
<input type="checkbox"/> dents in cars			
<input type="checkbox"/> damaged shingles			
<input type="checkbox"/> broken house windows			
<input type="checkbox"/> broken car windows			
What angle did the hail fall most of the time? Select Angle			
Hail pad information:			
Number of indentations on pad :			
Number of Small Stones			
Number of Medium Stones			
Number of Large Stones			
Number of Jumbo Stones			
Average distance between hailstone indentations on your pad.			
inches apart.			
If this is less than 1/4 inch, tell us the depth of the hail on the ground.			
depth of hail on ground in inches.			
Was any hail preserved? <input type="radio"/> Yes <input type="radio"/> No			
Notes			
Submit Data			
Reset			

Significant Weather Report		Submit Data	Reset
Station Number : CO-LR-607			
Station Name : Fort Collins 3.8 SSW			
* Denotes Required Field			
9/26/2018		*Observation Date	
PM		*Observation Time	
Minutes		Time duration that the report covers	
Rain			
in.		New Rain and Melted Snow that has fallen during the report duration, in inches to the nearest hundredth	
in.		Total Precipitation, rain and melted snow, since storm began, in inches to the nearest hundredth	
Snow			
in.		Depth of New Snow that has fallen during the report duration, in inches to the nearest tenth	
in.		Total depth of snow and ice on ground at the time of this observation to nearest half inch	
Additional Information			
<input type="radio"/> Yes <input type="radio"/> No Report was taken at registered location?			
Was There Flooding?			
<input type="radio"/> No			
If Yes, how severe?			
<input type="radio"/> Minor (typical). Street or field flooding.			
<input type="radio"/> Unusual street or field flooding (only see this every few years)			
<input type="radio"/> Severe Flooding			
<input type="radio"/> Extreme (never seen it this bad before)			
Observation Notes (This will be available to the public)			
Submit Data			
Reset			

Observation Protocols Used in Drought Monitoring

My Data Entry : Condition Monitoring Report Form

Condition Monitoring Report Form
Submit Data Reset

Station Number : CO-LR-607
Station Name : Fort Collins 3.8 SSW

Condition monitoring reports are submitted on a regular (weekly, biweekly, monthly) basis to share information about the effects of local precipitation on the environment and society. By submitting reports on a regular basis, you create a baseline to see change through time, such as seasonal differences or changes caused by more or less precipitation. Please refer to the [Condition Monitoring training slide show](#) for more information.
** indicates required field*

Report Date *

Condition Scale Bar [More information on the scale bar](#)

Severely Dry	Moderately Dry	Mildly Dry	Near Normal	Mildly Wet	Moderately Wet	Severely Wet
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Description
 Please provide a description of how dry, normal or wet conditions are affecting you, your livelihood, your activities, etc. *

Report Categories
 Please check at least one report category. If you check a category, please provide supporting information in the description. [More information on condition monitoring categories.](#)

- General Awareness
- Agriculture
- Business & Industry
- Energy
- Fire
- Plants & Wildlife
- Relief, Response & Restrictions
- Society & Public Health
- Tourism & Recreation
- Water Supply & Quality

Submit Data Reset

My Data Entry : Evapotranspiration (ETo) Report Form

Evapotranspiration Report Form
Submit Data Reset

Station Number : CO-LR-607
Station Name : Fort Collins 3.8 SSW

Previous ET Report : [Edit](#)

Date: Jun 18, 2011 7:00 AM **Gauge Reading:** 0.20"

Create New ET Report

* Denotes Required Field

***Observation Date** ?

AM ***Observation Time** ?

***Gauge Reading** ?

Refill Level ?

Notes

Next ET Report :

This is the last ET report for this station.

My Data Entry : Soil Moisture Report Form

Soil Moisture Report Form
Submit Data Reset

Station Number : CO-LR-607
Station Name : Fort Collins 3.8 SSW

* Denotes Required Field

***Observation Date** ?

AM ***Observation Time** ?

Observation Notes: (This will be available to the public) ?

Information about where the sample was taken

Distance from previous sample in meters:

Is the land irrigated? Yes No

Did you begin a new row? Yes No

Soil Samples

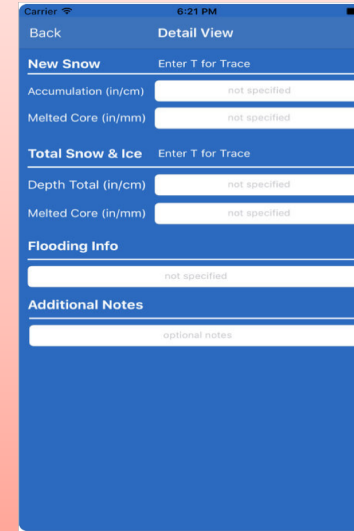
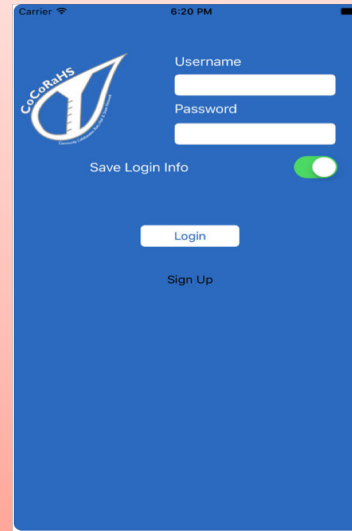
Depth	Soil Type	Weight Before Drying (grams)	Volume of Rocks and Roots Removed (cm ³)	Weight After Drying (grams)
0-2"	Select Soil Type... ▾	<input type="text"/>	<input type="text"/>	<input type="text"/>
7-9"	Select Soil Type... ▾	<input type="text"/>	<input type="text"/>	<input type="text"/>

Submit Data Reset

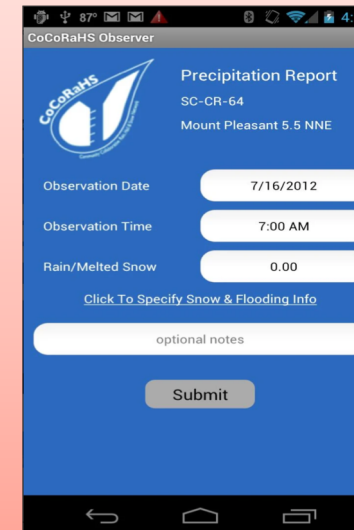
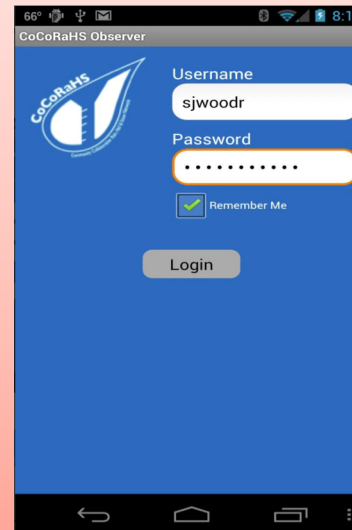
Mobile Apps

Android and iOS apps currently support entry and editing of daily and multi-day precipitation observations with more observation types and features to come

iOS



Android



Viewing the Data

COMMUNITY COLLABORATIVE RAIN, HAIL & SNOW NETWORK
 "Because every drop counts"

Home | Countries | States | View Data | Maps | My Data | My Account | Admin | Logout

Welcome to CoCoRaHS! "Volunteers working together to measure precipitation across the nations."

Who uses CoCoRaHS Observations?

Reports received today 9/26/2018 as of 1:37 PM EDT	Daily	Multi-day	SigWx	Hail	Condition	ET
	9,693	131	5	0	17	109

Daily Precipitation (inches x.xx)
USA
9/26/2018

Things to know about...
 Rain
 Hail
 Snow

Download on the App Store
 ANDROID APP ON Google Play

CoCoRaHS WeTalk Webinar Series

Purchase an official CoCoRaHS 4" Rain Gauge "The official CoCoRaHS Rain Gauge supplier"

WEATHERYOURWAY.COM
Fast, Friendly service

AMBASSADOR WFN WEATHER-FRIENDLY NATION

NOAA

View Data : List Daily Precipitation Reports [US Units]

Search Daily Precipitation Reports

Station Fields: Station Number Station Name

Location: USA | Colorado | ALL COUNTIES

Date Range: Start Date: 9/26/2018 End Date: 9/26/2018

Precip Value: All Precip Values Operator

Searched: Stations in Colorado. Report date on 9/26/2018.

Showing 1 - 50 of 470 Records. <Back Page 1 Next>

Date	Time	Station Number	Station Name	Total Precip in.	New Snow in.	Total Snow in.	State	County	View	Maps	
9/26/2018	4:30 AM	CO-LR-1009	Fort Collins 2.8 W	0.00	0.0	NA	NA	CO	Larimer	Classic New	
9/26/2018	5:00 AM	CO-AD-204	Brighton 1.9 NNW	0.00	0.0	NA	NA	NA	CO	Adams	Classic New
9/26/2018	5:07 AM	CO-GF-2	Rifle 0.9 NE	0.00	0.0	NA	NA	NA	CO	Garfield	Classic New
9/26/2018	5:18 AM	CO-GL-15	Rollinsville 0.1 N	0.00	NA	NA	NA	NA	CO	Gilpin	Classic New
9/26/2018	5:20 AM	CO-SU-69	Silverthorne 1.0 NNE	0.00	0.0	NA	NA	NA	CO	Summit	Classic New
9/26/2018	5:30 AM	CO-JF-425	Golden 11.8 NW	0.00	0.0	NA	NA	NA	CO	Jefferson	Classic New
9/26/2018	5:30 AM	CO-SA-2	Crestone 1.2 SSE	0.00	0.0	NA	NA	NA	CO	Saguache	Classic New
9/26/2018	5:30 AM	CO-WE-303	Galeton 1.6 E	0.00	NA	NA	NA	NA	CO	Weld	Classic New
9/26/2018	5:40 AM	CO-BO-99	Hygiene .79 N	0.00	0.0	NA	NA	NA	CO	Boulder	Classic New
9/26/2018	6:00 AM	CO-AR-99	Aurora 4.1 S	0.00	0.0	NA	NA	NA	CO	Arapahoe	Classic New
9/26/2018	6:00 AM	CO-BO-497	Boulder 3.2 S	0.00	0.0	NA	NA	NA	CO	Boulder	Classic New
9/26/2018	6:00 AM	CO-DN-141	Denver 5.3 SW	0.00	NA	NA	NA	NA	CO	Denver	Classic New
9/26/2018	6:00 AM	CO-DN-236	Denver 4.6 ENE	0.00	0.0	NA	NA	NA	CO	Denver	Classic New
9/26/2018	6:00 AM	CO-DG-271	Parker 4.8 NE	0.00	NA	NA	NA	NA	CO	Douglas	Classic New
9/26/2018	6:00 AM	CO-EP-66	Black Forest 3.9 NNE	0.00	0.0	NA	NA	NA	CO	El Paso	Classic New
9/26/2018	6:00 AM	CO-EP-343	Peyton 6.8 WSW	0.00	0.0	0.00	0.0	0.00	CO	El Paso	Classic New
9/26/2018	6:00 AM	CO-EP-347	Colorado Springs 6.9 ENE	0.00	0.0	NA	NA	NA	CO	El Paso	Classic New
9/26/2018	6:00 AM	CO-GN-47	Cimarron 11.2 S	0.00	0.0	NA	NA	NA	CO	Gunnison	Classic New
9/26/2018	6:00 AM	CO-JK-28	Walden 18.0 NNW	0.00	0.0	NA	NA	NA	CO	Jackson	Classic New
9/26/2018	6:00 AM	CO-JF-331	Golden 12.5 NW	0.00	0.0	NA	0.0	NA	CO	Jefferson	Classic New
9/26/2018	6:00 AM	CO-LR-1091	Loveland 5.3 SSW	0.00	0.0	NA	NA	NA	CO	Larimer	Classic New
9/26/2018	6:00 AM	CO-LR-1177	Wellington 0.2 NNE	0.00	NA	NA	NA	NA	CO	Larimer	Classic New
9/26/2018	6:00 AM	CO-LN-57	Hugo 0.3 SSW	0.00	0.0	NA	NA	NA	CO	Lincoln	Classic New
9/26/2018	6:00 AM	CO-ME-143	Grand Junction 8.0 W	0.00	0.0	NA	NA	NA	CO	Mesa	Classic New
9/26/2018	6:00 AM	CO-PU-55	Pueblo West 6.0 W	0.00	0.0	NA	NA	NA	CO	Pueblo	Classic New
9/26/2018	6:00 AM	CO-PU-115	Rye 1.4 N	0.00	NA	NA	NA	NA	CO	Pueblo	Classic New

View Data : View Hail Report

Hail Report

Hail Report Information

Station Number: CO-LR-885

Station Name: Fort Collins 3.7 S

Date: 5/22/2018 5:56 PM

Submitted: 8/09/2018 3:17 PM [Click to enlarge image.](#) [Upload Image](#)

Taken at registered location: True

Notes: Hail started about 3-4 minutes after initial rainfall. First hailstones about 3/4" in diameter. Received .35" of precipitation during total thunderstorm event (approx 12 minutes) {Observer indicated in the report that the largest hail size was 0.75", largest measured on the hail pad was 0.50" CoCoSTAFF DNT}

Hailstone Information

Largest Size: 1/2" Grape

Average Size: 3/8"

Smallest Size: 1/4" Pea Size

Stone Consistency: Mixed, White Ice

Hail Storm Information

Duration Minutes: 6

Duration Accuracy: 1min

Timing: More Rain than Hail: True

Hail Started: After rain

Largest Hail Started: Before smaller hail

Damage: shredded leaves

Hail pad information

Angle of Impact: 10-20

Number of Stones On Pad: 212

Distance Between Stones On Pad: .5

Depth Of Stones on Ground:

Has Samples: False



Water Year Summary Reports



2013 CoCoRaHS Water Year Summary for Station CO-LR-387

Station Number	CO-LR-387	Latitude	40.5984
Station Name	Bellvue 2.4 SSW	Longitude	-105.189
County	Larimer	Elevation	5554 feet

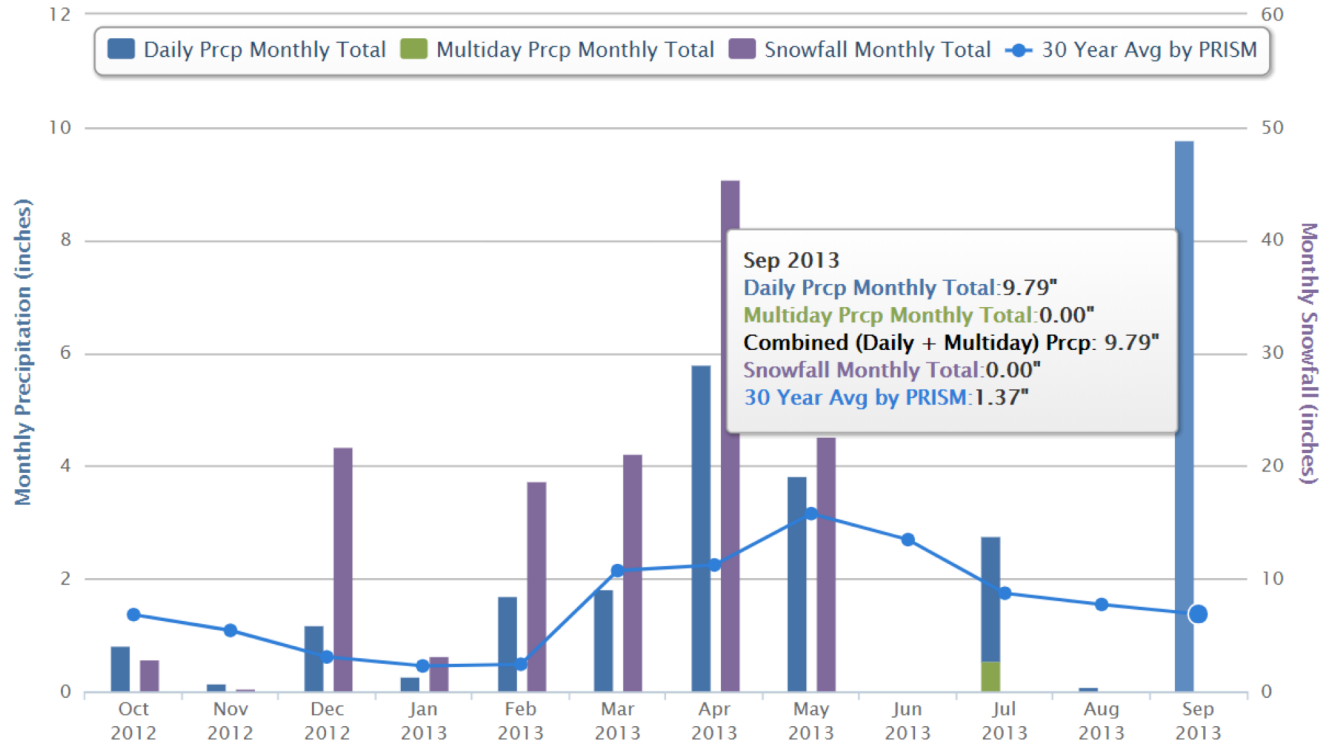
Monthly Prcp Totals Chart

Accumulated Prcp Chart

Daily Prcp Chart

Monthly Precipitation for the 2013 Water Year (Oct 2012 - Sept 2013)

Station: CO-LR-387 Bellvue 2.4 SSW



Sep 2013
 Daily Prcp Monthly Total: 9.79"
 Multiday Prcp Monthly Total: 0.00"
 Combined (Daily + Multiday) Prcp: 9.79"
 Snowfall Monthly Total: 0.00"
 30 Year Avg by PRISM: 1.37"

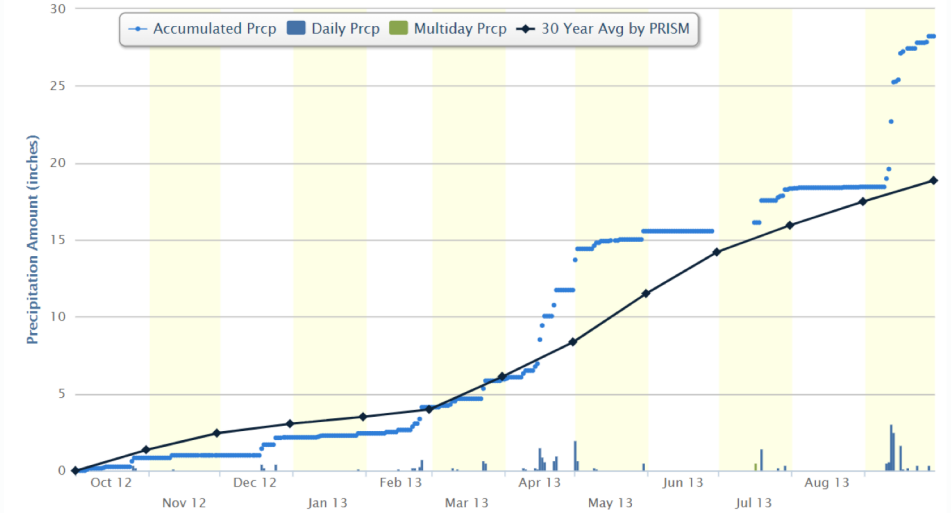
Monthly Prcp Totals Chart

Accumulated Prcp Chart

Daily Prcp Chart

2013 Water Year (Oct 2012 - Sept 2013) Accumulated Precipitation

Station: CO-LR-387 Bellvue 2.4 SSW



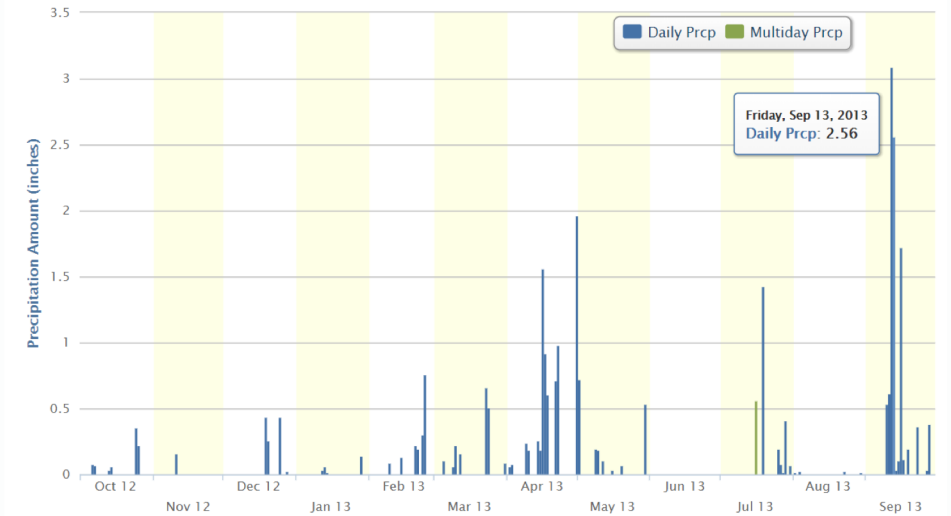
Monthly Prcp Totals Chart

Accumulated Prcp Chart

Daily Prcp Chart

2013 Water Year (Oct 2012 - Sept 2013) Daily Precipitation

Station: CO-LR-387 Bellvue 2.4 SSW



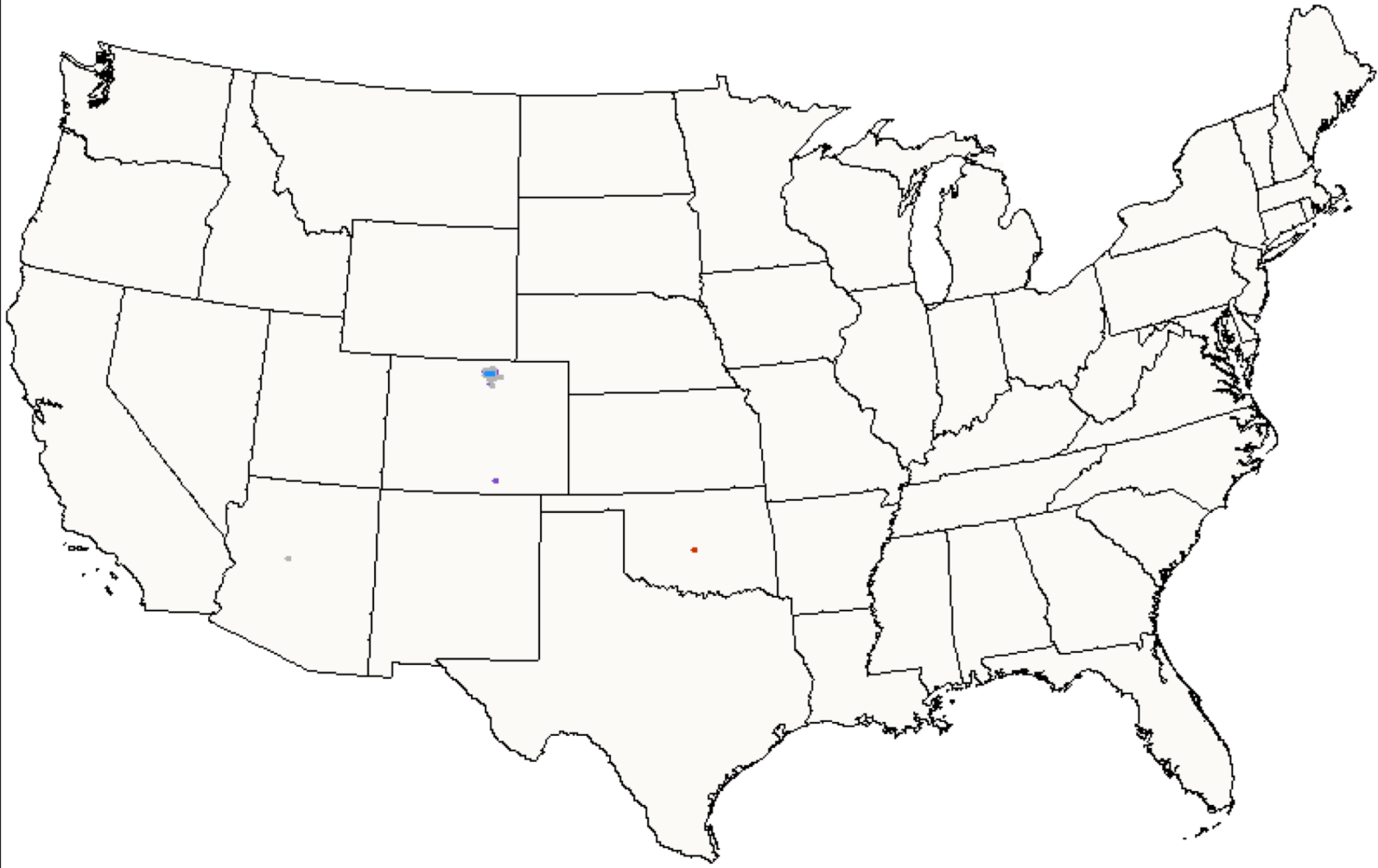
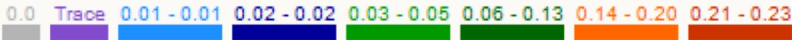
Friday, Sep 13, 2013
 Daily Prcp: 2.56"

Growth in the Network

Daily Precipitation Observations for July 1st 1998

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

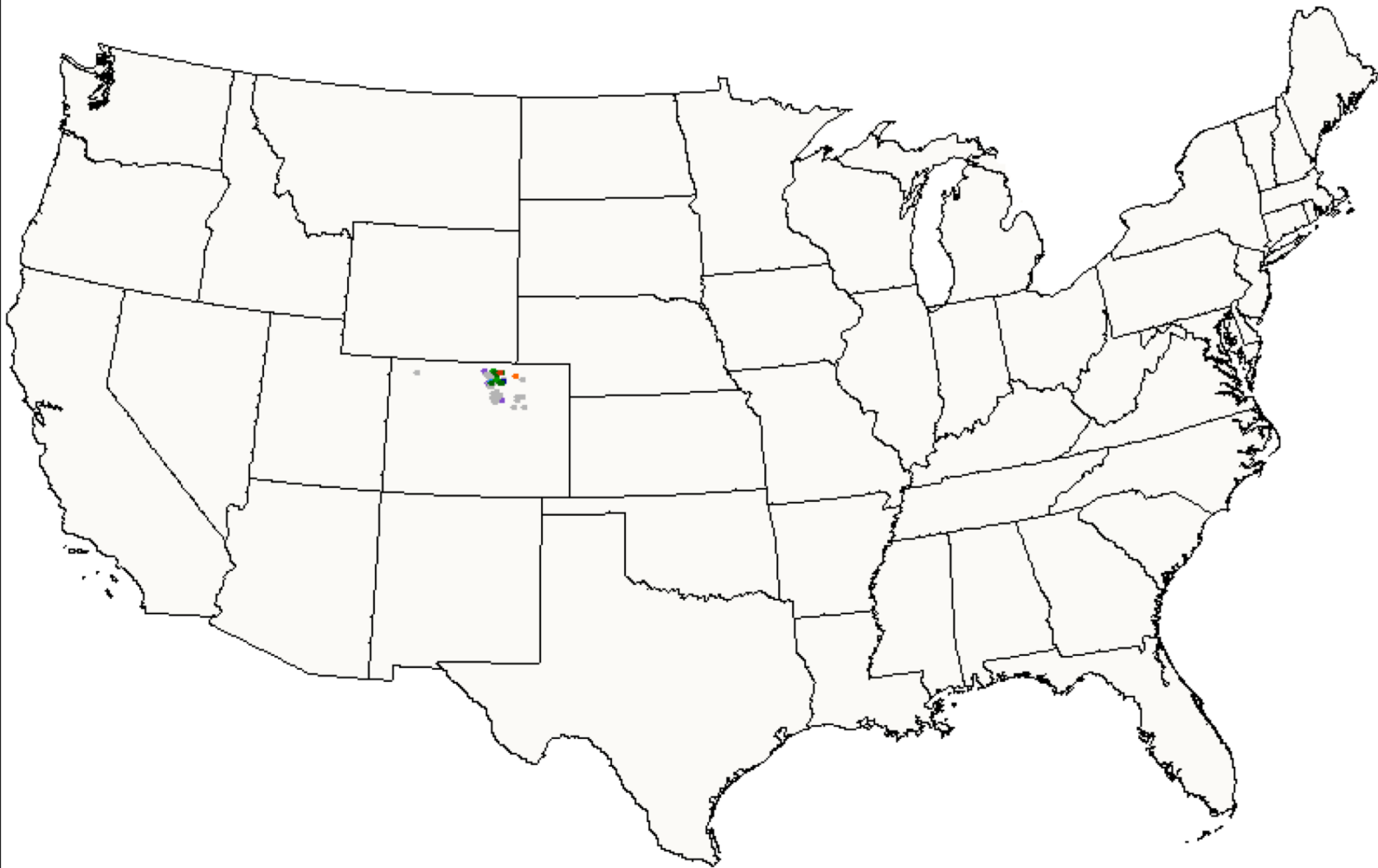
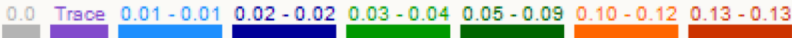
USA 7/1/1998



Daily Precipitation Observations for July 1st 1999

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

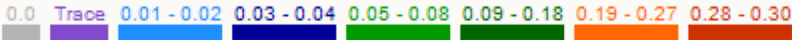
USA 7/1/1999



Daily Precipitation Observations for July 1st 2000

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

USA 7/1/2000



Daily Precipitation Observations for July 1st 2001

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

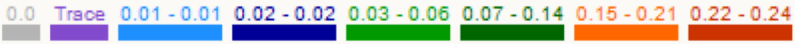
USA 7/1/2001

0.0 Trace 0.01 - 0.06 0.07 - 0.12 0.13 - 0.30 0.31 - 0.72 0.73 - 1.08 1.09 - 1.20



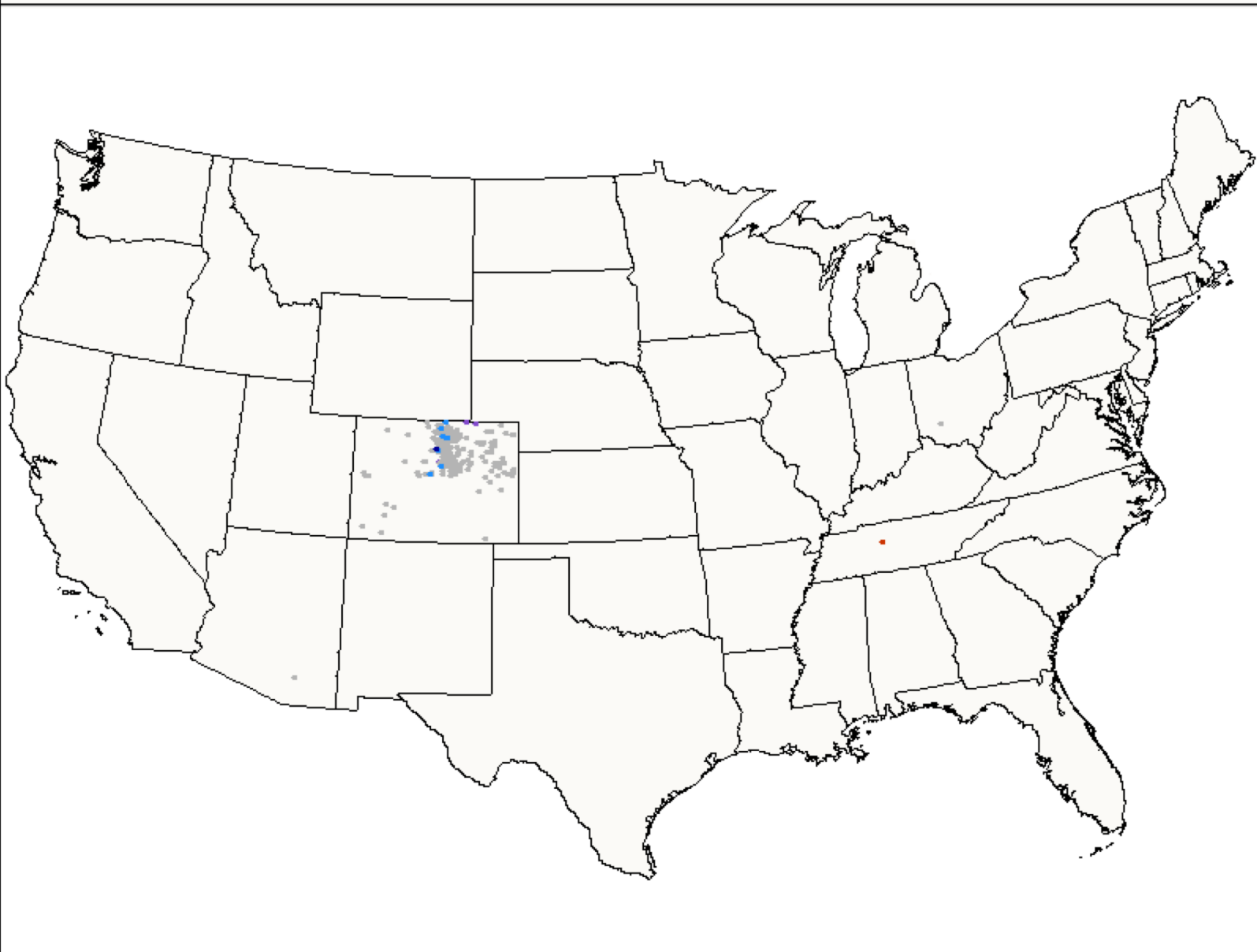
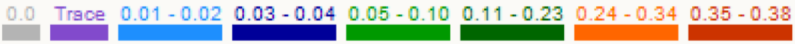
Daily Precipitation Observations for July 1st 2002

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2002



Daily Precipitation Observations for July 1st 2003

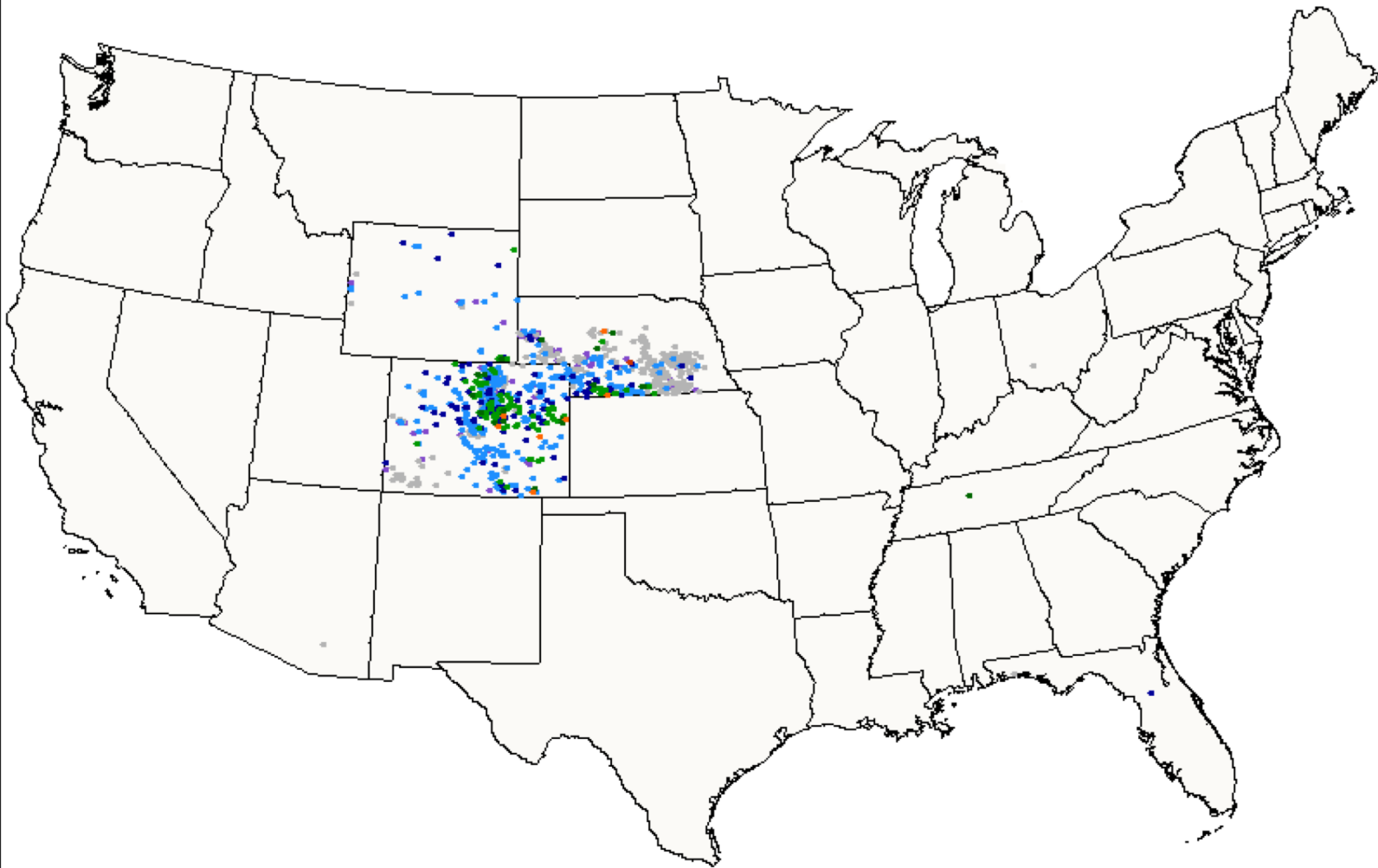
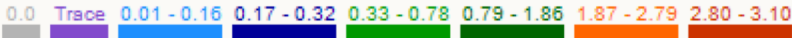
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2003



Daily Precipitation Observations for July 1st 2004

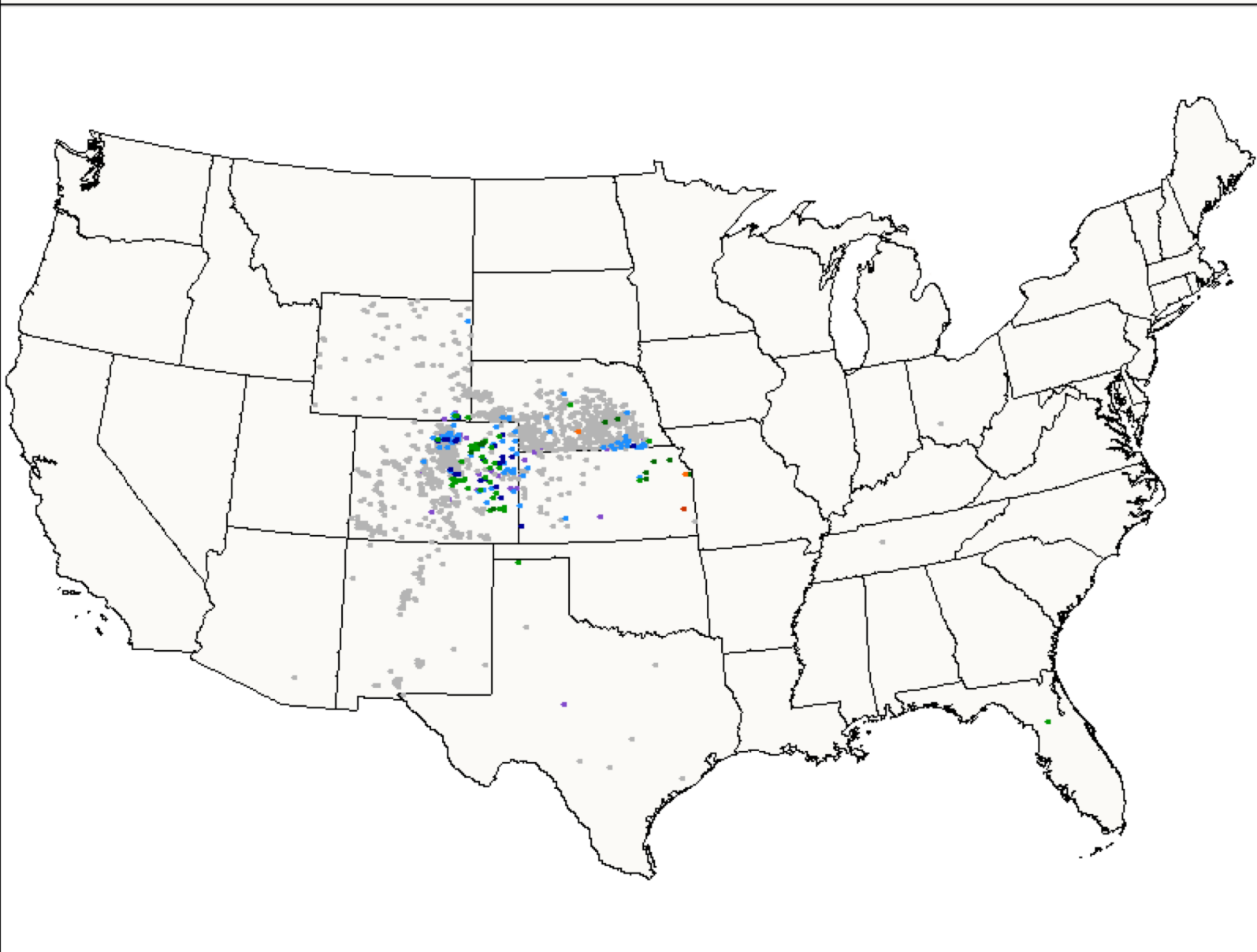
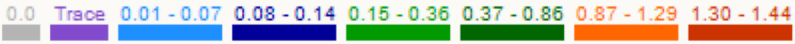
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 7/1/2004



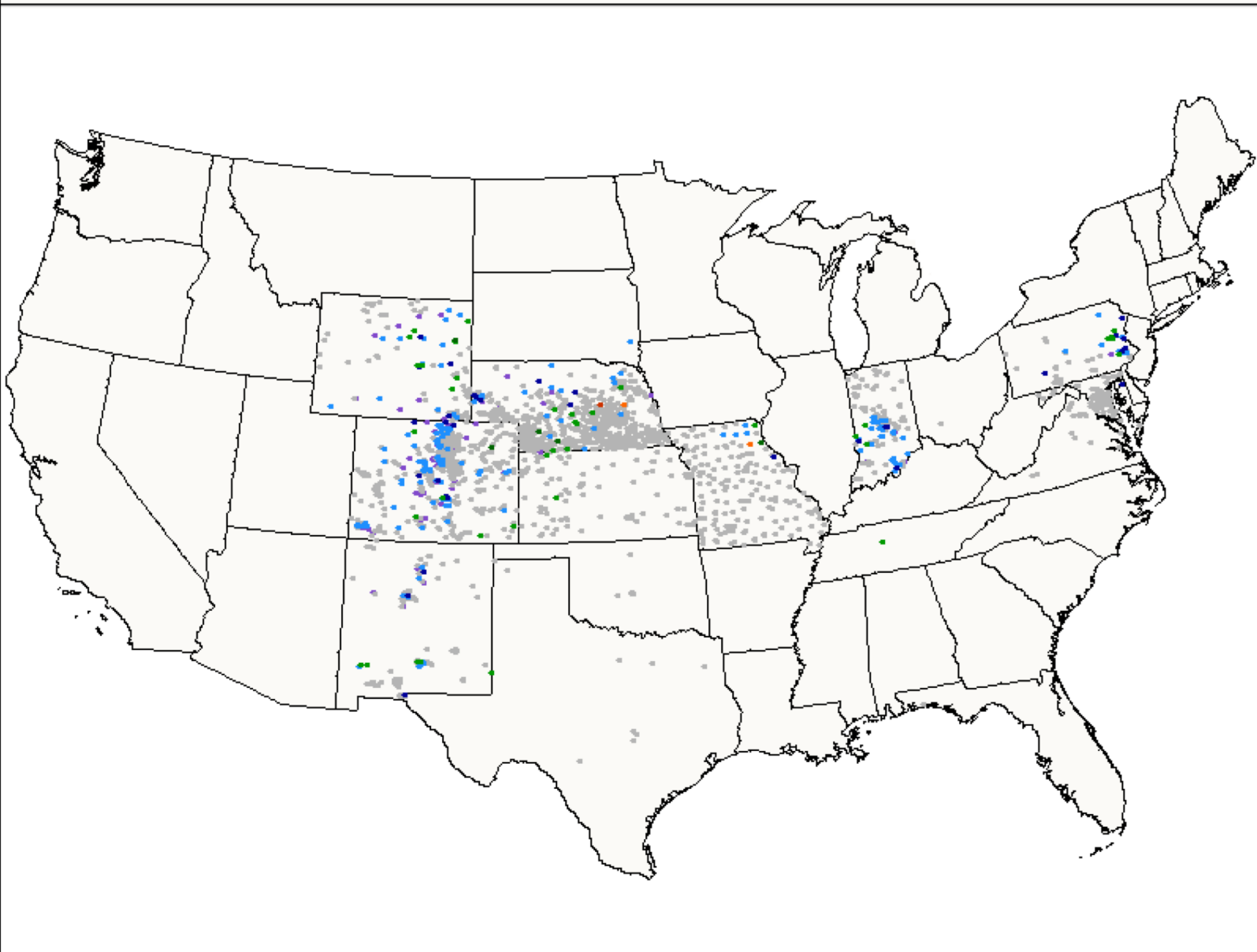
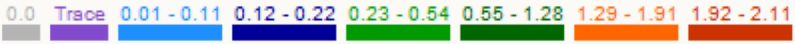
Daily Precipitation Observations for July 1st 2005

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2005



Daily Precipitation Observations for July 1st 2006

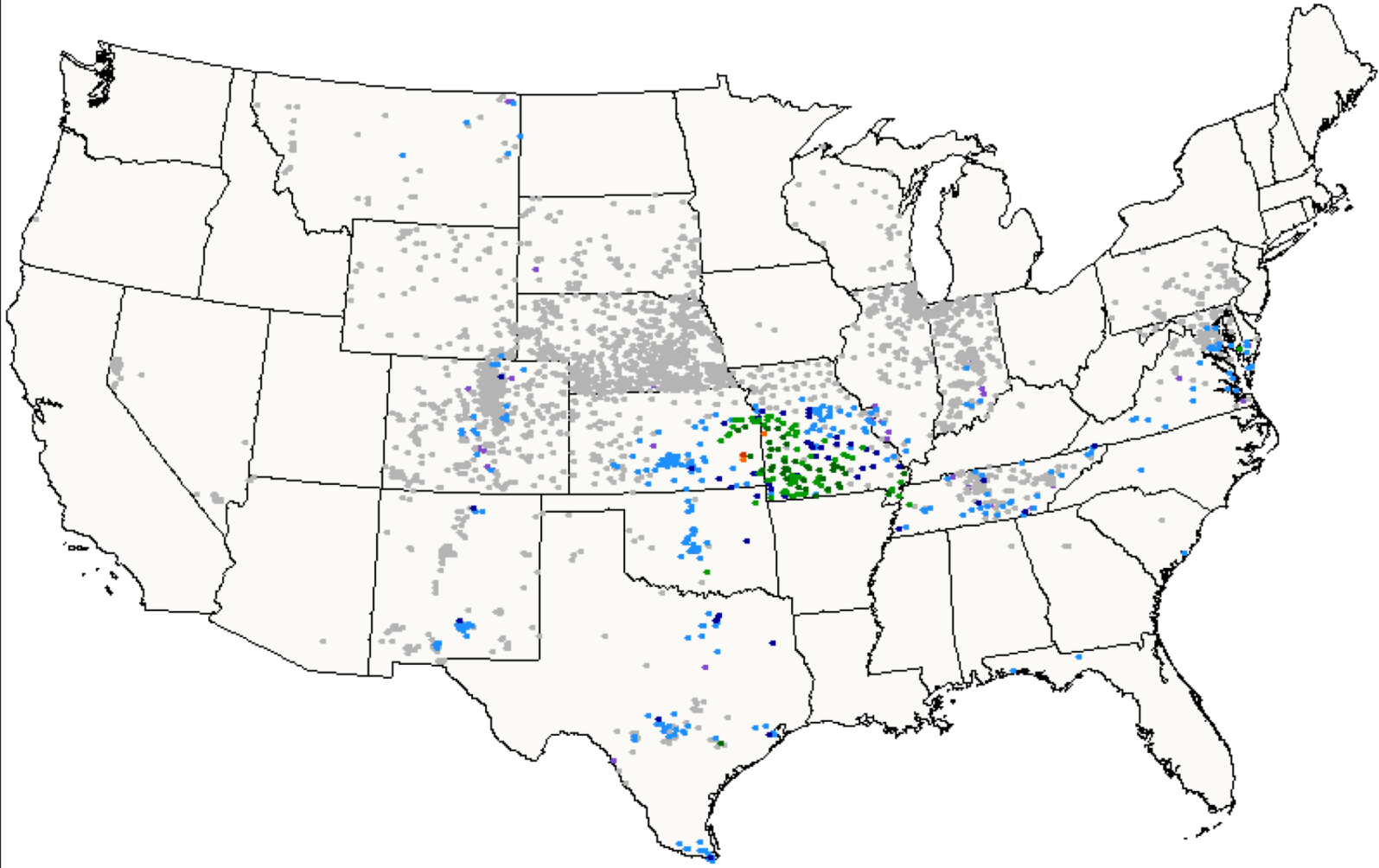
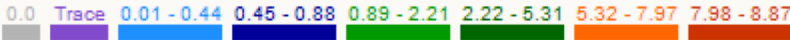
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2006



Daily Precipitation Observations for July 1st 2007

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

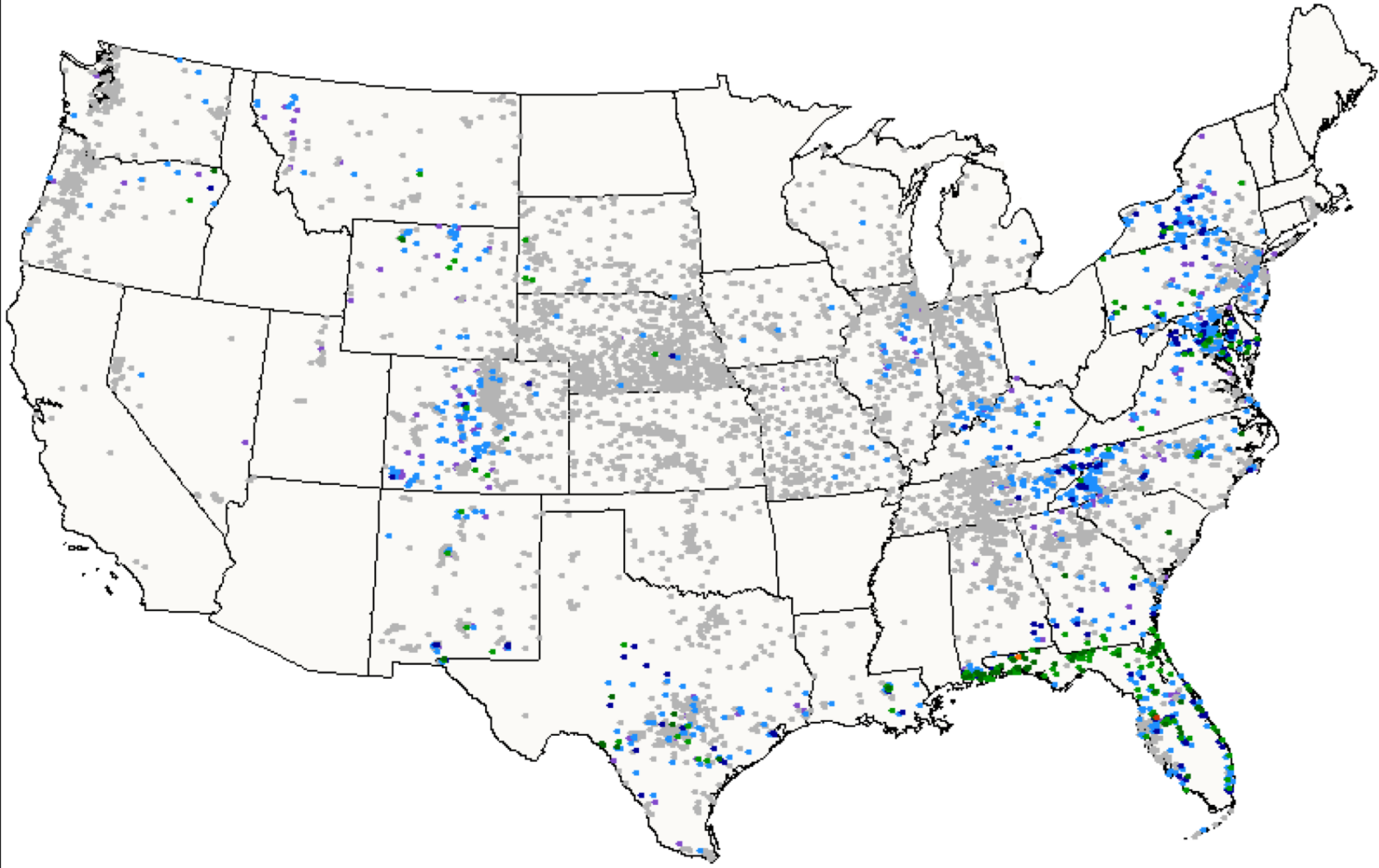
USA 7/1/2007



Daily Precipitation Observations for July 1st 2008

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

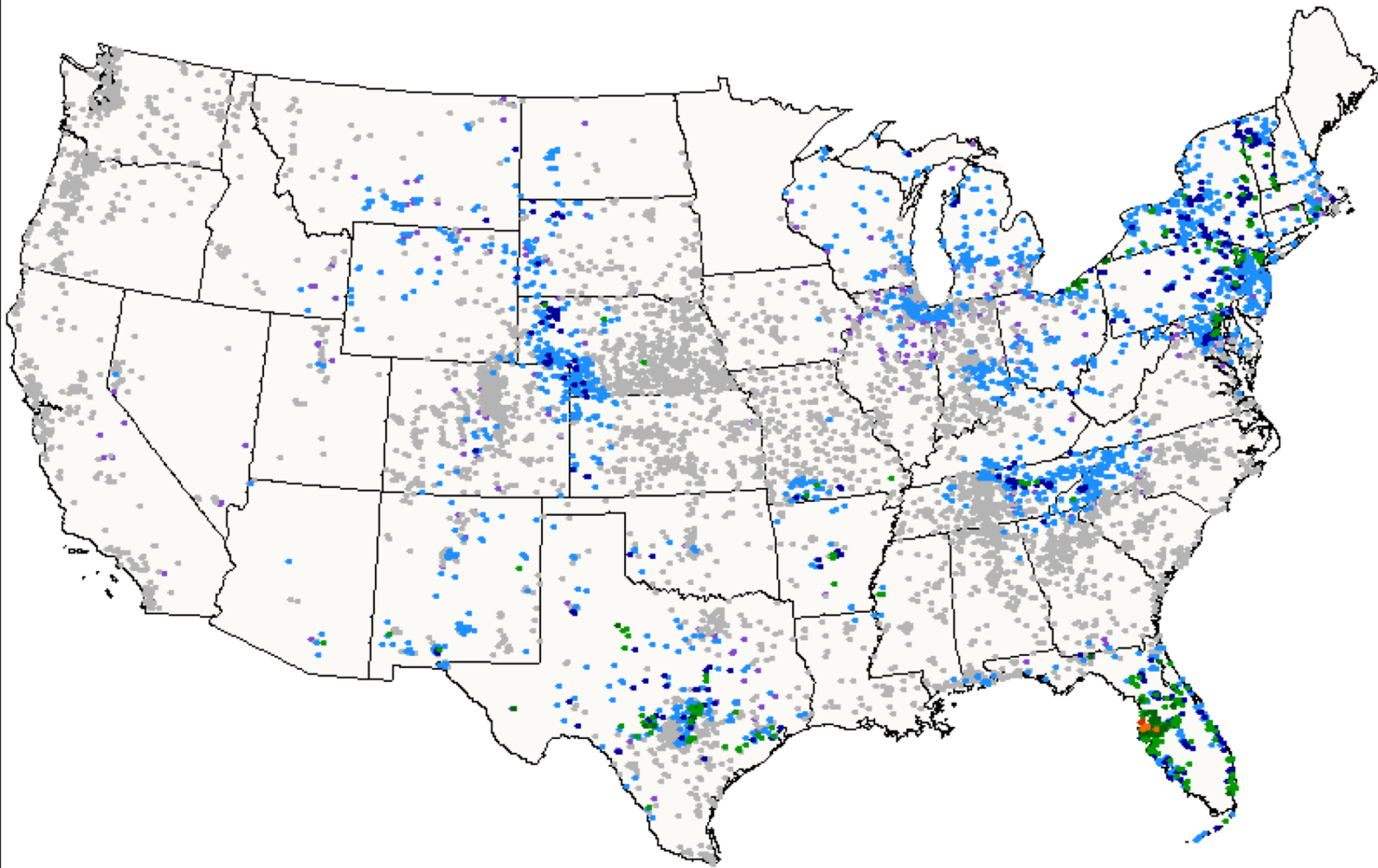
USA 7/1/2008



Daily Precipitation Observations for July 1st 2009

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

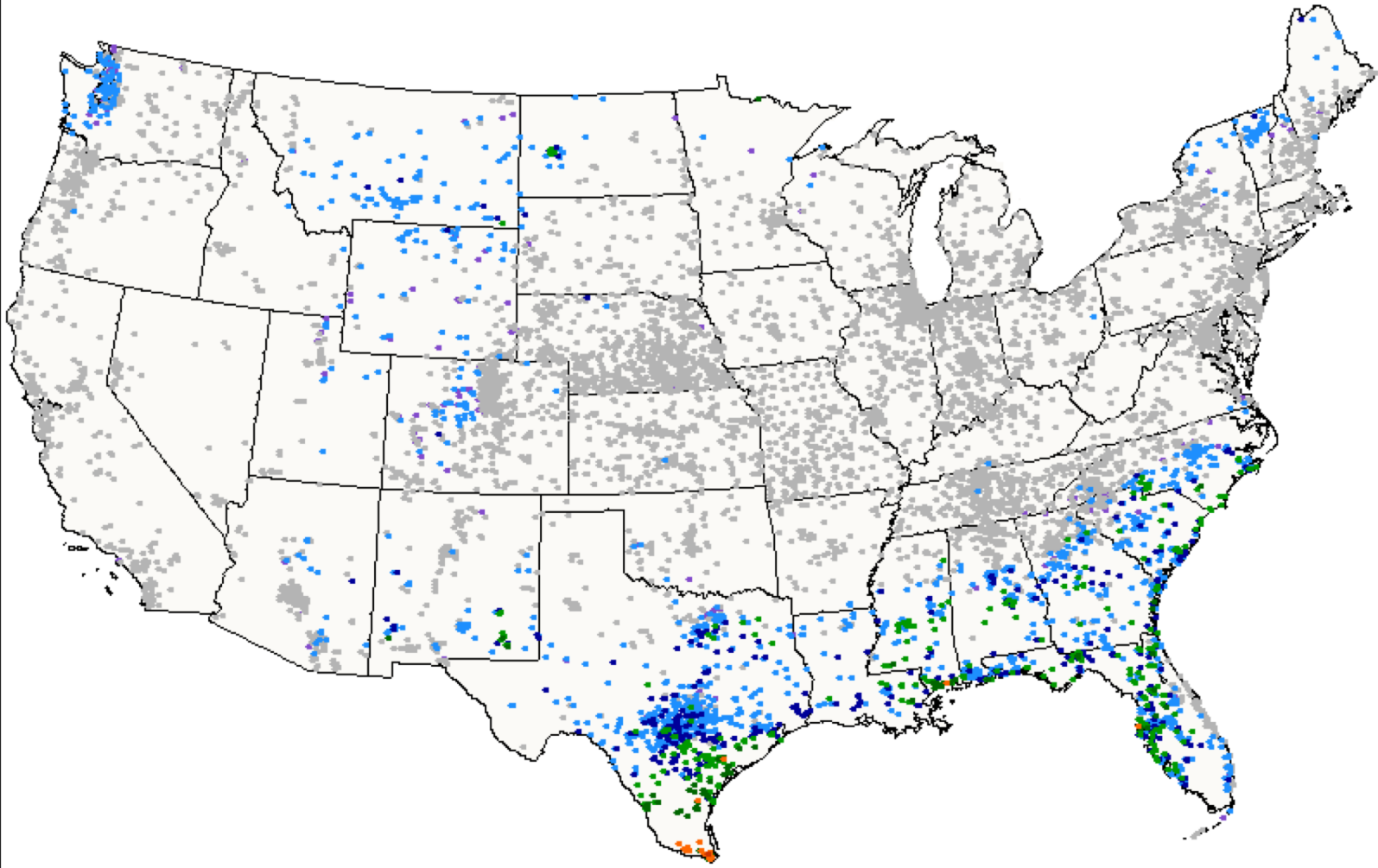
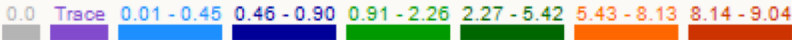
USA 7/1/2009



Daily Precipitation Observations for July 1st 2010

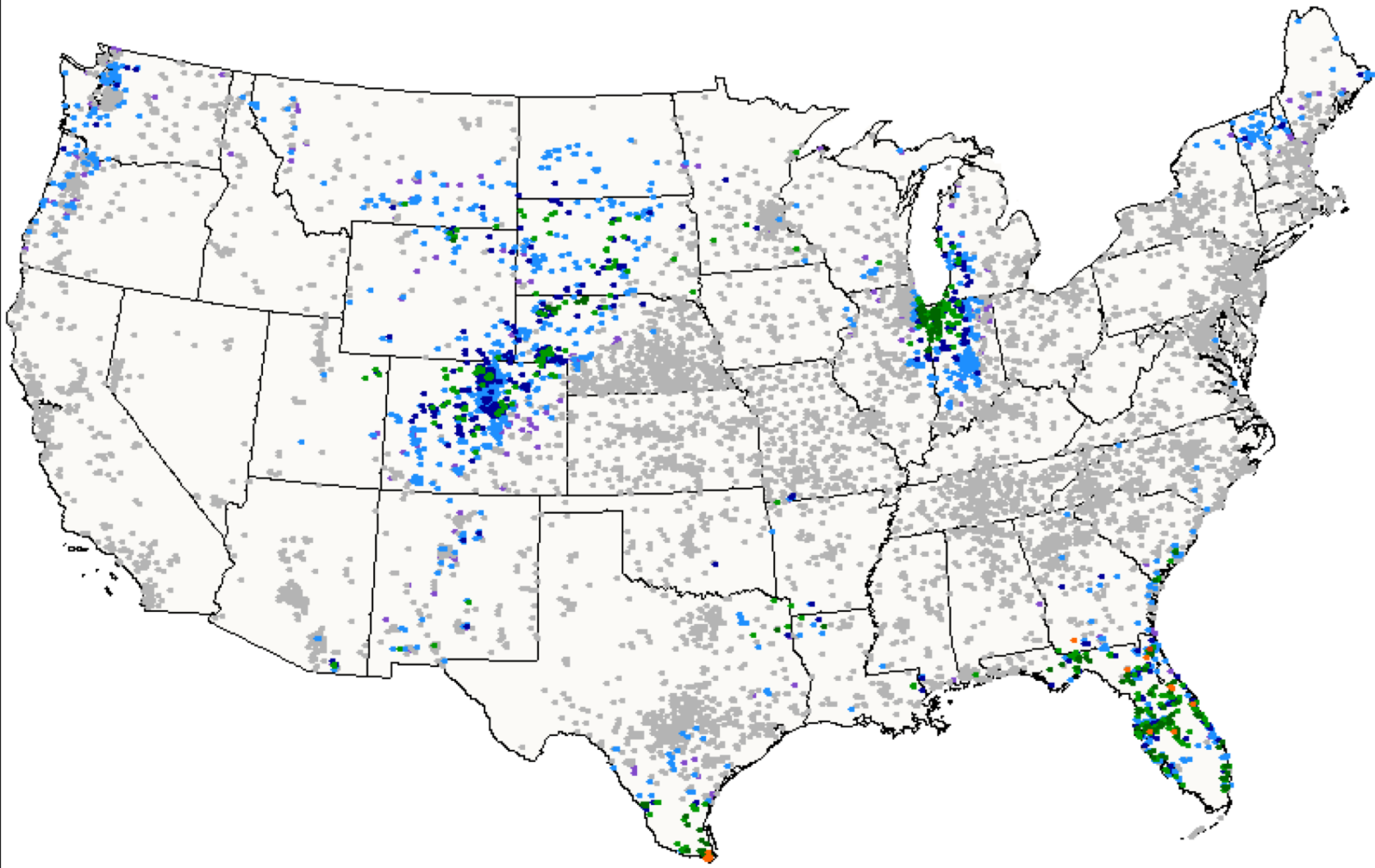
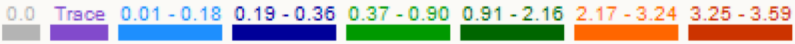
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 7/1/2010



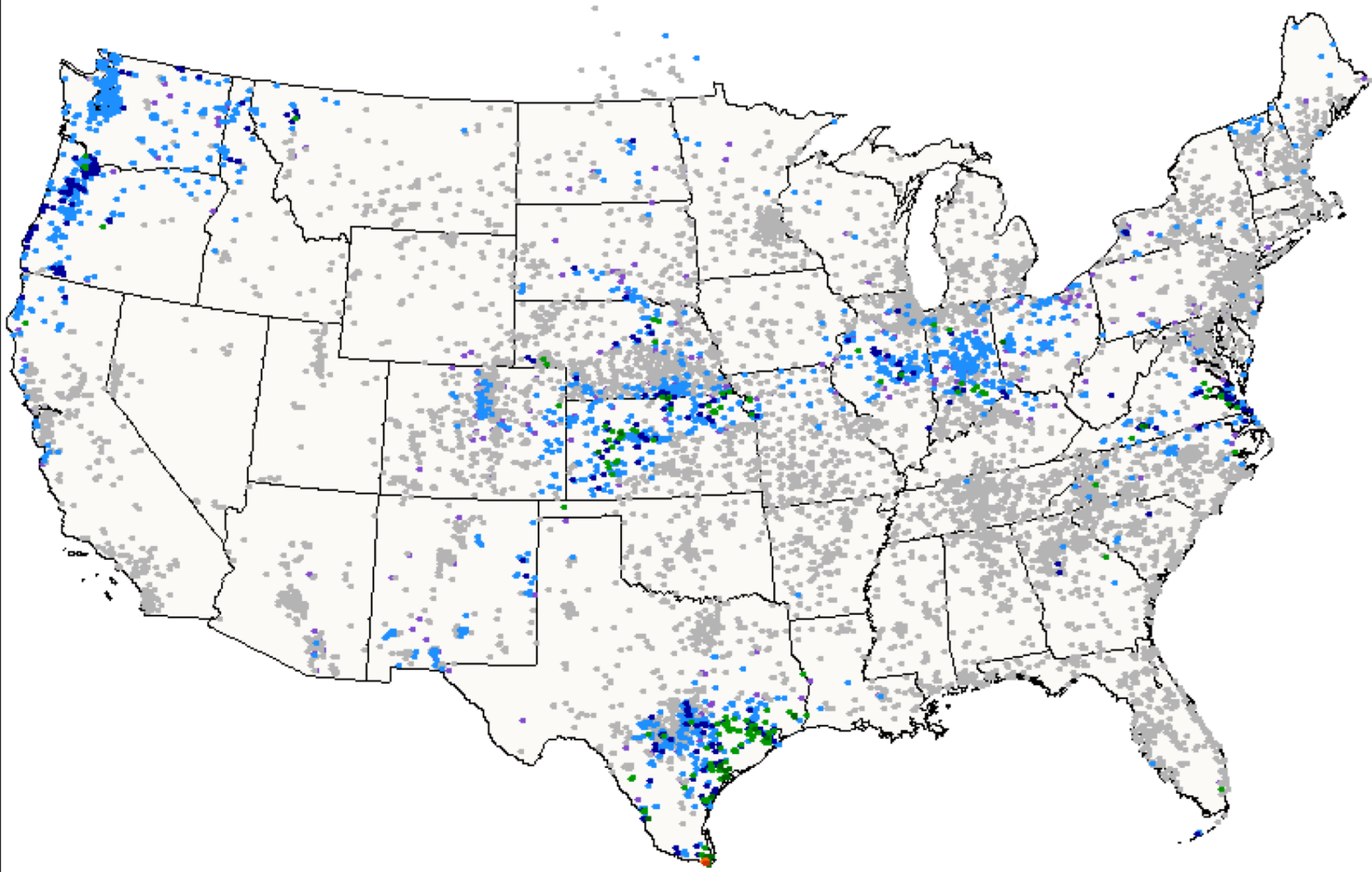
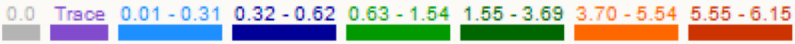
Daily Precipitation Observations for July 1st 2011

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2011



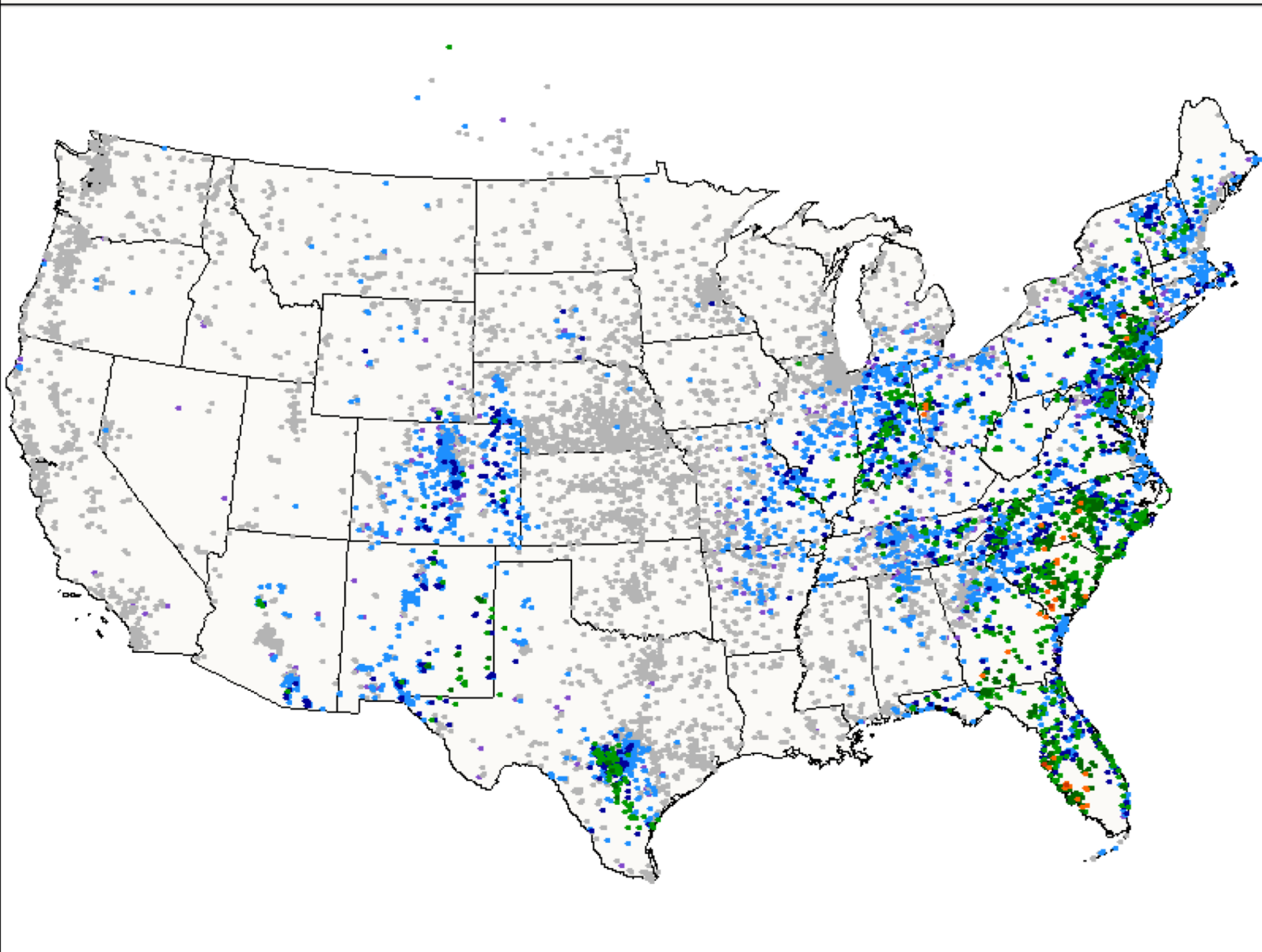
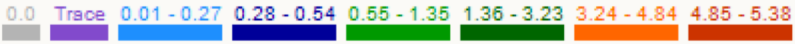
Daily Precipitation Observations for July 1st 2012

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2012



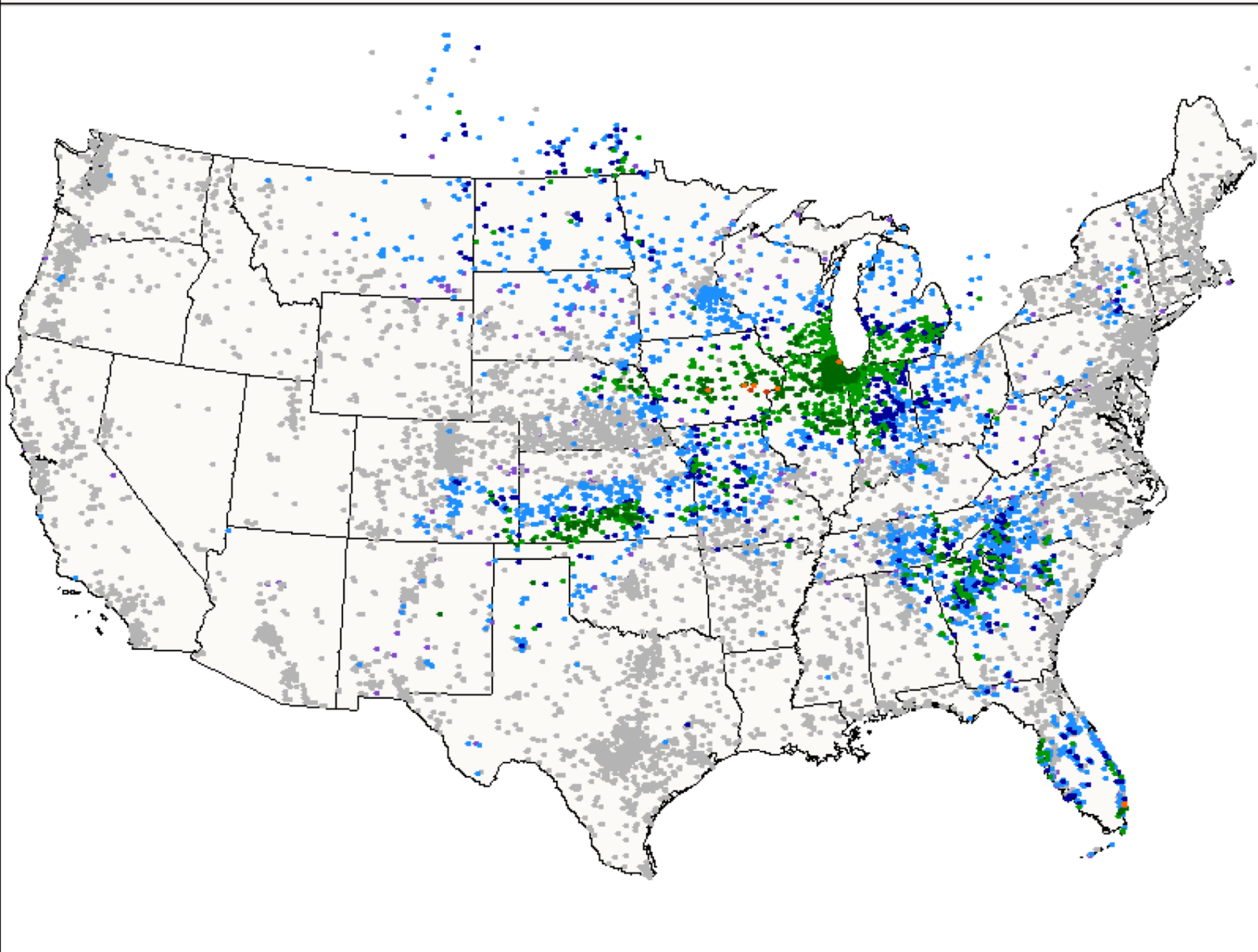
Daily Precipitation Observations for July 1st 2013

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2013



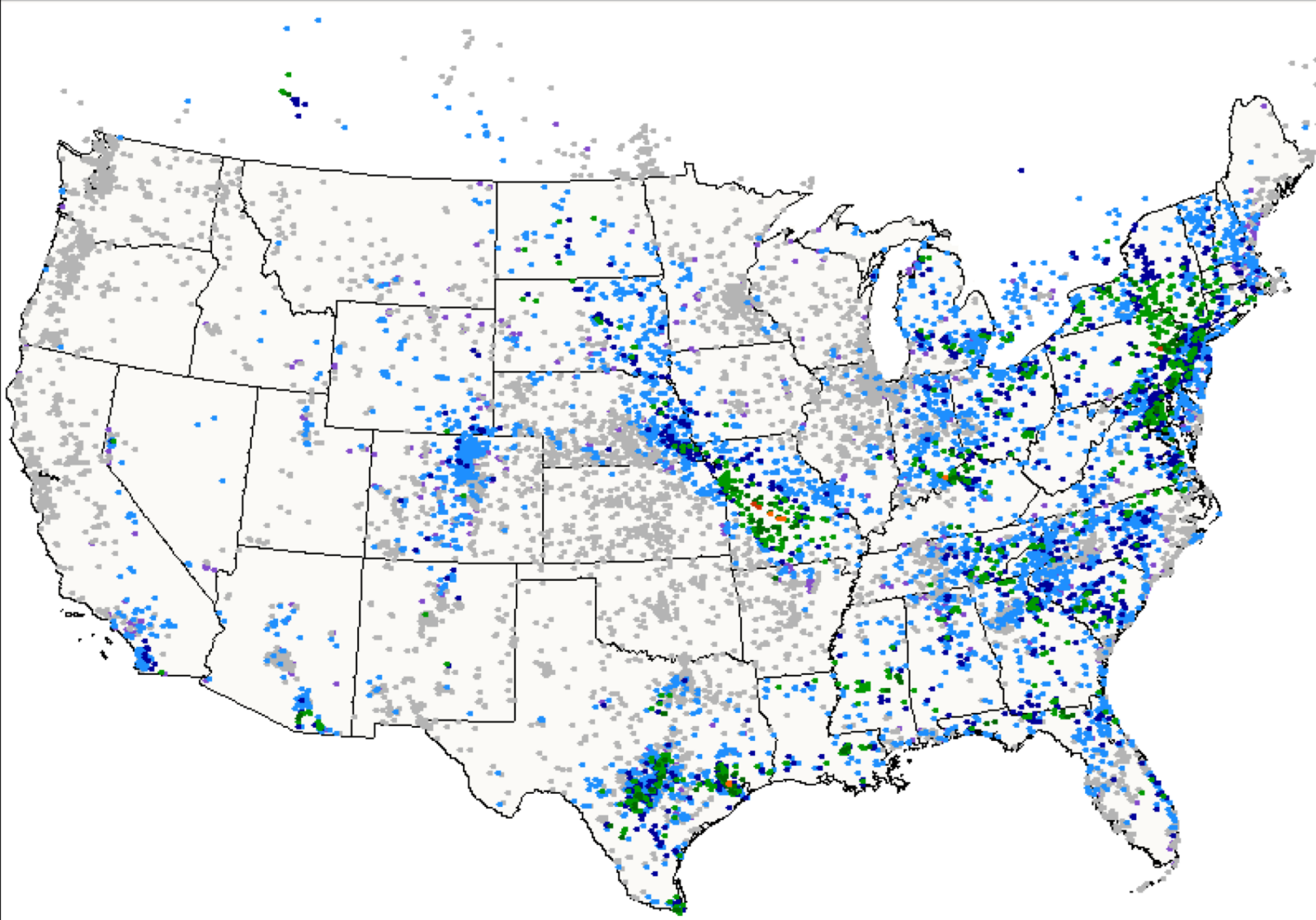
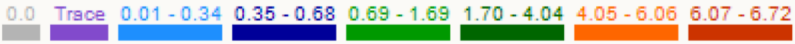
Daily Precipitation Observations for July 1st 2014

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2014



Daily Precipitation Observations for July 1st 2015

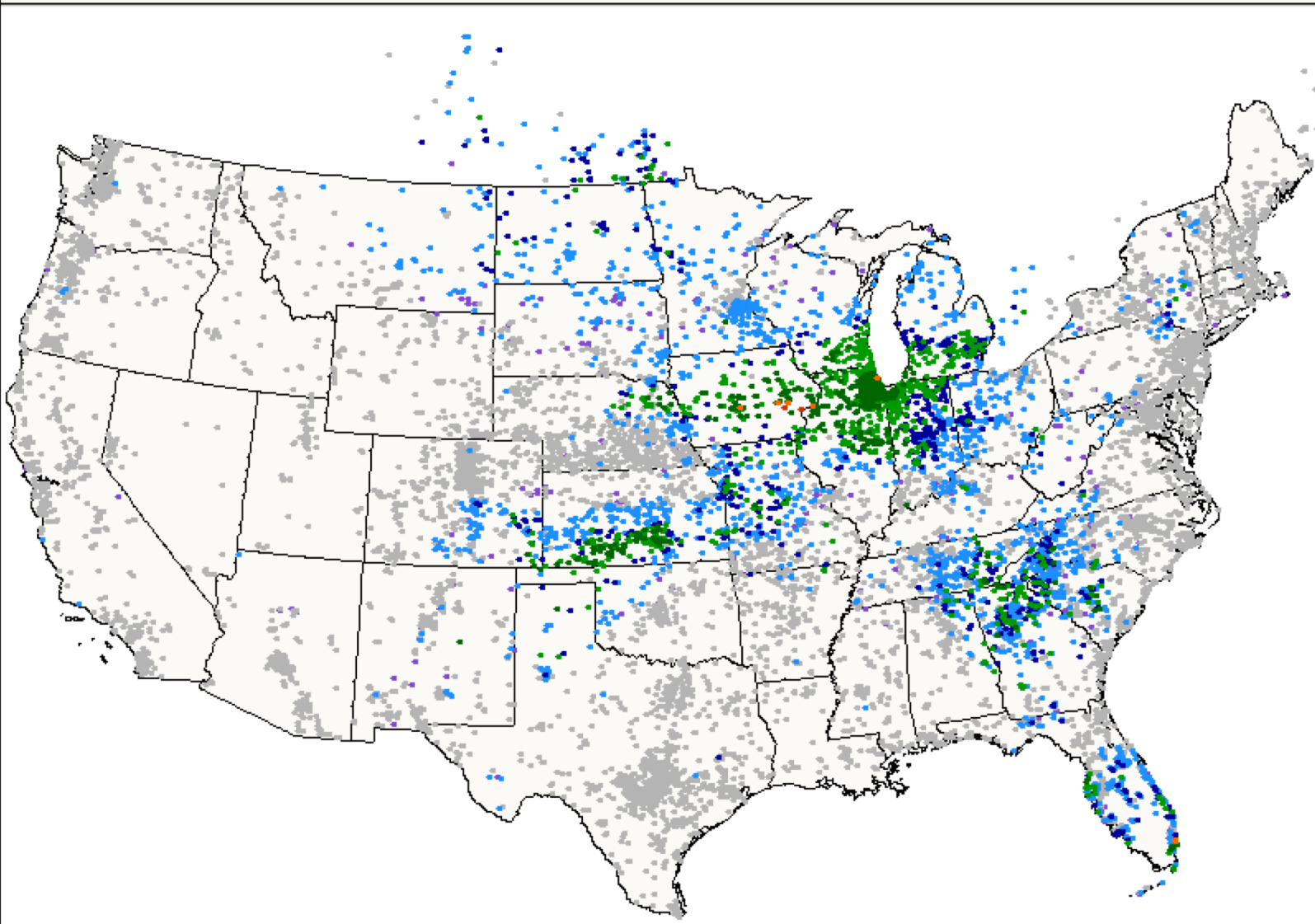
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2015



Daily Precipitation Observations for July 1st 2014

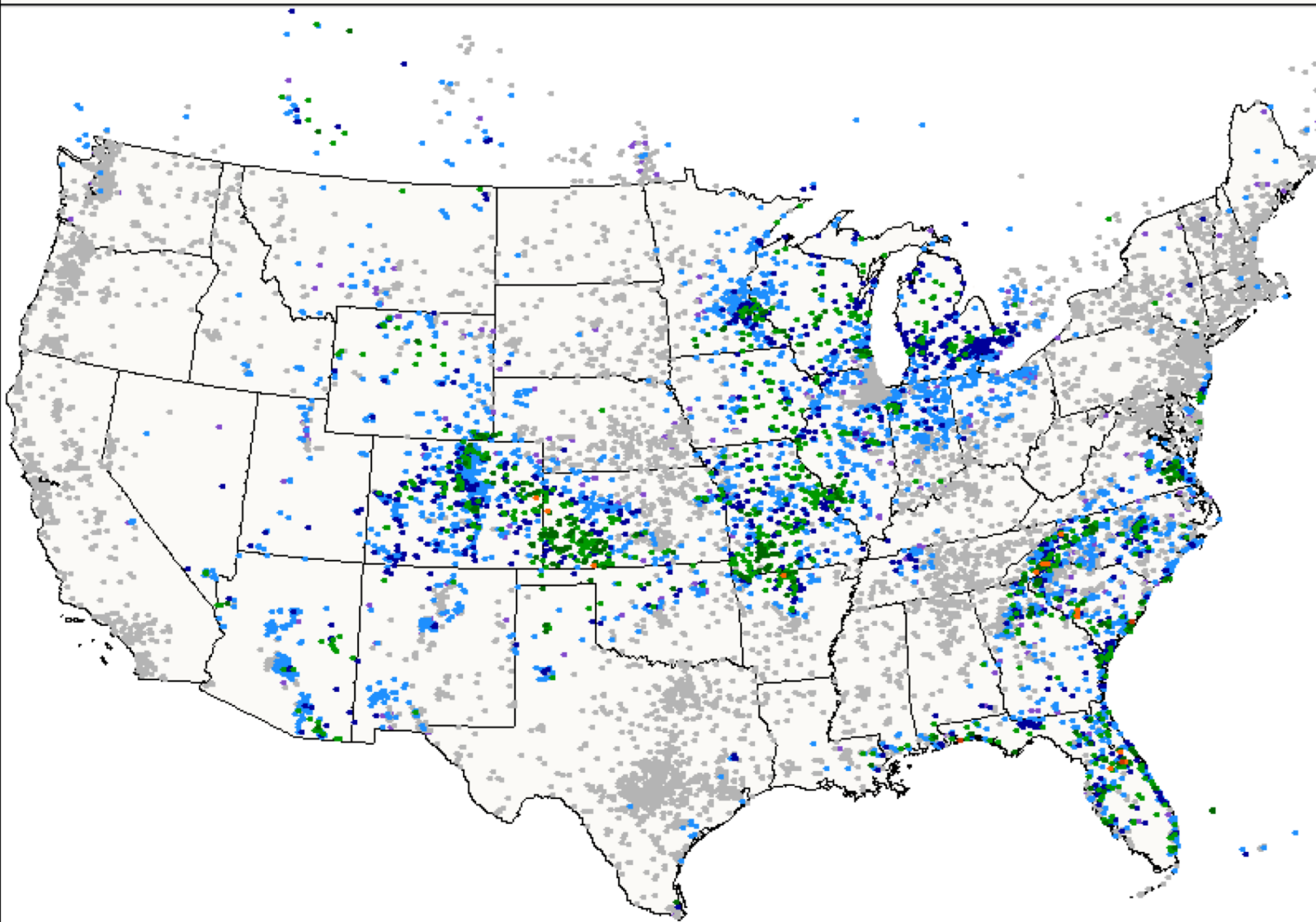
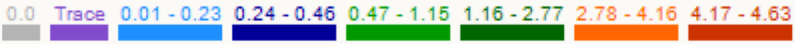
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 7/1/2014



Daily Precipitation Observations for July 1st 2016

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2016

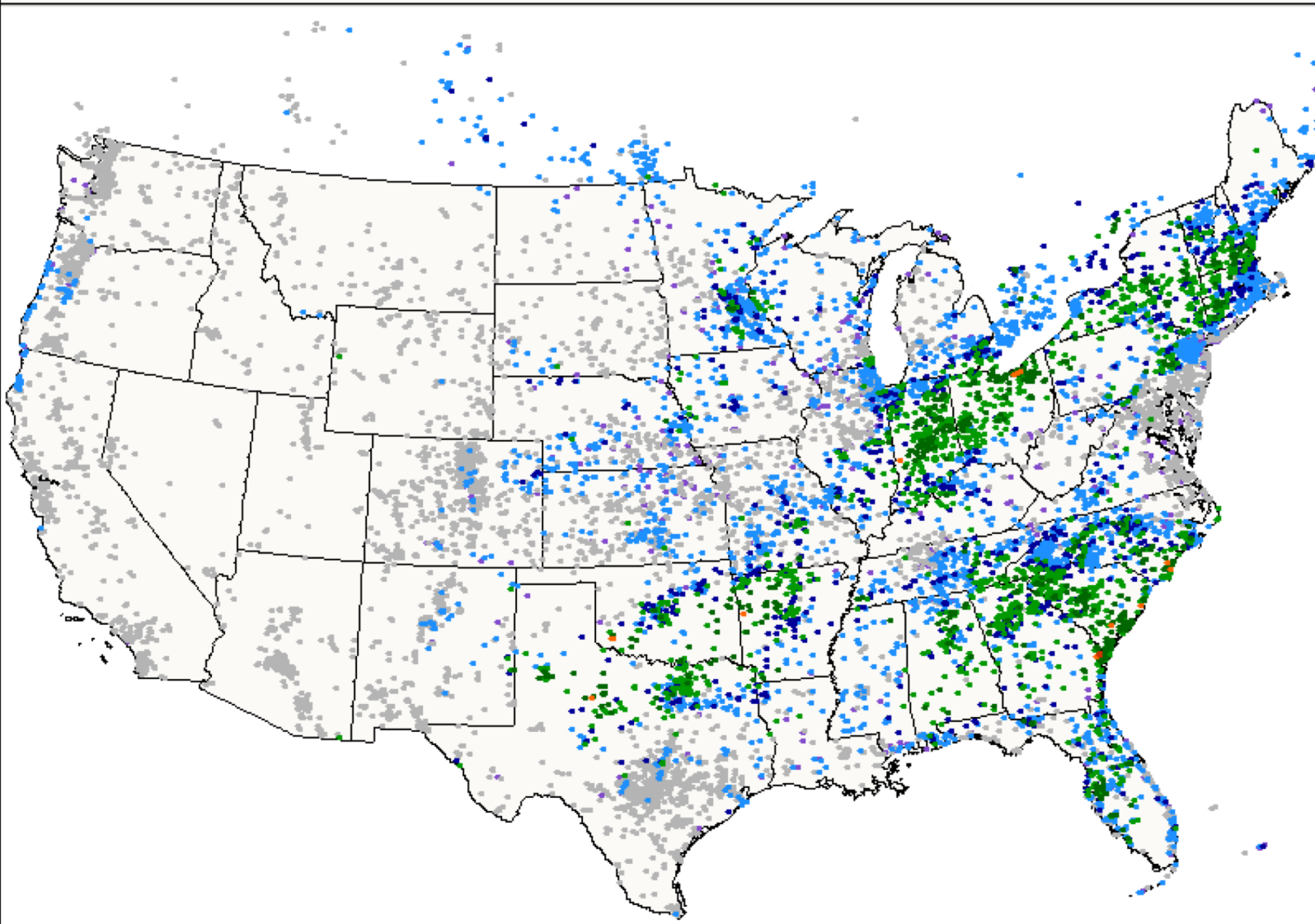


Daily Precipitation Observations for July 1st 2017

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

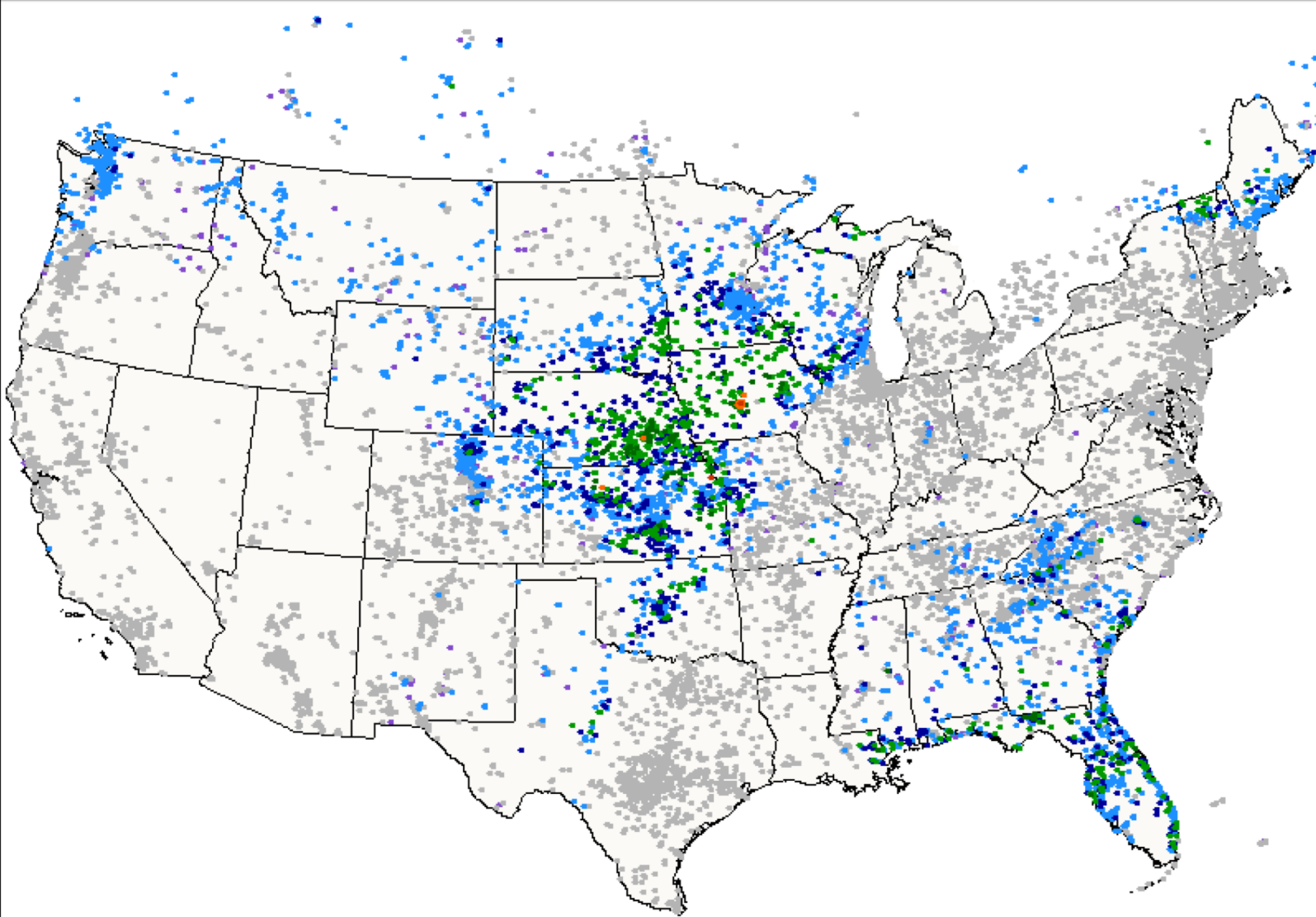
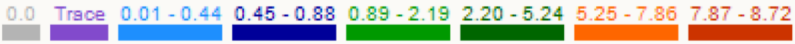
USA 7/1/2017

0.0 Trace 0.01 - 0.24 0.25 - 0.48 0.49 - 1.20 1.21 - 2.88 2.89 - 4.32 4.33 - 4.79



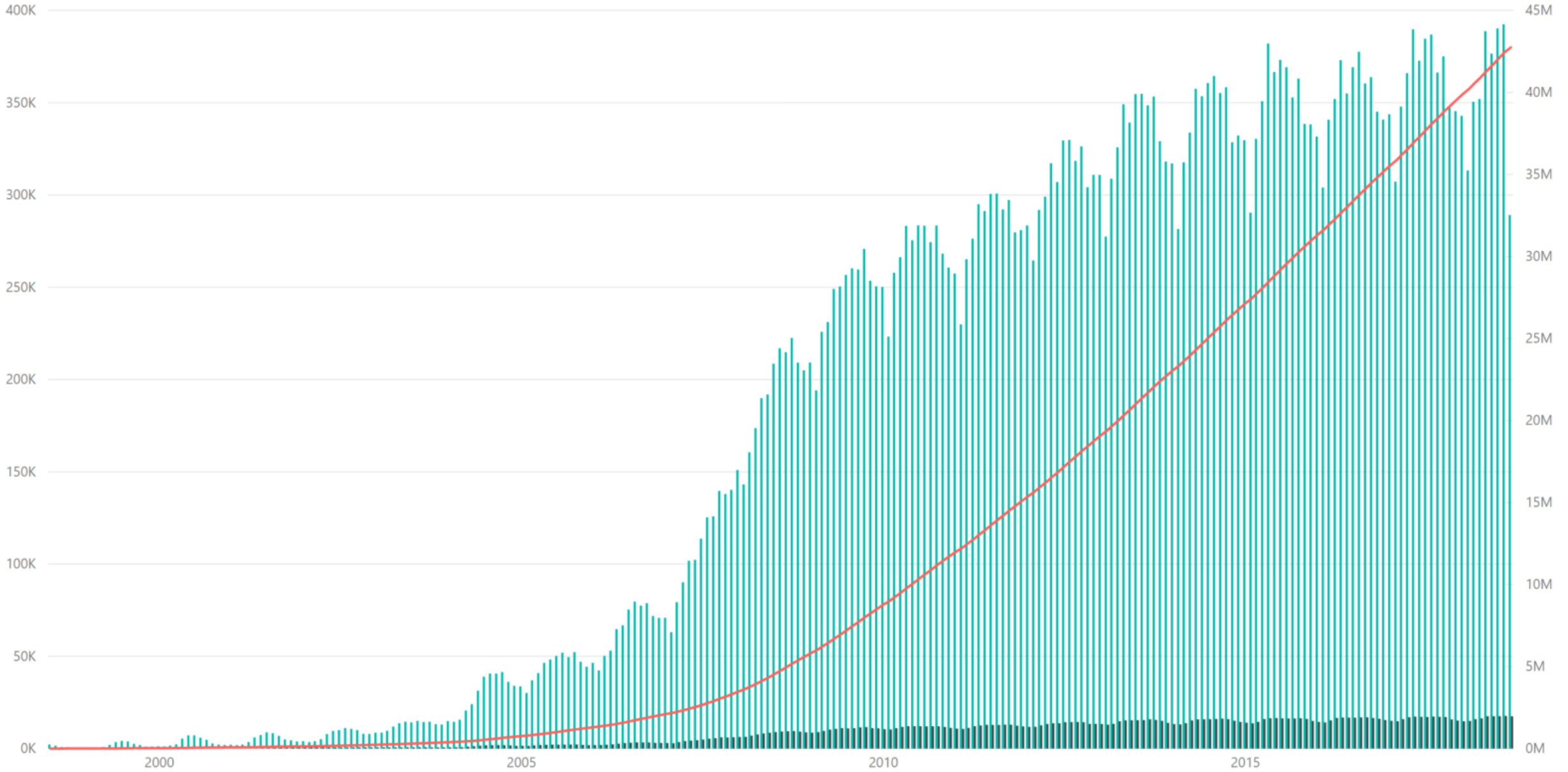
Daily Precipitation Observations for July 1st 2018

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 7/1/2018



Number of Daily Precip Obs and Active Stations by Month with the Running Daily Precip Archive Count

● Number of Daily Precip Obs ● Number of Active Stations ● Total Daily Precip Obs Count



Condition Monitoring

My Data Entry : Condition Monitoring Report Form

Condition Monitoring Report Form

Submit Data Reset

Station Number : CO-LR-607

Station Name : Fort Collins 3.8 SSW

Condition monitoring reports are submitted on a regular (weekly, biweekly, monthly) basis to share information about the effects of local precipitation on the environment and society. By submitting reports on a regular basis, you create a baseline to see change through time, such as seasonal differences or changes caused by more or less precipitation. Please refer to the [Condition Monitoring training slide show](#) for more information.

* indicates required field

Report Date *

9/25/2018

Condition Scale Bar [More information on the scale bar](#) Clear Scale Bar

Severely Dry	Moderately Dry	Mildly Dry	Near Normal	Mildly Wet	Moderately Wet	Severely Wet
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Description

Please provide a description of how dry, normal or wet conditions are affecting you, your livelihood, your activities, etc. *

Report Categories

Please check at least one report category. If you check a category, please provide supporting information in the description. [More information on condition monitoring categories.](#)

- General Awareness
- Agriculture
- Business & Industry
- Energy
- Fire
- Plants & Wildlife
- Relief, Response & Restrictions
- Society & Public Health
- Tourism & Recreation
- Water Supply & Quality

Submit Data Reset

Condition Monitoring Summary Report

Home CM Maps CM Reports

Filter Condition Monitoring Data

By Location: ?

United States North Carolina Entire State

By Station Field: ?

Station Number or Name Station Number Station Name

Reset Filter Generate Report

Current Summary Report Settings

Location: North Carolina, United States

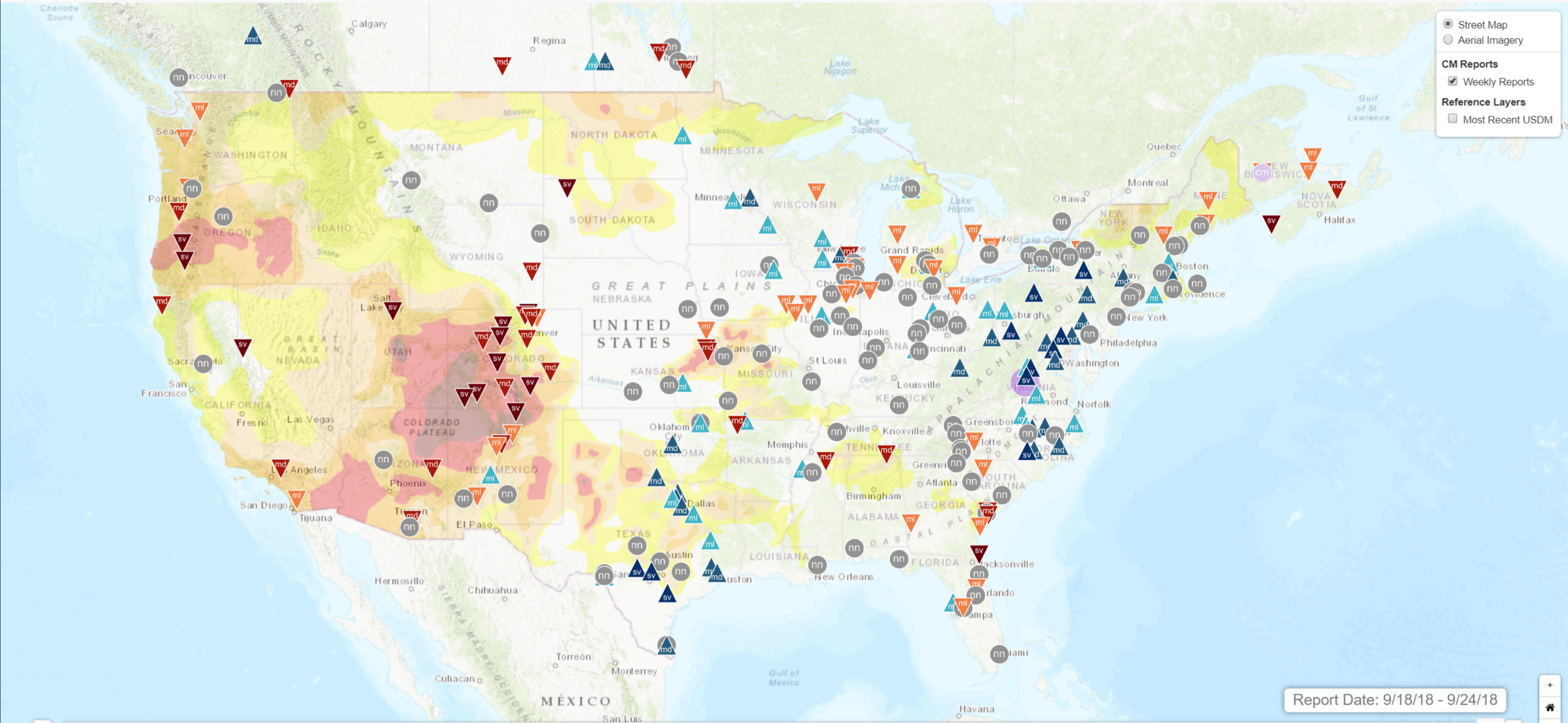
Station: Any Station

Period of Record: From the week starting on Oct 11, 2016 through the week ending on Oct 01, 2018

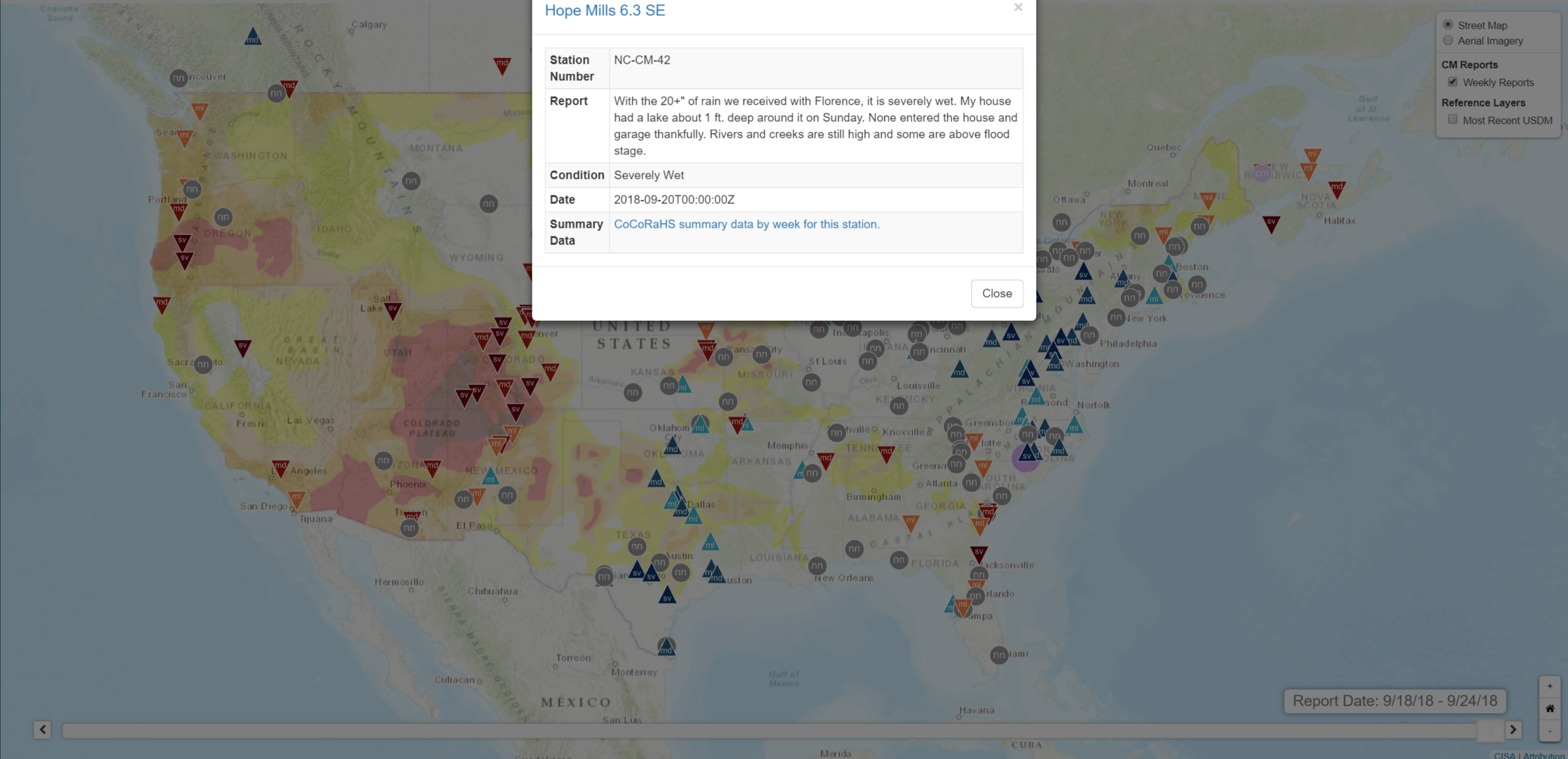
About the summary

The summary charts display information provided in condition monitoring reports to document changing on-the-ground conditions that are affected by precipitation, or a lack thereof. The data in the charts represent observers' scale bar and condition monitoring category selections.

- Street Map
- Aerial Imagery
- CM Reports**
 - Weekly Reports
- Reference Layers**
 - Most Recent USDM



Report Date: 9/18/18 - 9/24/18



Hope Mills 6.3 SE

Station Number	NC-CM-42
Report	With the 20+" of rain we received with Florence, it is severely wet. My house had a lake about 1 ft. deep around it on Sunday. None entered the house and garage thankfully. Rivers and creeks are still high and some are above flood stage.
Condition	Severely Wet
Date	2018-09-20T00:00:00Z
Summary Data	CoCoRaHS summary data by week for this station.

Close

Street Map
 Aerial Imagery
CM Reports
 Weekly Reports
Reference Layers
 Most Recent USDM

Report Date: 9/18/18 - 9/24/18

+
 Home
 -

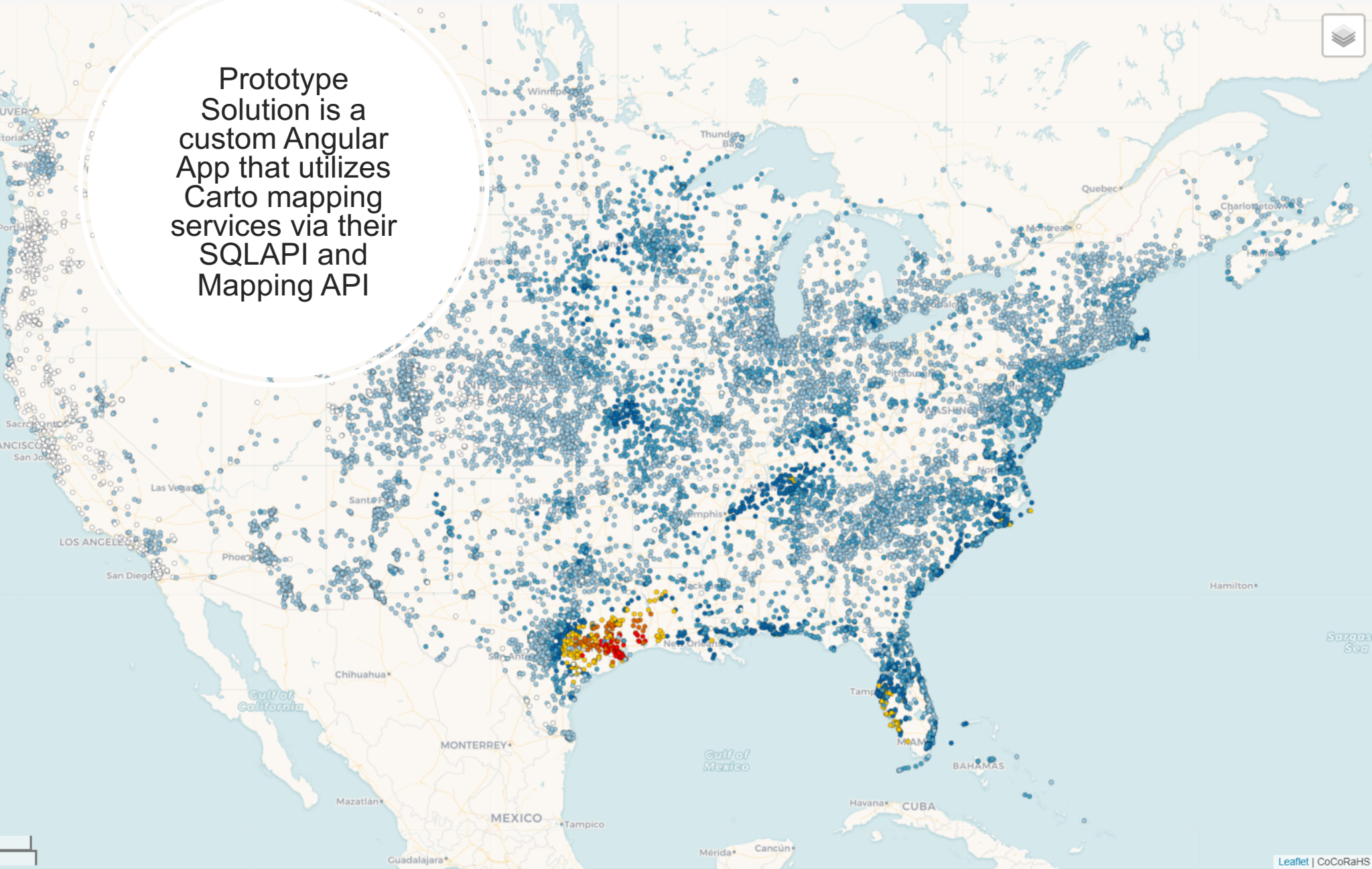
CoCoRaHS Mapping vNext

Overview of CoCoRaHS Mapping Requirements

- Ability to map tens of thousands of data points without crashing the browser
- Make every data point interactive
- Ability to provide maps for the entire CoCoRaHS archive of over 40 million daily precip observations
- Provide accumulation maps over entire archive of daily and multi-day observations for dynamic (user-defined) date ranges
- Ability to map the observer contributed data in near real-time
- Support for a multitude of stakeholder filtering and visualization requirements



● NA ○ Zero ○ Trace ○ 0.01 - 2.20 ○ 2.21 - 5.55 ● 5.56 - 11.09 ● 11.10 - 20.76 ● 20.77 - 29.61 ● 29.62 - 49.31



Map Options

▼ What

Precipitation

📅 When

Type Custom

From 8/17/2017

To 9/3/2017

⚙️ How

Units US Units

Color Scheme Blue2Red

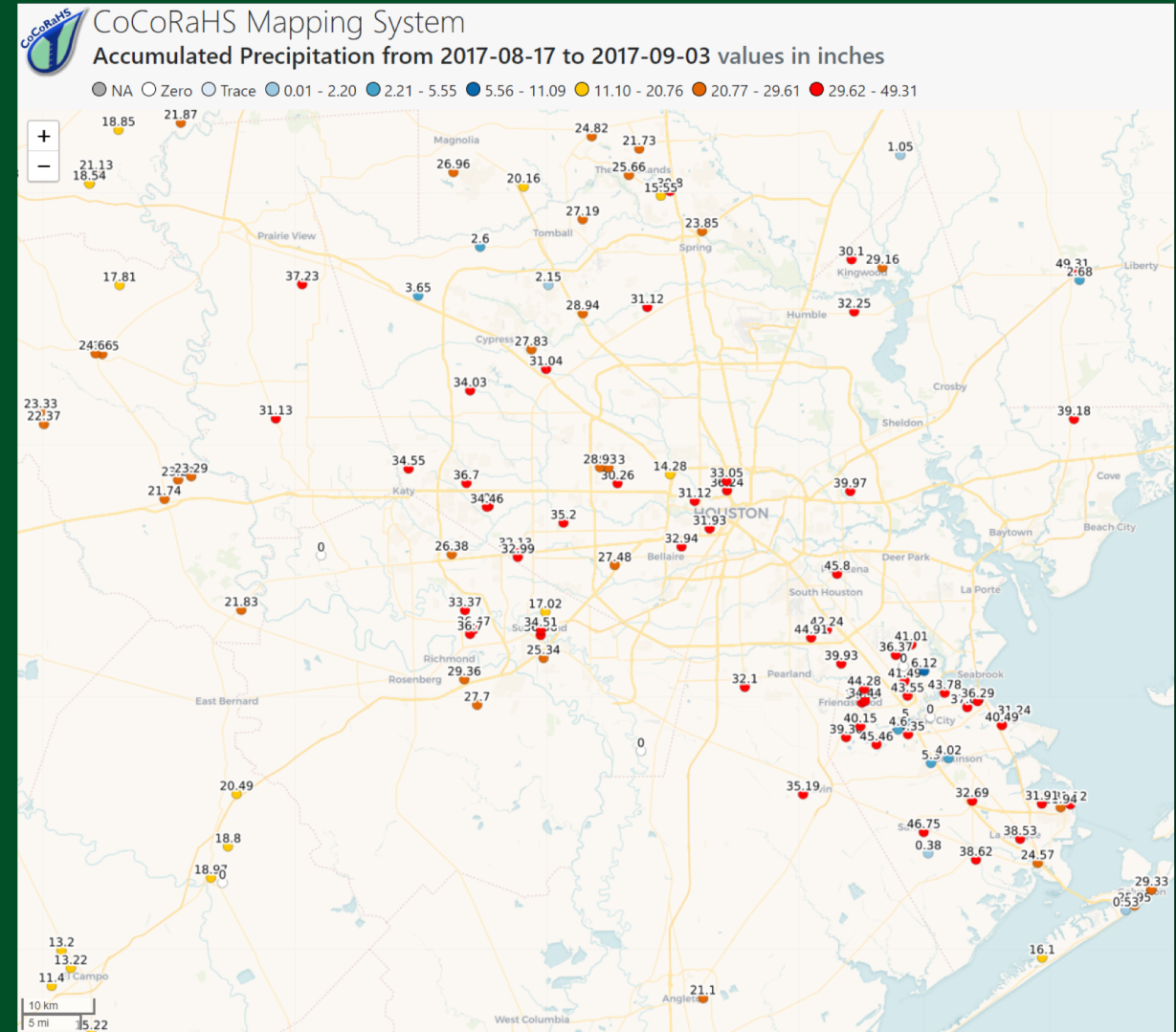
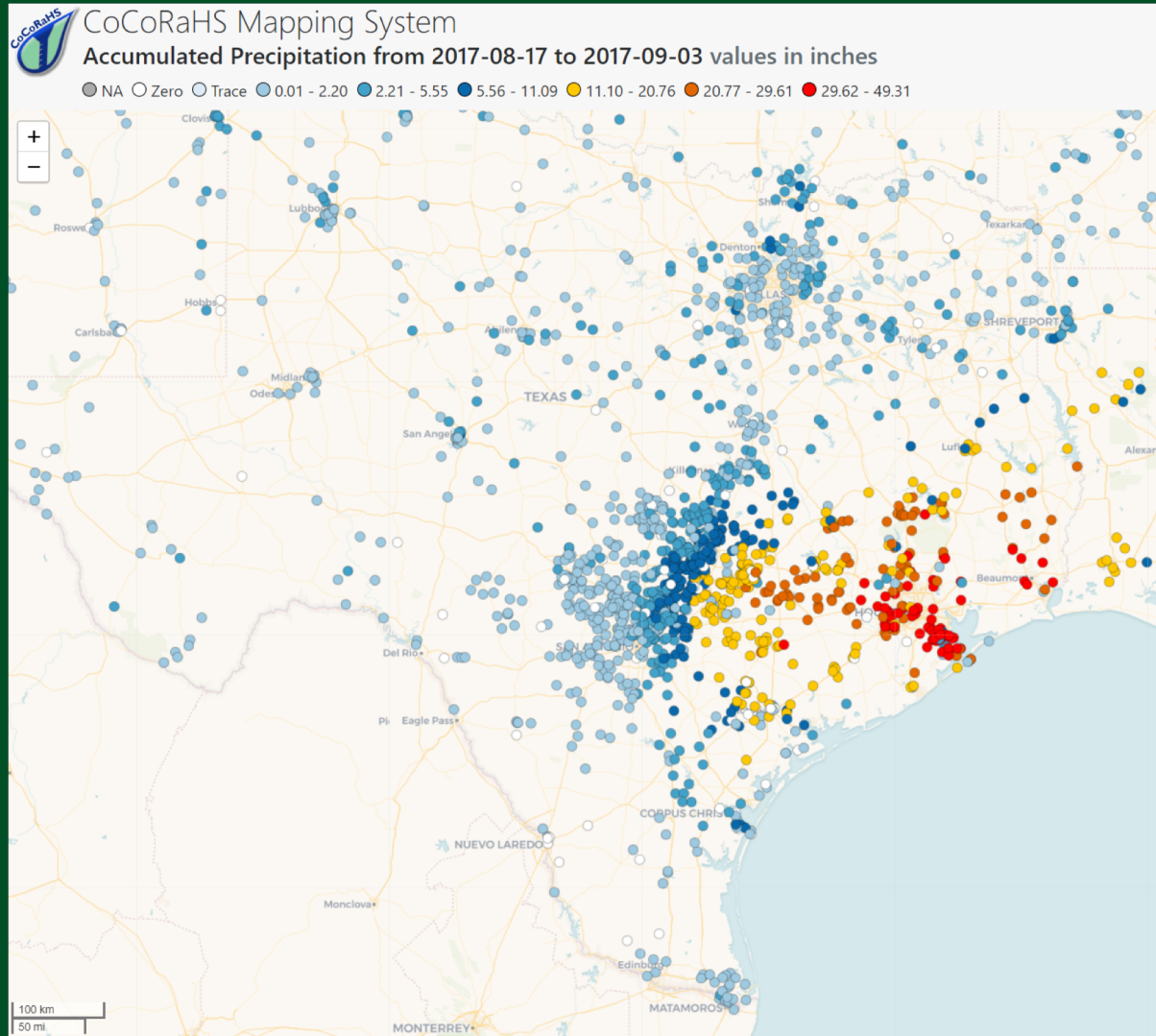
⚙️ Actions

🔄 Reset Options [Update Map](#)

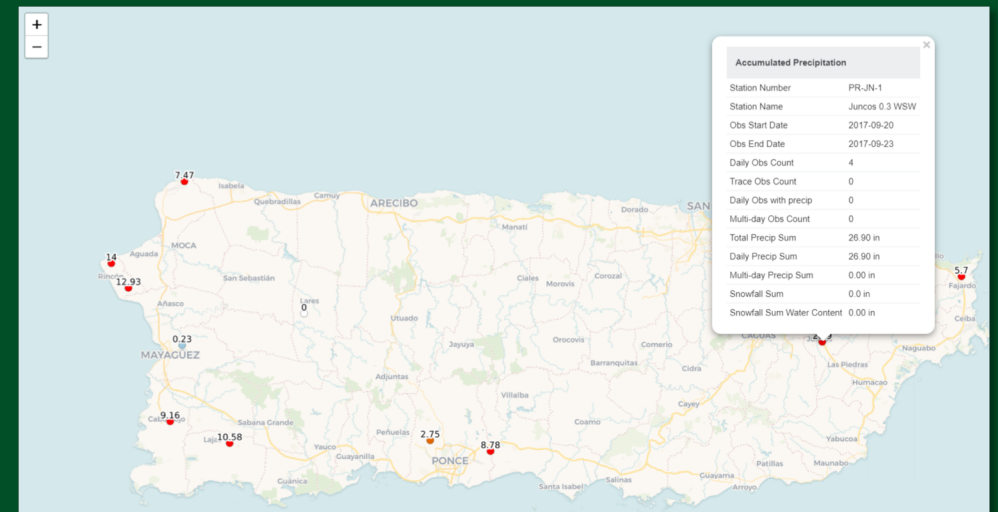
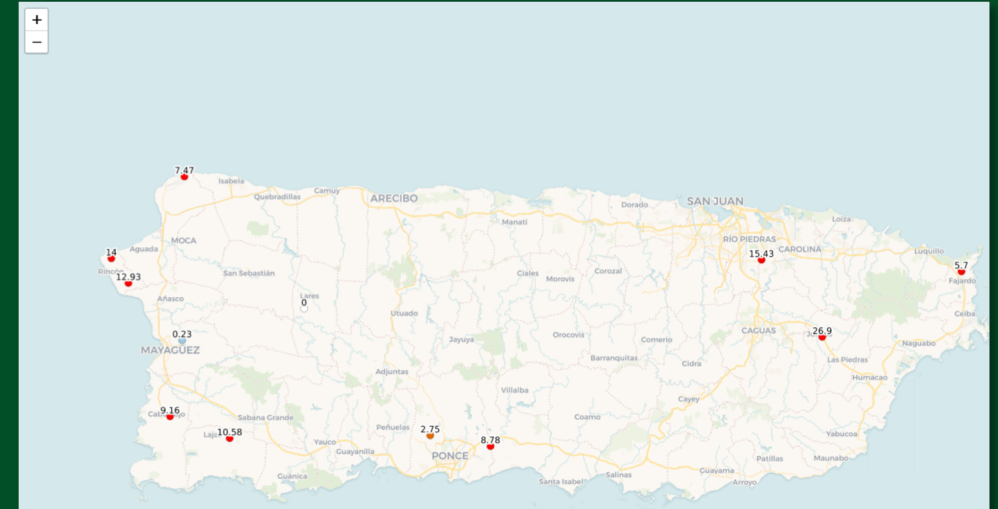
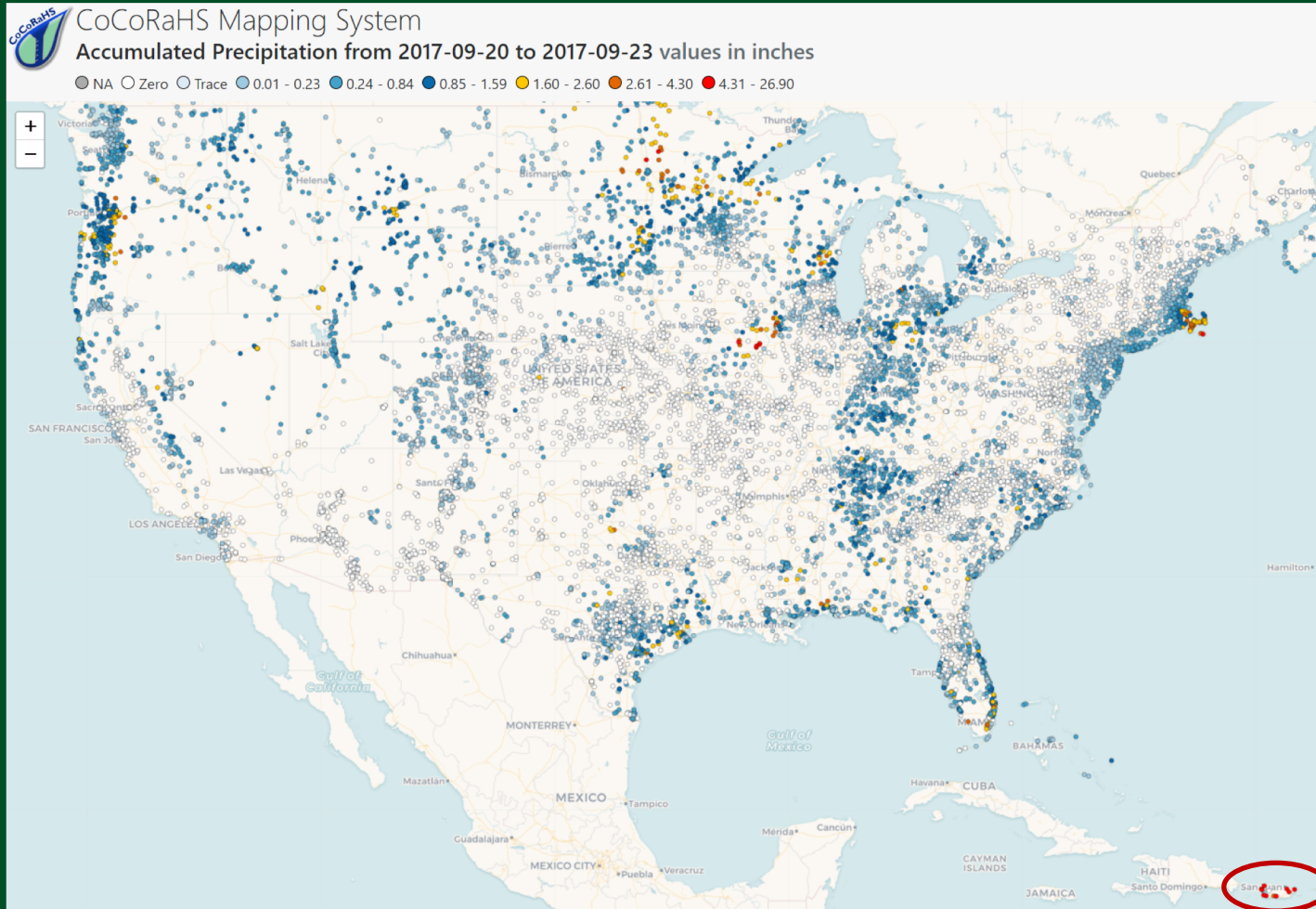
<http://data.cocorahs.org> [Copy link](#)

▼ Sponsors

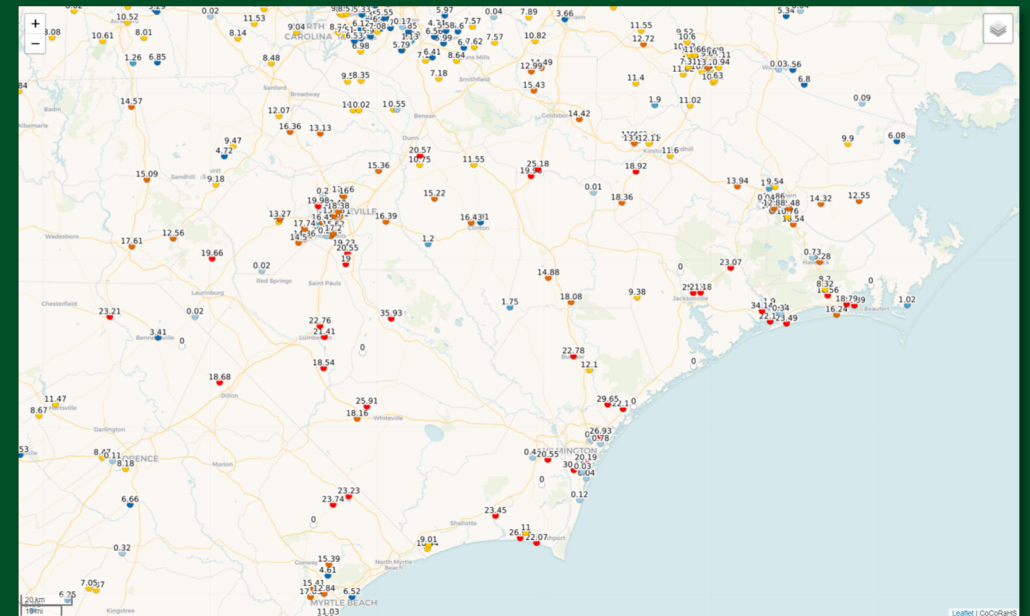
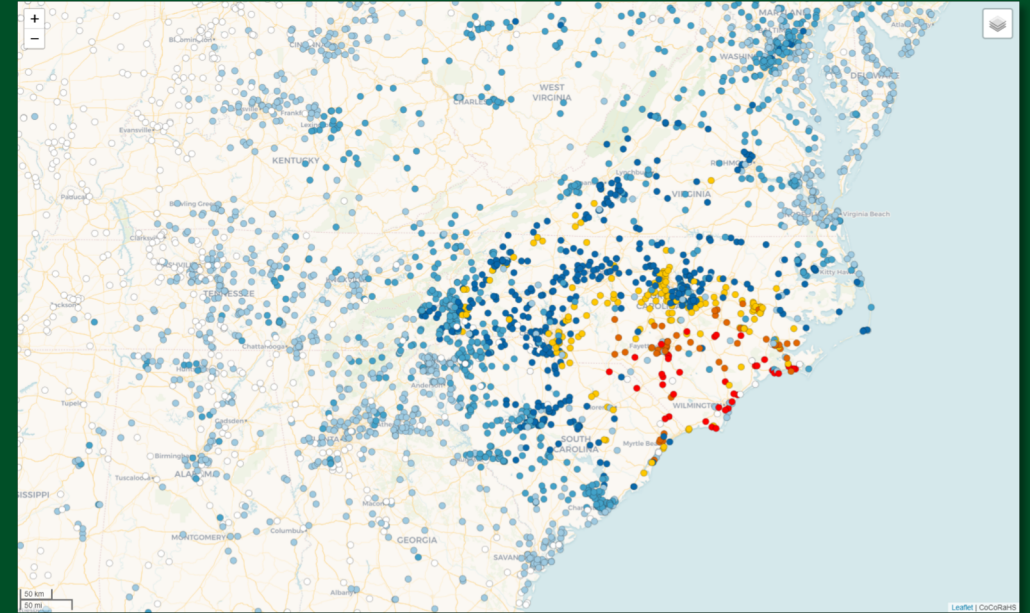
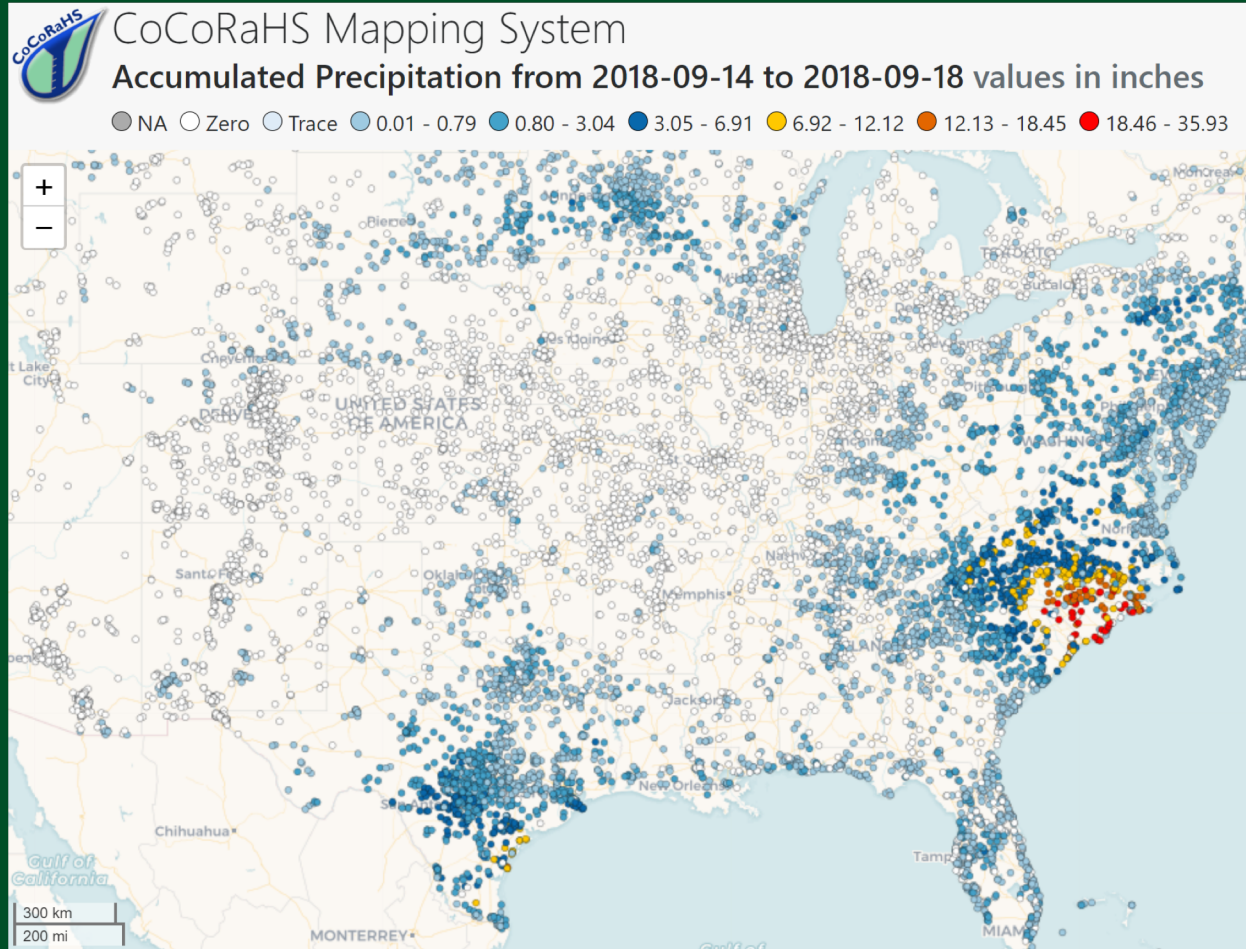
CoCoRaHS Observations of Hurricane Harvey



CoCoRaHS Observations of Hurricane Maria

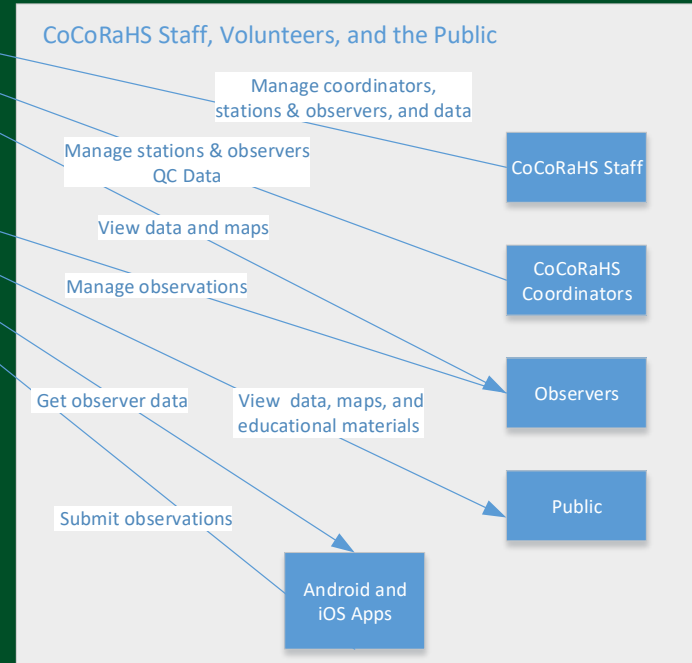
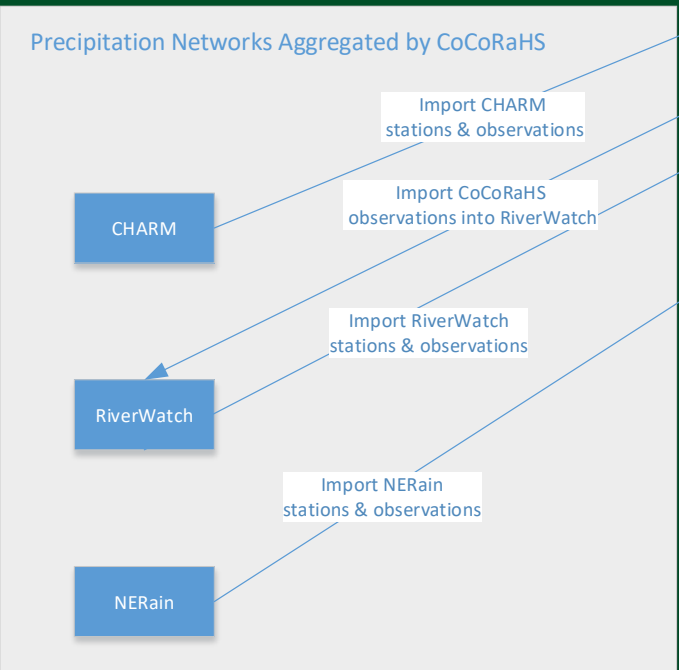
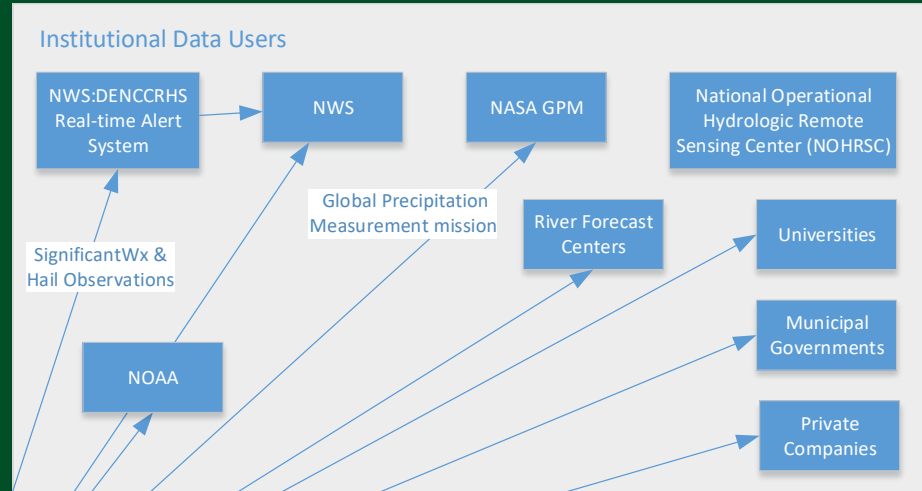
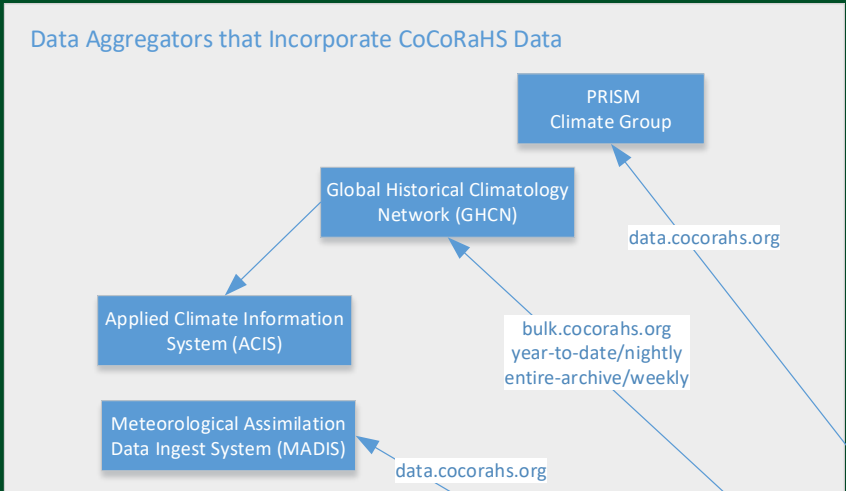


CoCoRaHS Observations of Hurricane Florence

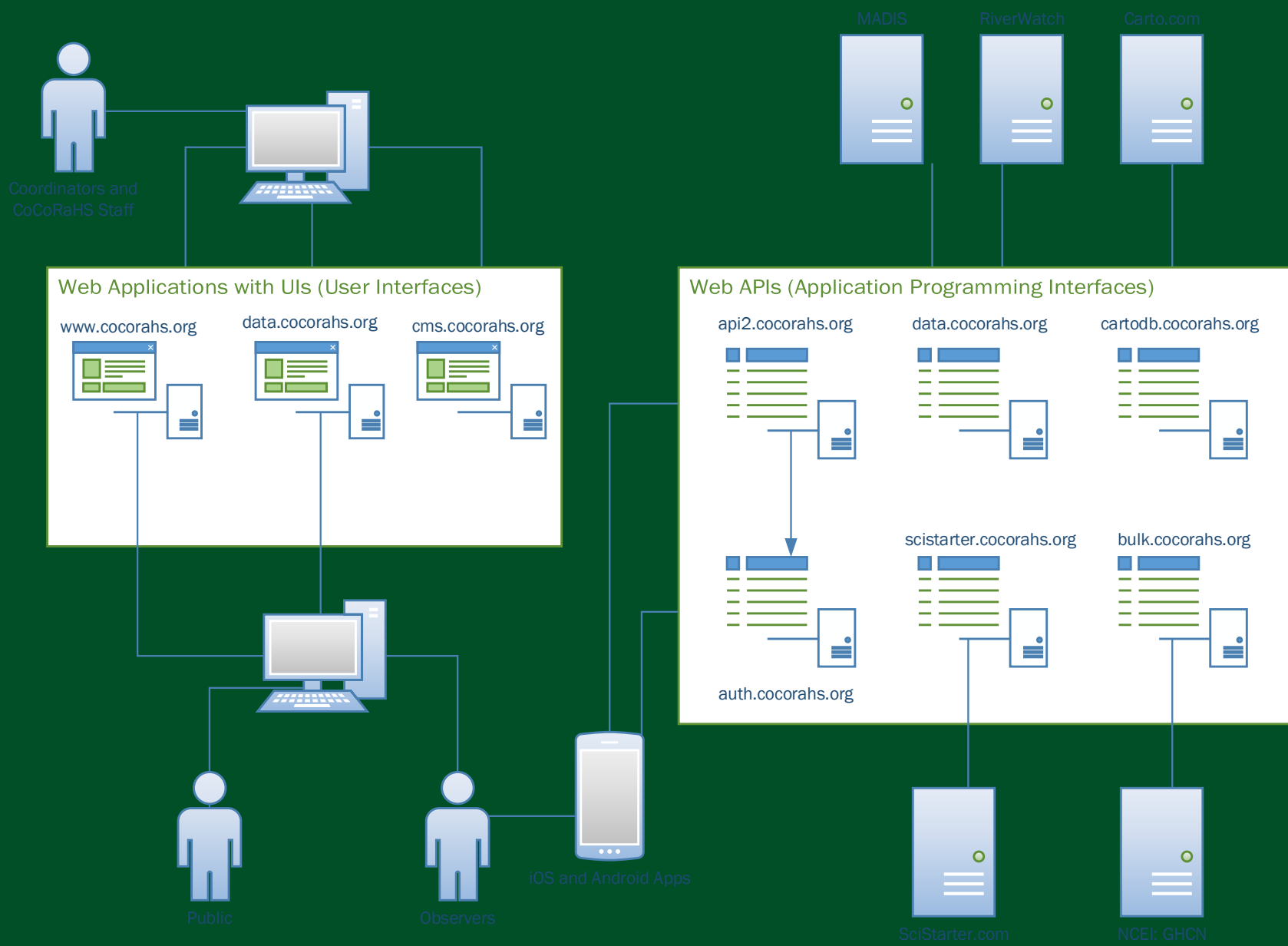


What you don't see

CoCoRaHS Cyber-Infrastructure Data Flow Context








CoCoRaHS Web App and Web API Overview



CoCoRaHS Network and External Service Overview

Microsoft Azure

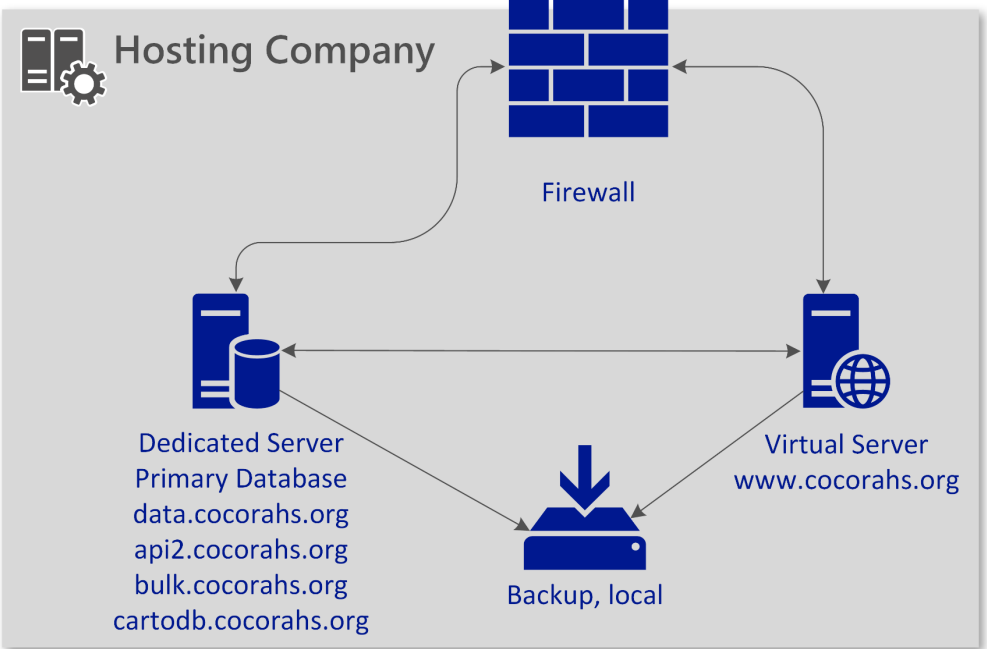


-  Storage (Azure): Hourly Database Backups
-  Virtual machine: legacy.cocorahs.org
-  Azure SQL Database: Dev Copy of Primary DB
-  Azure Function App: SciStarter.com Integration

Office 365 Cloud



-  Outlook
-  Word
-  Excel
-  PowerPoint
-  OneNote
-  Access
-  Publisher
-  Skype
-  Exchange
-  OneDrive
-  Microsoft Teams
-  Power BI



Social Media Services



-  Blogspot: CoCoRaHS Blog
-  YouTube: CoCoRaHS Channel
-  Facebook: CoCoRaHS HQ Page, CoCoRaHS Group, Local Groups and Pages
-  Twitter

3rd Party Services



-  DNS Service
-  MailChimp: Bulk Email & Newsletter
-  GoToMeeting by Citrix: WxTalk Webinar Series
-  CART: Mapping Services

Why use the data



Canadian Regional Deterministic Precipitation Analysis System (CaP A-RDPA RDPA)

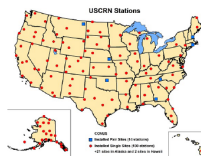
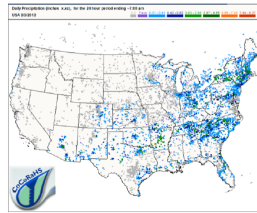
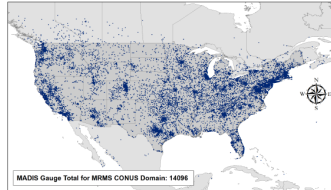
- Product of Environment and Climate Change Canada
- Is a regional deterministic precipitation analysis system that provides objective estimates of precipitation amounts for a specific domain by combining readings from precipitation gauges, radar and a trial field generated from RDPS -V6
- As of September 18, 2018 is incorporating CoCoRaHS data into the analysis after testing its impact on the data product
- “The addition of the CoCoRaHS network combined with the change in trial field brings value to the 24-hour analysis in summer across the entire CaPA domain. It is clearly seen by the gain in skill.”

Inter-comparison of gauge data quality

National Severe Storms Laboratory - Jian Zhang, Steve Martinaitis, Micheal Simpson

Gauge data in MRMS

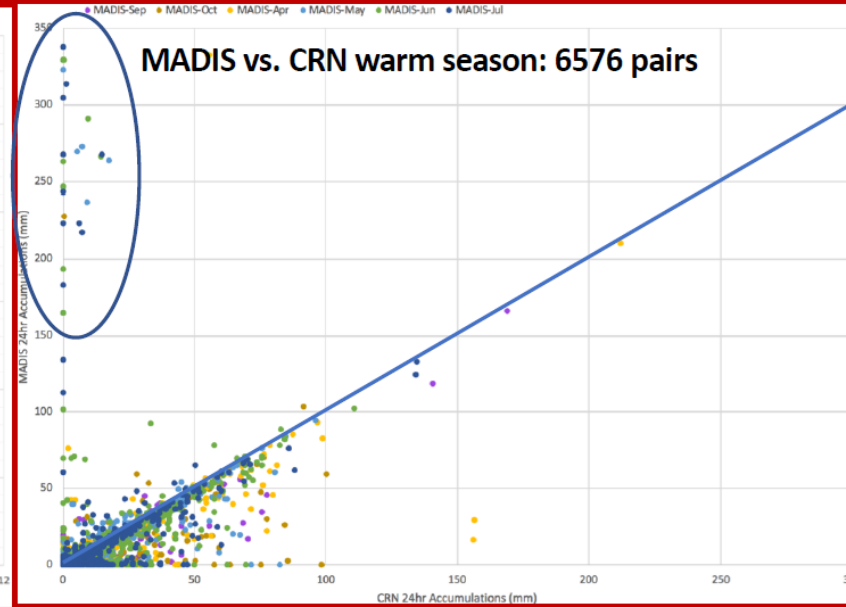
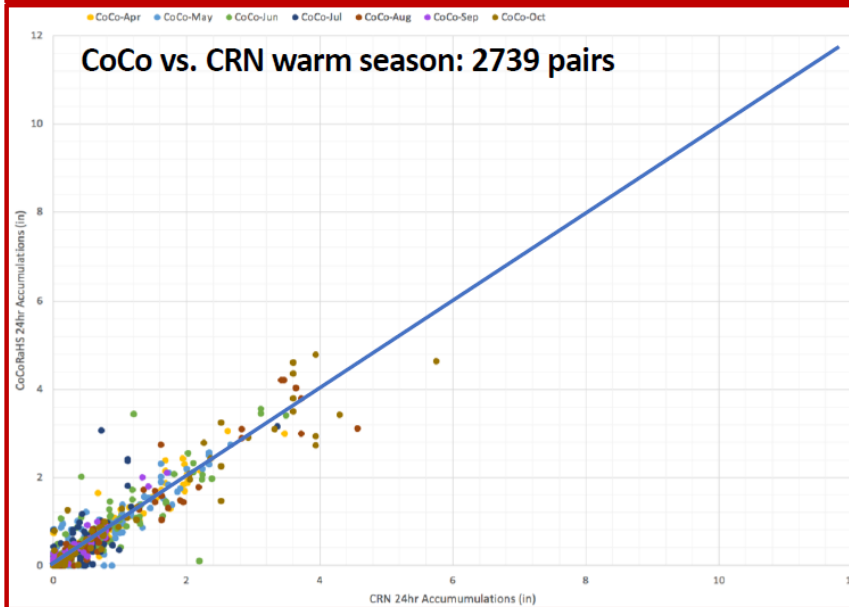
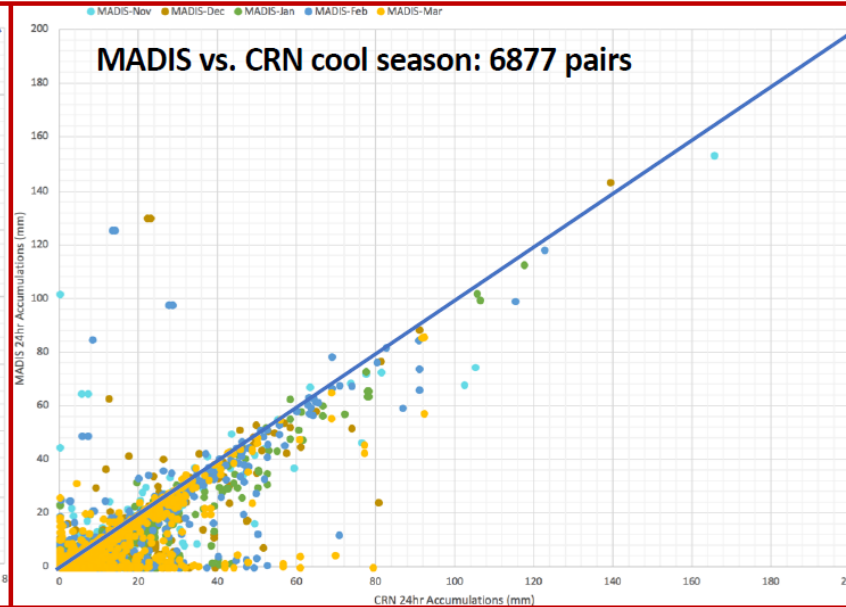
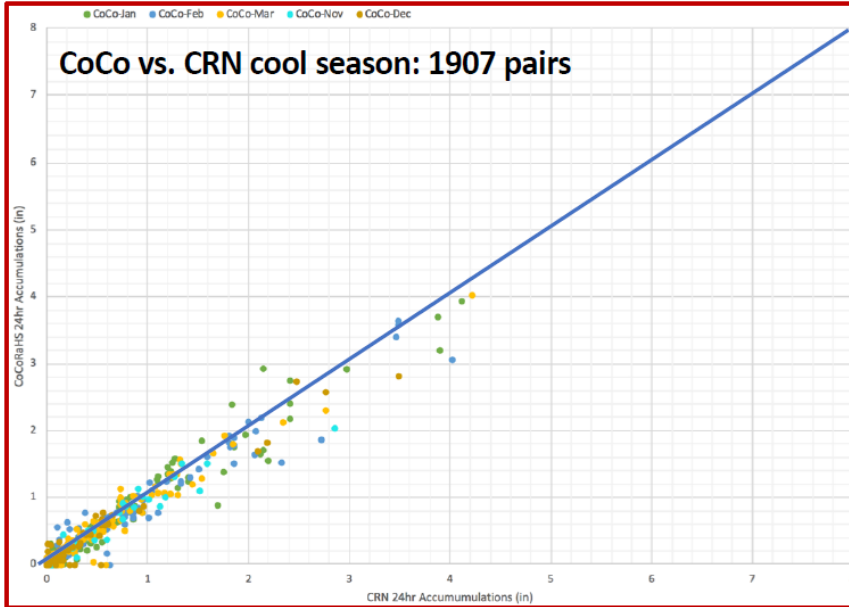
- MADIS
 - Hourly
 - Contains many networks including ASOS, Mesowest, DOT, etc.
 - ~15,000 each hour at the top of the hour (+/- 4min)
 - ~11,000 after QC
 - Used in MRMS local gauge corrected QPE and Mountain Mapper
- CoCoRaHS
 - Daily
 - ~13,000 at the top of the hour (+/-15min)
 - 450 (10Z) + 2800 (11Z) + 3700 (12Z) + 2500 (13Z) + 2000 (14Z) + 1000 (15Z) + 350 (16Z) + 60 (17Z)
 - Not used in any MRMS products
 - For evaluations only
- CRN
 - Hourly
 - ~150
 - Considered the most reliable rain gauges
 - Included in MADIS (different ID, slightly different lat/lon and amounts due to truncation errors?)



Intercomparison of gauge data

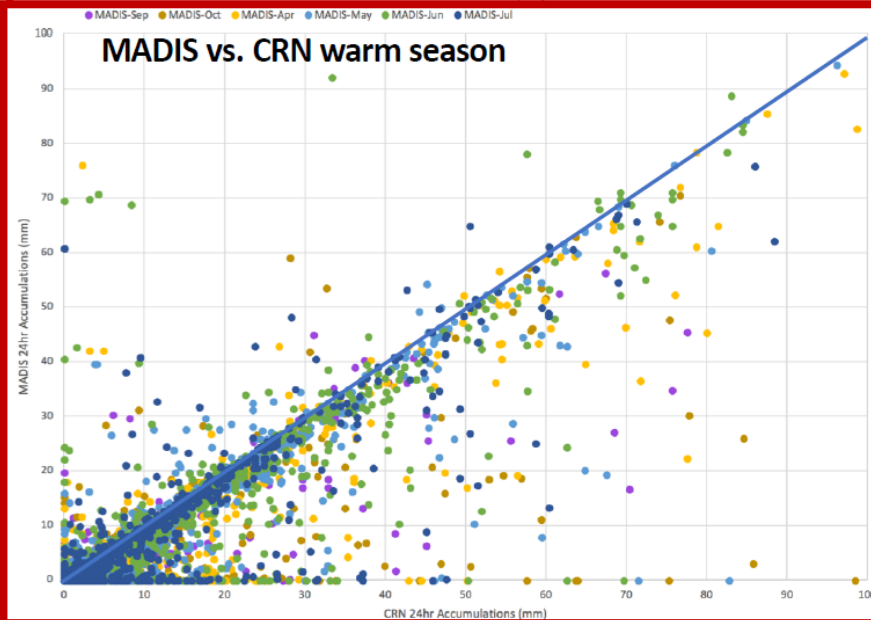
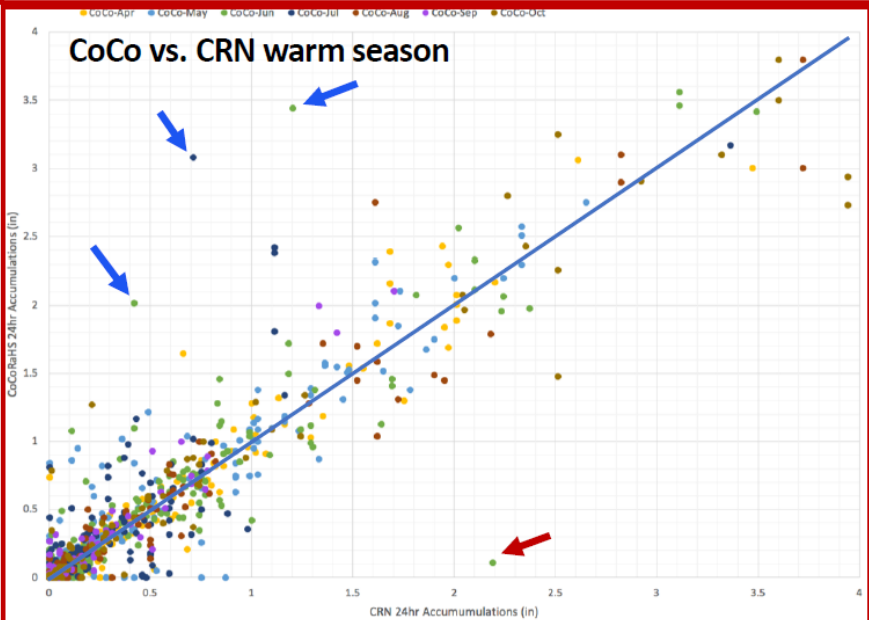
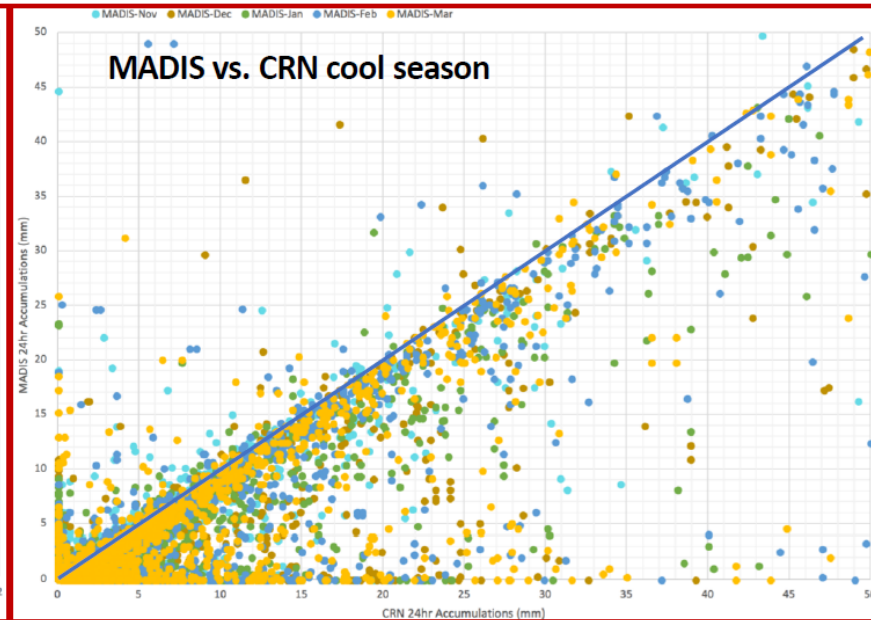
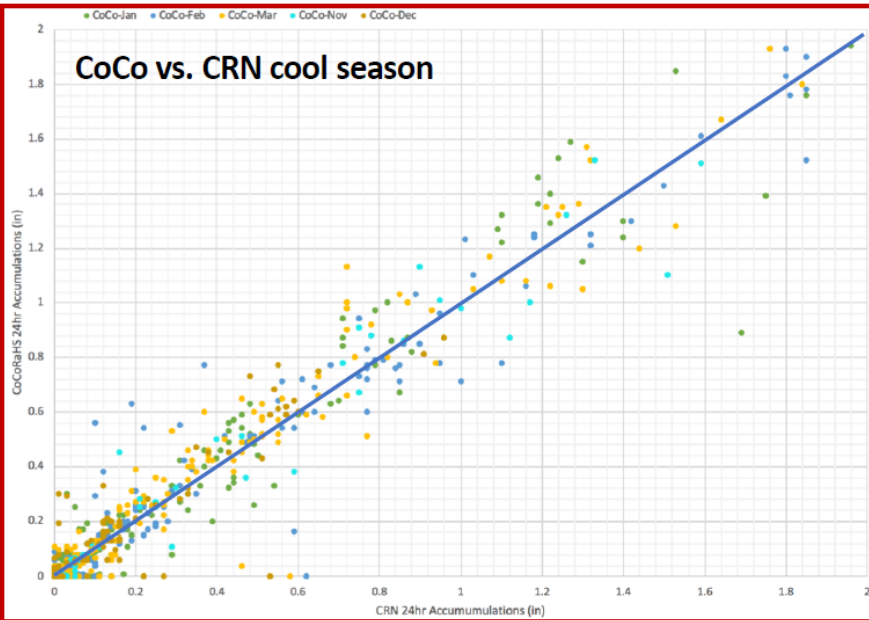
- Using CRN as reference to assess the quality of MADIS and CoCoRaHS data
- Criteria for “co-located” CRN-CoCo (MADIS) gauges: 3km radius
- CRN vs. CoCoRaHS: Jan 2017 – Jul 2018
 - Cool season: Jan – Mar 2017 and 2018, Nov – Dec 2017
 - Warm season: Apr – Oct 2017, Apr-Jul 2018
- CRN vs. MADIS: Sep 2017 – Jul 2018
 - Cool season: Nov – Dec 2017, Jan – Mar 2018,
 - Warm season: Sep – Oct 2017, Apr-Jul 2018

CRN vs. CoCoRaHS and MADIS gauges



- CoCo matches CRN much better than does MADIS
- MADIS amounts are often lower than CRN indicating undercatch issue?
- abnormal high amounts in MADIS indicating malfunctioned sites?

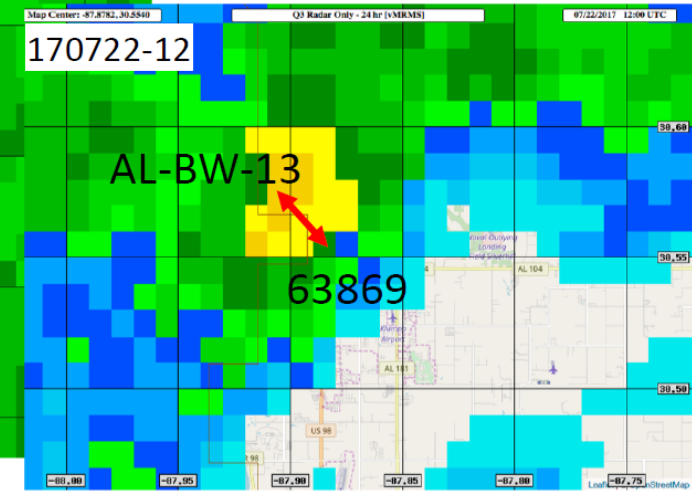
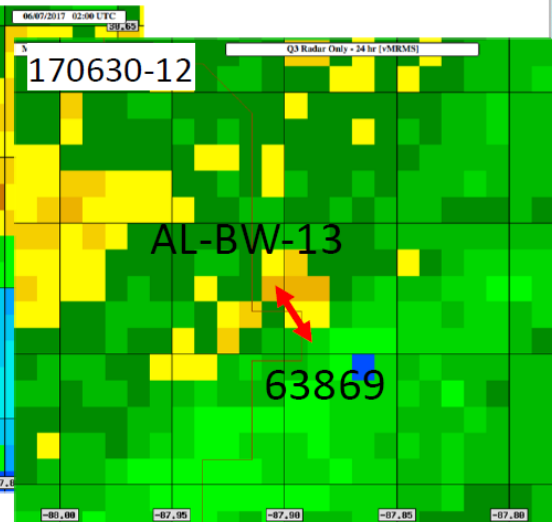
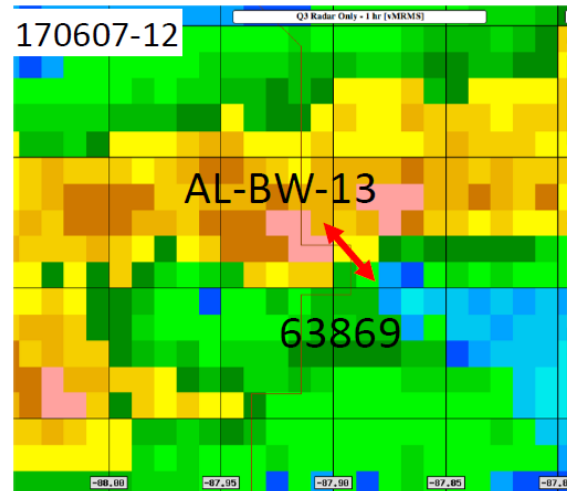
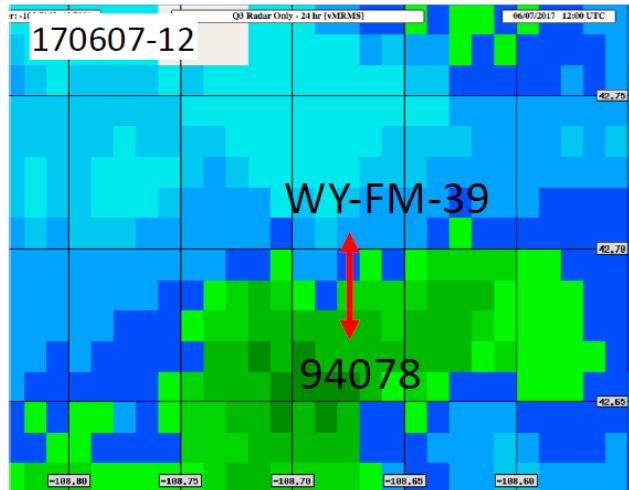
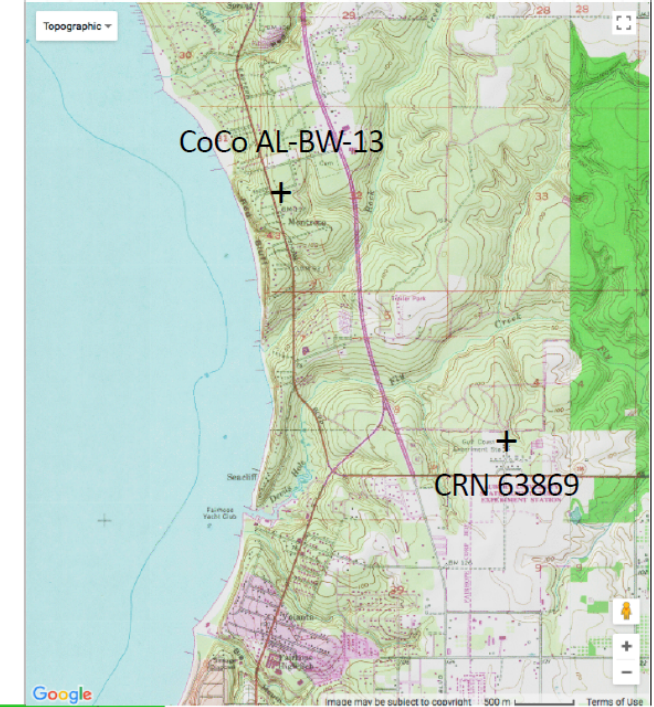
CRN vs. CoCoRaHS and MADIS gauges: enlarged view



- CoCo matches CRN much better than does MADIS
- MADIS amounts are often lower than CRN indicating undercatch issue?
- A few outliers in warm season CRN-CoCo pairs (see arrows) are investigated further (next slide)

Four CoCo vs. CRN data pairs with large differences were analyzed, and all were real and attributed to large precipitation gradients between the gauge pairs.

Date-hr	CRN	CoCo	Lat/lon	remark
170607-12	2.19	0.11	94078 42.6800 -108.6700 WY-FM-39 42.70168 -108.67567	radar QPE@CRN: 1.2in radar QPE@CoCo: 0.13in
170607-12	1.2	3.44	63869 30.5500 -87.8800 AL-BW-13 30.56674 -87.90053	Radar QPE @CRN: 1.63in radar QPE @CoCo: 3.59in
170630-12	0.42	2.02	63869 30.5500 -87.8800 AL-BW-13 30.56674 -87.90053	Radar QPE @CRN: 0.8in radar QPE @CoCo: 3.36in
170722-12	0.71	3.08	63869 30.5500 -87.8800 AL-BW-13 30.56674 -87.90053	Radar QPE @CRN: 1.6in radar QPE @CoCo: 2.8in



The CoAgMET Network



Zach Schwalbe
CoAgMET Manager
zach.schwalbe@colostate.edu
970-491-8140

CoAgMET =

Colorado Agricultural Meteorological Network

also known as “Colorado’s Mesonet”



History

- ▶ In the early 1990's, CSU extension plant pathologists and ARS scientists decided to collaborate efforts to collect detailed agricultural weather data.
- ▶ Standard instruments and data collection platform were selected and a small network of stations were deployed in fully irrigated agriculture.
- ▶ As the network grew, the Colorado Climate Center became increasingly interested in using the data, began daily data collection, quality control and built a web interface to distribute data and products to users across the state.

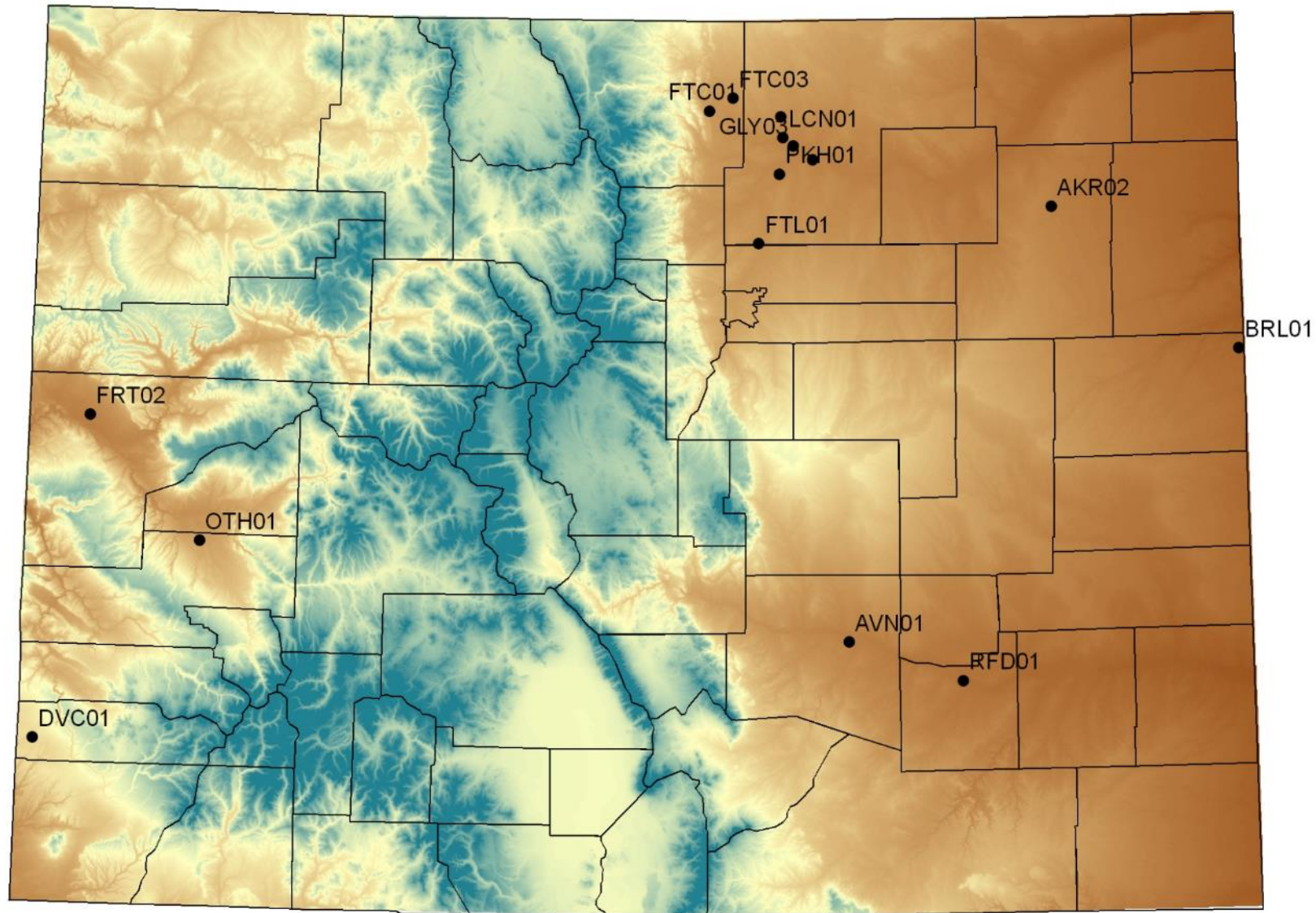


Colorado Climate Center's role

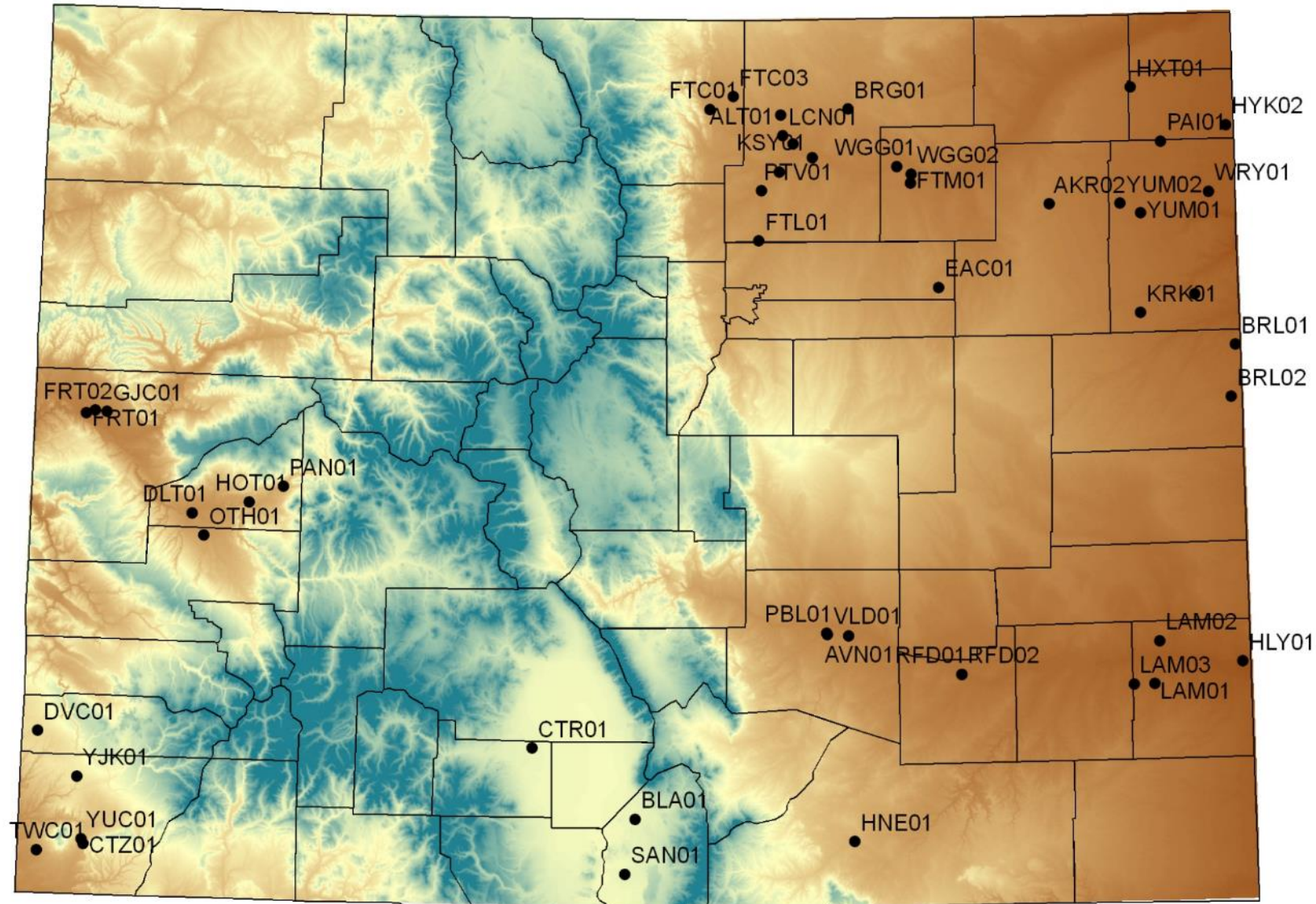
- ▶ Coordination, data management, web support
- ▶ We hosted annual meetings of key partners and data users – set priorities, secure commitments, prepare proposals (rarely funded but we persisted)
- ▶ We now run the network including station maintenance, product development, funding, etc.



CoAgMET 1992

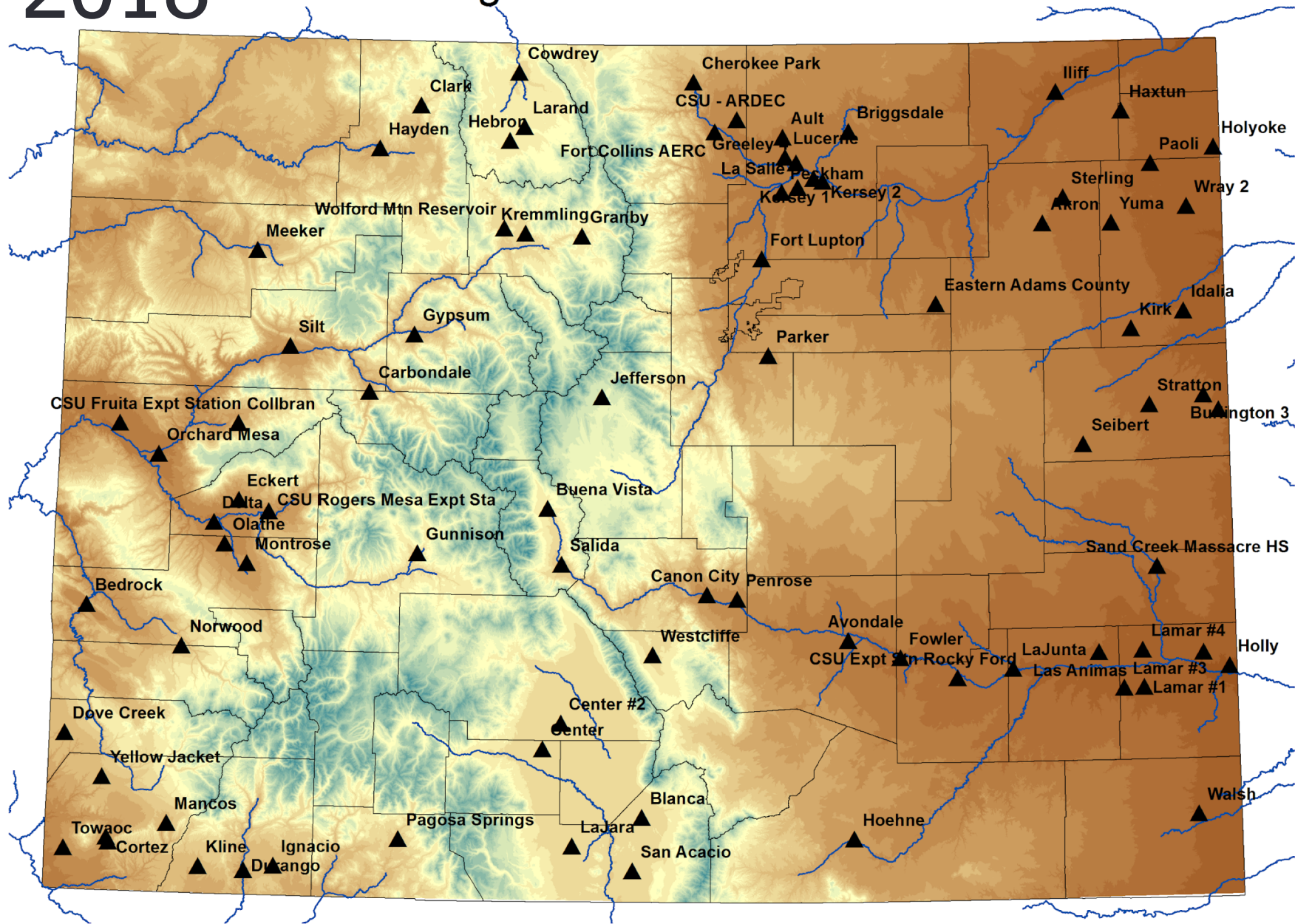


CoAgMET 2002



2018

CoAgMET Station Locations



Overview of CoAgMET Network

- ▶ Currently there are 85 stations
- ▶ Data are collected hourly, daily and 60 stations with 5-minute data
- ▶ Data include: temperature, humidity, solar radiation, wind speed and direction, and soil temperatures.

About the stations

Anemometer and wind vane: Wind speed, direction and gusts

2 m

Above all else facing South

Pyranometer: Solar radiation

Temperature/Humidity sensor in radiation shield

2 m

Tipping bucket rain gage

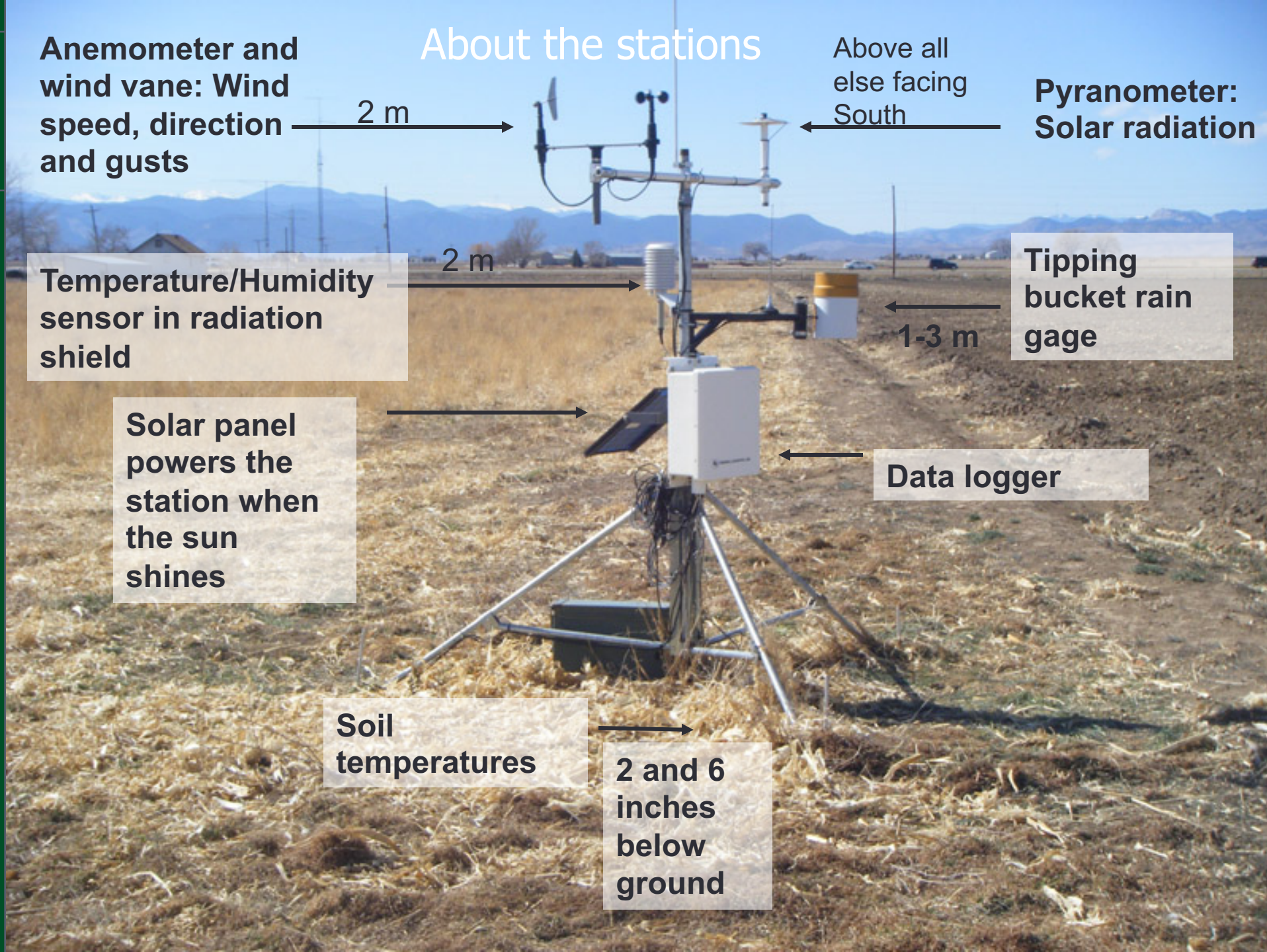
1-3 m

Solar panel powers the station when the sun shines

Data logger

Soil temperatures

2 and 6 inches below ground



Why these measurements?

- ▶ The main goal of CoAgMET is to calculate evapotranspiration (ET) from meteorological measurements.
- ▶ The standard CoAgMET station collects the elements needed to calculate evapotranspiration.
- ▶ These are also very important data for real-time weather monitoring.



CoAgMET web access:

<http://coagmet.colostate.edu/>

Data are free and available to the public



COLORADO STATE UNIVERSITY



CoAgMET Colorado's Mesonet



[Home](#) [Daily Summaries](#) [Hourly Plots](#) [5 Min Plots](#) [Water Use \(ET\)](#) [Map by eRAMS](#)

CoAgMET Homepage

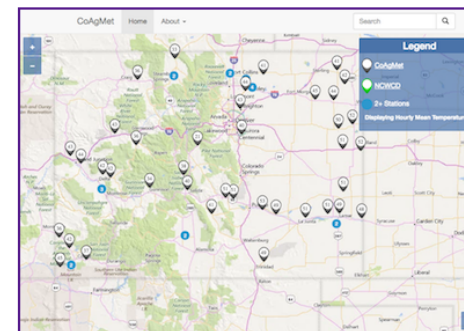
News

- Becky Bolinger has created a [2017 Growing Season Report](#), giving a nice overview of Evapotranspiration and what factors go into it.
- Our website has a new look! We hope you find it enjoyable and easier to navigate.
- A growing number of stations have 5 minute data available. You can view [plots](#) or read [tabular data](#). In addition, our [web services](#) provide a machine-readable form of the data.

Services

- [CoAgMET Crop Water Use \(ET\)](#)
Page for obtaining crop and turf water use information (Evapotranspiration).
- [Evapotranspiration Reports](#)
ETRs are daily reports for selected stations by region.
- [2017 Growing Season Report](#)
An interactive web-based report for the 2017 growing season at our 7 long-term CoAgMET sites where we monitor ET accumulations.
- [Monthly Summaries](#)
Interactive access to the daily data set for a particular station and selected months.
- [Daily Summaries \(all stations\)](#)
Daily summary files are formatted to display selected parameters for all stations.
- [Hourly Data Access](#)
Interactive access to the hourly data set for a particular station and selected days.
- [Hourly Data Plots](#)
Plots of temperature, humidity and wind for all CoAgMET stations.
- [Five Minute Data Access](#)

CoAgMET Mapping and Metadata by eRAMS



Daily Data

CoAgMet Daily Summary - 07/01/2016

Daily Summary

Sta	Mon	Day	Tmax Temp degF	Tmin Temp degF	Vapor Press mb	Solar Rad Lngly	Prec in.	Wind Gust mph	Wind Run mi.	Soil Temp degF	Min RH Pct	Grow DgDy F.	P-Kim ET in.	ASCE HLY ET in.
akr02	7	1	73.1	59.7	17.75	248	0.64	***	229	***	66.2	1270	0.161	0.123
alt01	7	1	78.5	60.4	17.62	391	0.04	27.9	127	70.0	49.0	1157	0.193	0.162
avn01	7	1	81.8	62.6	19.95	345	0.06	18.3	51	70.6	51.5	1510	0.163	0.132
bla01	7	1	74.4	53.5	12.93	373	0.00	30.4	117	62.1	36.3	957	0.190	0.168
bnv01	7	1	69.4	52.1	13.14	264	0.05	17.3	66	56.0	44.4	882	0.120	0.107
brg01	7	1	80.6	58.2	18.03	336	0.14	22.7	162	68.0	52.1	1243	0.200	0.140
brk01	7	1	72.8	62.3	16.63	224	0.05	13.5	58	74.2	50.9	1486	0.140	0.106
brl02	7	1	72.9	61.5	20.64	298	0.07	16.2	149	65.2	77.1	1342	0.131	0.103
brl03	7	1	72.2	61.5	20.18	325	0.31	15.8	153	67.7	78.6	1035	0.135	0.109
cbl01	7	1	68.5	57.8	17.07	251	0.01	9.7	38	59.8	68.1	1044	0.102	0.091
ckp01	7	1	76.9	56.4	15.70	370	0.76	17.2	72	64.8	49.2	997	0.166	0.140
cnn01	7	1	80.5	61.6	17.69	384	0.56	24.4	68	66.9	45.0	1420	0.185	0.161
cow01	7	1	69.5	50.0	12.71	415	0.00	17.2	49	60.5	43.0	589	0.148	0.149
ctr01	7	1	71.1	52.5	13.83	326	0.36	14.7	55	60.7	50.7	887	0.135	0.114
ctr02	7	1	73.9	53.4	13.60	378	0.12	21.0	94	67.1	43.2	943	0.171	0.145
ctz01	7	1	68.3	59.3	15.91	198	0.09	10.1	50	65.7	59.9	1261	0.111	0.081
dlt01	7	1	72.4	60.5	17.68	262	0.09	10.1	55	64.1	59.3	1400	0.132	0.106
dvc01	7	1	67.9	55.9	14.93	226	0.09	13.3	79	66.7	60.8	981	0.126	0.093
eac01	7	1	75.5	57.6	17.92	351	1.08	32.7	237	64.1	61.7	1250	0.198	0.138
ekt01	7	1	71.2	60.0	16.75	243	0.08	10.5	35	63.0	56.0	1241	0.121	0.097
frr02	7	1	72.6	61.3	18.92	223	0.07	11.7	78	67.1	63.3	812	0.094	0.090
ftc01	7	1	76.4	58.9	17.84	294	0.02	12.2	42	66.0	58.7	1087	0.130	0.112
ftc03	7	1	76.7	59.3	17.54	247	0.02	15.1	102	68.7	57.4	1126	0.138	0.111
ftl01	7	1	79.6	60.9	17.27	411	0.02	23.5	92	70.6	41.0	1176	0.198	0.176
fwl01	7	1	82.3	63.9	18.78	341	0.09	25.2	95	76.1	47.0	1526	0.191	0.156
gly04	7	1	80.6	60.5	18.19	415	0.20	17.8	111	69.2	47.6	1191	0.201	0.167

Daily data for a month

Station:Kersey 2

Location:4 mi SE Kersey

Elevation:4563

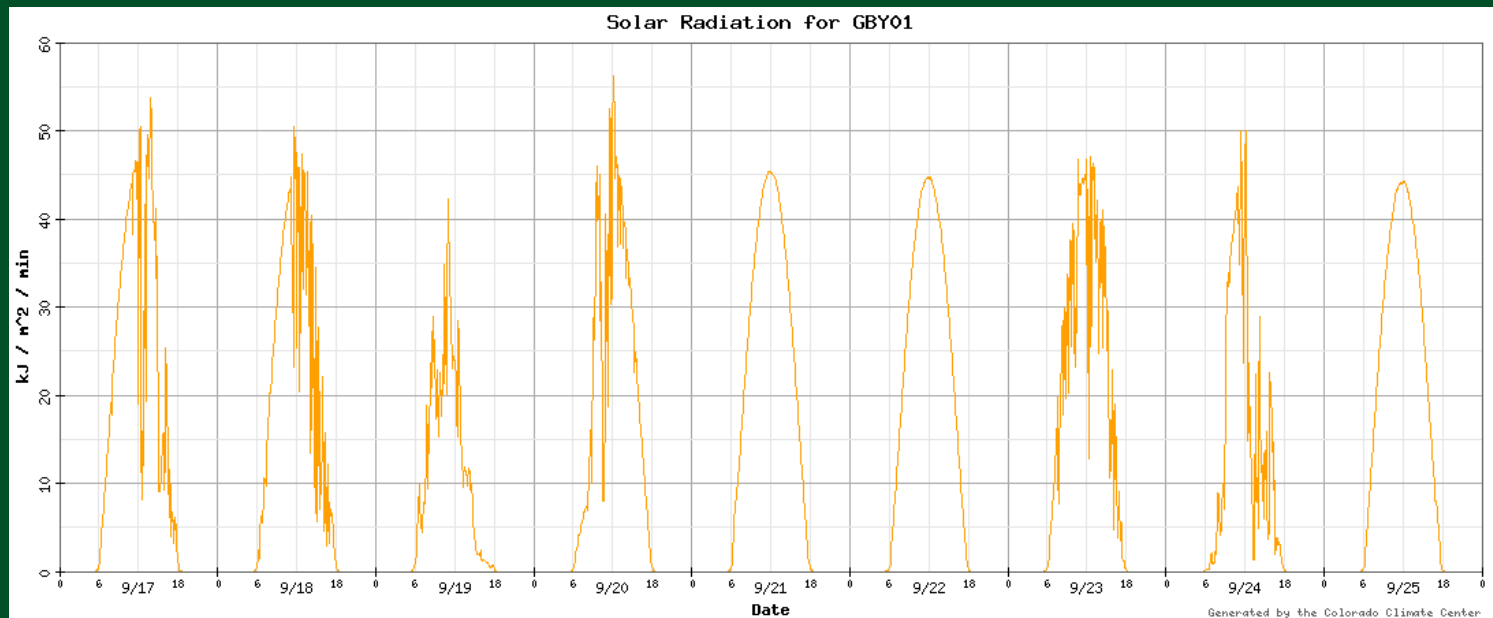
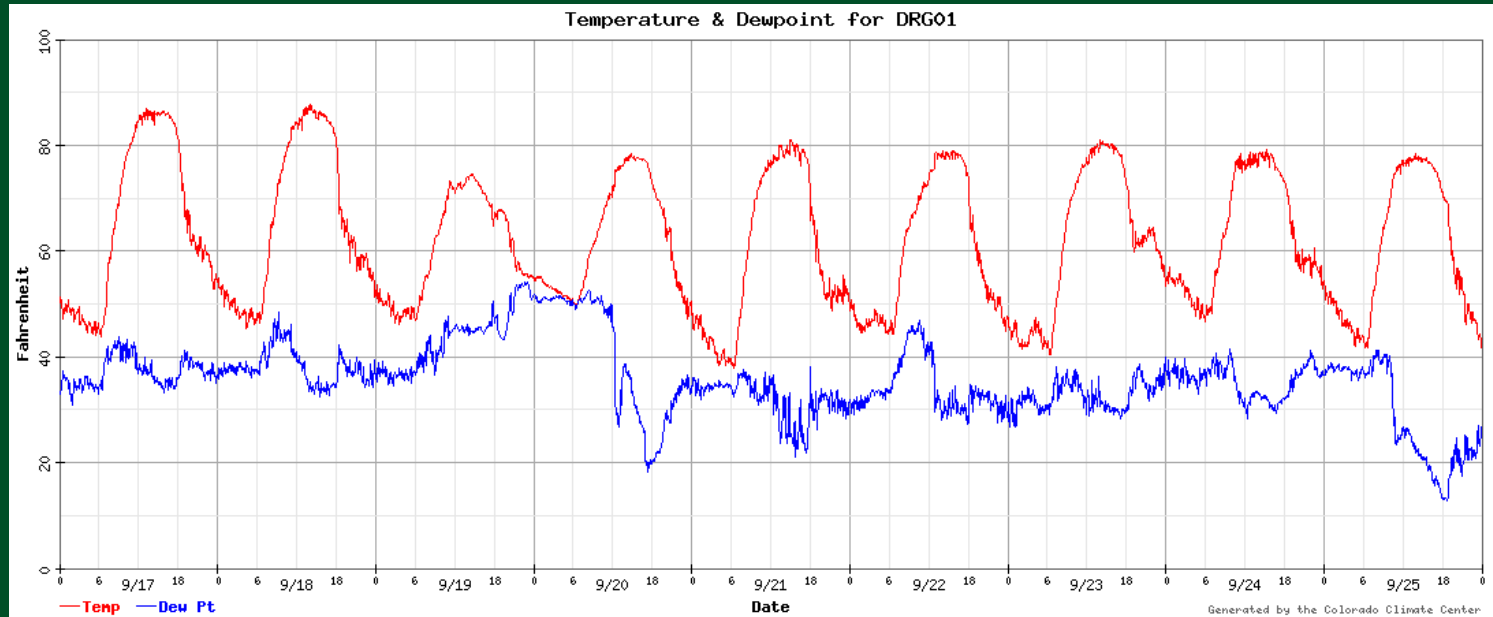
Longitude:104.478

Latitude:40.3629

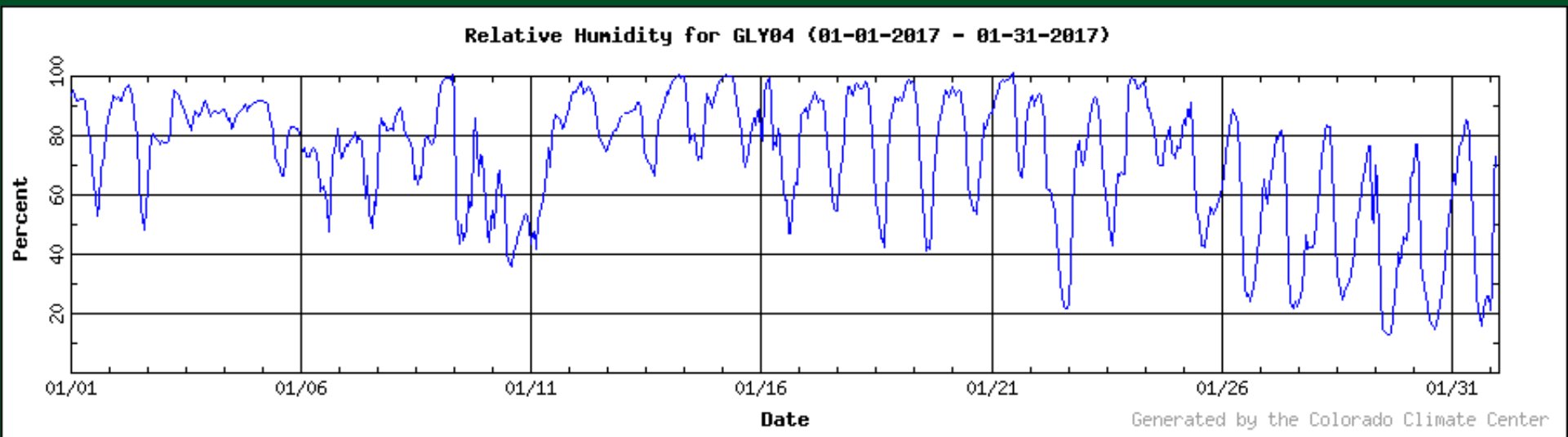
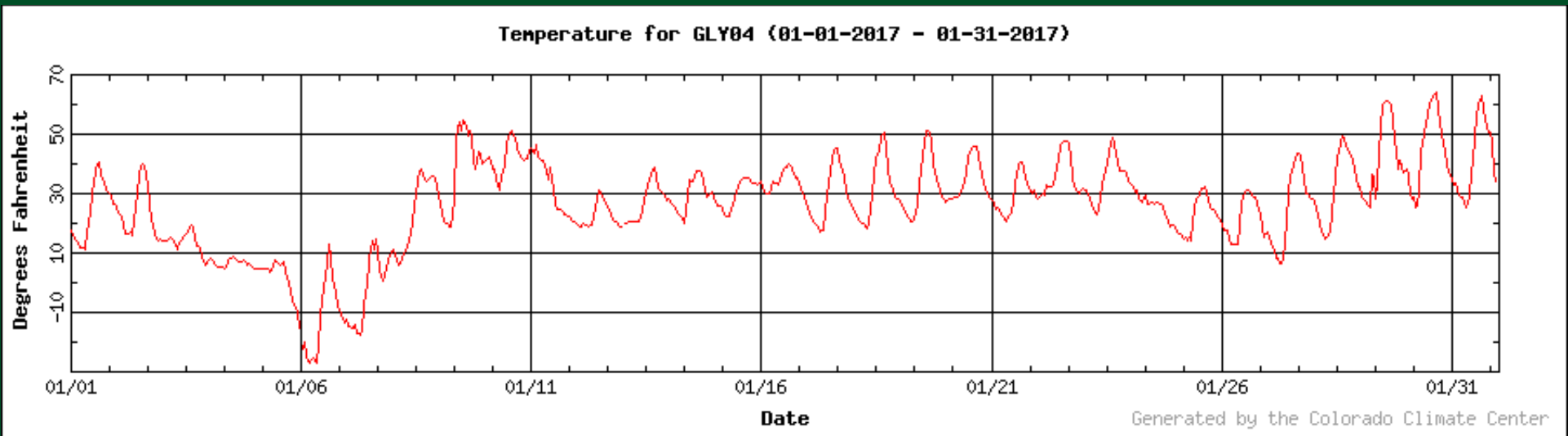
Summary for Kersey 2 - 06/2017

Station	Mon	Day	Tmax Temp degF	Tmin Temp degF	Vapor Press mb	Solar Rad Lngly	Prec in.	Wind Gust mph	Wind Run mi.	Soil Temp degF	Min RH Pct	Grow DgDy F.	P-Kim ET in.	ASCE HLY ET in.
ksy02	6	1	86.6	48.8	11.60	581	0.00	18.0	93	58.6	18.3	856	0.267	0.289
ksy02	6	2	83.9	47.1	11.40	554	0.00	25.0	139	58.7	22.4	873	0.286	0.333
ksy02	6	3	84.2	51.5	10.69	648	0.00	20.0	98	60.0	15.1	891	0.293	0.312
ksy02	6	4	86.8	46.2	10.06	721	0.00	14.0	82	59.7	16.4	909	0.317	0.317
ksy02	6	5	89.7	50.5	11.21	592	0.00	21.7	94	61.5	18.5	927	0.296	0.317
ksy02	6	6	82.8	58.3	13.15	587	0.00	15.5	94	63.2	33.1	947	0.264	0.276
ksy02	6	7	88.6	55.1	14.76	587	0.00	24.9	168	64.3	24.7	968	0.318	0.297
ksy02	6	8	90.2	49.6	13.83	664	0.00	16.0	103	63.5	22.0	986	0.318	0.326
ksy02	6	9	97.8	51.7	9.87	689	0.00	16.7	123	64.8	5.6	1005	0.395	0.406
ksy02	6	10	92.9	54.3	11.35	636	0.00	23.9	213	66.2	19.1	1025	0.424	0.488
ksy02	6	11	85.1	51.2	13.65	627	0.00	22.5	139	66.4	30.7	1043	0.314	0.317
ksy02	6	12	97.3	59.9	14.58	608	0.00	35.6	253	68.4	7.8	1066	0.445	0.487
ksy02	6	13	81.6	49.5	6.23	615	0.00	16.0	90	66.2	9.7	1082	0.324	0.292
ksy02	6	14	88.9	45.6	7.02	635	0.00	14.0	86	63.9	11.1	1100	0.342	0.321
ksy02	6	15	91.3	47.8	7.57	606	0.00	14.2	63	65.0	9.1	1118	0.317	0.286
ksy02	6	16	94.4	49.7	9.52	569	0.00	17.8	103	65.6	11.5	1136	0.336	0.352
ksy02	6	17	82.5	54.4	11.41	380	0.00	25.4	131	67.2	31.5	1154	0.258	0.237
ksy02	6	18	87.4	53.5	9.71	654	0.00	17.7	83	66.0	17.9	1174	0.318	0.290
ksy02	6	19	87.6	52.2	10.37	625	0.00	14.5	94	66.8	19.8	1193	0.318	0.302
ksy02	6	20	99.6	55.1	10.79	635	0.00	29.4	97	68.0	10.2	1214	0.360	0.321
ksy02	6	21	100.9	60.9	10.55	650	0.00	22.2	121	71.1	8.2	1237	0.393	0.424
ksy02	6	22	88.4	57.5	12.09	425	0.00	23.7	156	71.0	22.6	1259	0.323	0.335
ksy02	6	23	68.7	50.7	11.44	485	0.25	22.9	105	66.3	41.3	1269	0.237	0.175
ksy02	6	24	79.8	48.8	10.92	637	0.00	21.2	110	63.3	30.3	1284	0.301	0.278
ksy02	6	25	75.1	53.2	13.38	379	0.00	12.0	104	64.3	46.3	1298	0.191	0.152
ksy02	6	26	90.3	50.9	13.25	689	0.00	20.5	128	63.3	18.7	1316	0.333	0.327
ksy02	6	27	99.7	55.7	12.05	602	0.00	27.0	126	66.6	9.0	1337	0.367	0.338
ksy02	6	28	91.8	51.2	9.97	633	0.02	33.4	112	66.6	14.1	1356	0.357	0.353
ksy02	6	29	86.8	52.3	11.26	561	0.26	19.7	127	67.2	18.0	1375	0.326	0.302
ksy02	6	30	77.0	53.8	12.45	633	0.06	11.5	60	64.8	32.1	1390	0.260	0.220

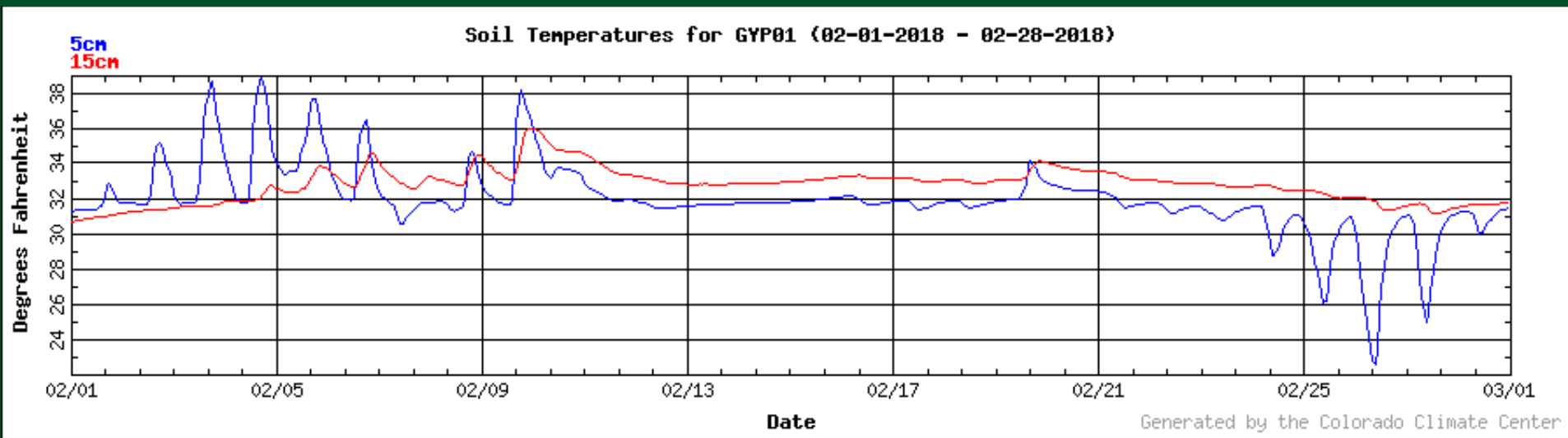
Five minute data



Hourly Data

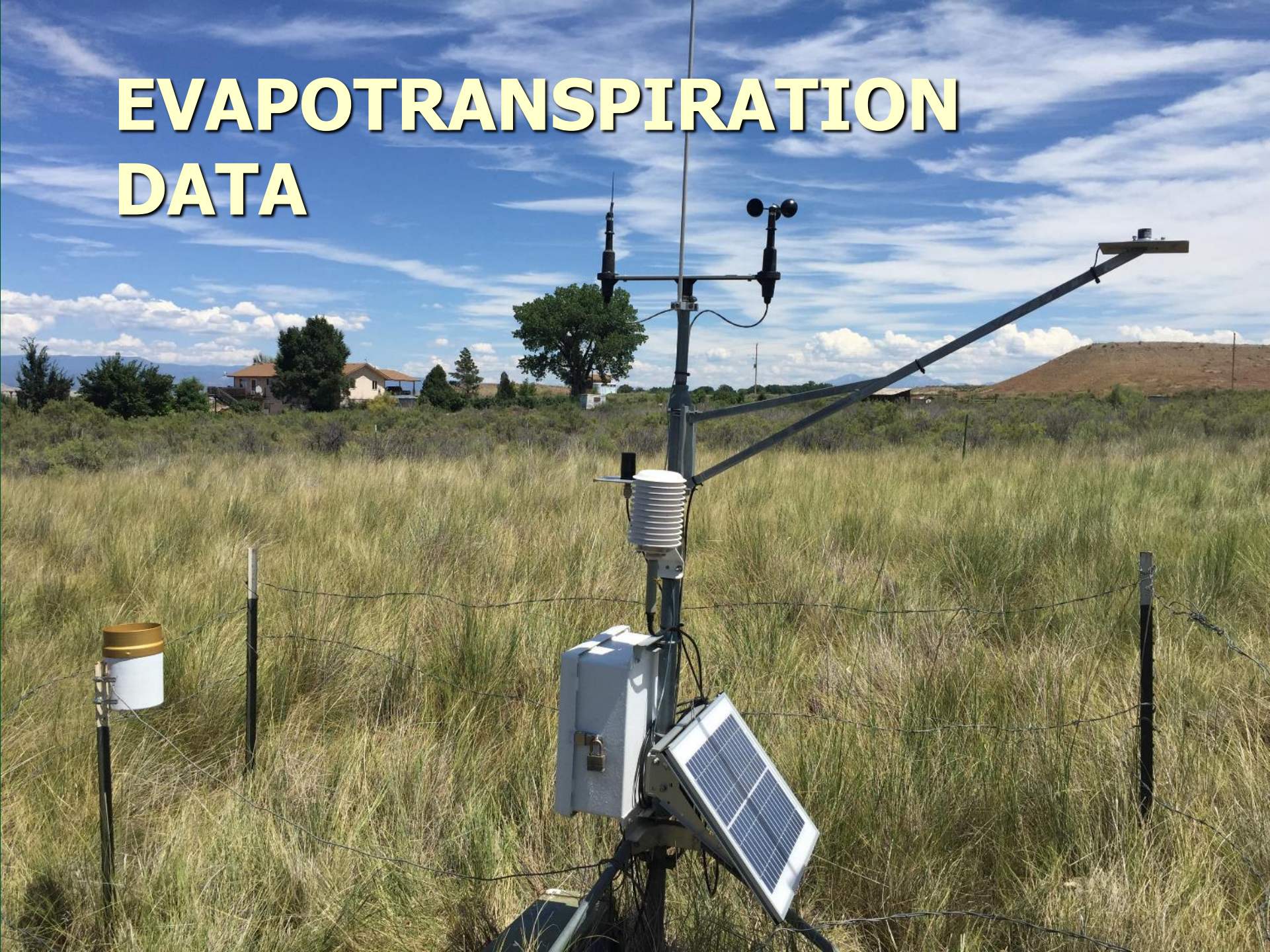


Soil Temperatures



Can you see the difference between when the ground was snow covered and when it was free of snow?

EVAPOTRANSPIRATION DATA





CoAgMET Homepage

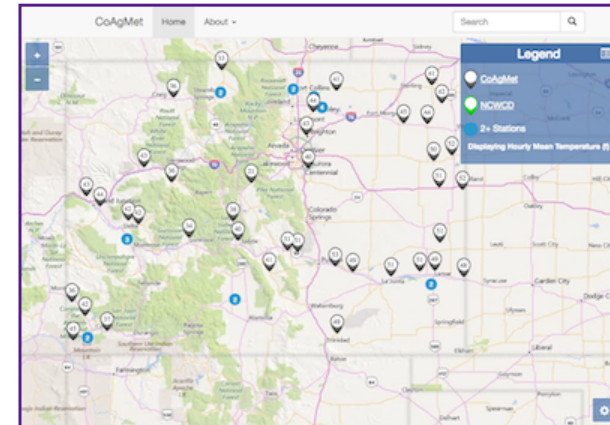
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CoAgMET Mapping and Metadata by eRAMS



Year	Month	Day	# to do	Station ftc03	Irrigation Status Key*
2017	January	18	01	cnn01 - Canon City	Fully Irrigated
2016	February	19	02	cow01 - Cowdrey	Fully Irrigated
2015	March	20	03	ctr01 - Center	Fully Irrigated
2014	April	21	04	ctr02 - Center #2	Fully Irrigated
2013	May	22	05	ctz01 - Cortez	Fully Irrigated
2012	June	23	06	dlt01 - Delta	Partially Irrigated
2011	July	24	07	dvc01 - Dove Creek	Partially Irrigated
2010	August	25	08	eac01 - Eastern Adams County (landfill)	Dryland
2009	September	26	09	ekt01 - Eckert	Fully Irrigated
2008	October	27	10	frit02 - CSU Fruita Expt Station	Partially Irrigated
2007	November	28	11	ftc01 - Fort Collins AERC	Partially Irrigated
2006	December	29	12	ftc03 - CSU - ARDEC	Partially Irrigated

Key gives irrigation status by color

Select from a number of crop types.

Select Crops and Planting Date:

Check

- Alfalfa (Green Up Date) m 04 ▼ d 24 ▼
- Corn (Plant Date) m 04 ▼ d 20 ▼
- Drybeans (Plant Date) m 05 ▼ d 31 ▼
- GrassHay (Green Up Date) m 03 ▼ d 15 ▼
- Smallgrn (Plant Date) m 03 ▼ d 23 ▼
- Sgrbeets (Plant Date) m 04 ▼ d 08 ▼
- Potatoes (Plant Date) m 06 ▼ d 03 ▼
- Onion/sd (Plant Date) m 03 ▼ d 22 ▼
- WntrWheat (Green Up Date) m 03 ▼ d 01 ▼
- Cool Season Turf

Reference ET Model

- Penman-Kimberly
 - ASCE Standardized (daily data)
 - ASCE Standardized (hourly data)
- The crop coefficients used to generate crop ET reports were developed for the Penman-Kimberly model. Selection of another model is only appropriate to obtain reference ET.

Select Ref ET Model

* Some stations are located in areas that are predominately non-irrigated (dryland) or partially irrigated. Users should be aware that ET values from these sites will typically be higher than values from sites in fully irrigated areas. More site information can be found on the [Station Index](#) page.

CoAgMET Extended Crop Evapotranspiration

Station: Fort Collins AERC
 Location: Fort Collins AERC
 Elevation: 5120
 Longitude: 105.1370
 Latitude: 40.5947

Crop Evapotranspiration in Inches

Date	Alfalfa	Corn	Drybeans	GrassHay	Smallgrn	Sgrbeets	Potatoes	Onion/sd	WntrWheat	Turf	ETr	ETo	Precip
09/06/2018	0.15	0.13	0.15	0.13	0.03	0.15	0.13	0.12	0.03	0.10	0.15	0.13	0.00
09/07/2018	0.18	0.16	0.18	0.15	0.04	0.18	0.16	0.14	0.04	0.12	0.18	0.15	0.00
09/08/2018	0.17	0.15	0.17	0.15	0.04	0.17	0.16	0.14	0.04	0.12	0.17	0.15	0.00
09/09/2018	0.18	0.16	0.18	0.16	0.04	0.18	0.17	0.15	0.04	0.12	0.18	0.16	0.00
09/10/2018	0.20	0.17	0.20	0.17	0.04	0.19	0.18	0.16	0.04	0.13	0.20	0.18	0.00
09/11/2018	0.16	0.13	0.16	0.14	0.03	0.15	0.14	0.13	0.03	0.11	0.16	0.14	0.00
09/12/2018	0.23	0.19	0.23	0.20	0.05	0.23	0.21	0.18	0.05	0.16	0.23	0.19	0.00
09/13/2018	0.25	0.20	0.25	0.22	0.05	0.24	0.22	0.19	0.05	0.17	0.25	0.21	0.00
09/14/2018	0.24	0.20	0.24	0.21	0.05	0.24	0.22	0.18	0.05	0.16	0.24	0.19	0.00
09/15/2018	0.22	0.17	0.22	0.19	0.05	0.21	0.20	0.16	0.05	0.15	0.22	0.18	0.00
09/16/2018	0.20	0.16	0.20	0.17	0.04	0.19	0.18	0.14	0.04	0.13	0.20	0.17	0.00
09/17/2018	0.18	0.14	0.18	0.16	0.04	0.18	0.16	0.13	0.04	0.12	0.18	0.17	0.00
09/18/2018	0.19	0.14	0.19	0.16	0.04	0.18	0.17	0.13	0.04	0.12	0.19	0.16	0.00
09/19/2018	0.16	0.12	0.16	0.14	0.04	0.16	0.15	0.11	0.04	0.11	0.16	0.14	0.44
09/20/2018	0.20	0.15	0.20	0.17	0.04	0.19	0.18	0.13	0.04	0.13	0.20	0.17	0.00
09/21/2018	0.17	0.12	0.17	0.15	0.04	0.16	0.15	0.11	0.04	0.11	0.17	0.13	0.00
09/22/2018	0.19	0.13	0.19	0.16	0.04	0.18	0.17	0.11	0.04	0.12	0.19	0.15	0.00
09/23/2018	0.15	0.10	0.15	0.13	0.03	0.14	0.13	0.08	0.03	0.09	0.15	0.12	0.00
09/24/2018	0.18	0.12	0.18	0.15	0.04	0.17	0.16	0.10	0.04	0.11	0.18	0.15	0.00
09/25/2018	0.18	0.12	0.18	0.15	0.04	0.17	0.16	0.09	0.04	0.11	0.18	0.13	0.00
Sum	3.77	2.97	3.77	3.28	0.83	3.64	3.39	2.67	0.83	2.49	3.77	3.16	0.44
Average	0.19	0.15	0.19	0.16	0.04	0.18	0.17	0.13	0.04	0.12	0.19	0.16	0.02

ET reports by region

CoAgMet/NCWCD Meteorological Data for 8/29/2017

	North Front Range							
	FtColl	ARDEC	HortFm	LovInd	Cherpk	Lngmnt	Parker	
HiTemp	91	89	89	91	88	91	94	degF
LoTemp	52	53	50	54	56	51	62	degF
Precip	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in
P/Month	2.16	2.14	3.26	2.00	2.17	1.11	1.66	in
P/Year	10.17	4.02i	11.42	11.44	9.68	9.00	3.41i	in
WindGst	12.5	16.8	19.2	13.5	18.8	19.1	25.0	mph
Ref ET	0.20	0.26	0.25	0.20	0.26	0.23	0.32	in
GrowDD	2347	1191	2357	2594	2109	2331	1635	degF
5cm Soil	62.6	68.3	m	m	66.1	m	71.6	degF
	Crop Evapotranspiration							
Alfalfa	0.21	0.26	0.25	0.20	0.26	0.23	0.32	in
Corn	0.20	0.24	0.15	0.19	0.20	0.18	0.11	in
Drybeans	0.21	0.26	0.25	0.20	0.26	0.23	0.32	in
GrassHay	0.18	0.22	0.22	0.17	0.22	0.20	0.28	in
Smallgrn	0.05	0.06	0.05	0.04	0.06	0.05	0.07	in
Sgrbeets	0.21	0.26	0.22	0.20	0.25	0.23	0.26	in
Potatoes	0.18	0.23	0.22	0.18	0.23	0.21	0.29	in
Onion/sd	0.16	0.21	0.11	0.16	0.18	0.17	0.14	in
WntrWheat	0.05	0.06	0.15	0.04	0.06	0.05	0.32	in

CoAgMet/NCWCD Meteorological Data for 8/29/2017

	North Central									
	Peckhm	Kersey	Kersey	Lucern	Greely	Gilcrs	Ftlptn	Ault	Brigsd	
HiTemp	93	94	96	92	m	92	95	91	95	degF
LoTemp	52	50	52	50	m	50	58	51	47	degF
Precip	0.00	0.00	0.00	0.00	m	0.00	0.00	0.00	0.45	in
P/Month	2.11	1.58	1.85	0.63	1.84i	1.72	1.04	3.40	2.11	in
P/Year	2.28i	12.78i	8.75i	15.53i	11.37i	11.06	8.74i	13.08	8.85i	in
WindGst	14.3	19.3	18.2	14.8	m	17.0	19.2	14.2	25.9	mph
Ref ET	0.23	0.25	0.25	0.23	m	0.22	0.28	0.27	0.26	in
GrowDD	665	2363	2576	2442	m	2347	2701	2358	2392	degF
5cm Soil	70.0	67.4	70.1	71.3	m	m	72.4	66.1	65.8	degF
	Crop Evapotranspiration									
Alfalfa	0.23	0.25	0.25	0.23	m	0.22	0.28	0.27	0.26	in
Corn	0.10	0.22	0.15	0.18	m	0.20	0.16	0.19	0.18	in
Drybeans	0.23	0.25	0.25	0.23	m	0.22	0.28	0.27	0.26	in
GrassHay	0.20	0.22	0.22	0.20	m	0.19	0.24	0.23	0.23	in
Smallgrn	0.05	0.05	0.06	0.05	m	0.05	0.06	0.06	0.06	in
Sgrbeets	0.19	0.24	0.23	0.22	m	0.22	0.25	0.25	0.25	in
Potatoes	0.21	0.22	0.23	0.20	m	0.20	0.25	0.24	0.24	in
Onion/sd	0.10	0.20	0.11	0.16	m	0.17	0.12	0.17	0.12	in
WntrWheat	0.23	0.05	0.08	0.05	m	0.05	0.24	0.06	0.08	in

CoAgMet/NCWCD Meteorological Data for 8/29/2017

Lower South Platte



CoAgMET Homepage

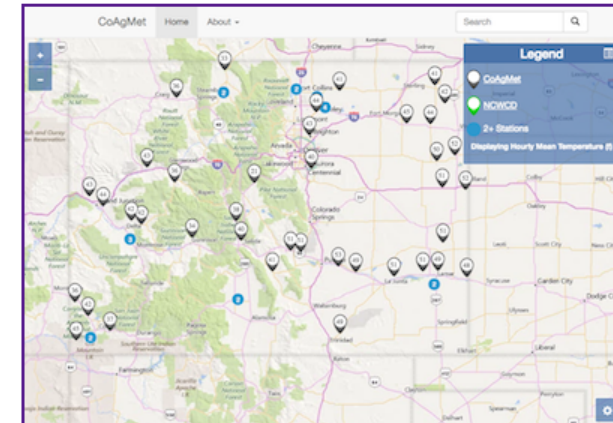
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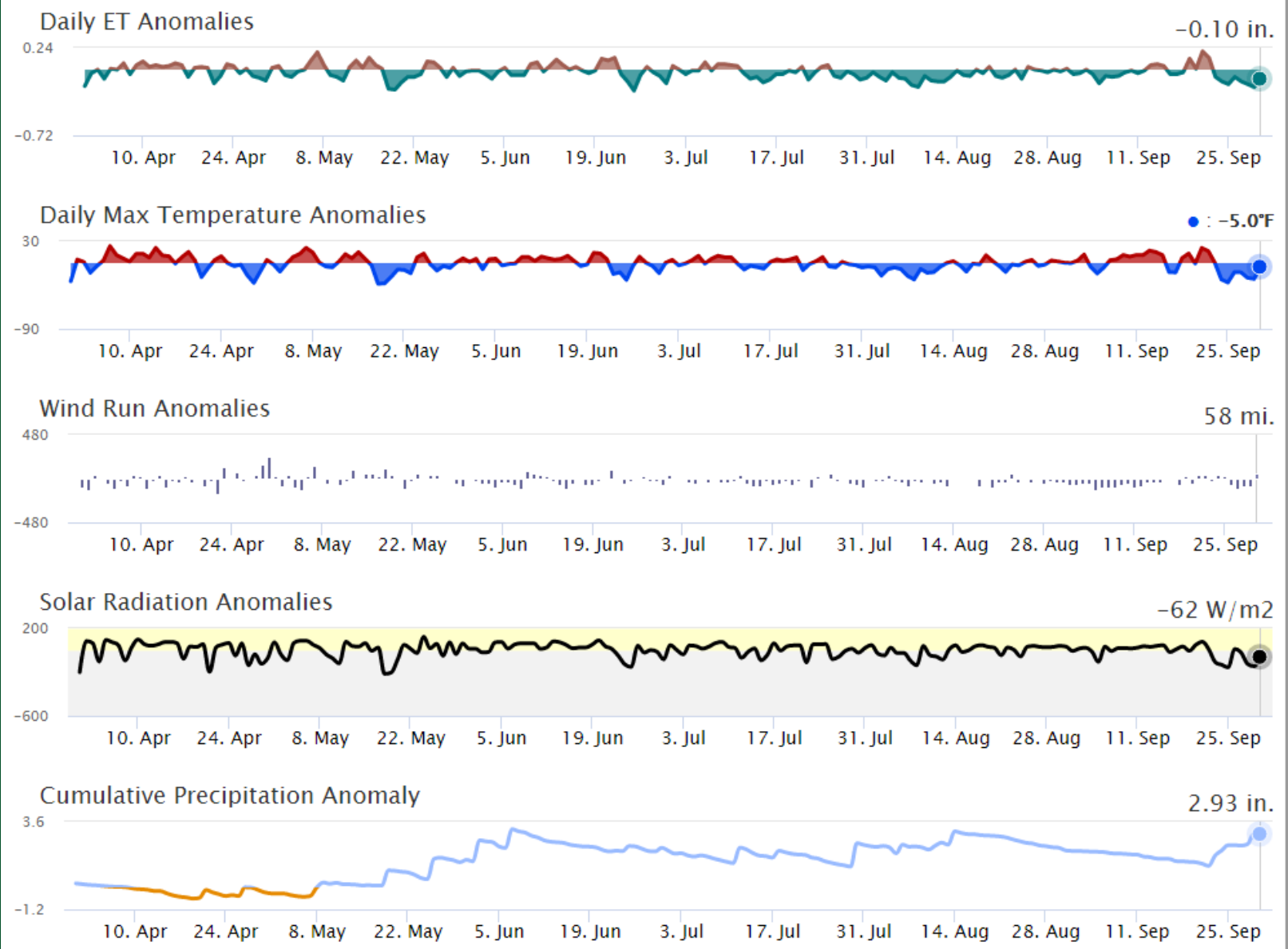




View Magnitudes View Anomalies Change station... ▾



View Magnitudes View Anomalies Change station...





CoAgMET Homepage <http://coagmet.colostate.edu/>

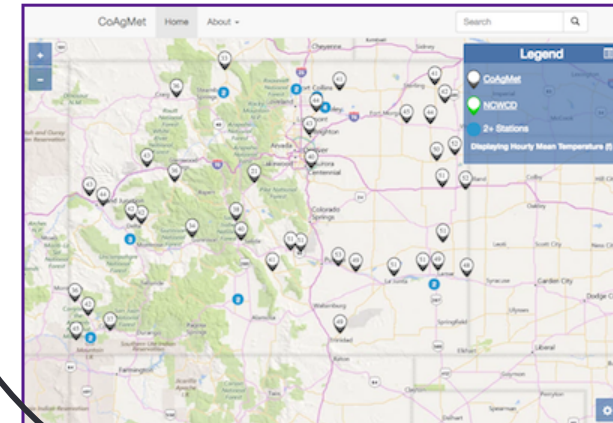
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CoAgMET Mapping and Metadata by eRAMS



Maintaining the data

- ▶ Our goal is to visit each station at least once a year to make sure the station is operating properly.
 - Sensor are swapped out once every 2 years.
 - Emergency visits to stations when there is a problem with the station causing bad data or an interruption of data.
- ▶ Data are quality controlled daily to catch data errors and catch issues with stations before it becomes a problem.



CoAgMET web access:

<http://coagmet.colostate.edu>

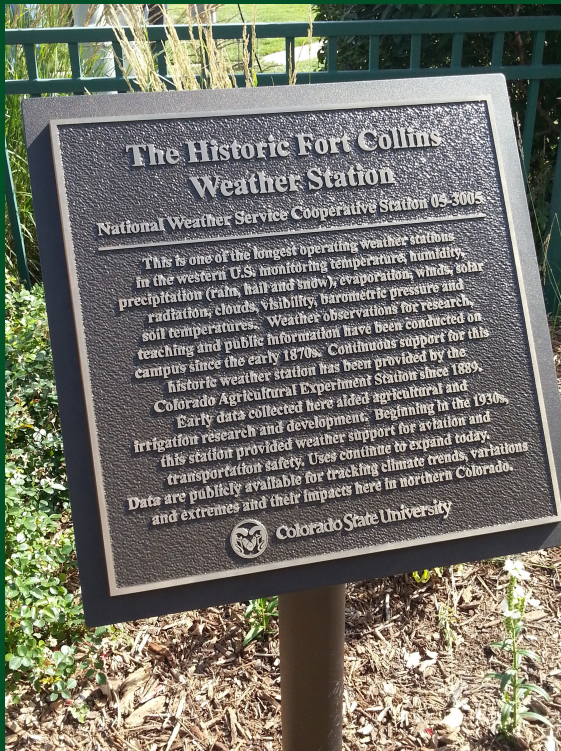
Web services are available for
downloading data

Zach Schwalbe
CoAgMET Manager
zach.schwalbe@colostate.edu
970-491-8140



The Historic Fort Collins Weather Station

First established in 1872, on the CSU campus since 1879, consistent data since 1889
At current location since 1961



Station Locations

- 1 R. Q. Tenney's Farm (1872-1874)
- 2 South of Old Main (1879-1885?)
- 3 Between Old Main and The Oval (1887-1910)
- 4 Civil Engineering Bldg. SW of the Oval (1911-1939)
- 5 The Lagoon (1940-1961)
- 6 Current position (May 15th, 1961- present)



Nolan Doesken discussing the history of the station:
<https://www.youtube.com/watch?v=c-Za8TPTVlc>



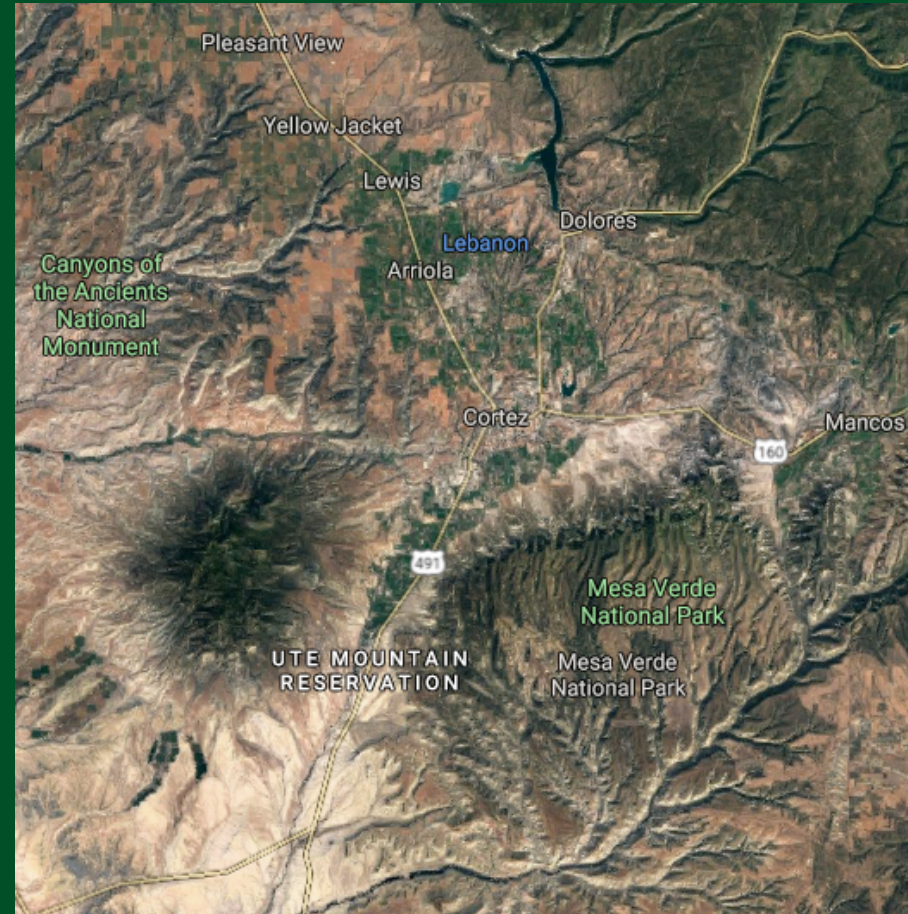
Collaboration with Colorado Wine Industry Development Board

Photo Credit: Canyon of the Ancients
Guest Ranch

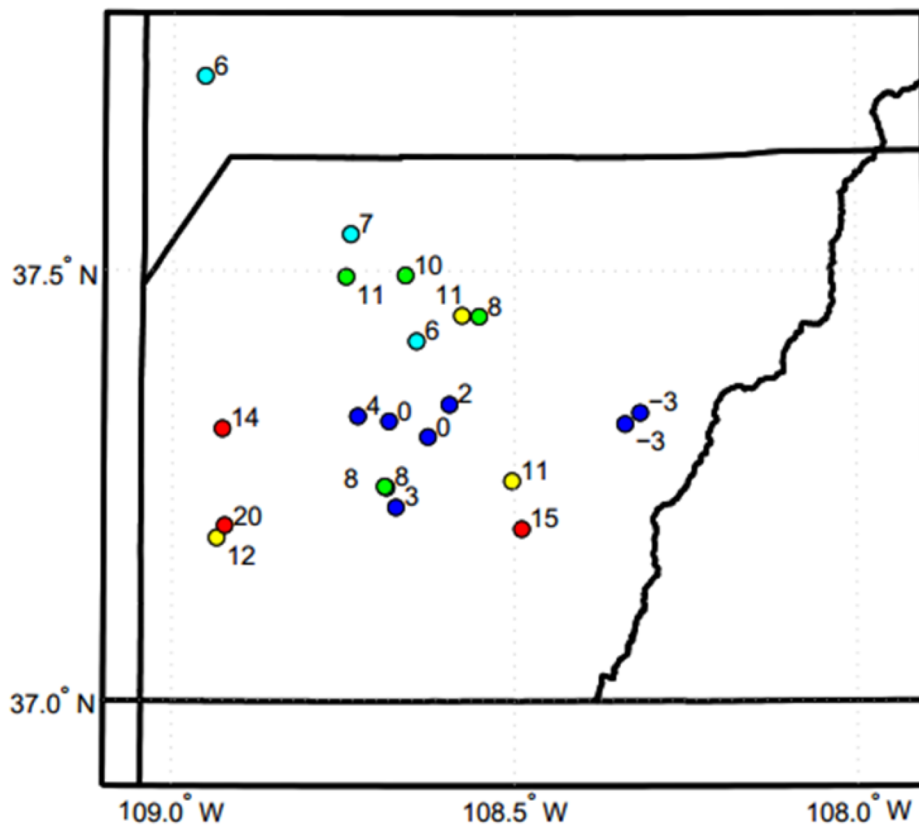


CWIDB

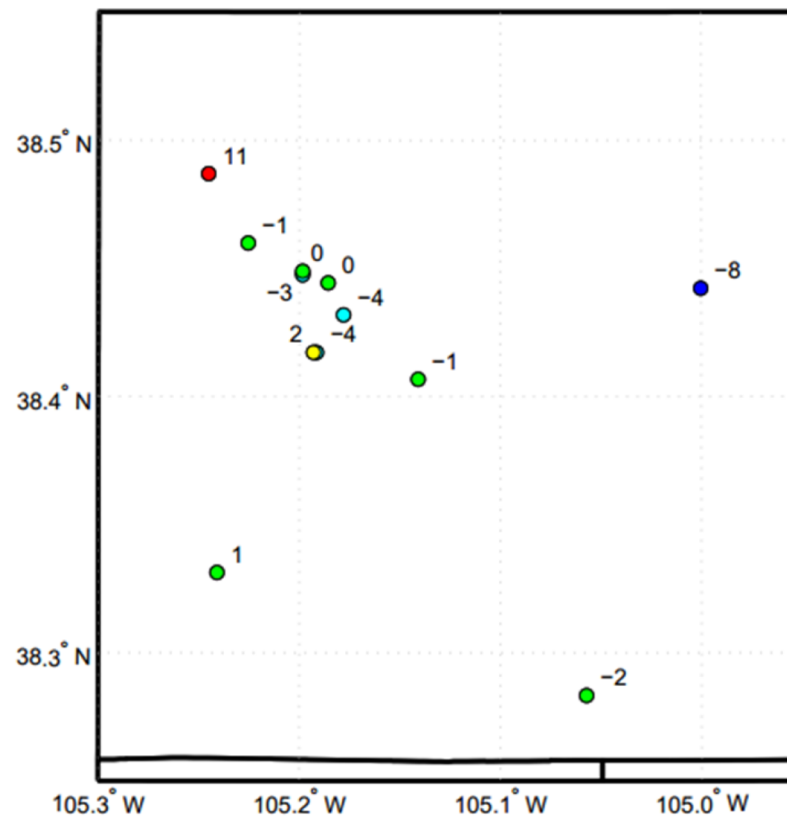
- The largest constraint on wine grape growth in Colorado is plant hardiness
- As the climate warms, more pockets of the state become suitable for an increased quantity and diversity of grapes
- Because of the complexity of western Colorado topography, this involves carefully-placed temperature observations



Montezuma County Minimum Temperatures:
January 22nd, 2018

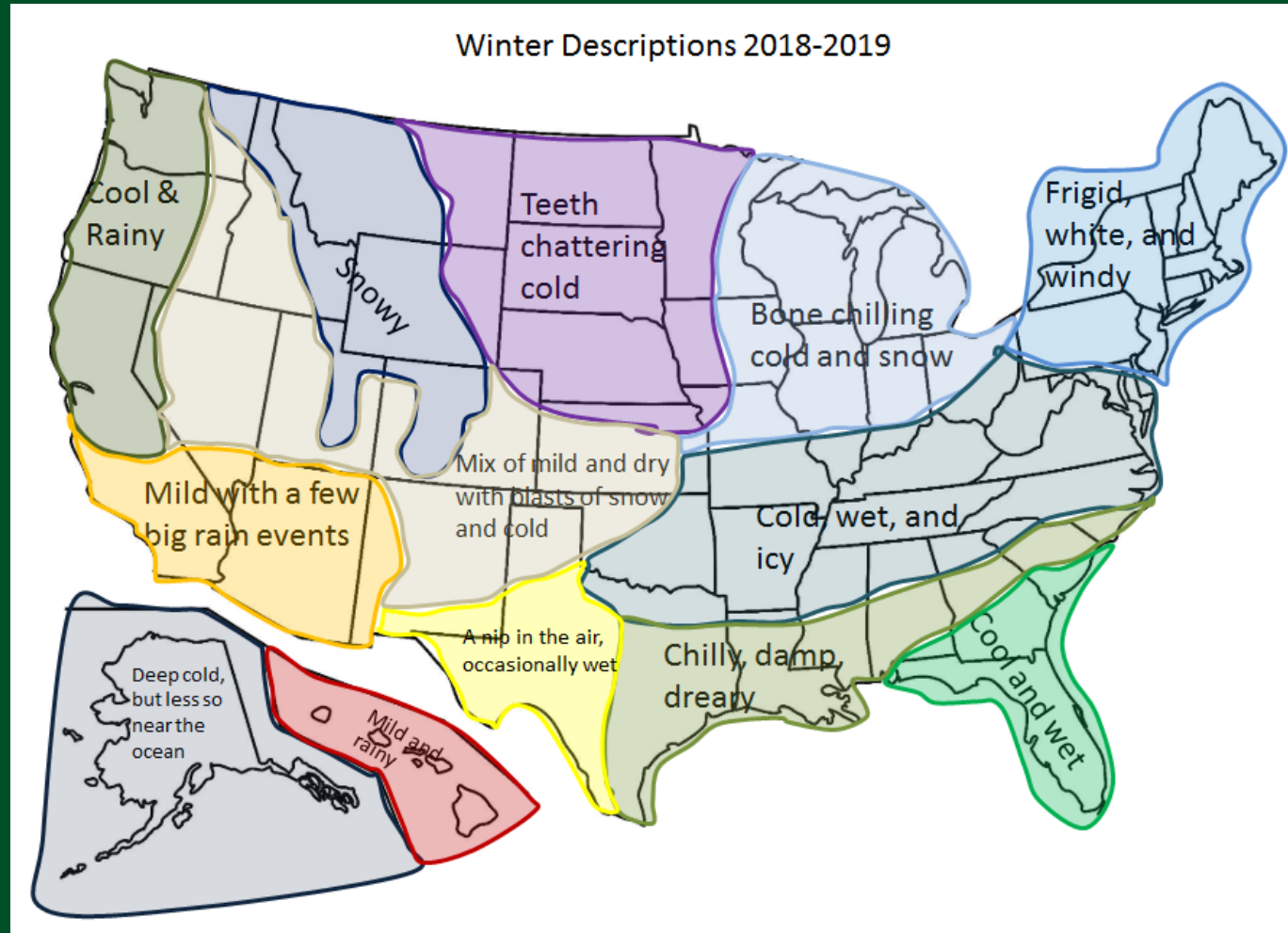


Fremont County Minimum Temperatures: February 11th,
2018



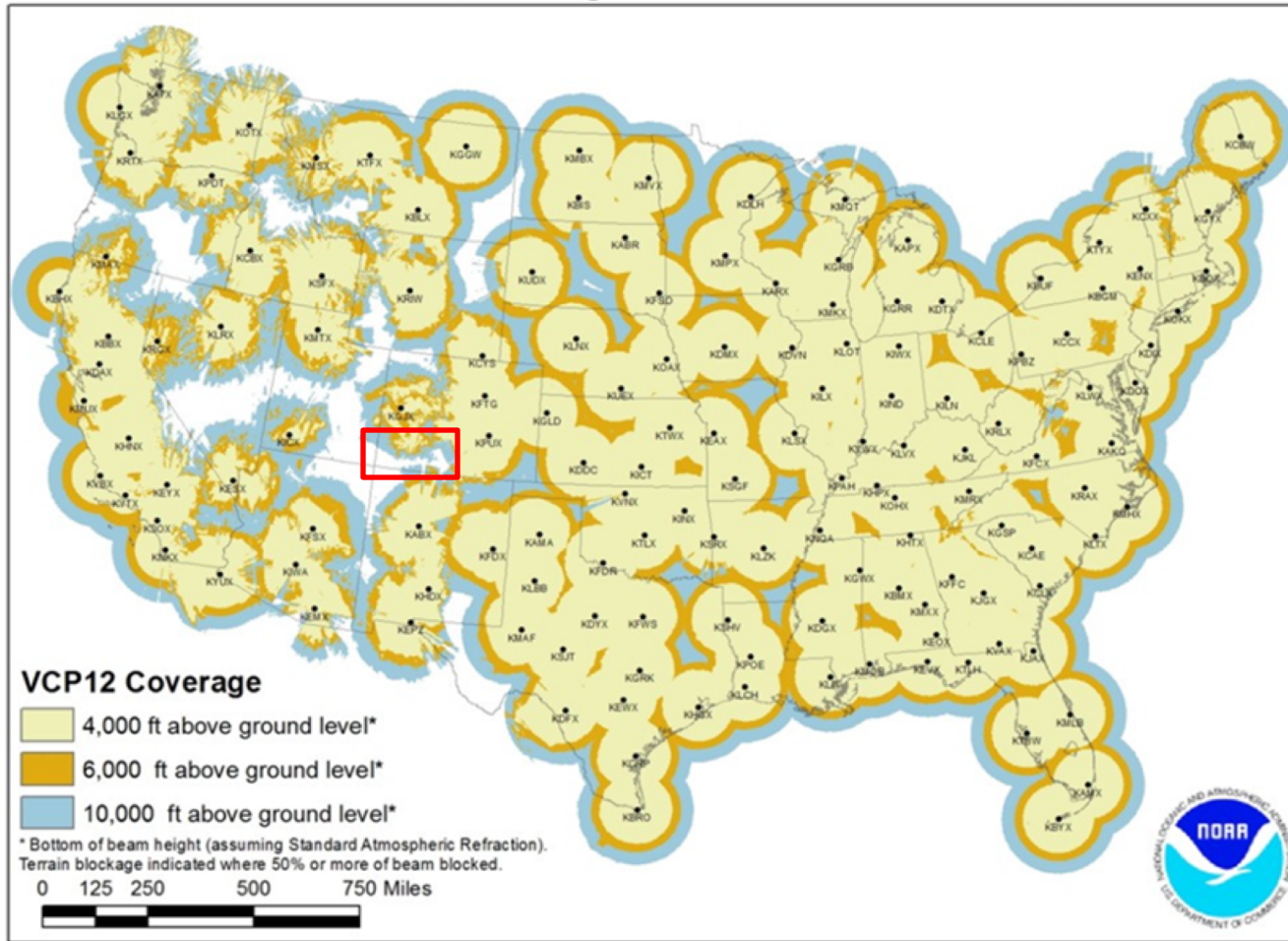
- Dangerous cold winter and spring nights can produce surprising variation in surface temperature
- In general, the coldest nights occur under synoptic high pressure conditions with near-surface inversions where wind patterns are dominated by cold air drainage
- Odds of avoiding freeze damage increase on hill slopes, and near the mouths of canyons where mixing is continuous

Social Media



Hazard Mitigation Grant Program

NEXRAD Coverage Below 10,000 Feet AGL



- The Colorado Climate Center lead a FEMA-commissioned study to assess the biggest data collection gaps in the state for emergency weather events
- Top recommendations were radar coverage in SW CO, and rain/stream gage flood alert networks for the cities of Colorado Springs and Pueblo

Thank you!



- We welcome collaboration ideas and opportunities – please don't hesitate to get in touch!

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Providing information and expertise on Colorado's complex climate