The History and Uses of Volunteer Weather Observations in the U.S.

Nolan Doesken, et al
Colorado State University

Colorado State University
Knowledge to Go Places

17 September 2015
CoCoRaHS
WxTalk Webinar #40

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

COLORADO CLIMATE CENTER

THANKS FOR THE HELP:

- Jim Zdrojewski (NWS)
- Glen Conner (KY SC Emeritus)
- William Angel + NCEI staff
- Steve Doty (NCDC retired)
- Grant Goodge (NCDC retired)
- Bob Bonack (NWS retired)
- Henry Reges (Colorado Climate Center)
- Noah Newman (Colorado Climate Center)
- Undoubtedly others

GREAT RESOURCES

- "List of climatological records in the National Archives (1942)
- "The evolution of Meteorological Institutions in the U.S" MWR (1931)
- Meteorology in America, 1800 – 1870 J.R. Fleming
- Instructions for Cooperative Observers, Circulars B and C

THIS YEAR, THE NATIONAL WEATHER SERVICE IS CELEBRATING 125 YEARS OF VOLUNTEER WEATHER OBSERVATIONS AS A PART OF THEIR "COOPERATIVE OBSERVER PROGRAM"

IN REALITY, VOLUNTEER WEATHER OBSERVATIONS GO BACK MUCH LONGER

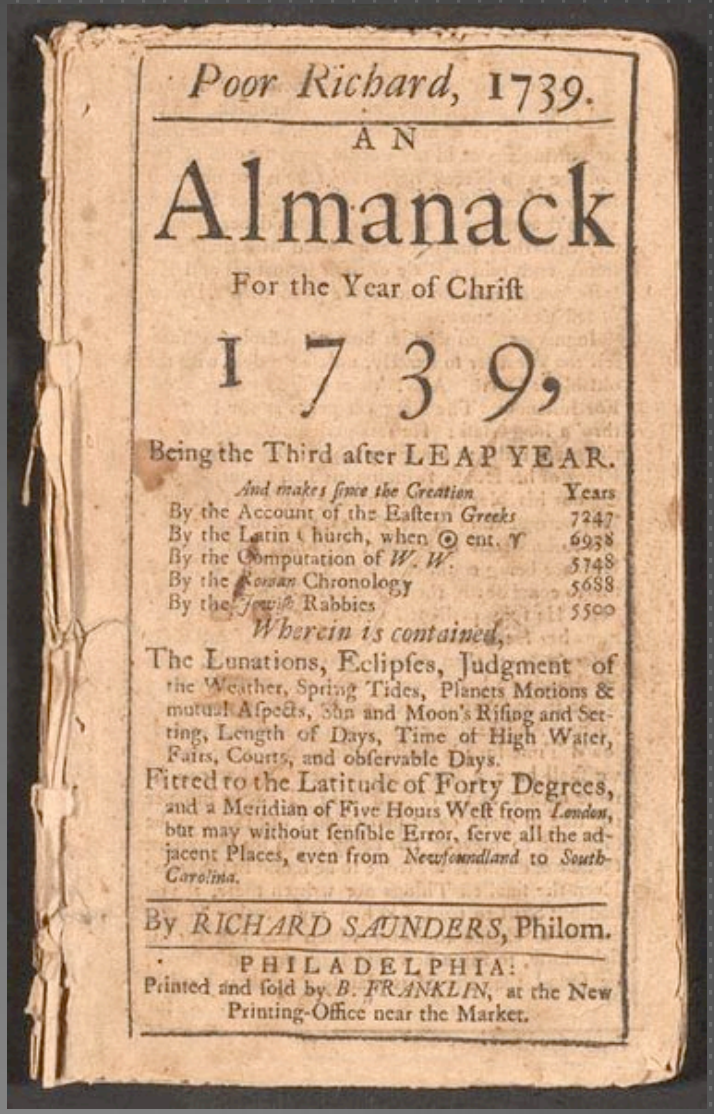
125 YEARS IS AN ARBITRARY STARTING POINT BASED ON THE FORMATION OF THE U.S. WEATHER BUREAU AND THEIR CONSOLIDATION OF COOPERATIVE OBSERVATIONS ~1890-1891

AS LONG AS THEIR HAVE BEEN PEOPLE THERE HAVE BEEN "VOLUNTEER WEATHER OBSERVERS"

BUT LET'S START WITH SOME FAMILIAR FACES

Benjamin Franklin

Recruited postmasters and shipmasters



Poor Richard, 1739.

AN

Almanack

For the Year of Chriſt

1 7 3 9,

Being the Third after LEAP YEAR.

And makes ſince the Creation	Years
By the Account of the Eaſtern *Greeks*	7247
By the Latin Church, when ⊙ ent. ♈	6938
By the Computation of *W. W.*	5748
By the *Roman* Chronology	5688
By the *Jewiſh* Rabbies	5500

Wherein is contained,

The Lunations, Eclipſes, Judgment of the Weather, Spring Tides, Planets Motions & mutual Aſpects, Sun and Moon's Riſing and Setting, Length of Days, Time of High Water, Fairs, Courts, and obſervable Days.

Fitted to the Latitude of Forty Degrees, and a Meridian of Five Hours Weſt from *London*, but may without ſenſible Error, ſerve all the adjacent Places, even from *Newfoundland* to *South-Carolina*.

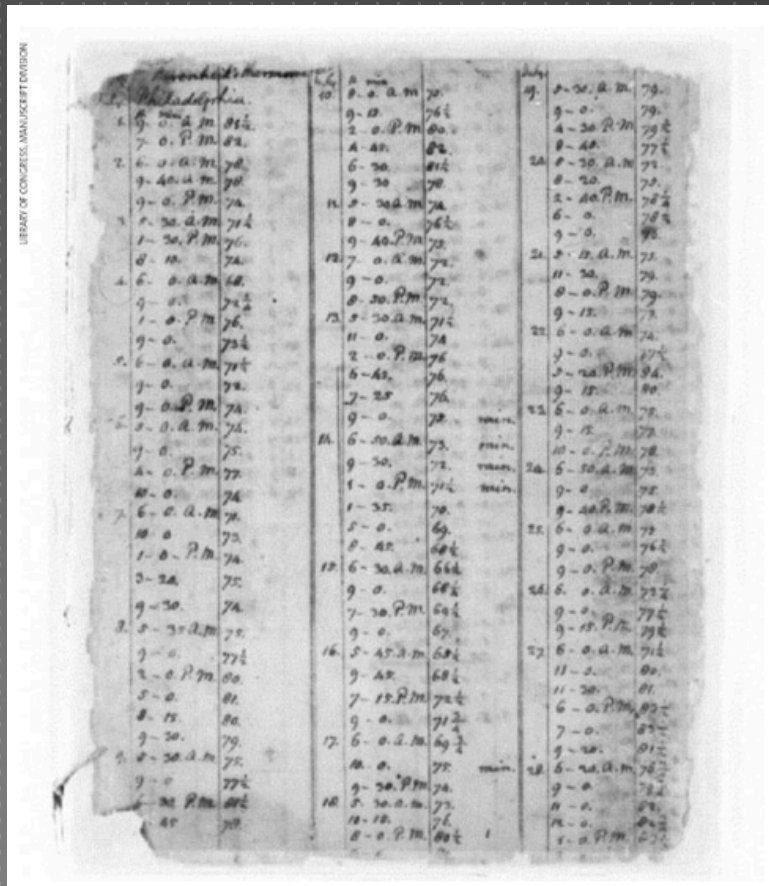
By *RICHARD SAUNDERS*, Philom.

PHILADELPHIA:
Printed and ſold by *B. FRANKLIN*, at the New Printing-Office near the Market.

Early Traditions in "backyard weather watching"

Thomas Jefferson

Over 50 years of weather records



Caption: A page from Thomas Jefferson's Weather Memorandum Book showing his temperature observations for the first two weeks in July 1776. He recorded a temperature of 76 degrees at 1:00 p.m. on July 4, the day the Declaration of Independence was adopted.

Weatherwise, July-Aug 2011

SURGEON GENERAL'S NETWORK 1810s – 1870s

- Primarily post surgeons, "Cooperative" but not volunteer
- Gradually standardized procedures and instrumentations
- Evolved into the U.S. Signal Service network

A champion for Public Participation in Scientific Research

Joseph Henry
First Secretary of the
Smithsonian Institution

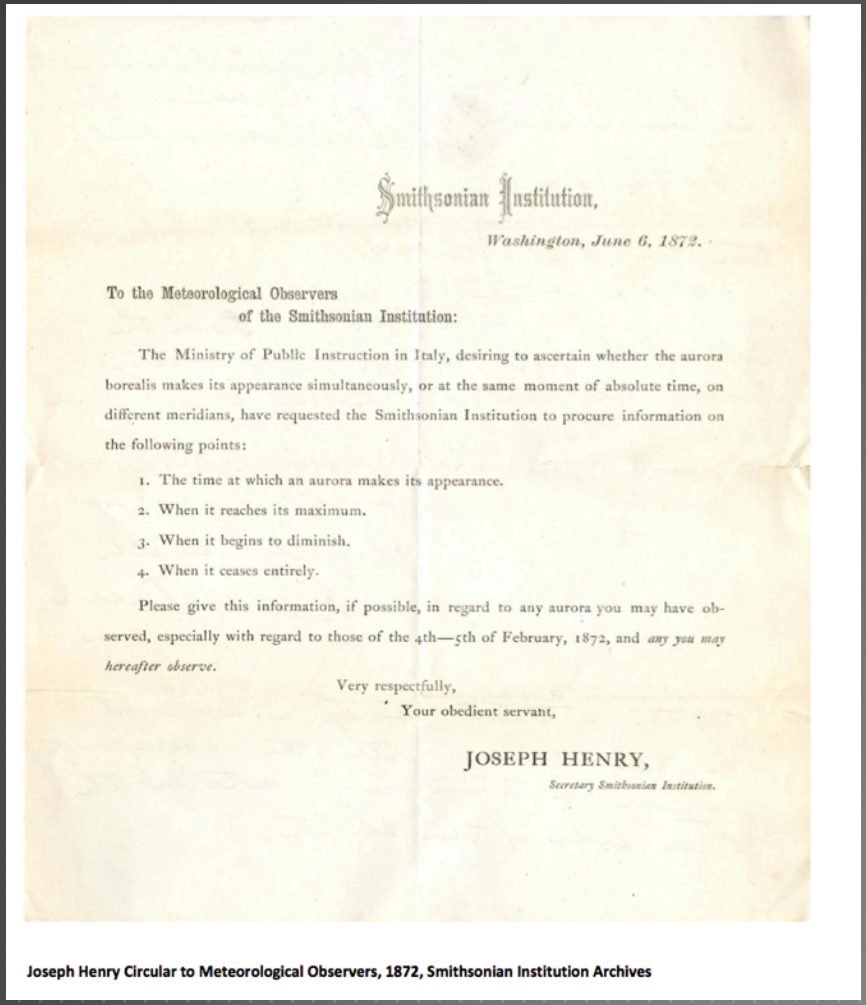
The Castle, the main information building of the Smithsonian Institution,
Photo Tony Cenicola/The New York Times

Henry envisioned a network of volunteer
Weather stations to help document
Climate resources of the country
And provide science-based
weather forecasts

The Smithsonian Meteorological Project began in 1849 and grew to over 600 active participants at times

Secretary Henry helped introduce new technologies – such as the use of the telegraph for sharing weather observations

Louise Rochon Hoover's painting, "Secretary Henry Posts Daily Weather Map in Smithsonian Building, 1858." Commissioned for the Smithsonian exhibition at the Chicago Century of Progress Exhibition in 1933.



Smithsonian Institution,

Washington, June 6, 1872.

To the Meteorological Observers
of the Smithsonian Institution:

The Ministry of Public Instruction in Italy, desiring to ascertain whether the aurora borealis makes its appearance simultaneously, or at the same moment of absolute time, on different meridians, have requested the Smithsonian Institution to procure information on the following points:

1. The time at which an aurora makes its appearance.
2. When it reaches its maximum.
3. When it begins to diminish.
4. When it ceases entirely.

Please give this information, if possible, in regard to any aurora you may have observed, especially with regard to those of the 4th—5th of February, 1872, and *any you may hereafter observe.*

Very respectfully,
Your obedient servant,

JOSEPH HENRY,
Secretary Smithsonian Institution.

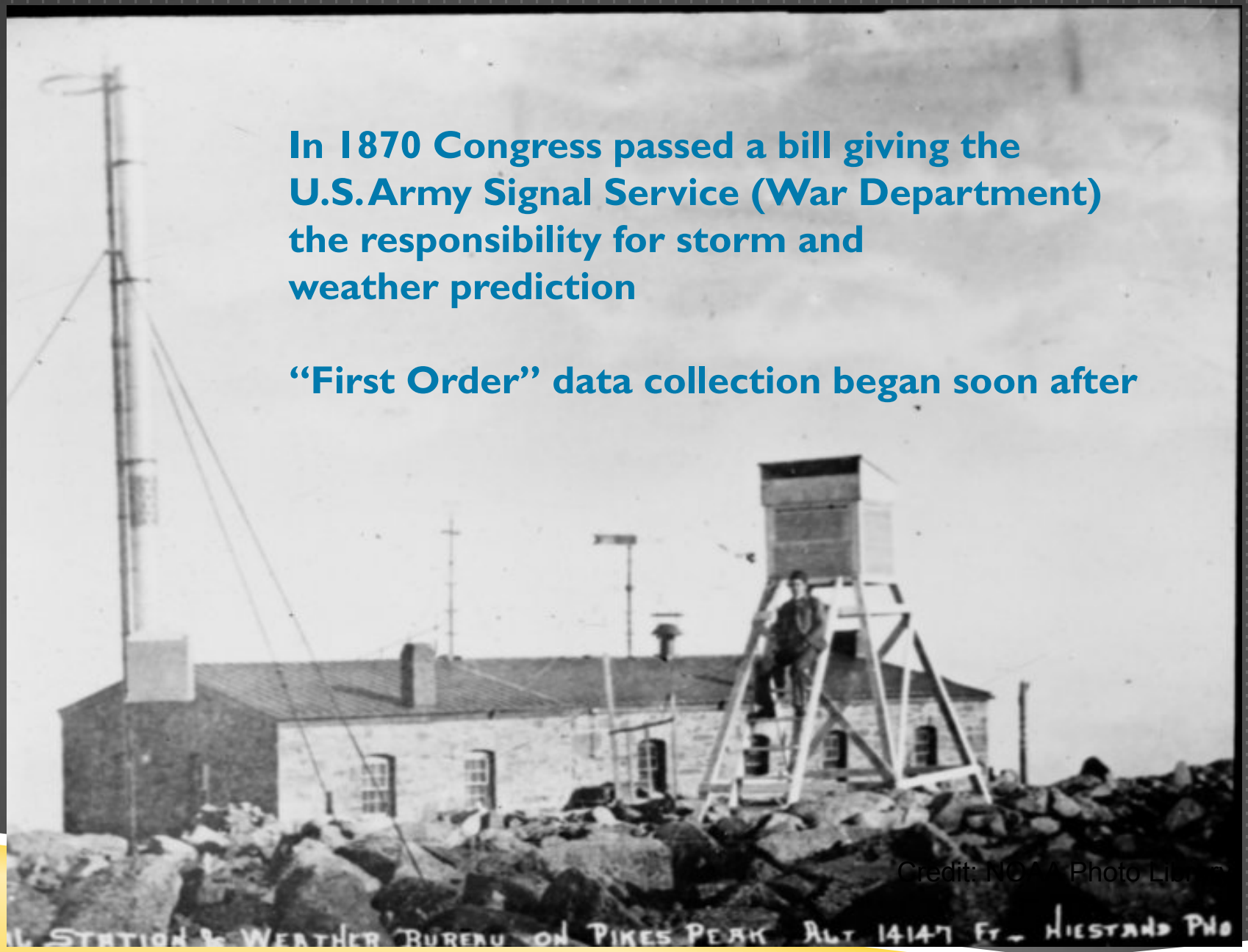
Joseph Henry Circular to Meteorological Observers, 1872, Smithsonian Institution Archives

The first compilation of data from the Smithsonian Meteorological Project was published in 1861

i.e. Patience was required by volunteers to see their data put to use.

In 1870 Congress passed a bill giving the U.S. Army Signal Service (War Department) the responsibility for storm and weather prediction

"First Order" data collection began soon after



Credit: NOAA Photo Library

IN 1874 THE SMITHSONIAN METEOROLOGICAL PROJECT ENDED – BUT PUBLIC PARTICIPATION CONTINUED

Credit: NOAA Photo Library

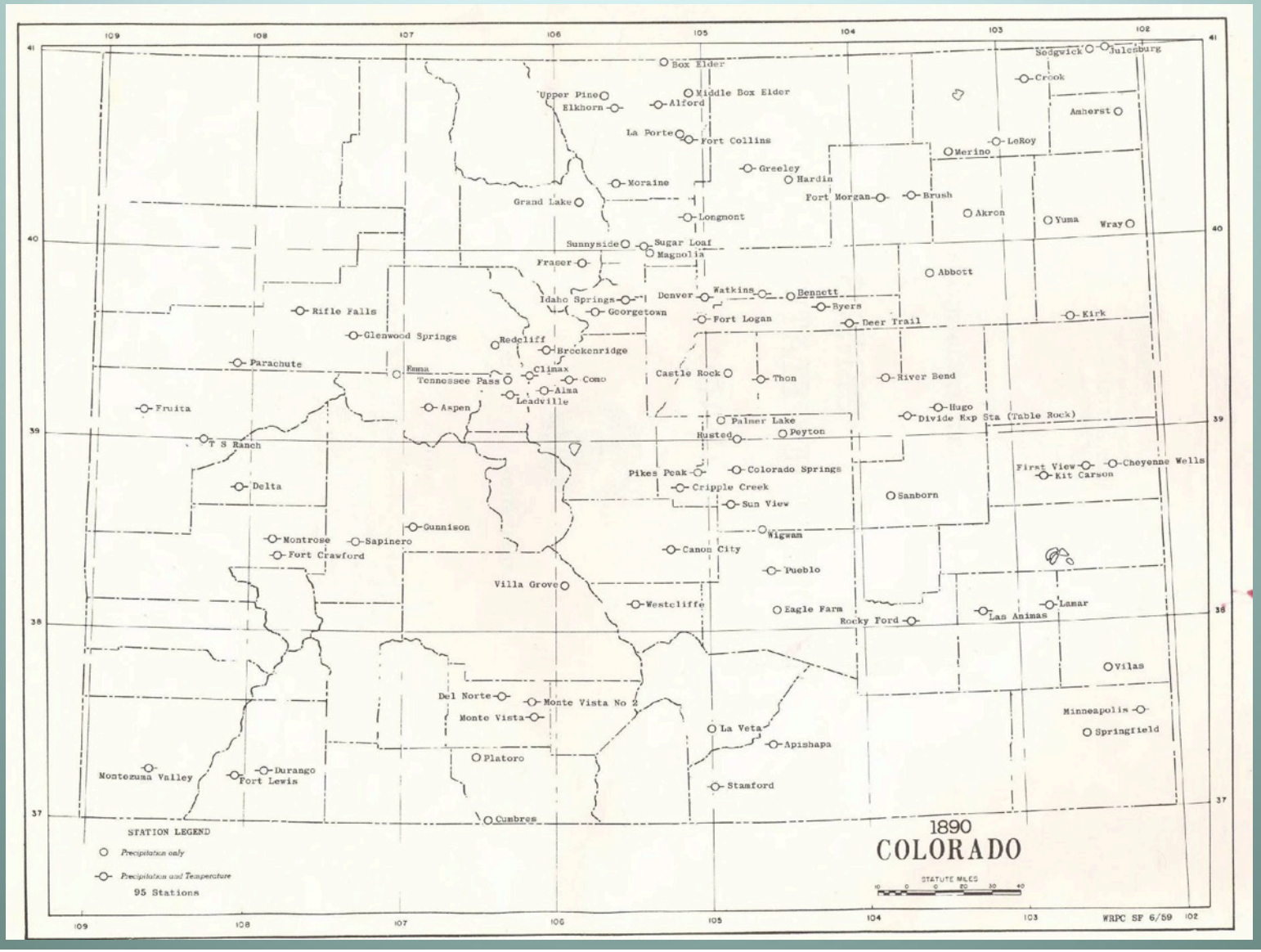
Colorado State Weather Service

- In the 1880s the Colorado State Legislature passed legislation creating the "Colorado State Weather Service".
- $2,000 was appropriated, and an effort was started immediately to establish improved monitoring
- Many other states did the same, some sooner, some later
- These state network were largely

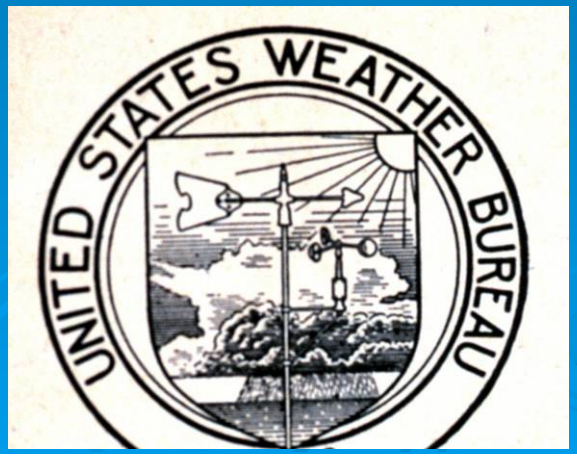
Those early stations formed the backbone for the eventual Cooperative Network

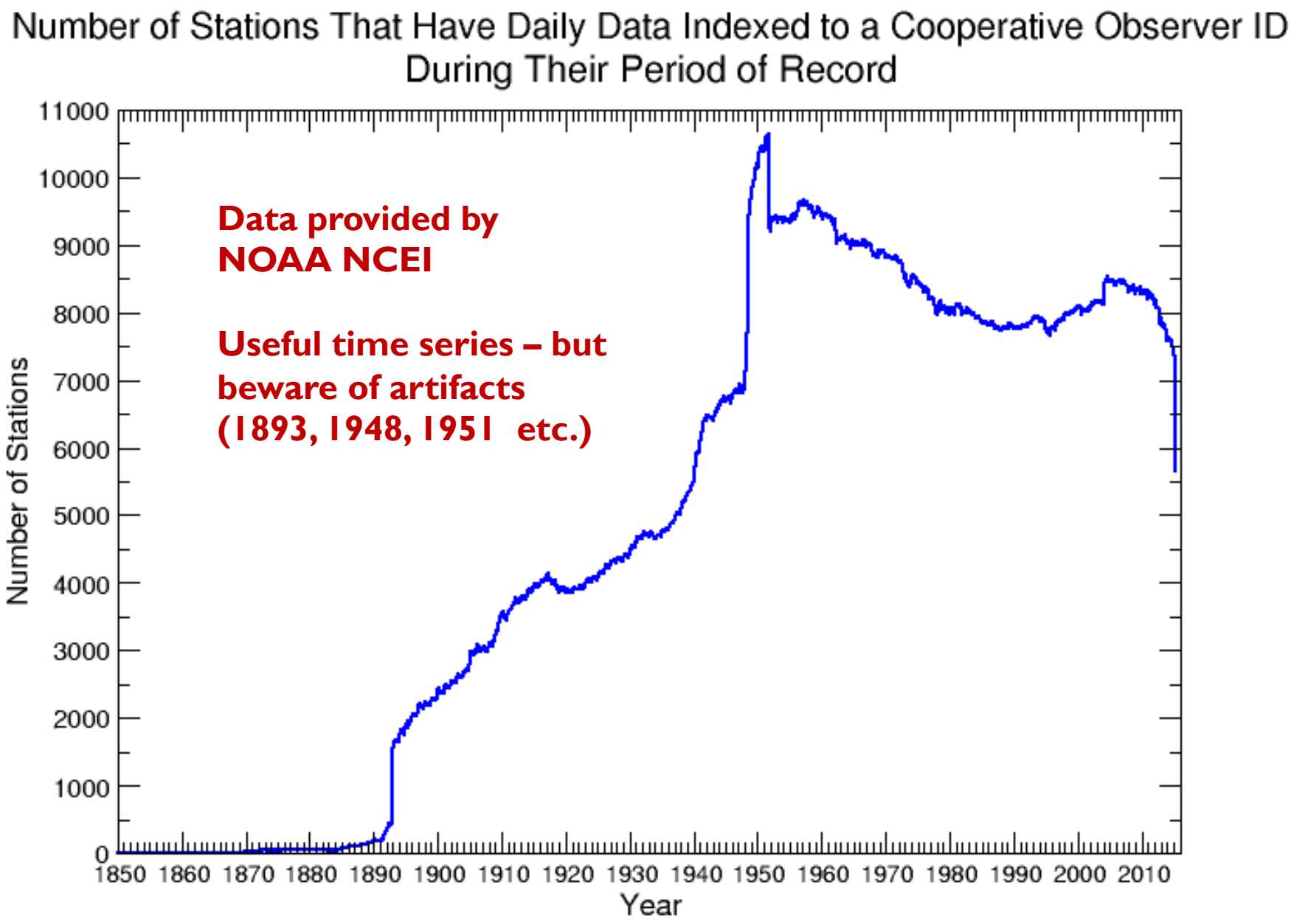
Early Days of the Fort Collins, CO Weather Station (1879-1885?)

By 1890 a robust statewide weather reporting network was in place with similar networks nationwide



In 1890 the USDA took over the responsibilities of climate monitoring on a national level, and the first civilian “national weather service” was formed – the “U.S. Weather Bureau”




Number of Stations That Have Daily Data Indexed to a Cooperative Observer ID
During Their Period of Record
Data provided by
NOAA NCEI
Useful time series – but
beware of artifacts
(1893, 1948, 1951 etc.)
Number of Stations
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010
Year

FOR EVERY STATION

THERE'S A STORY

Organizational hosts:
Historic U.S. Weather Networks

Army Medical Department – Post Surgeons (~1800 s – 1870s)

Smithsonian Meteorological Program (1847-1874)

U.S. War Department – Signal Service (1870-1890)

Colorado Meteorological Association (1886-1891)

U.S. Dept. of Agriculture, U.S. Weather Bureau (1890 - 1940)

U.S. Weather Bureau transferred to Dept. of Commerce (1940-1970)

Weather Bureau renamed to National Weather Service (1970- present)

And the COOP Network lives on -- evolving slowly (present – future)

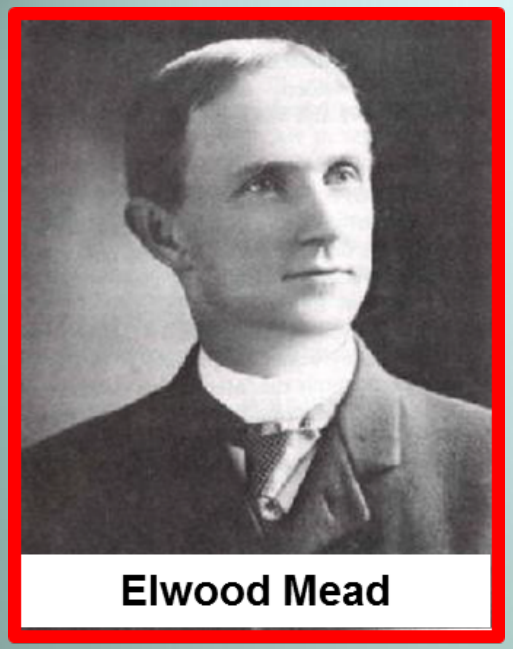
Our first "Official Weather Observer"

here in Fort Collins, CO

Roland Quartis Tennev

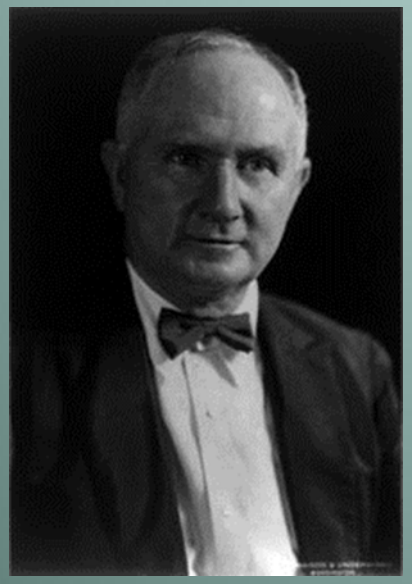
-- Arrived in Fort Collins in 1871
-- Began weather observations for the Smithsonian in 1872 on his farm in the Cache la Poudre Valley just NW of "Old Town"
-- involved in many things, but irrigation practices may have been first and foremost

-



Elwood Mead

Observations
1886 - 1888



Many examples of well-known COOP weather observers -- for our station, it was Elwood Mead

Elwood Mead: Studied under Charles Ingersoll at Purdue University and graduated with a degree in Civil Engineering from Iowa State Agricultural College in 1883. Hired as a temporary mathematics instructor at Colorado Agricultural College in 1883 and wrote the proposal to the State Board of Agriculture which led to the formation of the Irrigation Engineering Course at CAC. Resigned from 1884 to Sept. 14, 1886 to work as assistant state engineer and obtain a MS degree from Purdue. Returned to CAC in 1886 to head the newly formed department of Physics and Engineering. After leaving the college in 1888, Louis G. Carpenter was hired as his replacement. Elwood Mead served as: State engineer of Wyoming, 1888-89; Chief of the division of Irrigation and Drainage, USDA 1899-1907; chairman of State Rivers and Water Supply Commission, Victoria, Australia, 1907-1914; professor of rural institutions UC Berkeley 1915-1923; chairman of the State Land Settlement Board of California 1917-1923; and Commissioner of Reclamation, US Dept of the Interior 1924-1936. Lake Mead behind Hoover Dam is named in his honor.

- But most COOP Observers are just

good solid generous folks – with a few real characters mixed in here and there to keep things interesting

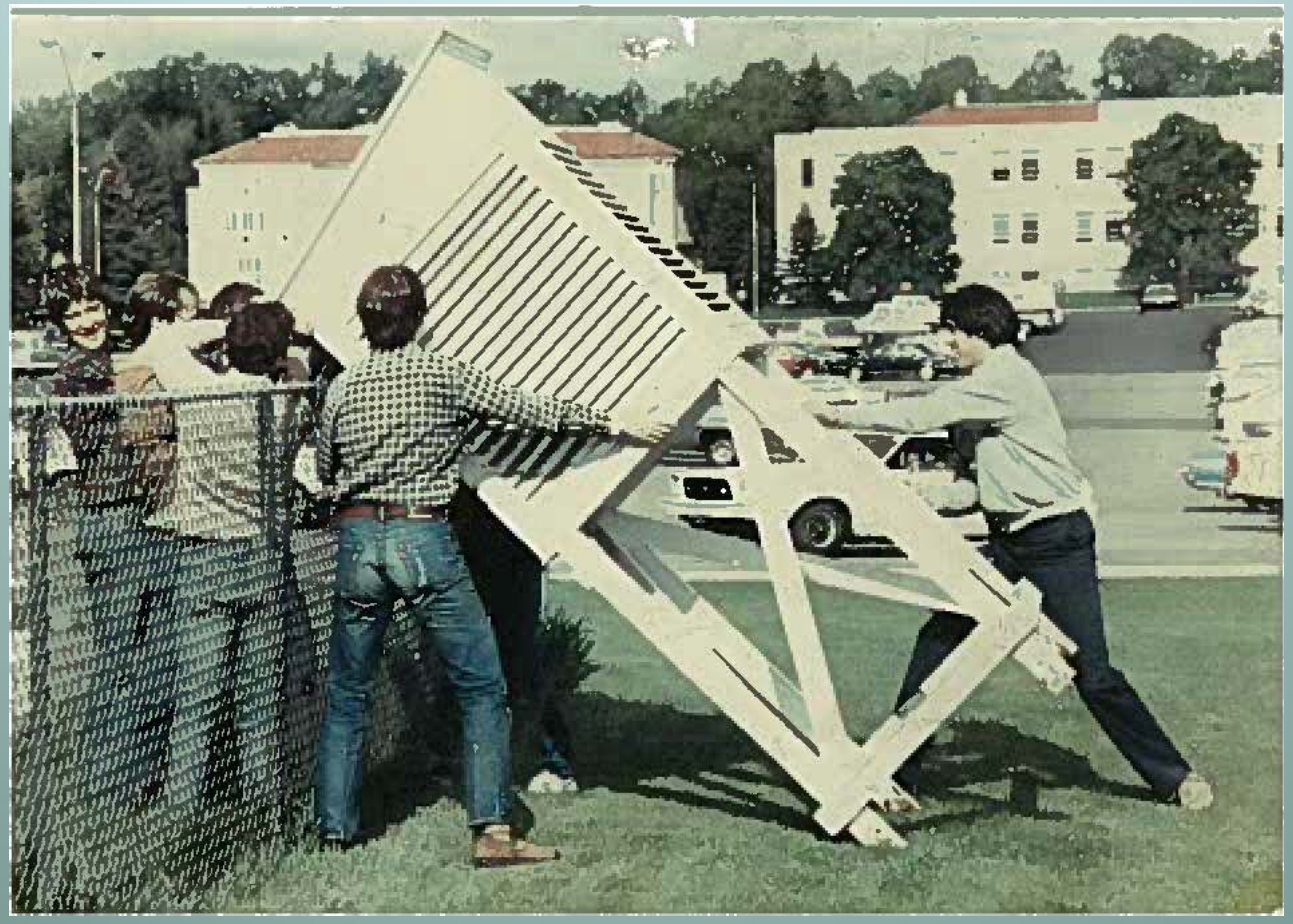
Growth and Progress: Weather Data collection continued

CO Ag. College Civil Engineering Building

Maxwell Parshall

Parshall's home near campus on S. Loomis

More Time Passes
Cooperative Network Remains



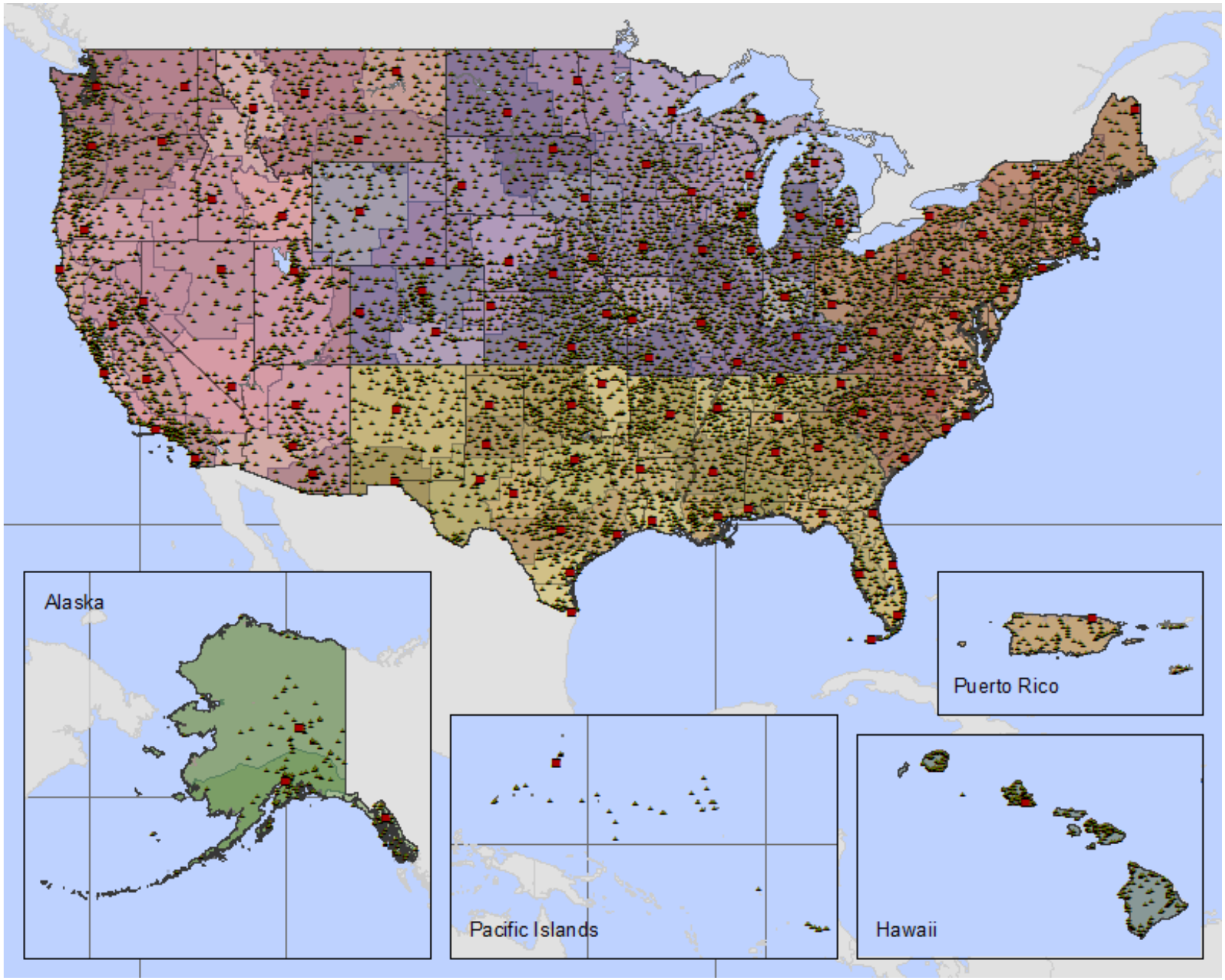
Nolan Doesken (far right), Jim Cowie, Dave Changnon, Doug Wesley, Paul Wolyn and ____ (student from Canada)

Photo by Grant Goodge – Cloudless summer day in 1988

COOP Network at work
Monitoring our Climate

- Elements: temperature, precipitation, snow, wind, solar, evaporation, soil temperatures, humidity, clouds, etc.

This is it -- Our 21st Century COOPERATIVE Network



What in the world is so special about the Cooperative Network?

Example of a traditional National Weather Service "Cooperative" weather station

Photo by Christopher Davey

The NWS COOP stations remain the backbone network for long-term climate monitoring and research

From Kelly Redmond, WRCC

Approximately 5000 daily max/min temperature stations, 8000 daily precipitation stations, 3000 automated hourly precipitation stations.

Why so valuable?
Let me count the ways

1) Simplicity and Uniformity of instrumentation and observing methods (adherence to basic standards)
2) Best source for precipitation and snowfall
3) National Extent and spatial density
4) Longevity with continuity
5) Metadata tracked and preserved
6) Data archived and accessible
7) Motivated Participants and so many users

HOW DO WE USE THE DATA FROM VOLUNTEERS?

MANY AND VARIED WAYS AND MEANS!

ORIGINALLY, MOST OF THE USES FOR VOLUNTEER DATA WERE FOR AGRICULTURE

Since World War II climate information used for many more purposes

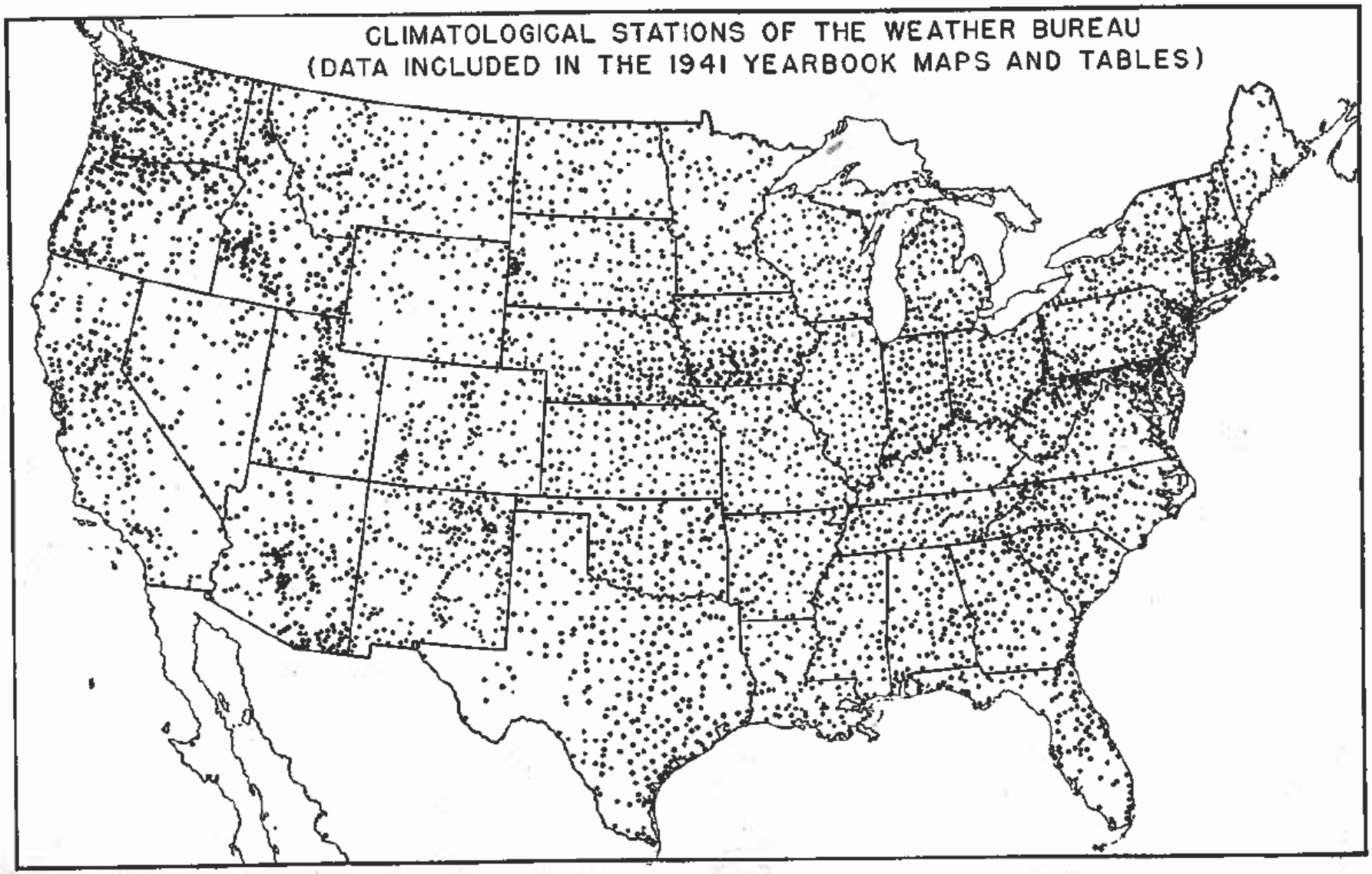
- Architecture
- Engineering
- Infrastructure
- Transportation
- Insurance
- Recreation
- You name it

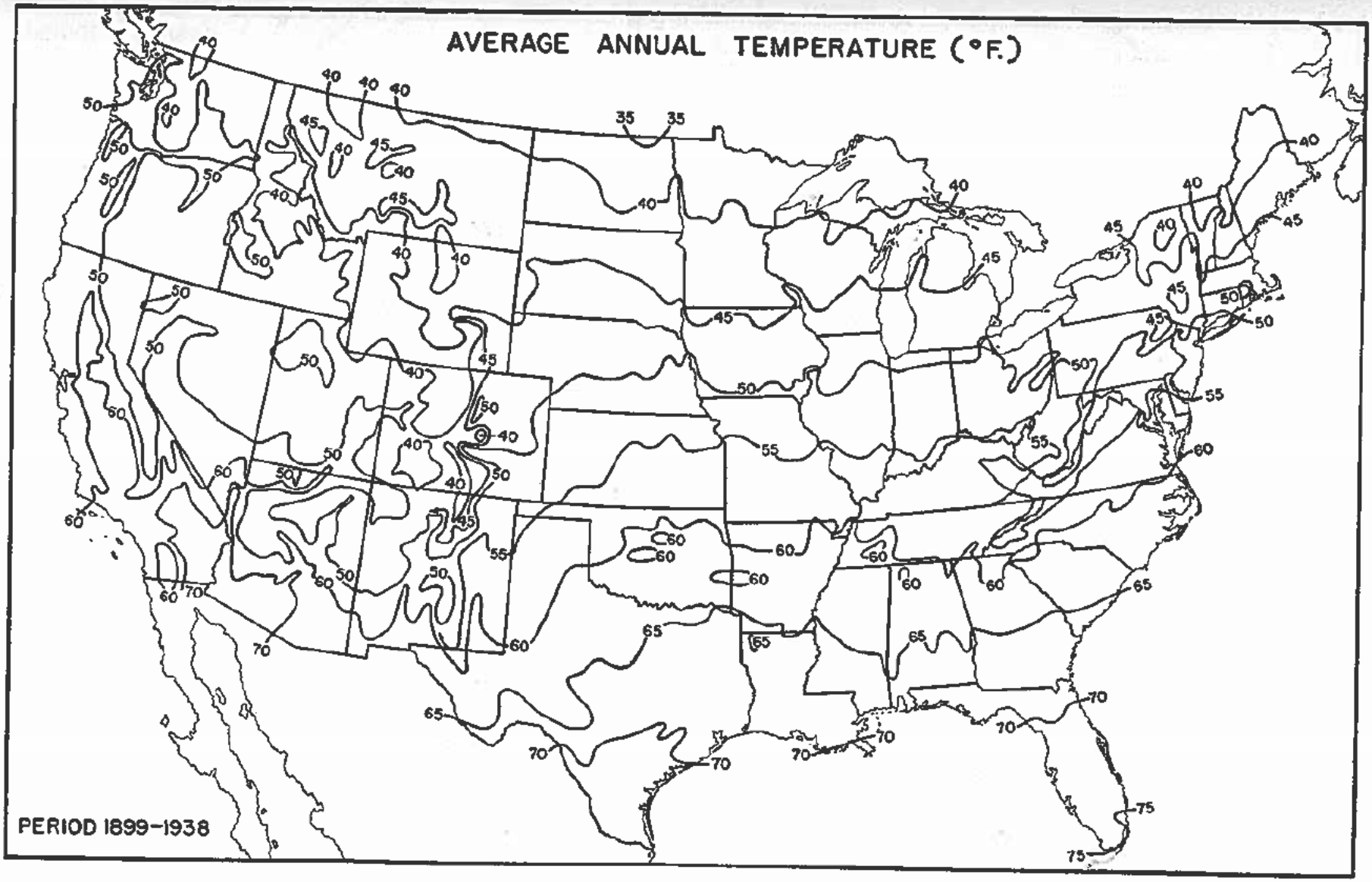
CLIMATE and MAN

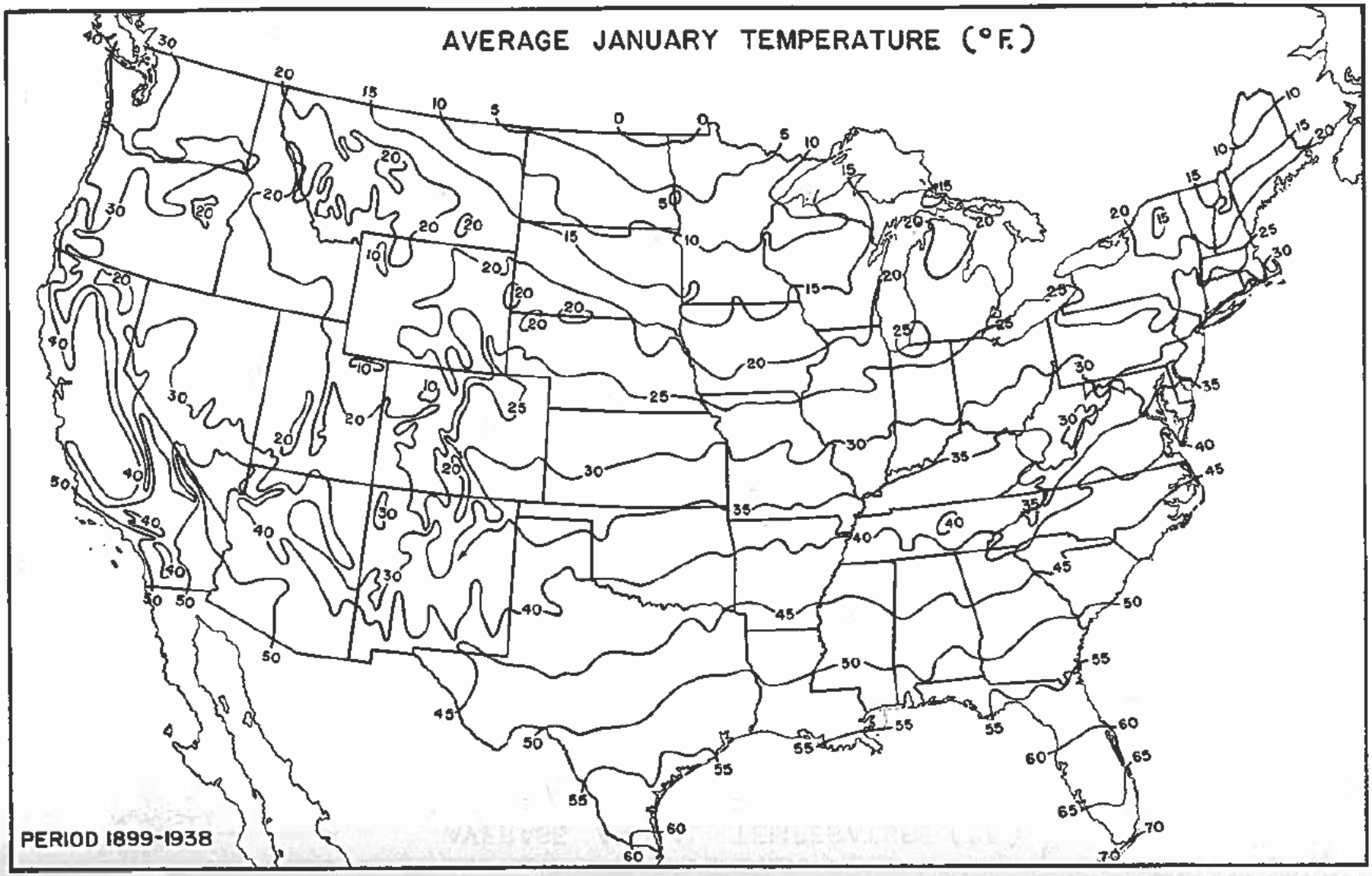
YEARBOOK OF AGRICULTURE

1941

UNITED STATES
DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.
UNITED STATES GOVERNMENT PRINTING OFFICE

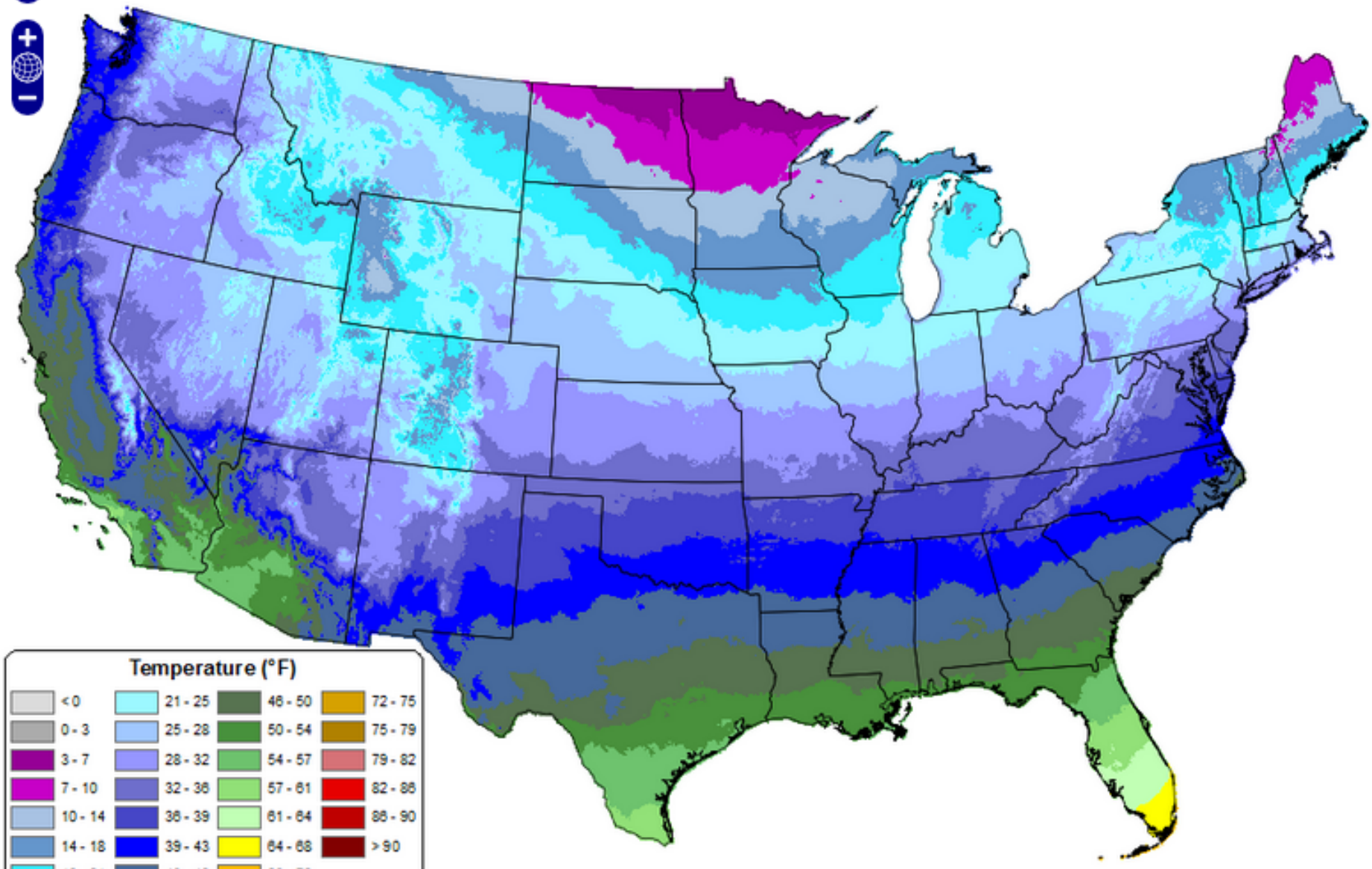

CLIMATOLOGICAL STATIONS OF THE WEATHER BUREAU
(DATA INCLUDED IN THE 1941 YEARBOOK MAPS AND TABLES)

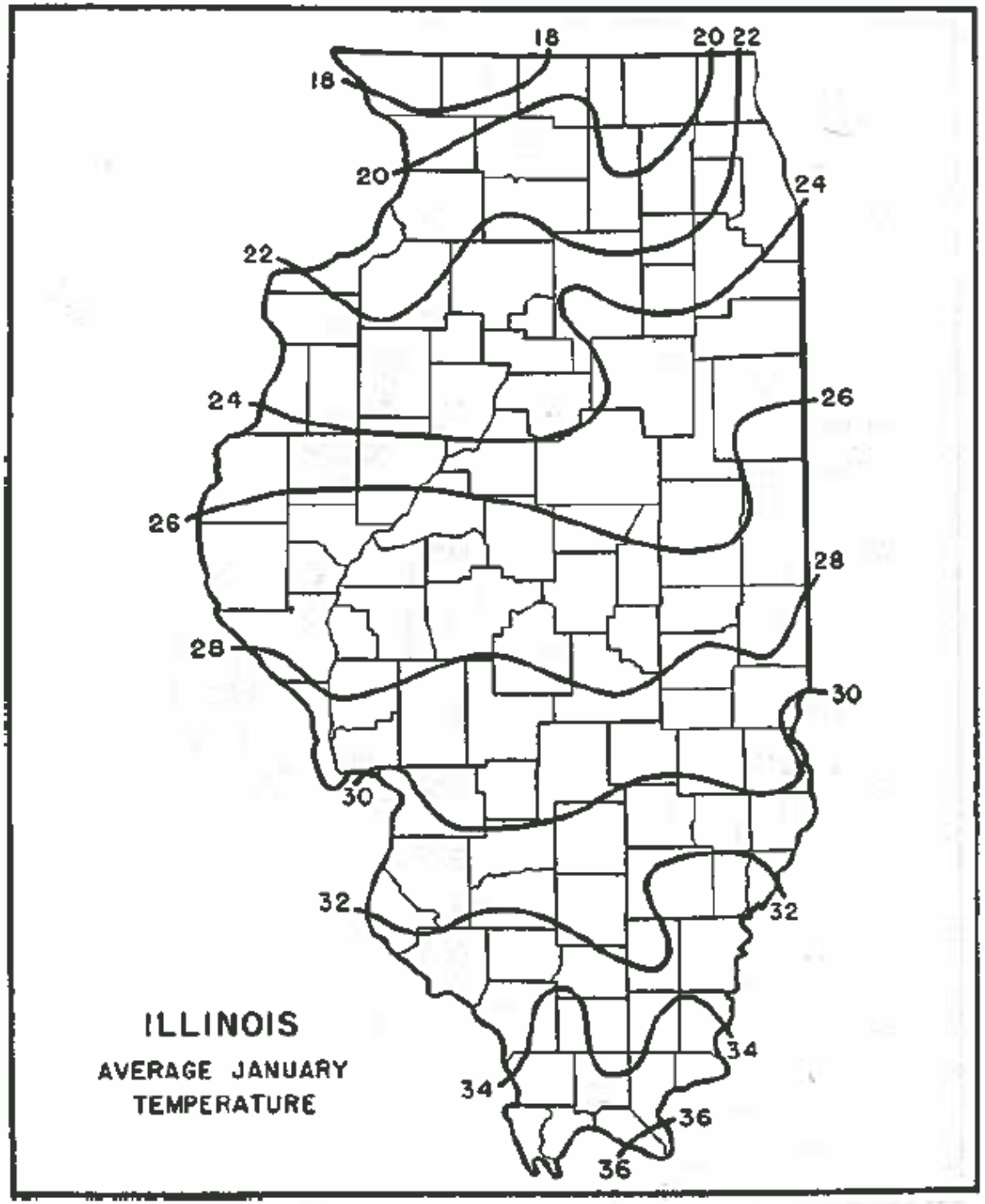

AVERAGE ANNUAL TEMPERATURE (°F.)
PERIOD 1899–1938


AVERAGE JANUARY TEMPERATURE (°F.)
PERIOD 1899-1938

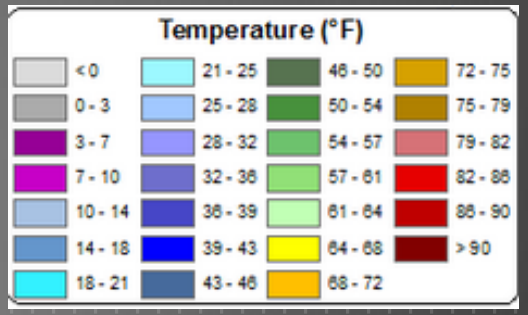
30-yr Normal Mean Temperature: January

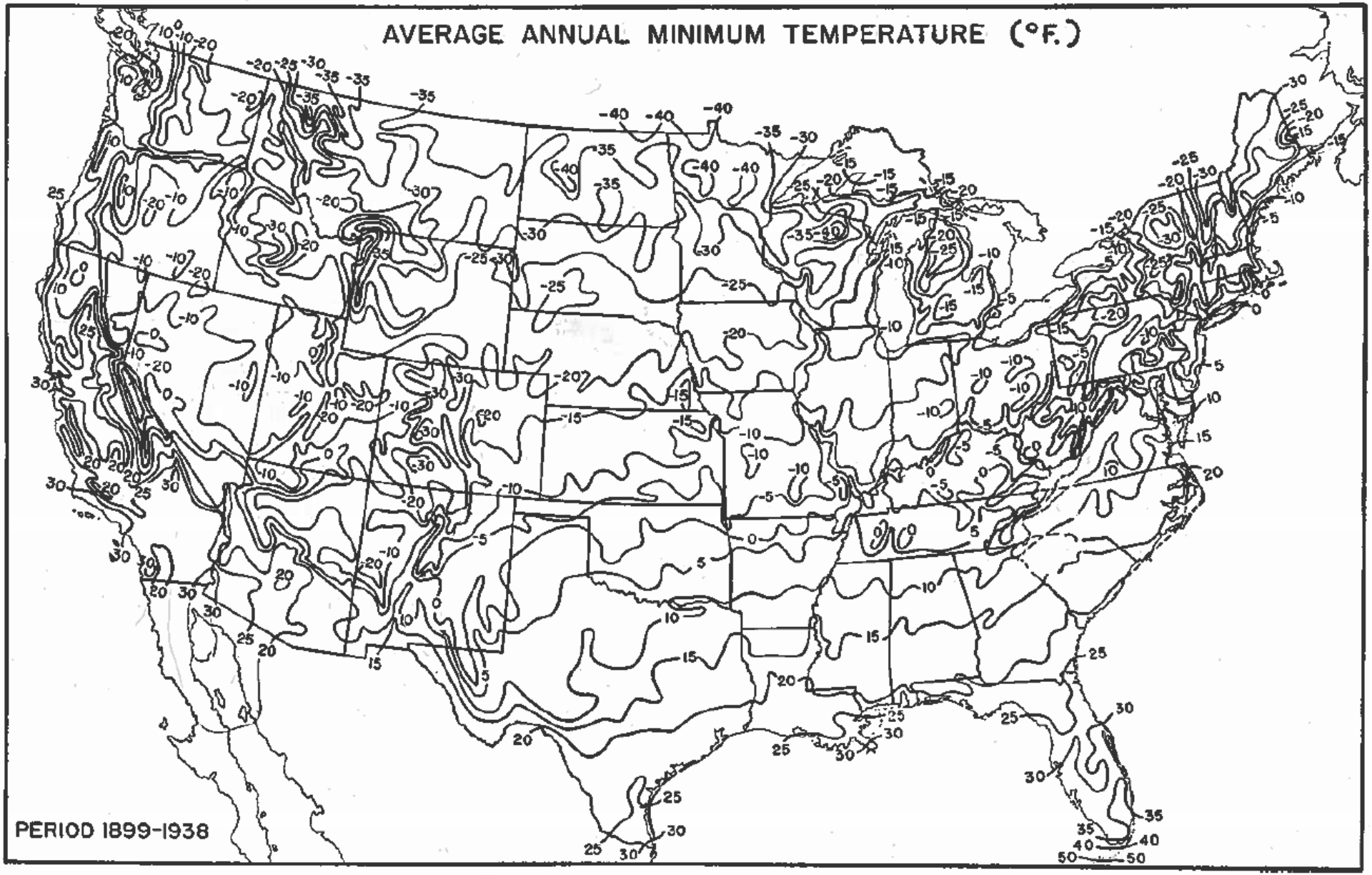
Period: 1981-2010

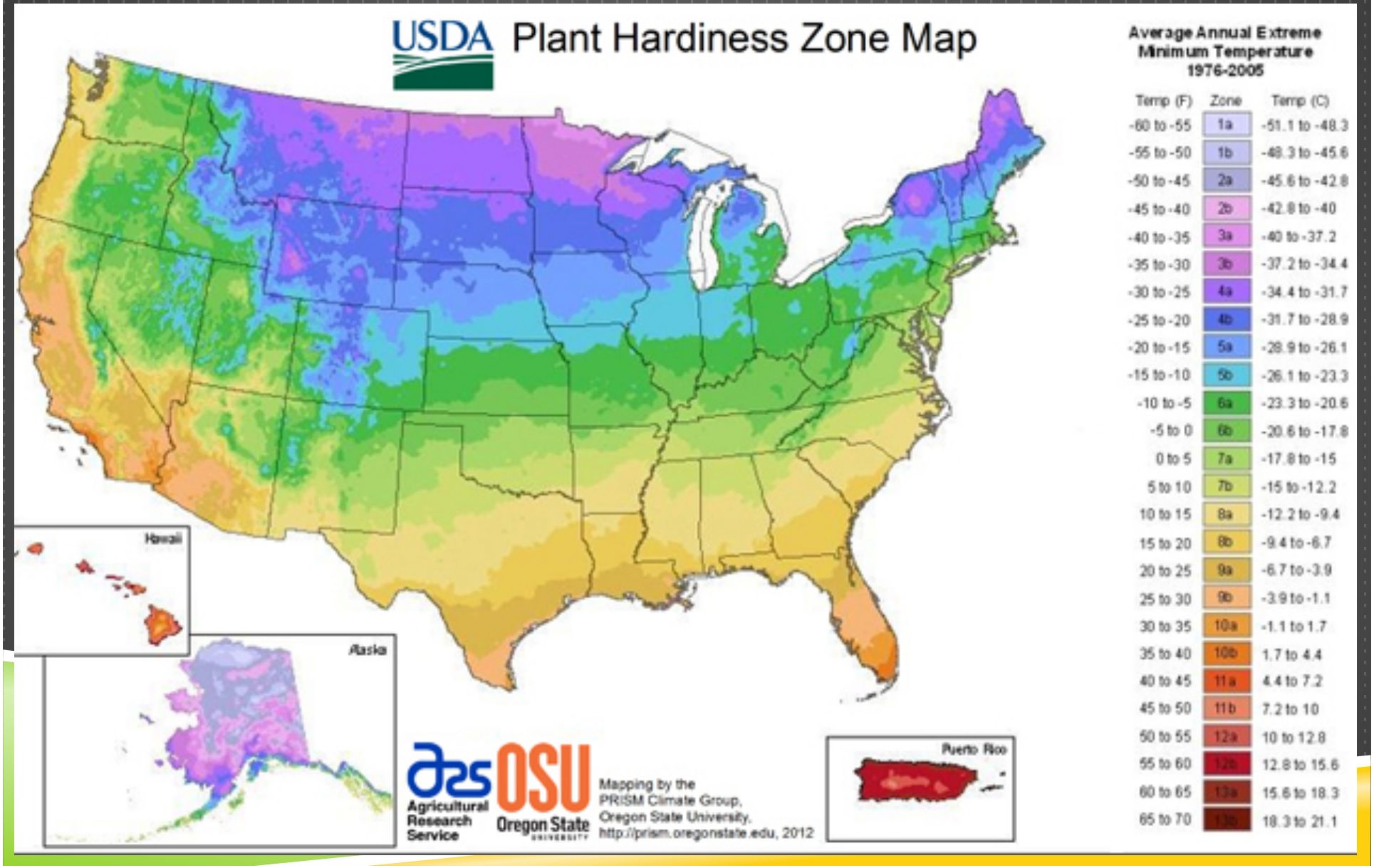


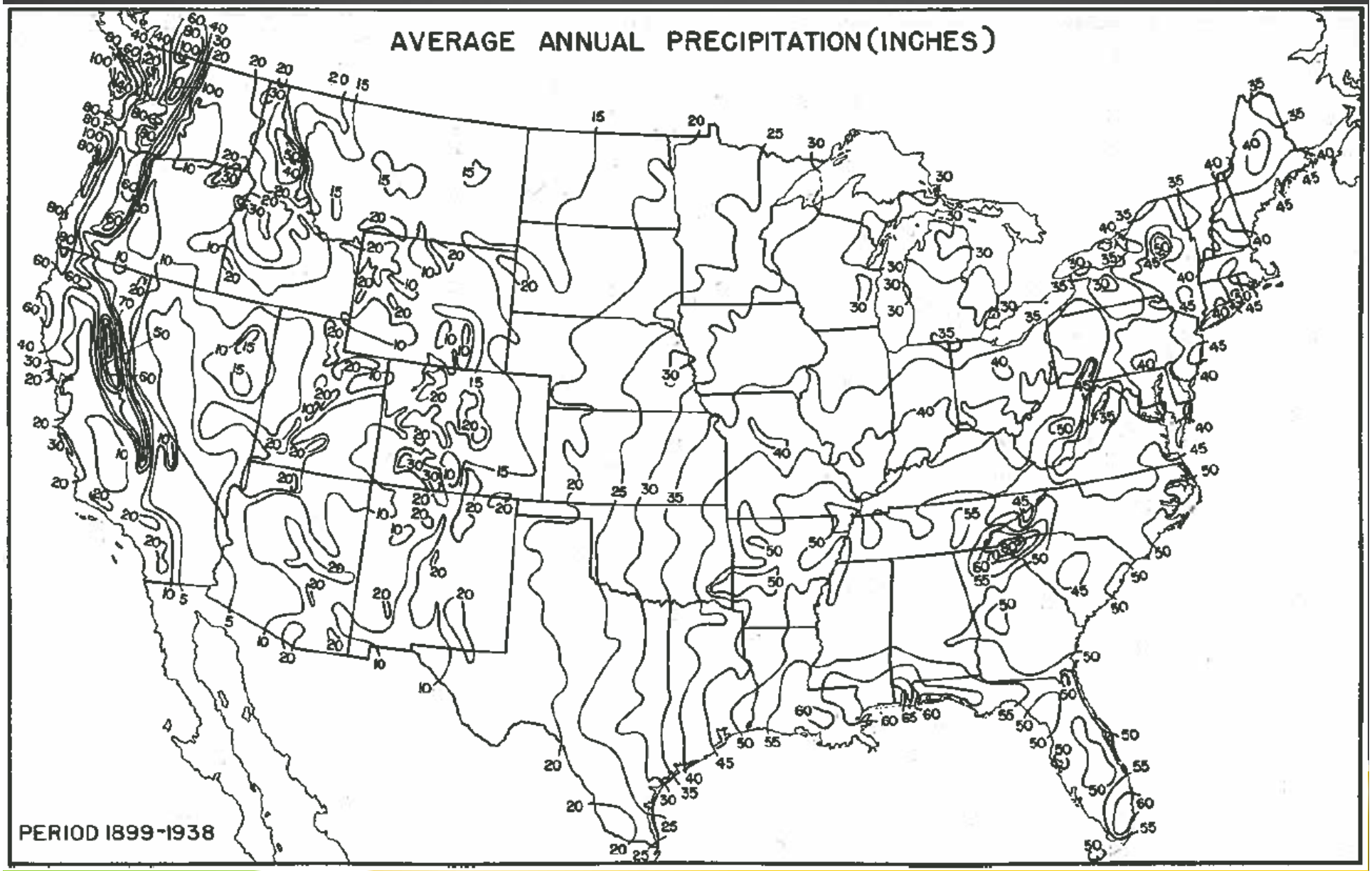

18
20
22
18
20
24
22
24
26
26
28
28
30
30
32
32
34
34
36
36
ILLINOIS
AVERAGE JANUARY
TEMPERATURE

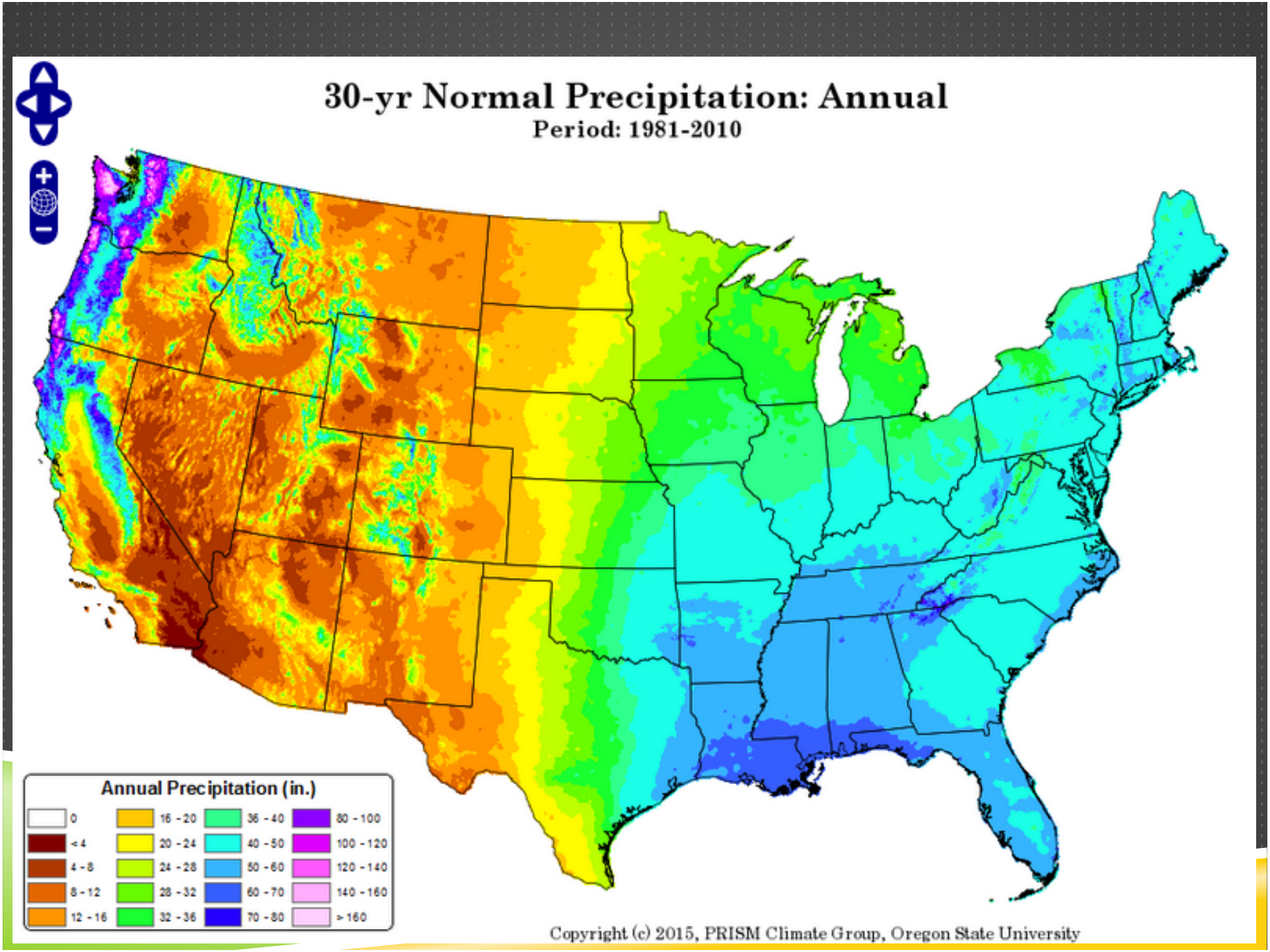
Illinois Average
January Temperature

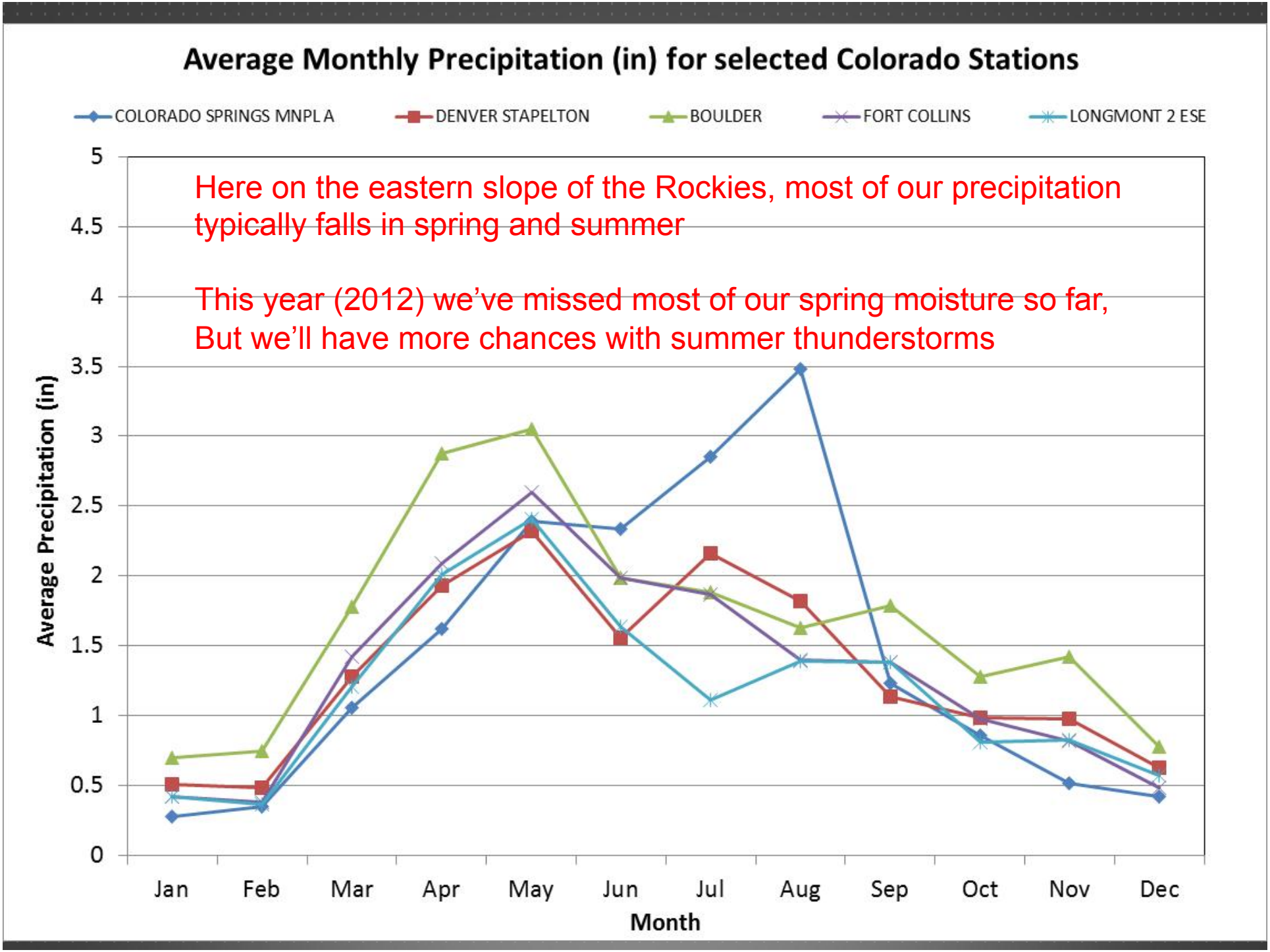


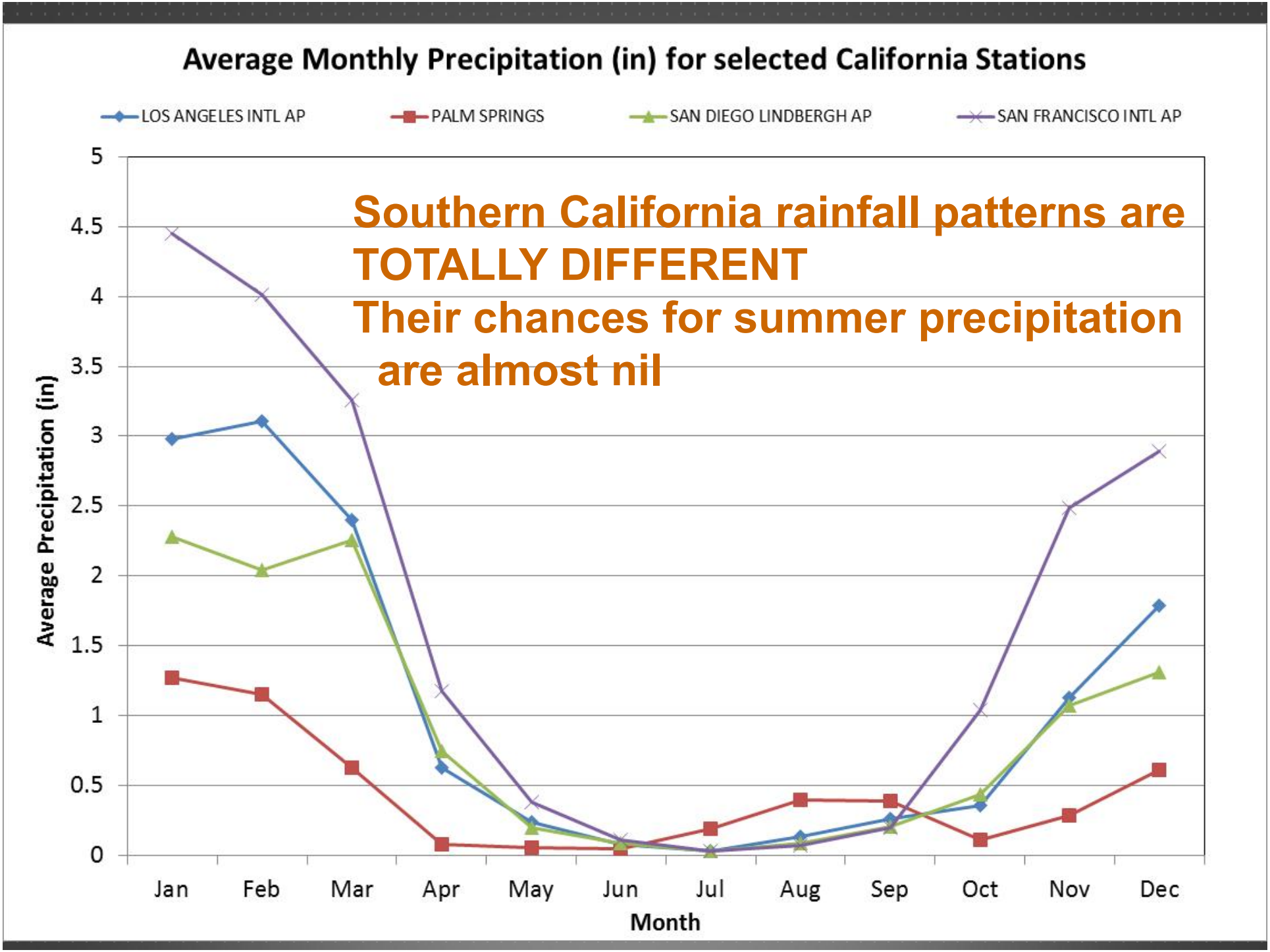

AVERAGE ANNUAL MINIMUM TEMPERATURE (°F.)
PERIOD 1899-1938

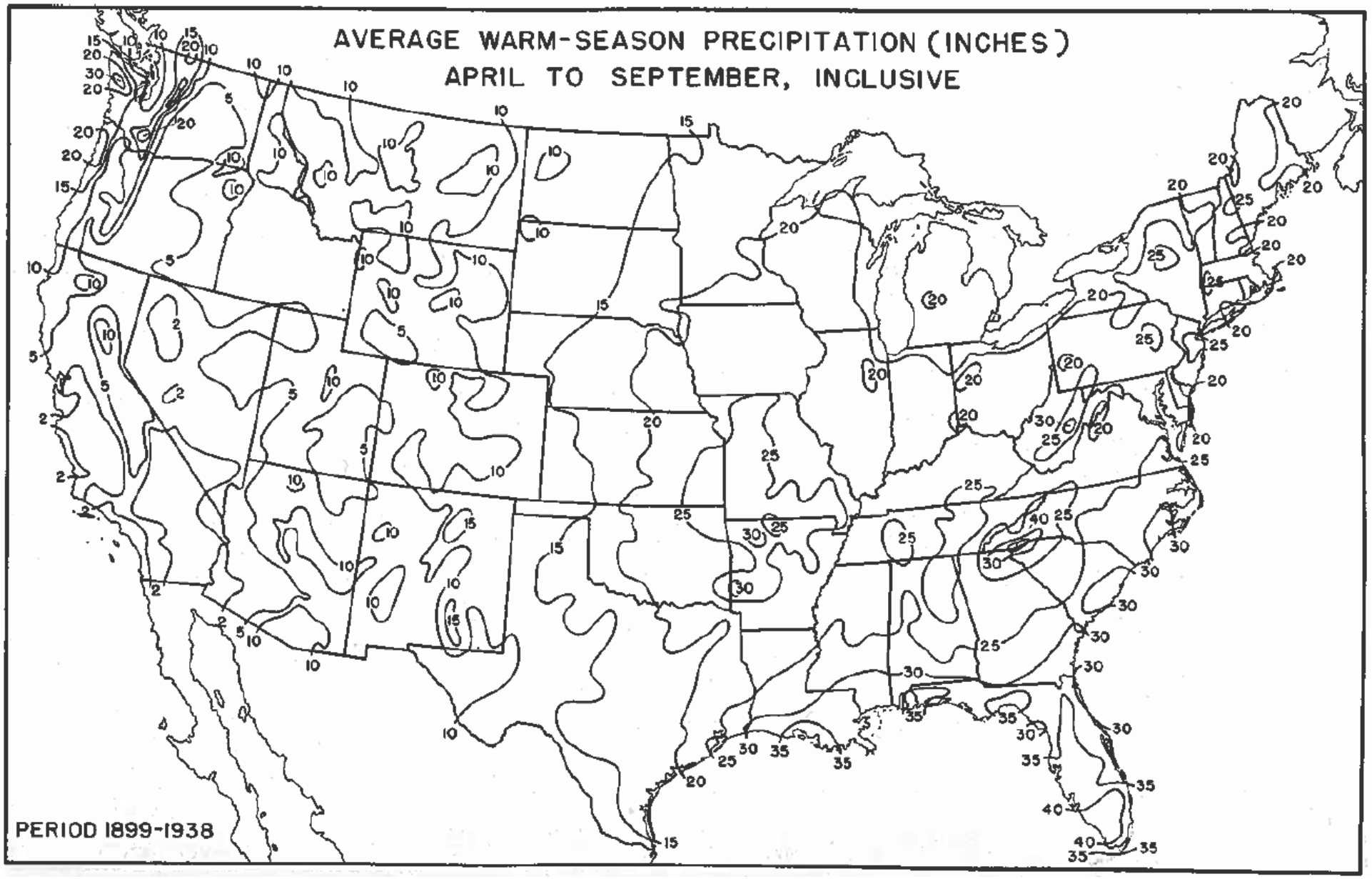

USDA Plant Hardiness Zone Map
Average Annual Extreme Minimum Temperature 1976-2005
Temp (F) Zone Temp (C)
-60 to -55 1a -51.1 to -48.3
-55 to -50 1b -48.3 to -45.6
-50 to -45 2a -45.6 to -42.8
-45 to -40 2b -42.8 to -40
-40 to -35 3a -40 to -37.2
-35 to -30 3b -37.2 to -34.4
-30 to -25 4a -34.4 to -31.7
-25 to -20 4b -31.7 to -28.9
-20 to -15 5a -28.9 to -26.1
-15 to -10 5b -26.1 to -23.3
-10 to -5 6a -23.3 to -20.6
-5 to 0 6b -20.6 to -17.8
0 to 5 7a -17.8 to -15
5 to 10 7b -15 to -12.2
10 to 15 8a -12.2 to -9.4
15 to 20 8b -9.4 to -6.7
20 to 25 9a -6.7 to -3.9
25 to 30 9b -3.9 to -1.1
30 to 35 10a -1.1 to 1.7
35 to 40 10b 1.7 to 4.4
40 to 45 11a 4.4 to 7.2
45 to 50 11b 7.2 to 10
50 to 55 12a 10 to 12.8
55 to 60 12b 12.8 to 15.6
60 to 65 13a 15.6 to 18.3
65 to 70 13b 18.3 to 21.1
Hawaii
Alaska
Puerto Rico
Agricultural Research Service
Oregon State University
Mapping by the PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, 2012

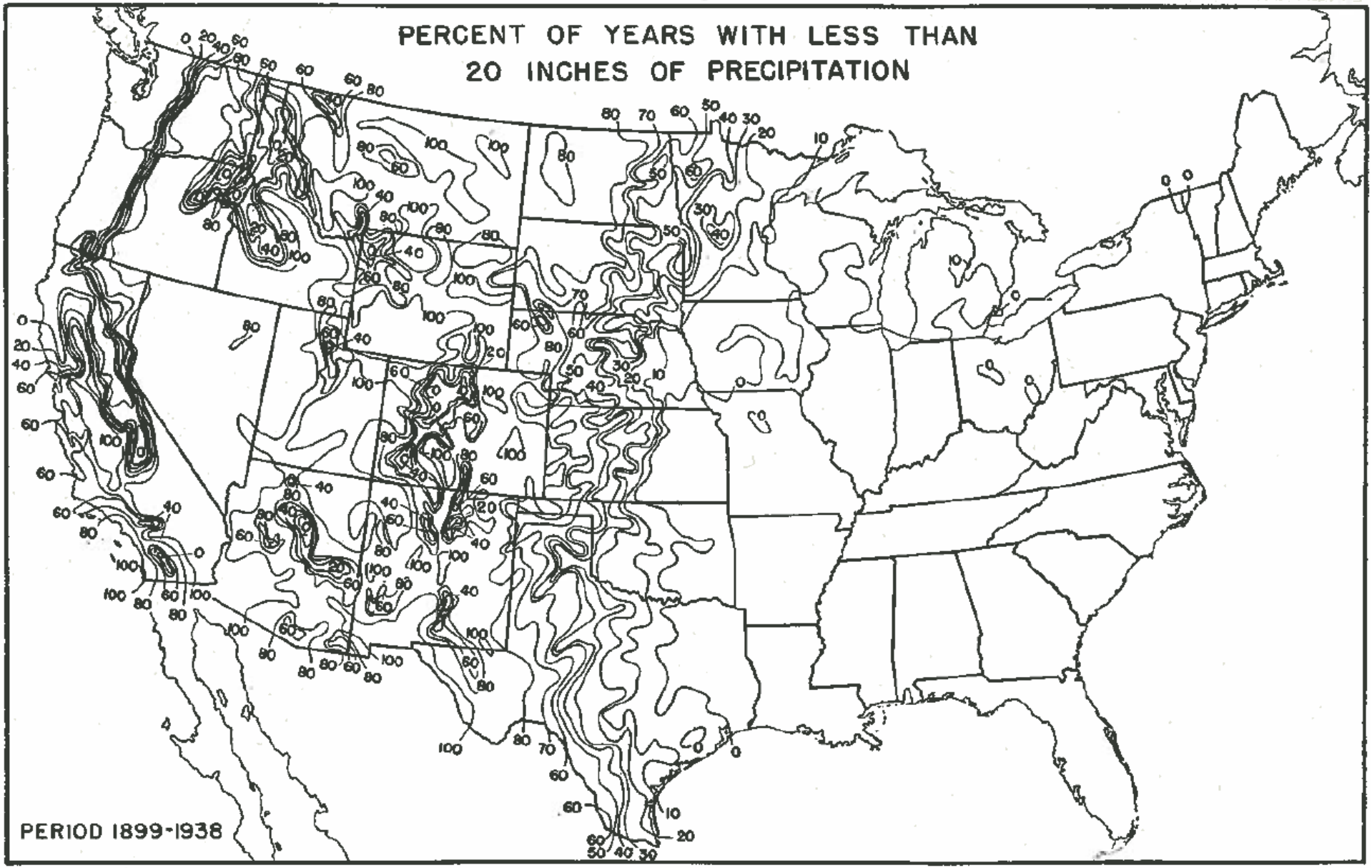

AVERAGE ANNUAL PRECIPITATION (INCHES)
PERIOD 1899-1938

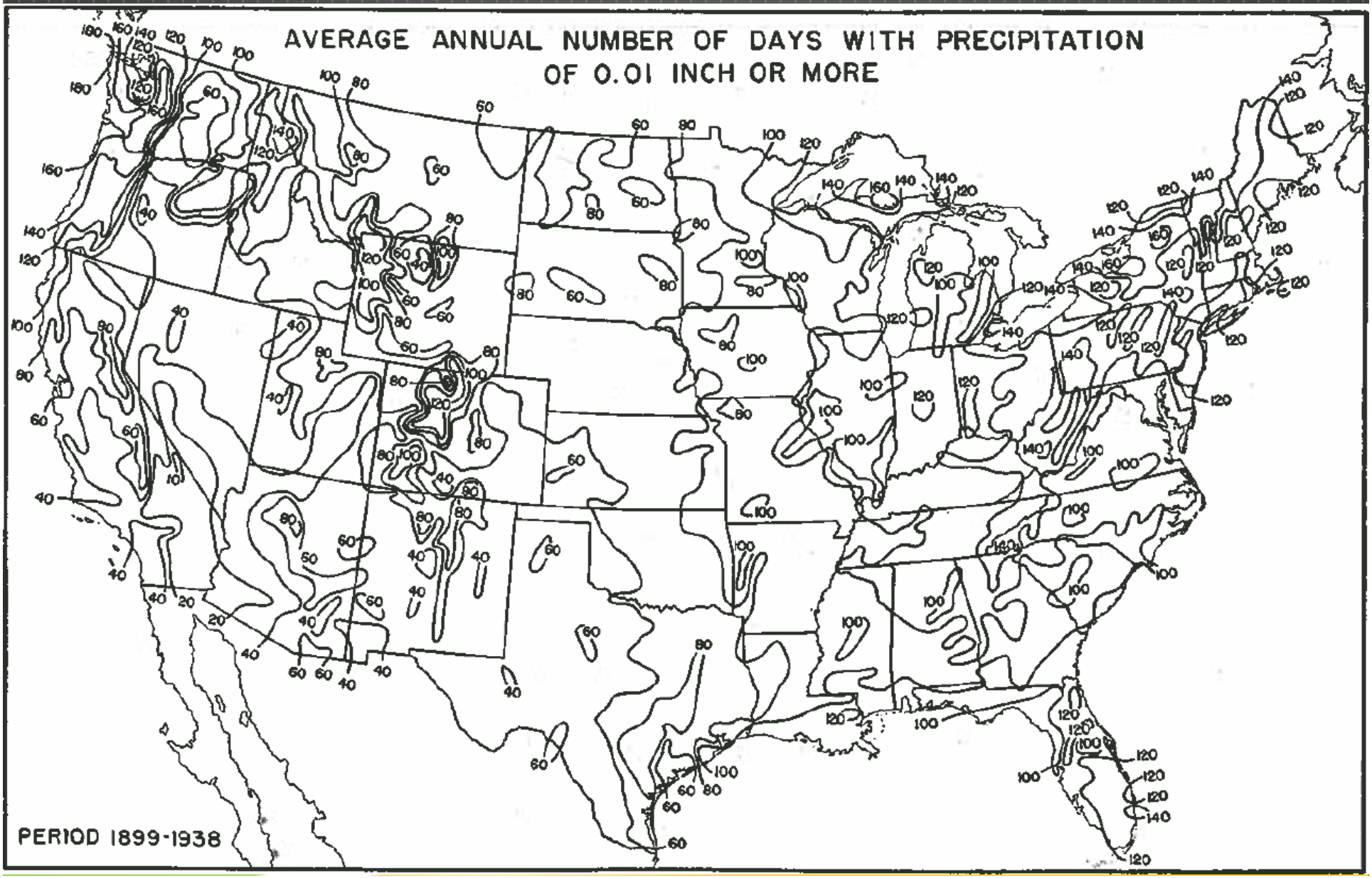

30-yr Normal Precipitation: Annual
Period: 1981-2010
Annual Precipitation (in.)
0
< 4
4 - 8
8 - 12
12 - 16
16 - 20
20 - 24
24 - 28
28 - 32
32 - 36
36 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 100
100 - 120
120 - 140
140 - 160
> 160
Copyright (c) 2015, PRISM Climate Group, Oregon State University

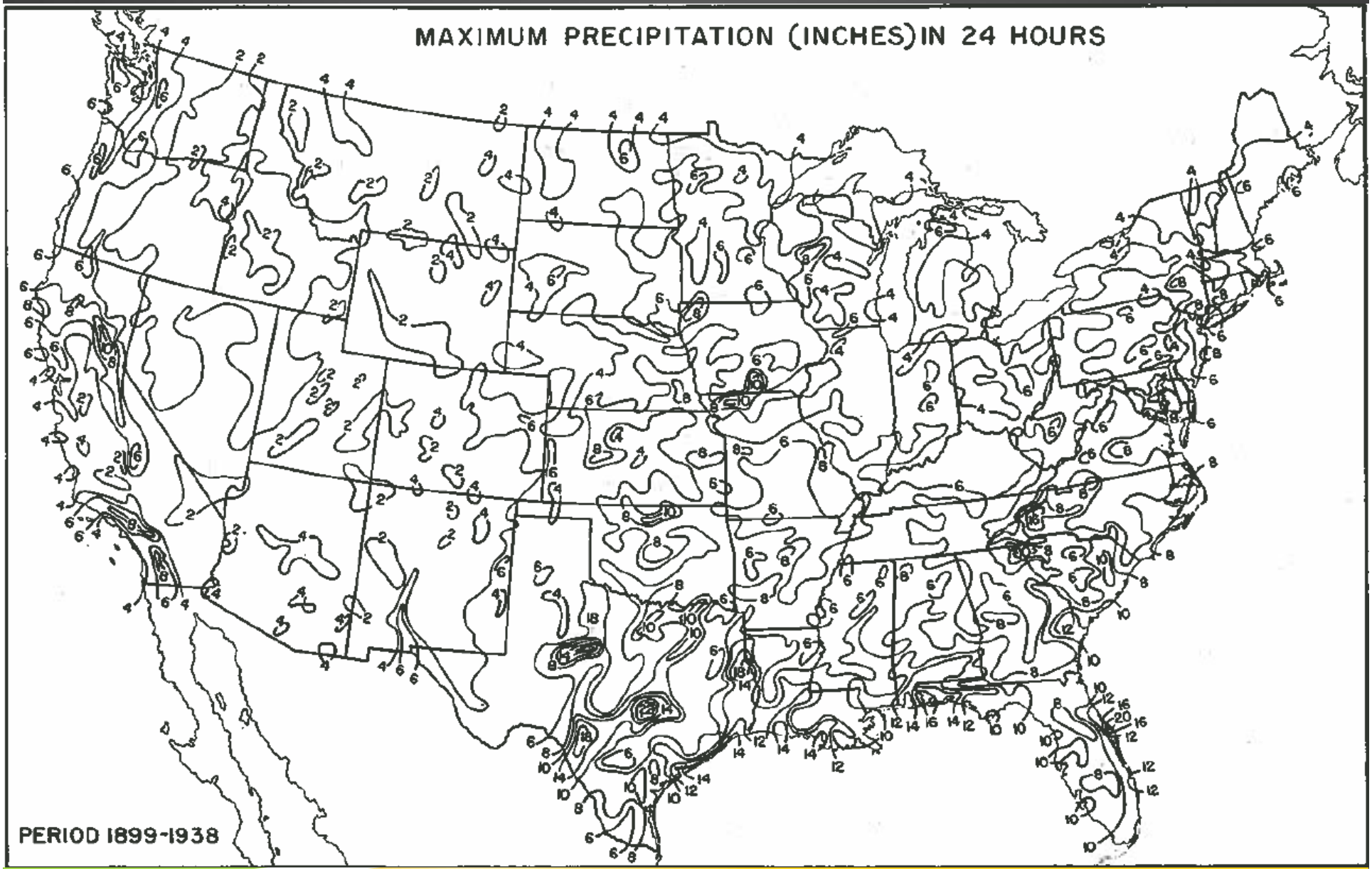

Average Monthly Precipitation (in) for selected Colorado Stations
COLORADO SPRINGS MNPL A
DENVER STAPELTON
BOULDER
FORT COLLINS
LONGMONT 2 ESE
Here on the eastern slope of the Rockies, most of our precipitation typically falls in spring and summer
This year (2012) we've missed most of our spring moisture so far,
But we'll have more chances with summer thunderstorms
Average Precipitation (in)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


Average Monthly Precipitation (in) for selected California Stations
LOS ANGELES INTL AP
PALM SPRINGS
SAN DIEGO LINDBERGH AP
SAN FRANCISCO INTL AP
Southern California rainfall patterns are TOTALLY DIFFERENT
Their chances for summer precipitation are almost nil
Average Precipitation (in)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


AVERAGE WARM-SEASON PRECIPITATION (INCHES)
APRIL TO SEPTEMBER, INCLUSIVE
PERIOD 1899-1938

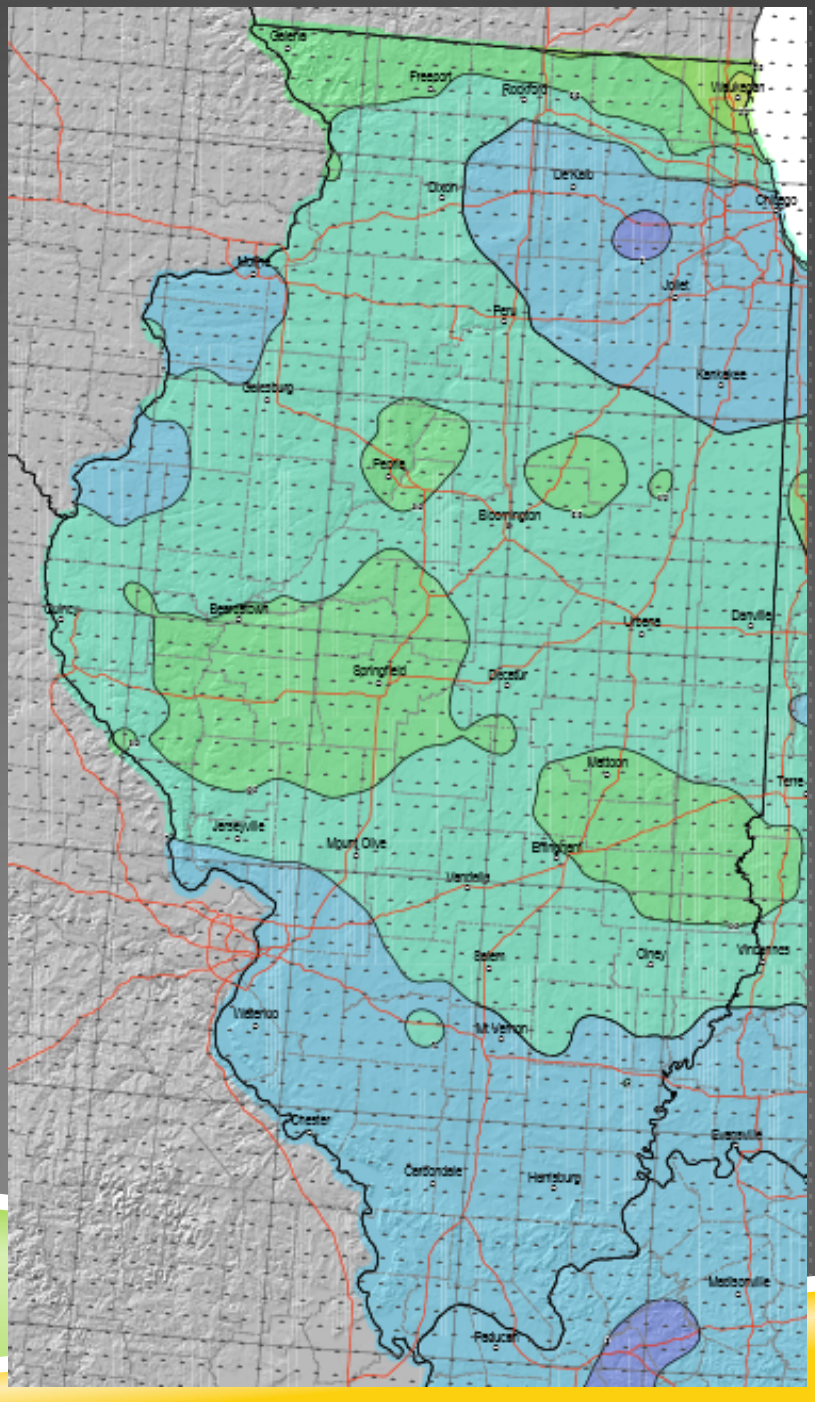

PERCENT OF YEARS WITH LESS THAN
20 INCHES OF PRECIPITATION
PERIOD 1899-1938


AVERAGE ANNUAL NUMBER OF DAYS WITH PRECIPITATION
OF 0.01 INCH OR MORE
PERIOD 1899-1938


MAXIMUM PRECIPITATION (INCHES) IN 24 HOURS
PERIOD 1899-1938

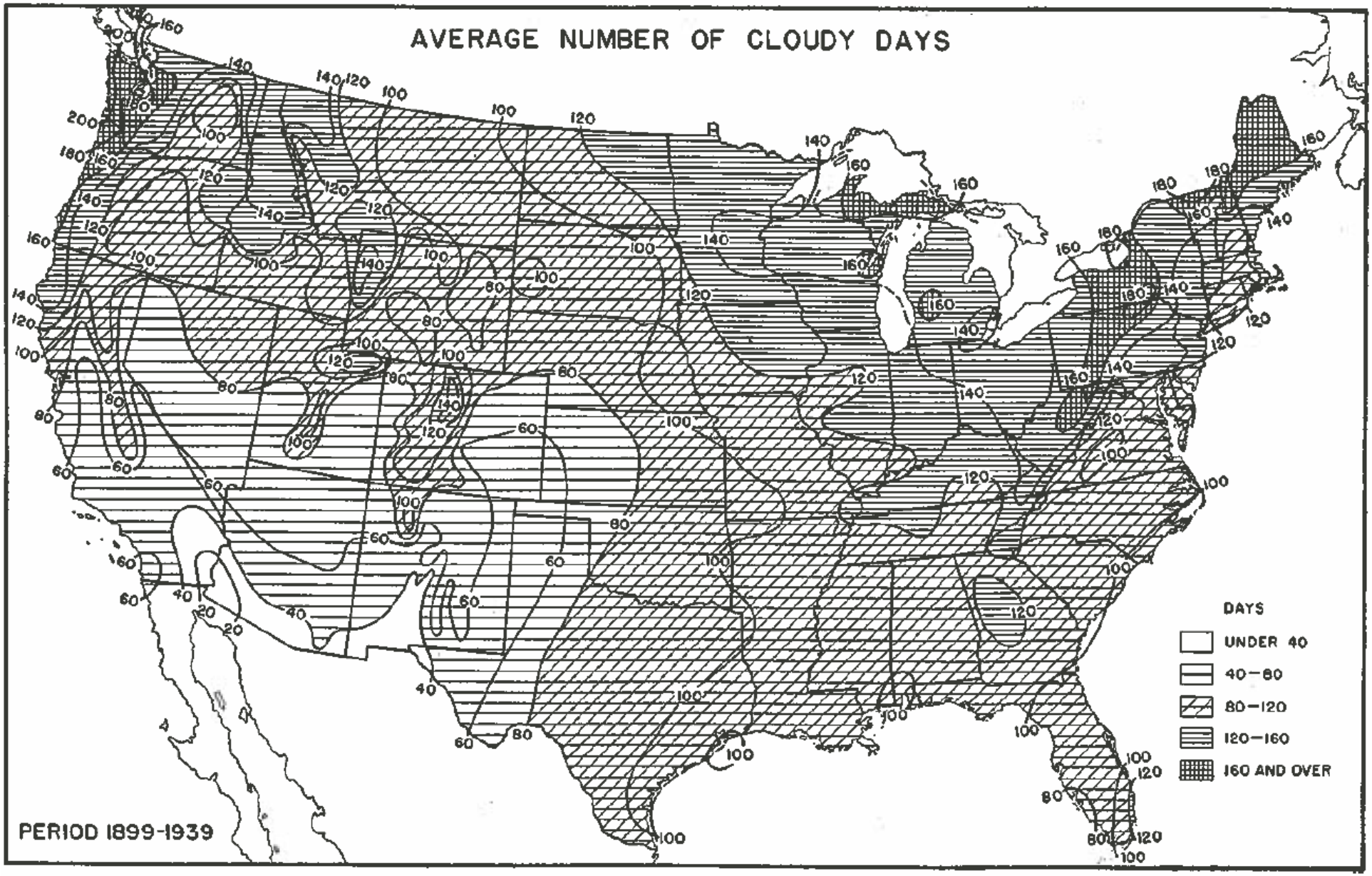
NOAA Atlas 14
Volume 2
Version 3

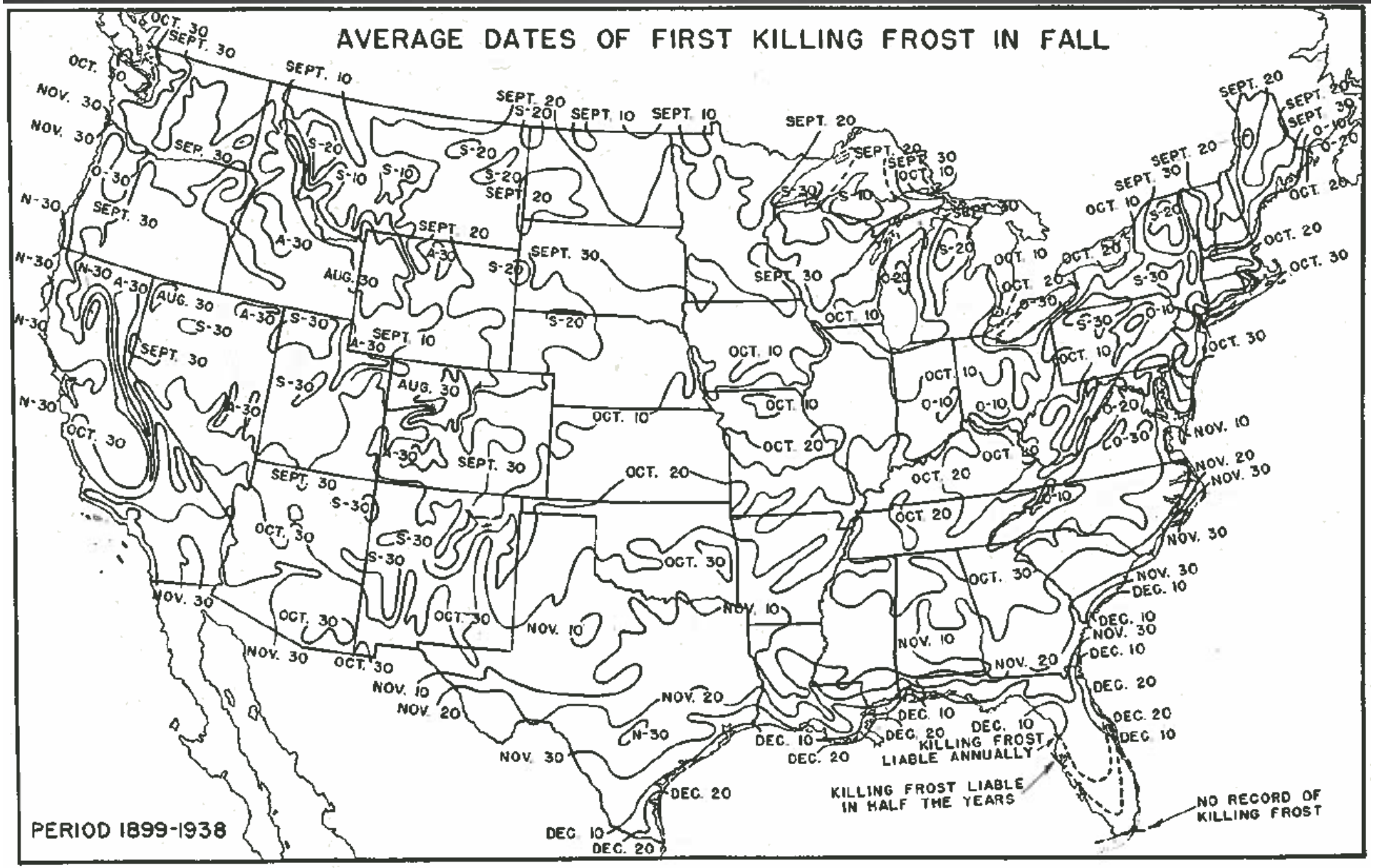
24 Hour Precipitation (Inches)
with
Average Recurrence Interval of
100 Years

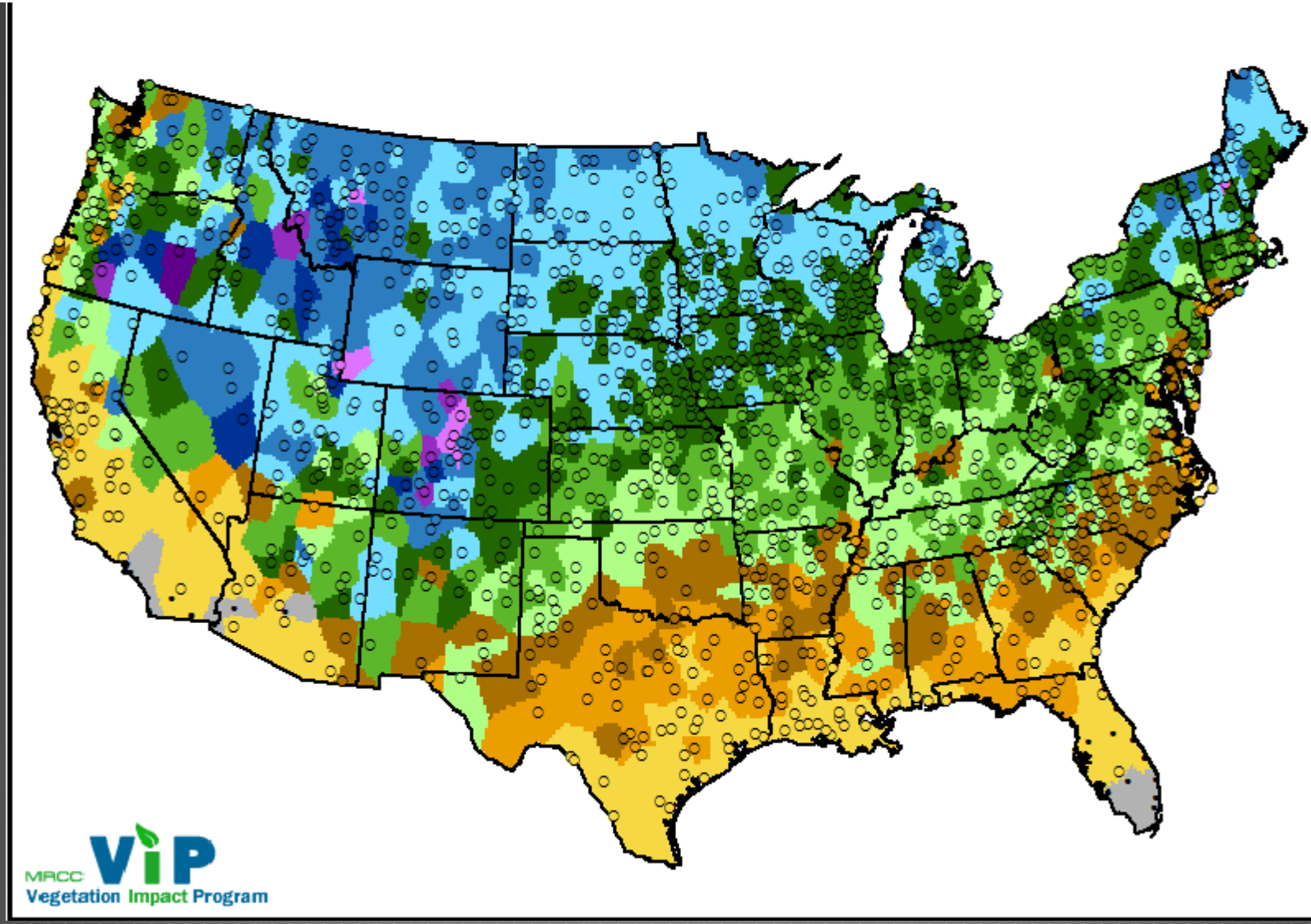


Inches

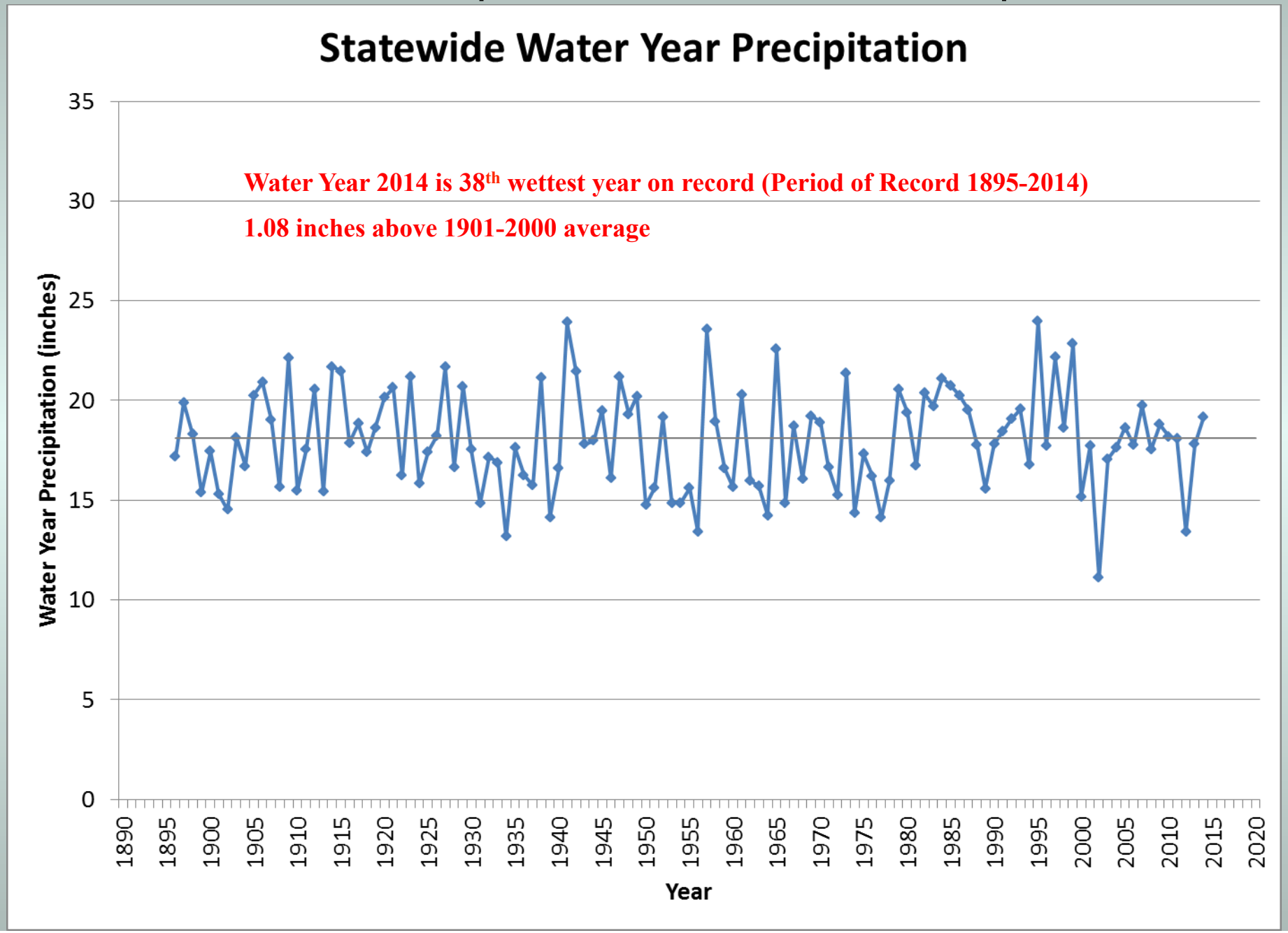
4.16 - 4.20	4.81 - 5.00	6.51 - 7.00	10.01 - 11.00
4.21 - 4.40	5.01 - 5.50	7.01 - 8.00	11.01 - 12.00
4.41 - 4.60	5.51 - 6.00	8.01 - 9.00	12.01 - 13.00
4.61 - 4.80	6.01 - 6.50	9.01 - 10.00	13.01 - 14.00


AVERAGE NUMBER OF CLOUDY DAYS
DAYS
UNDER 40
40–80
80–120
120–160
160 AND OVER
PERIOD 1899-1939

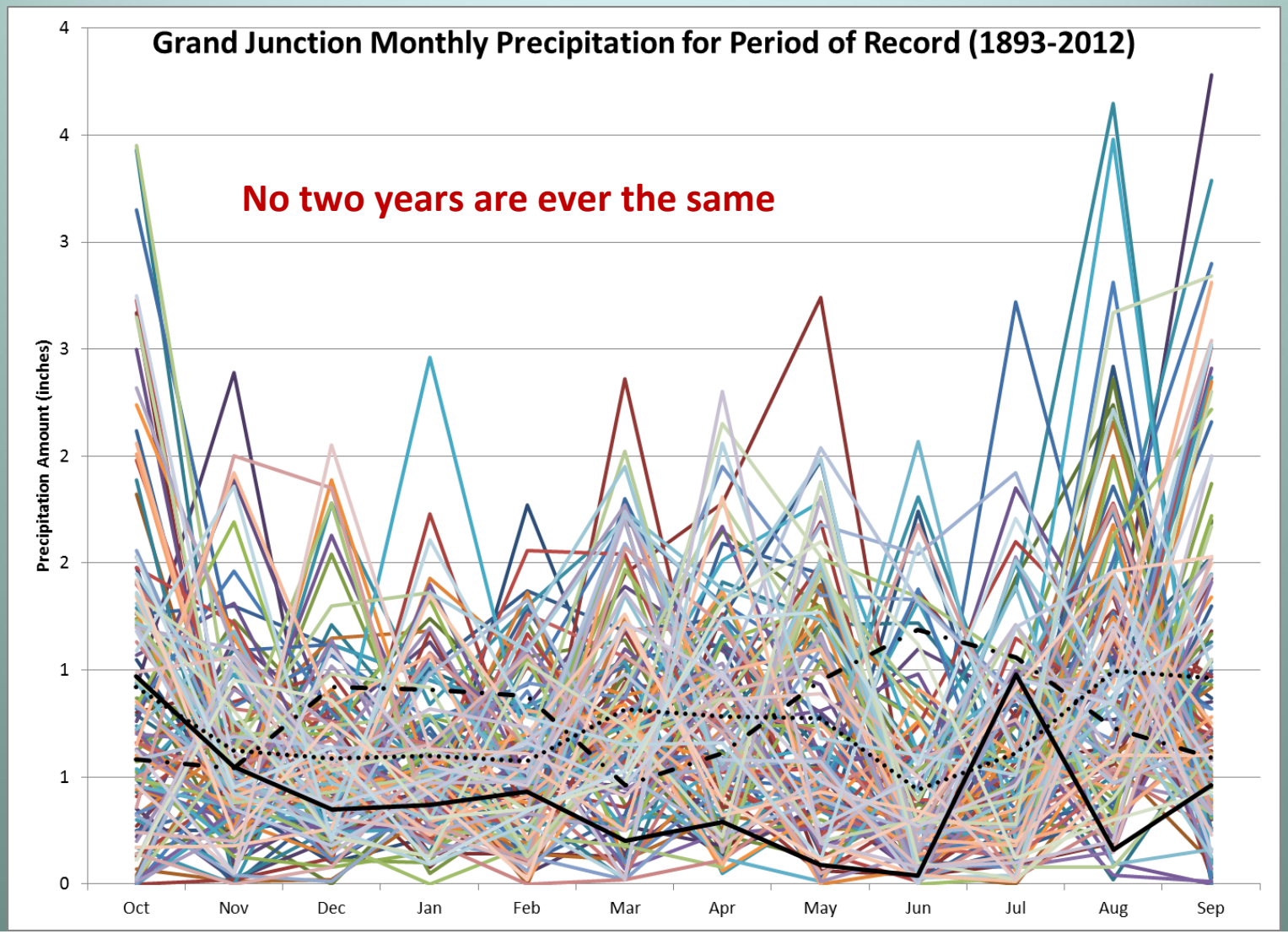

AVERAGE DATES OF FIRST KILLING FROST IN FALL
PERIOD 1899-1938
KILLING FROST LIABLE ANNUALLY
KILLING FROST LIABLE IN HALF THE YEARS
NO RECORD OF KILLING FROST


MRCC
ViP
Vegetation Impact Program

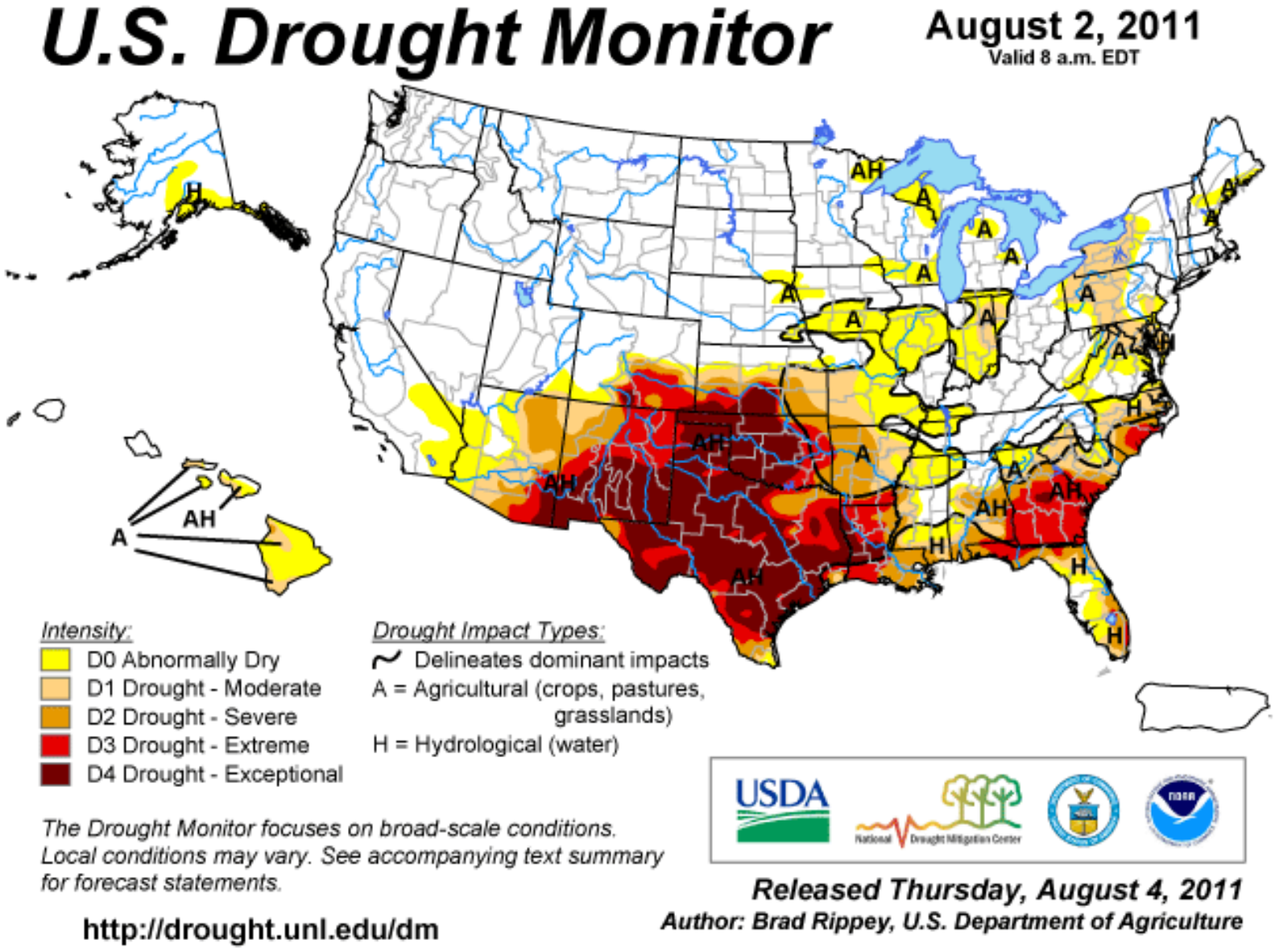
Colorado Precipitation in Historic Perspective



What climate variability looks like

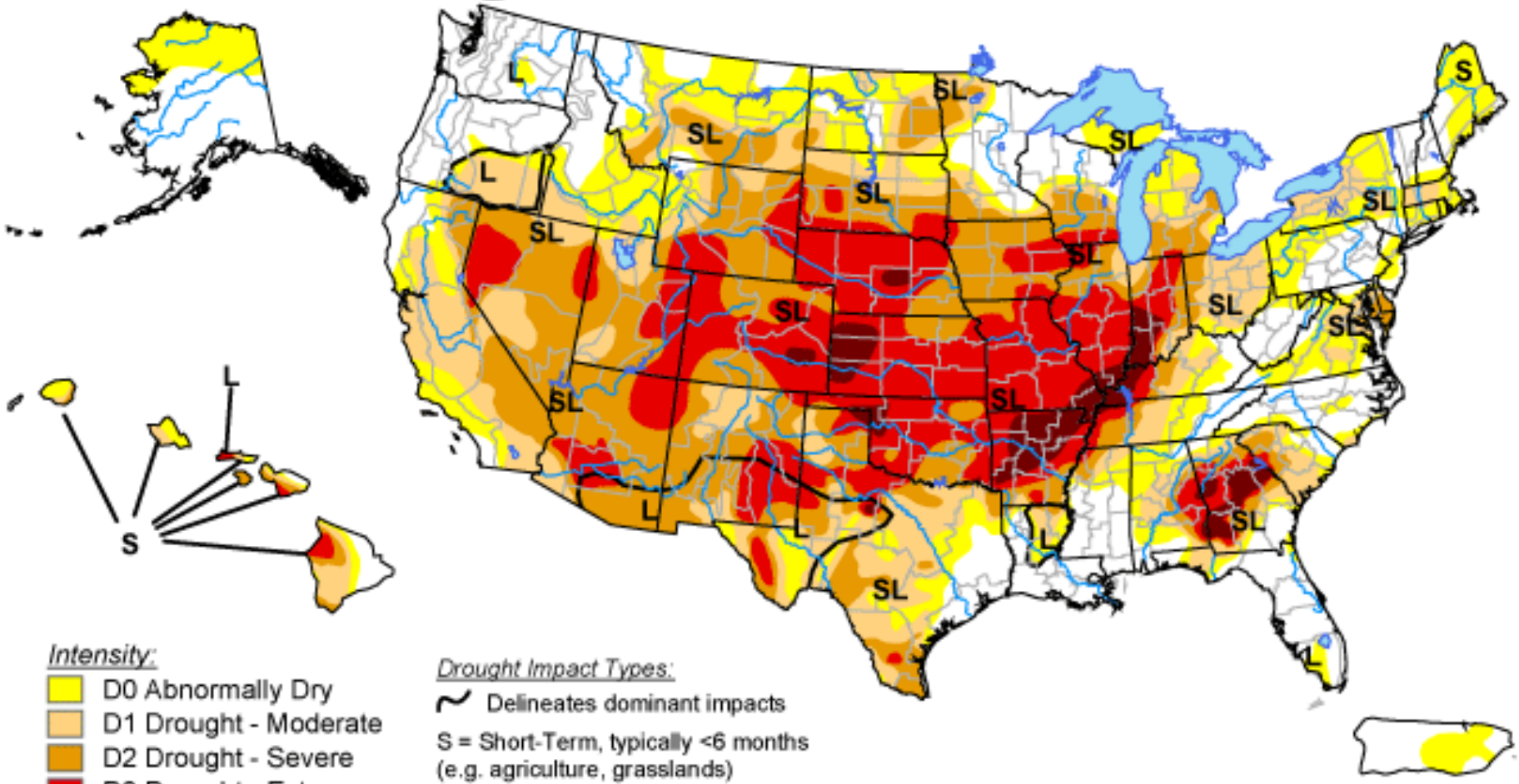


U.S. Drought Status – heavily relies on backyard volunteer measurements



U.S. Drought Monitor

July 31, 2012
Valid 7 a.m. EDT



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

Drought Impact Types:

Delineates dominant impacts

S = Short-Term, typically <6 months (e.g. agriculture, grasslands)

L = Long-Term, typically >6 months (e.g. hydrology, ecology)

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

http://droughtmonitor.unl.edu/

Released Thursday, August 2, 2012

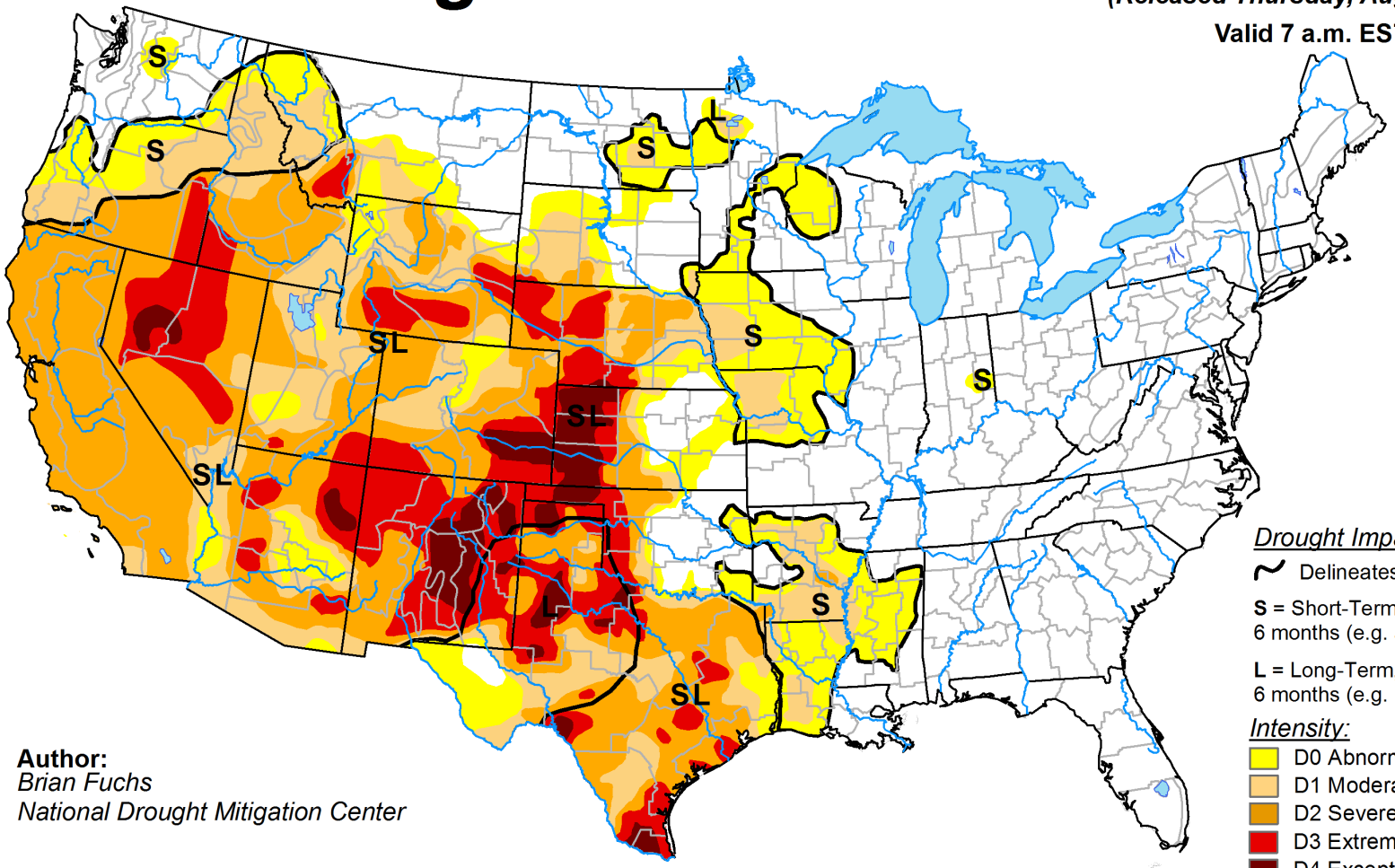
Author: Mark Svoboda, National Drought Mitigation Center

U.S. Drought Monitor

August 6, 2013

(Released Thursday, Aug. 8, 2013)

Valid 7 a.m. EST



Author:
Brian Fuchs
National Drought Mitigation Center

Drought Impact Types:

Delineates dominant impacts

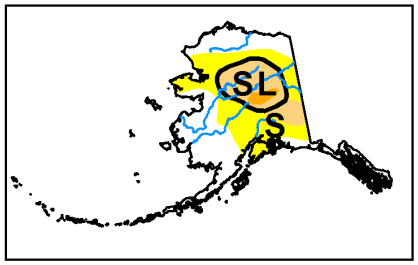
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

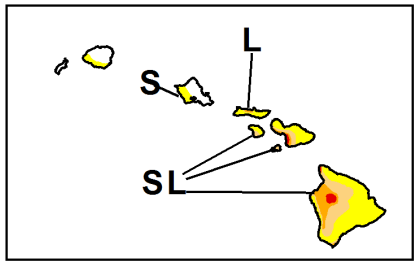
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

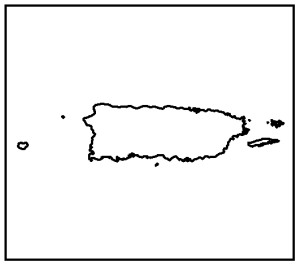
Intensity:

- 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.







USDA National Drought Mitigation Center

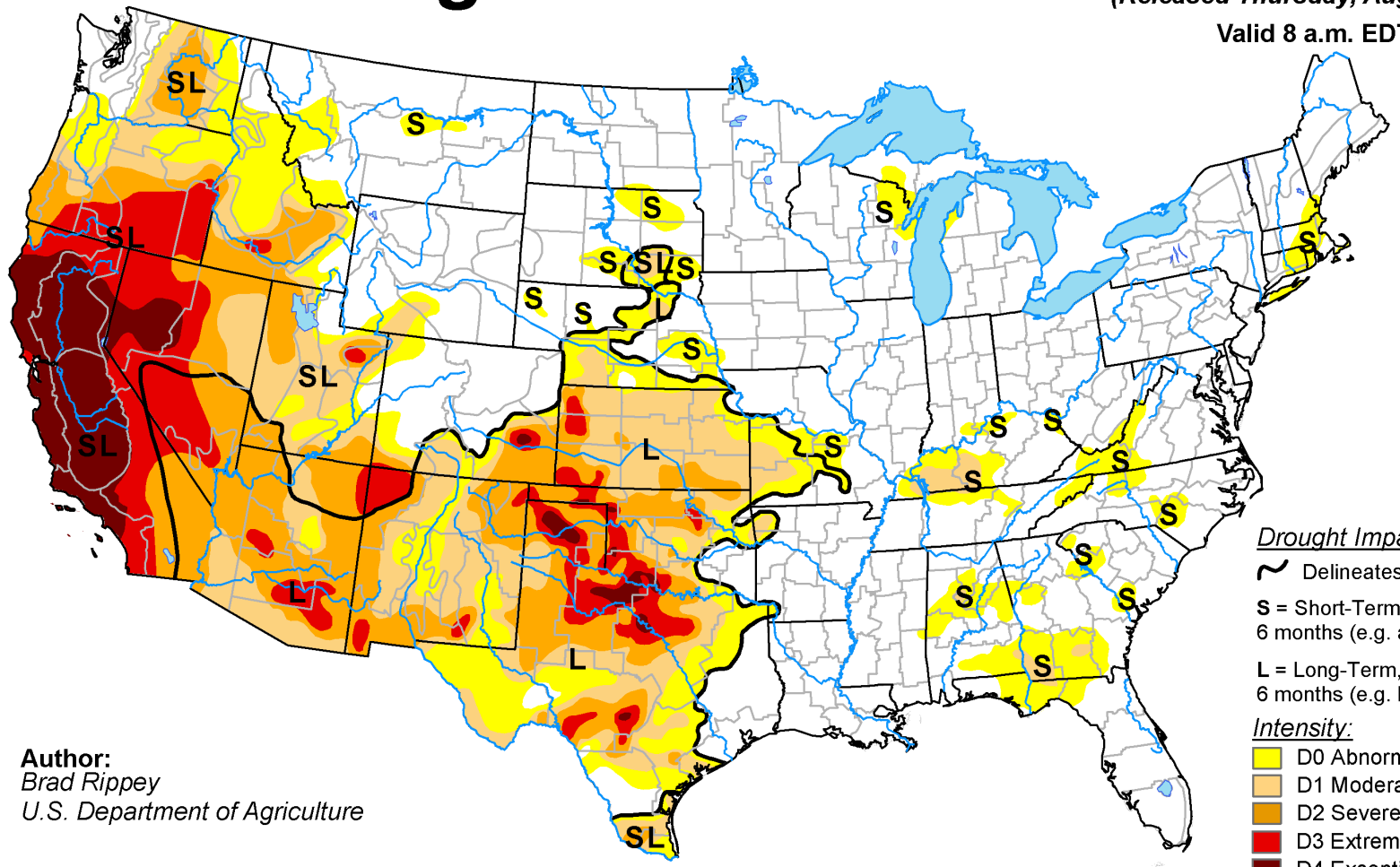
http://droughtmonitor.unl.edu/

U.S. Drought Monitor

August 5, 2014

(Released Thursday, Aug. 7, 2014)

Valid 8 a.m. EDT



Author:
Brad Rippey
U.S. Department of Agriculture

Drought Impact Types:

~ Delineates dominant impacts

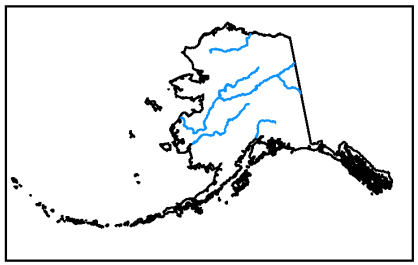
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

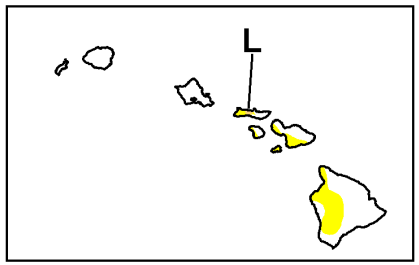
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

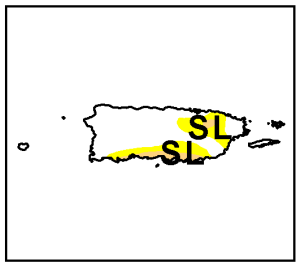
Intensity:

- 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.







USDA National Drought Mitigation Center

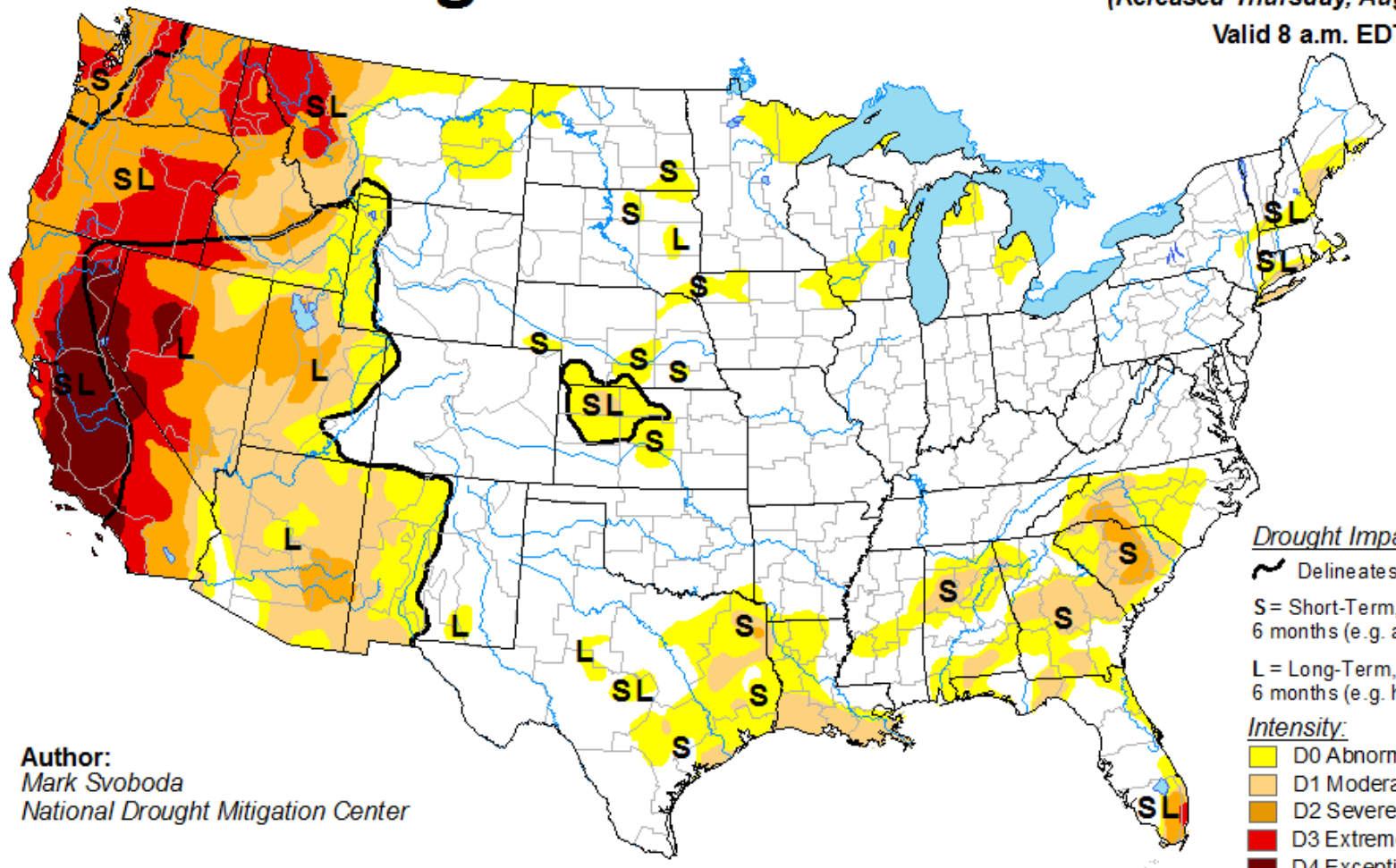
http://droughtmonitor.unl.edu/

U.S. Drought Monitor

August 4, 2015

(Released Thursday, Aug. 6, 2015)

Valid 8 a.m. EDT



Author:
Mark Svoboda
National Drought Mitigation Center

Drought Impact Types:

Delineates dominant impacts

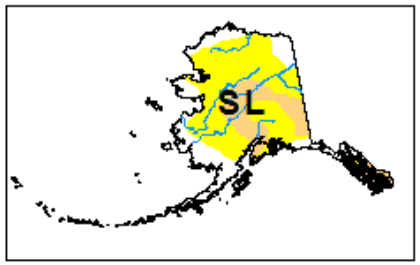
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

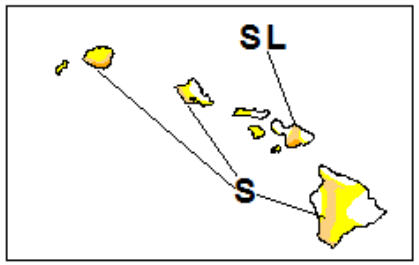
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

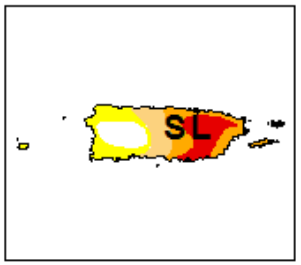
Intensity:

- 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.



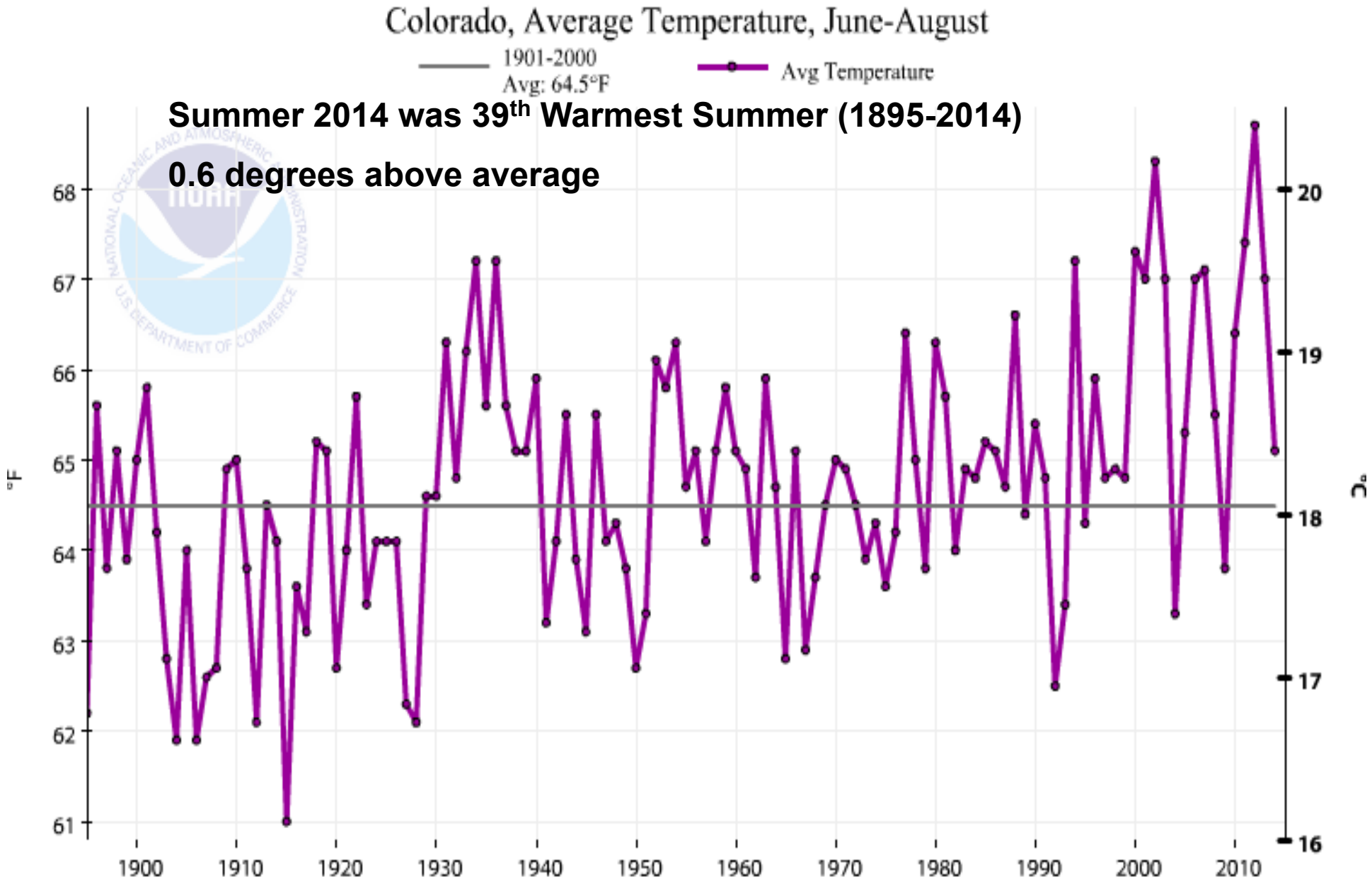




USDA National Drought Mitigation Center

http://droughtmonitor.unl.edu/

Colorado Mean Summer (JJA) Temperatures



Summer 2014 was 39th Warmest Summer (1895-2014)

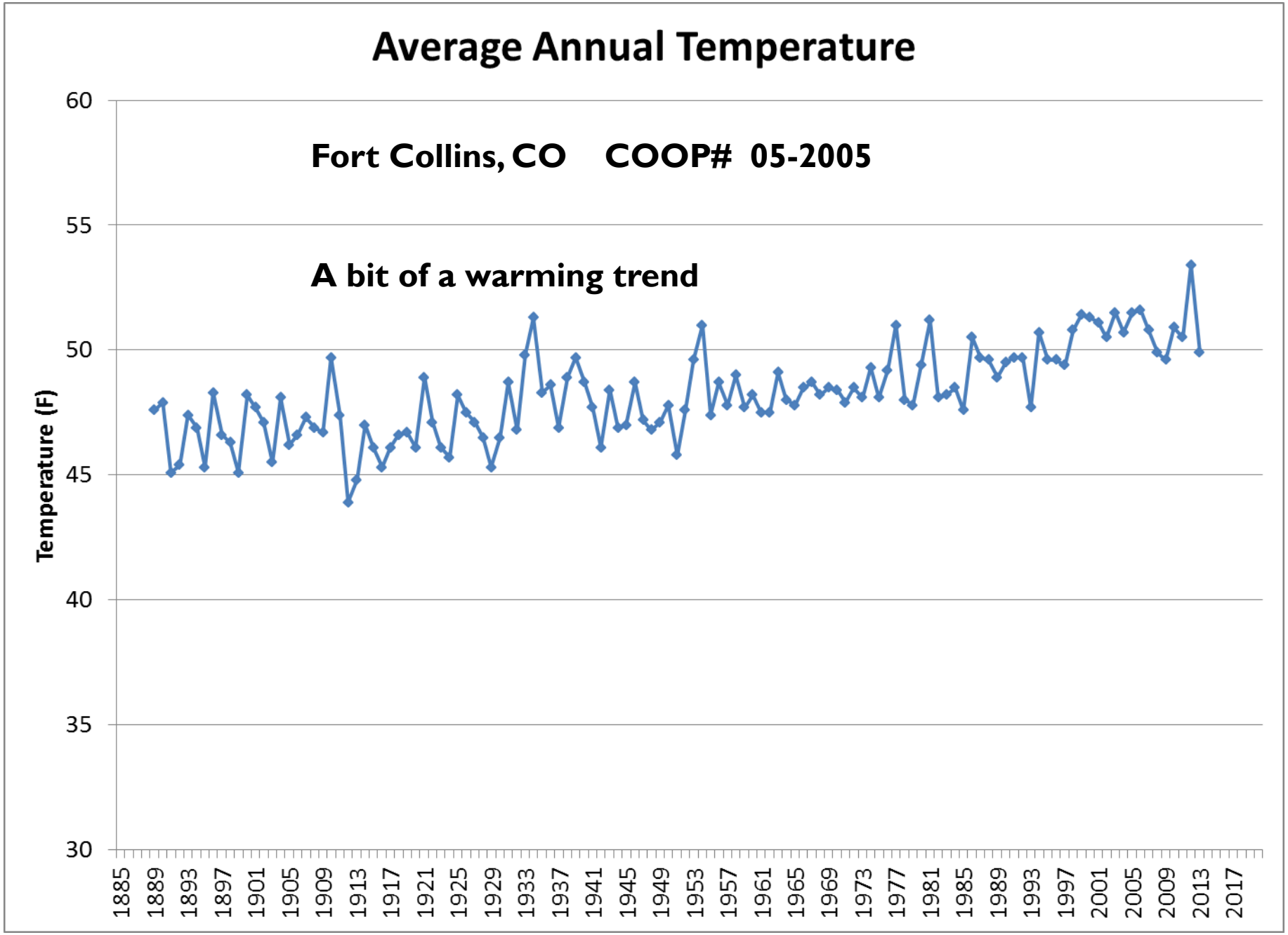
0.6 degrees above average

2011 MISSOURI RIVER FLOOD
OMAHA, NE

SO MANY USES,

SO MANY OPPORTUNITIES

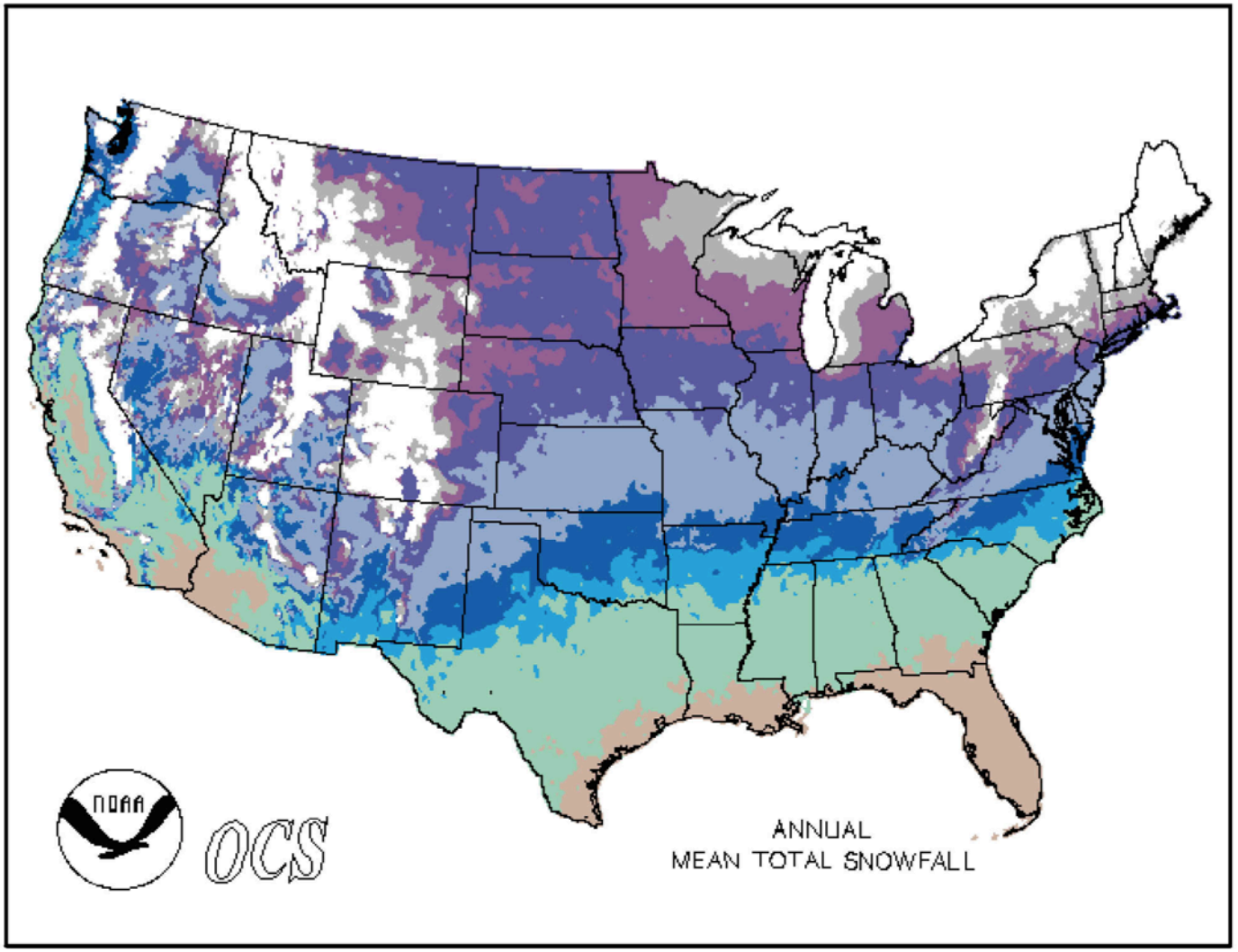
AND A FEW CHALLENGES HERE AND THERE ☺


Average Annual Temperature
Fort Collins, CO COOP# 05-2005
A bit of a warming trend
Temperature (F)
60
55
50
45
40
35
30
1885
1889
1893
1897
1901
1905
1909
1913
1917
1921
1925
1929
1933
1937
1941
1945
1949
1953
1957
1961
1965
1969
1973
1977
1981
1985
1989
1993
1997
2001
2005
2009
2013
2017

Station Locations with respect to current campus configuration


For much of the country, volunteer snow measurements are the best and sometimes the only source of snow data

National Annual Average Snowfall



STATES

13 MEAN TOTAL SNOW (INCHES)

- ANNUAL -
A 0.0
B 0.1 - 3.0
C 3.1 - 6.0
D 6.1 - 12.0
E 12.1 - 24.0
F 24.1 - 36.0
G 36.1 - 48.0
H 48.1 - 72.0
I > 72.0

TITLE

Considering our Latitude (40 N) Colorado is one of the snowiest areas of the world -- because of our high elevation

March 2003 Snow Storm aftermath in Fort Collins

WEATHER OBSERVATIONS ARE WORTH CELEBRATING


The Historic Fort Collins Weather Station
National Weather Service Cooperative Station 05-3005
This is one of the longest operating weather stations in the western U.S. monitoring temperature, humidity, precipitation (rain, hail and snow), evaporation, winds, solar radiation, clouds, visibility, barometric pressure and soil temperatures. Weather observations for research, teaching and public information have been conducted on campus since the early 1870s. Continuous support for this historic weather station has been provided by the Colorado Agricultural Experiment Station since 1889. Early data collected here aided agricultural and irrigation research and development. Beginning in the 1930s, this station provided weather support for aviation and transportation safety. Uses continue to expand today. Data are publicly available for tracking climate trends, variations and extremes and their impacts here in northern Colorado.
Colorado State University

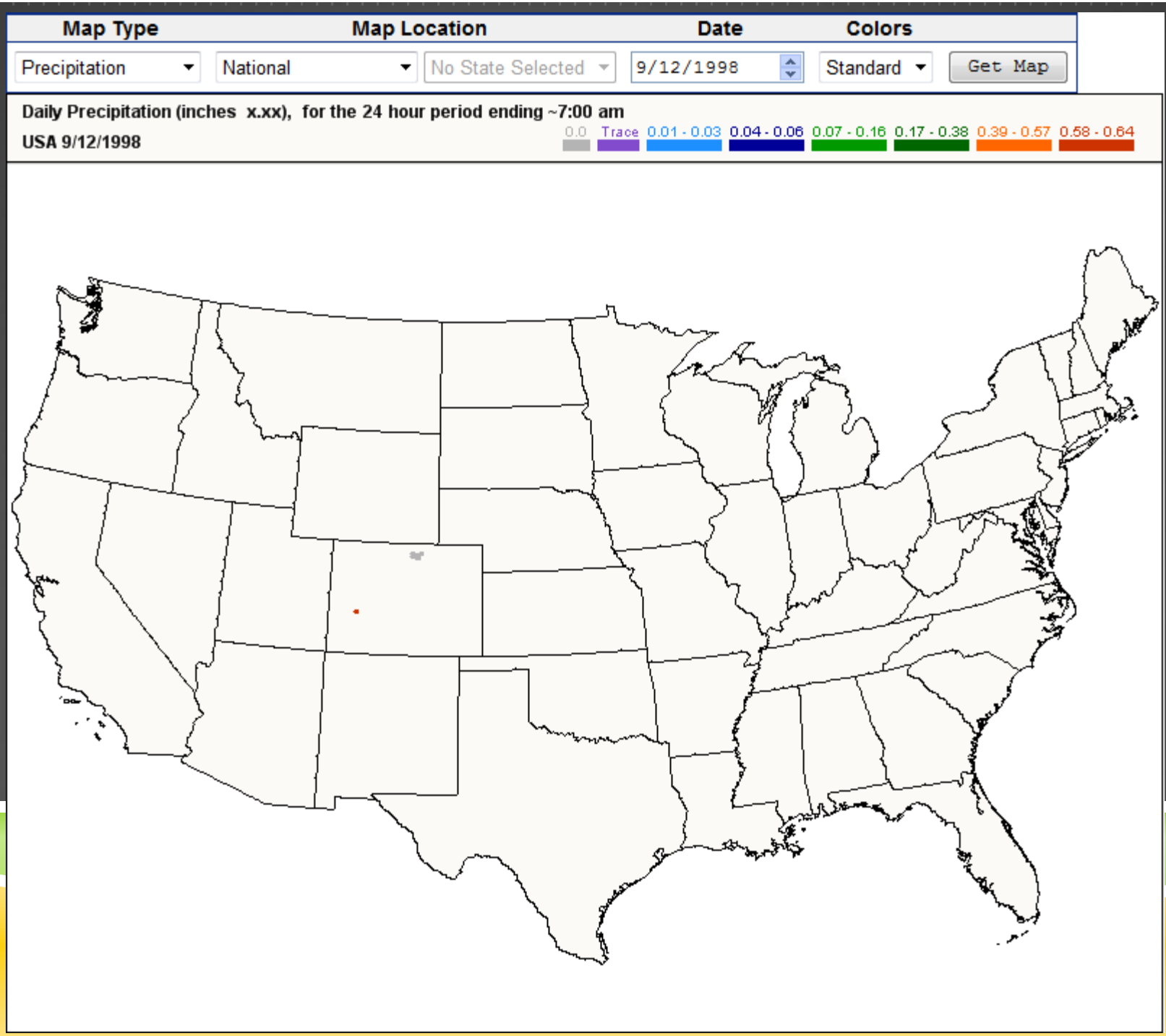
And then there's CoCoRaHS!

http://www.cocorahs.org

VOLUNTEERS EVERYWHERE, MANY MORE NEEDED

Photos by H. Reges

KEEP TALKING AND PLEASE HELP THE COOPERATIVE OBSERVER NETWORK CONTINUE TO THRIVE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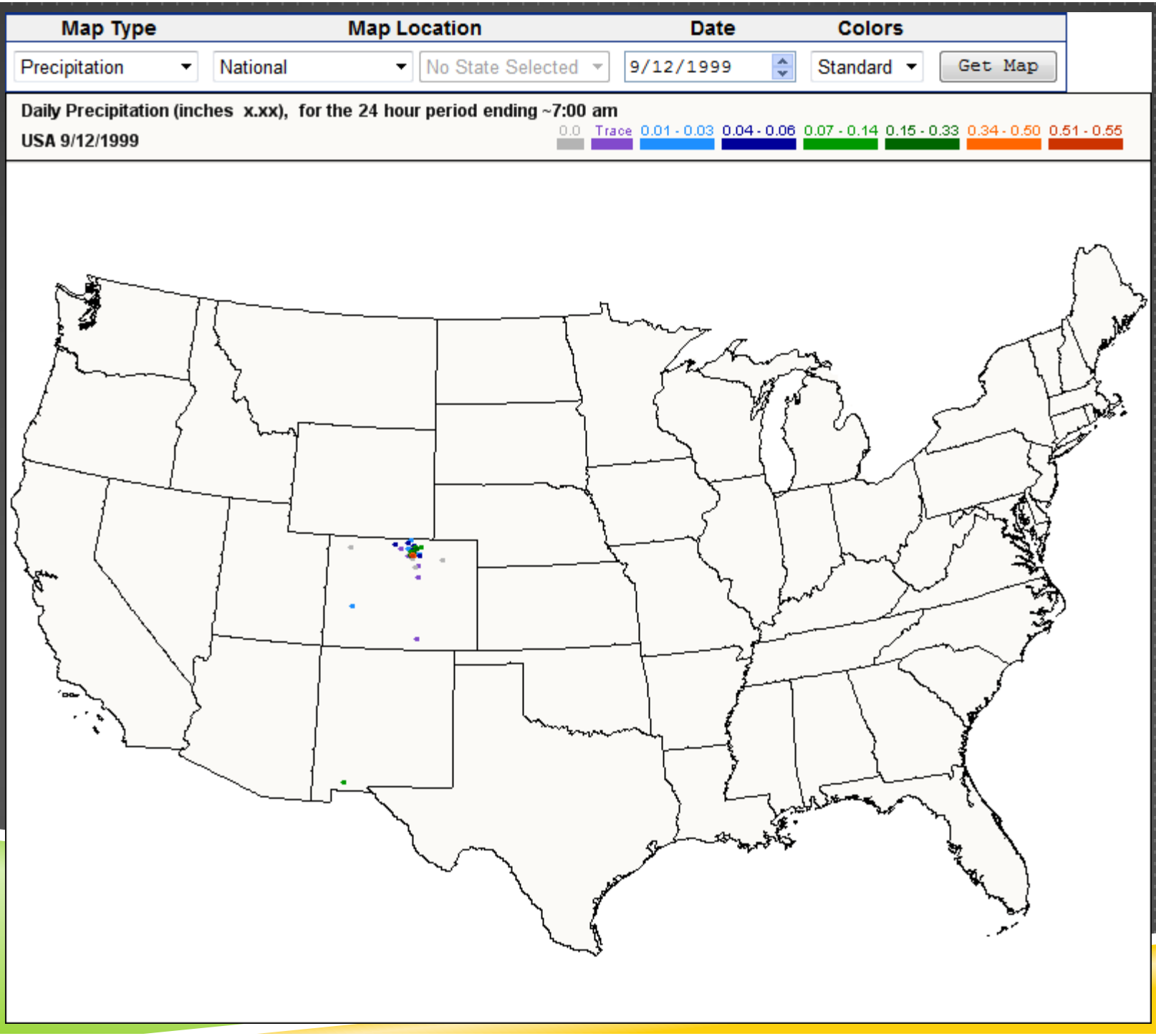
Date
Colors
Precipitation
National
No State Selected
9/12/1998
Standard
Get Map
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 9/12/1998
0.0
Trace
0.01 - 0.03
0.04 - 0.06
0.07 - 0.16
0.17 - 0.38
0.39 - 0.57
0.58 - 0.64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Colors
Precipitation
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9/12/1999
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Get Map
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USA 9/12/1999
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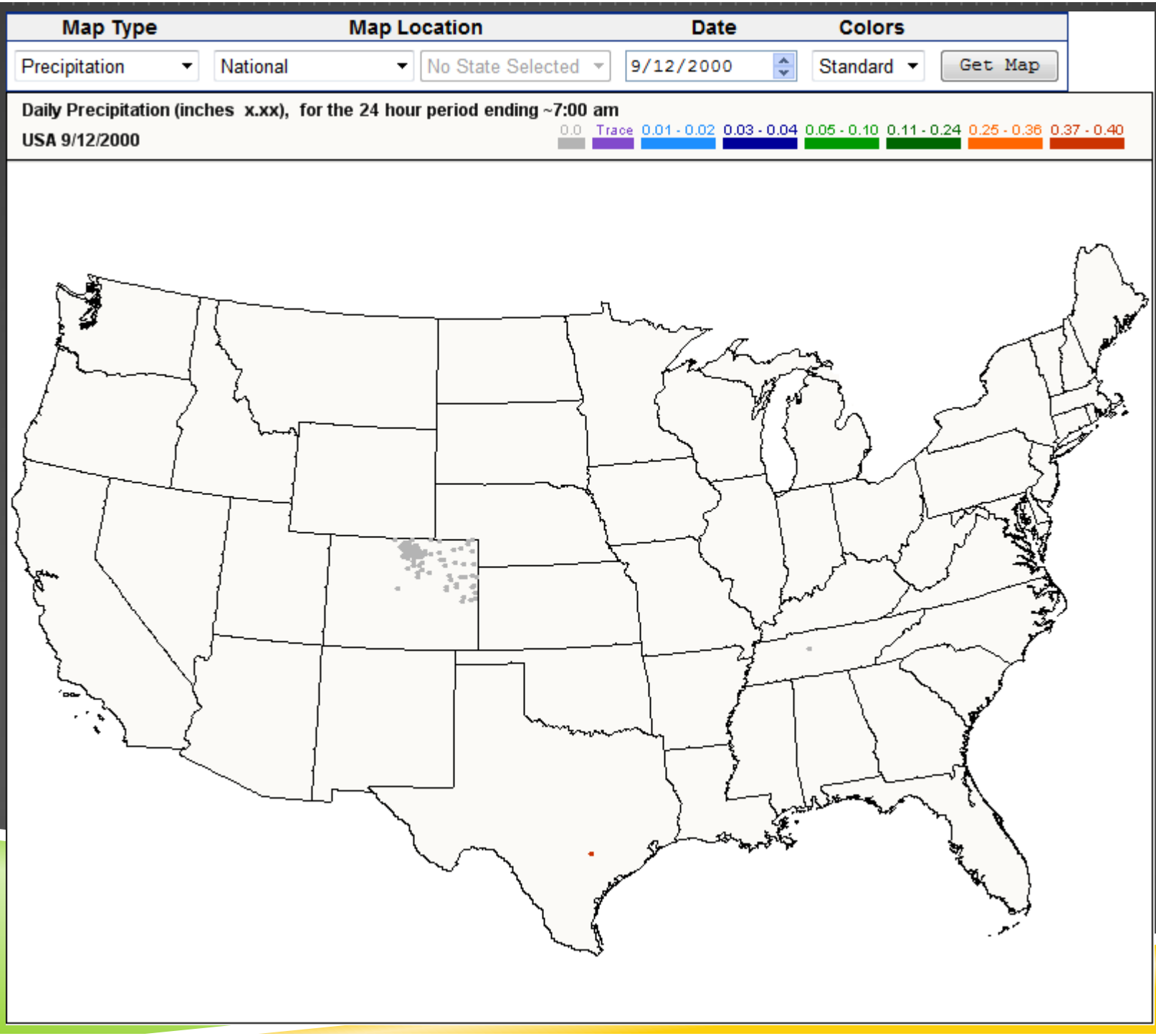
0.07 - 0.14
0.15 - 0.33
0.34 - 0.50
0.51 - 0.55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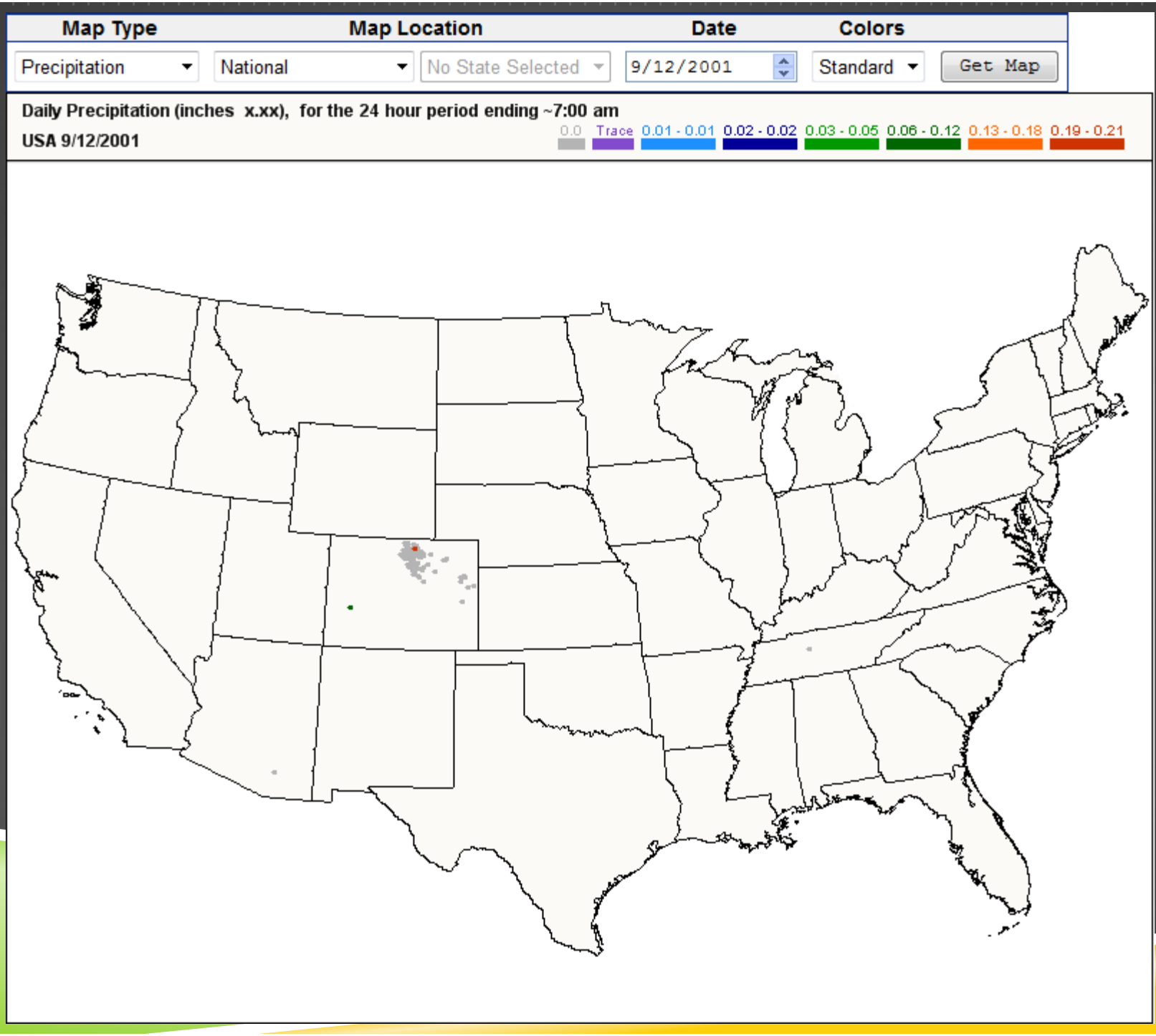
0.03 - 0.04
0.05 - 0.10
0.11 - 0.24
0.25 - 0.36
0.37 - 0.40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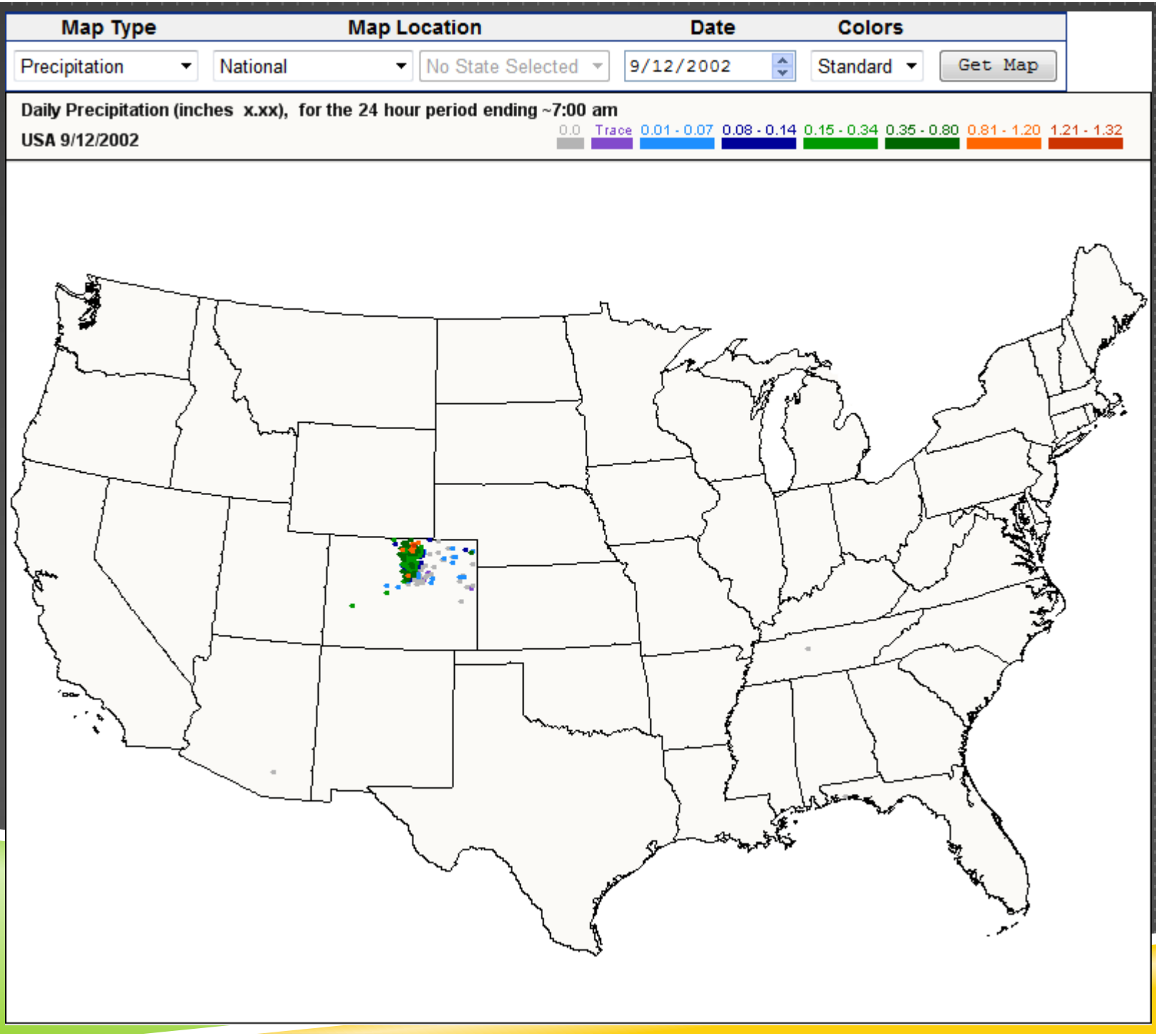
0.02 - 0.02
0.03 - 0.05
0.06 - 0.12
0.13 - 0.18
0.19 - 0.21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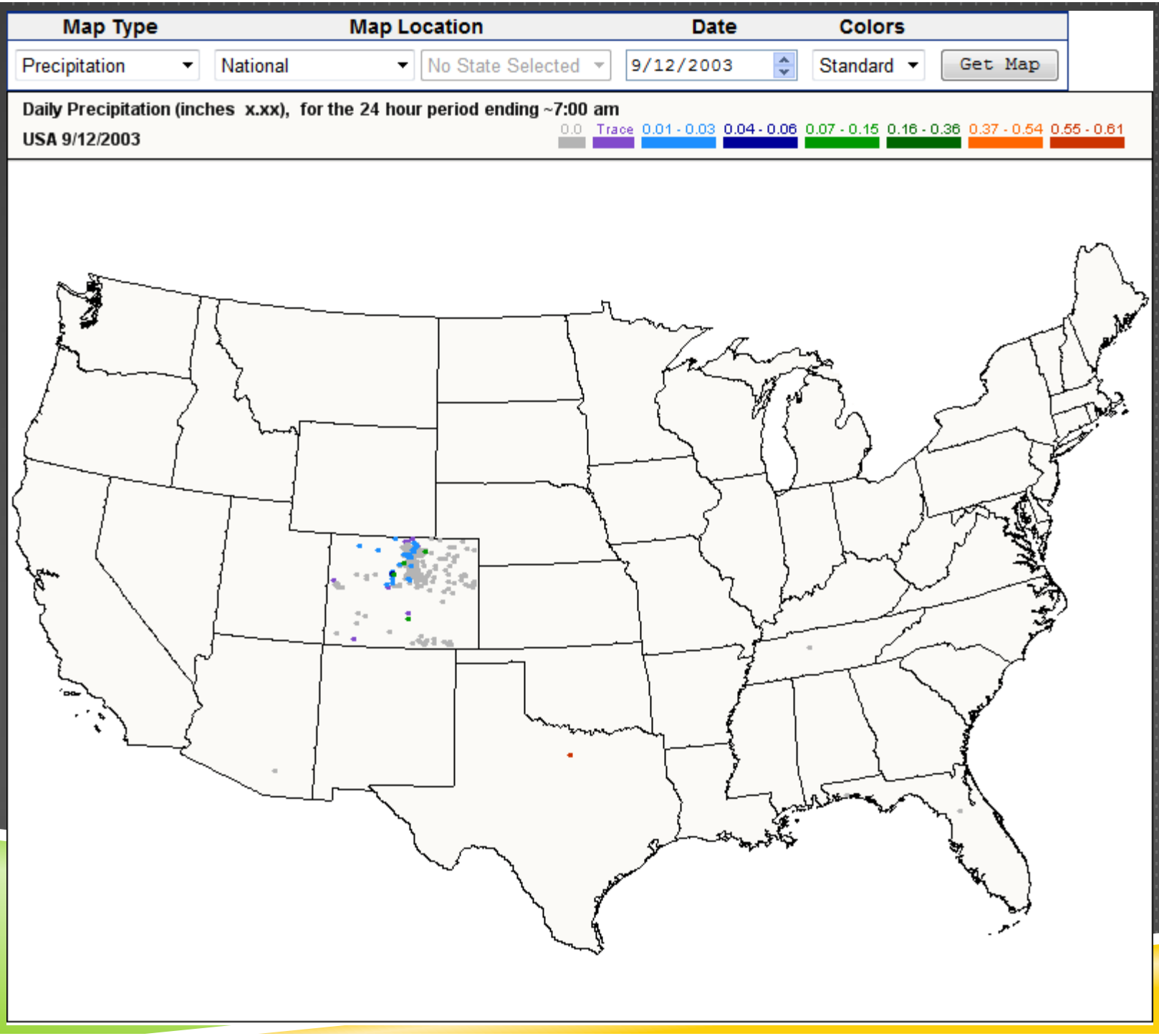
0.15 - 0.34
0.35 - 0.80
0.81 - 1.20
1.21 - 1.32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0.07 - 0.15
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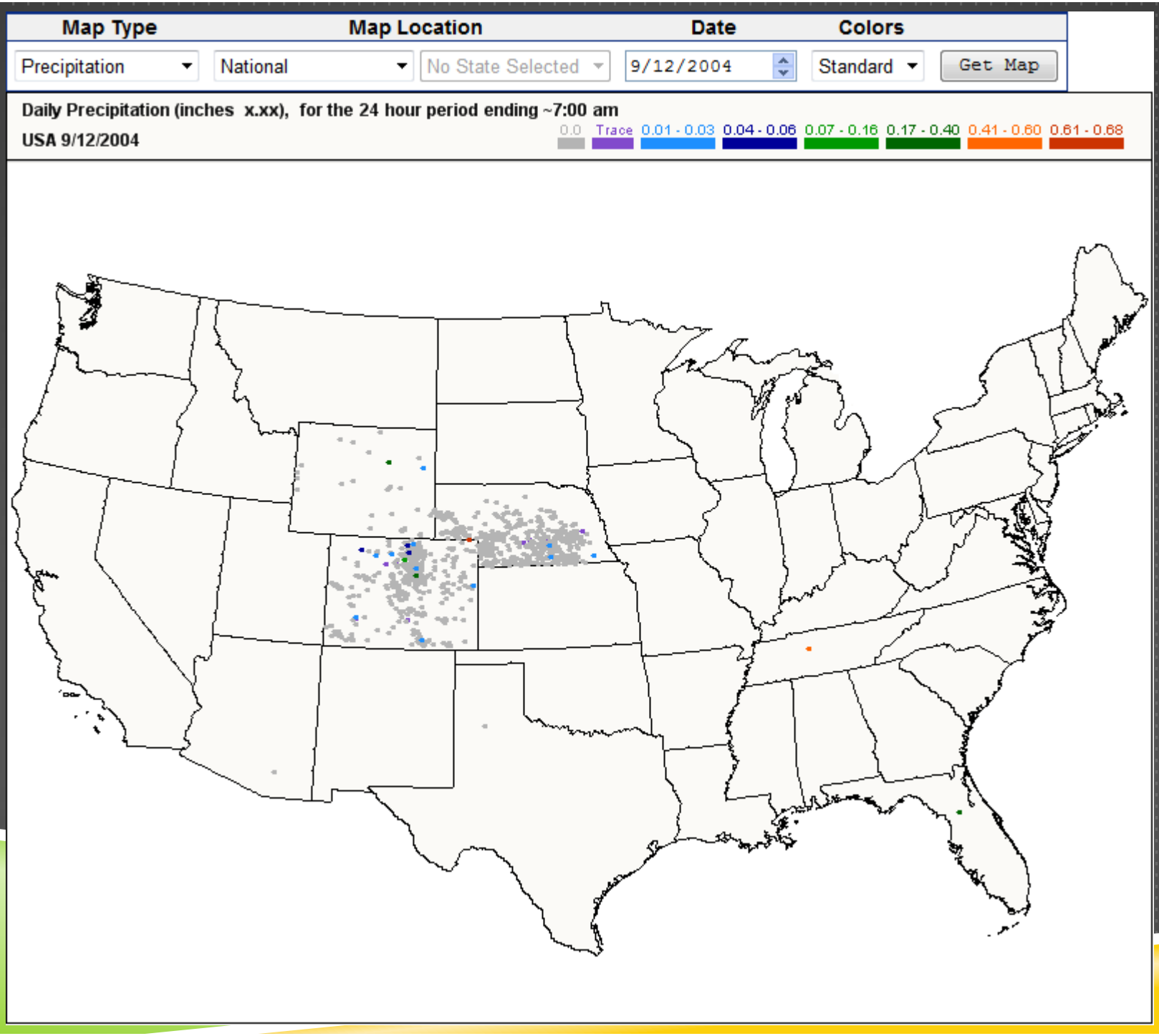
0.37 - 0.54
0.55 - 0.61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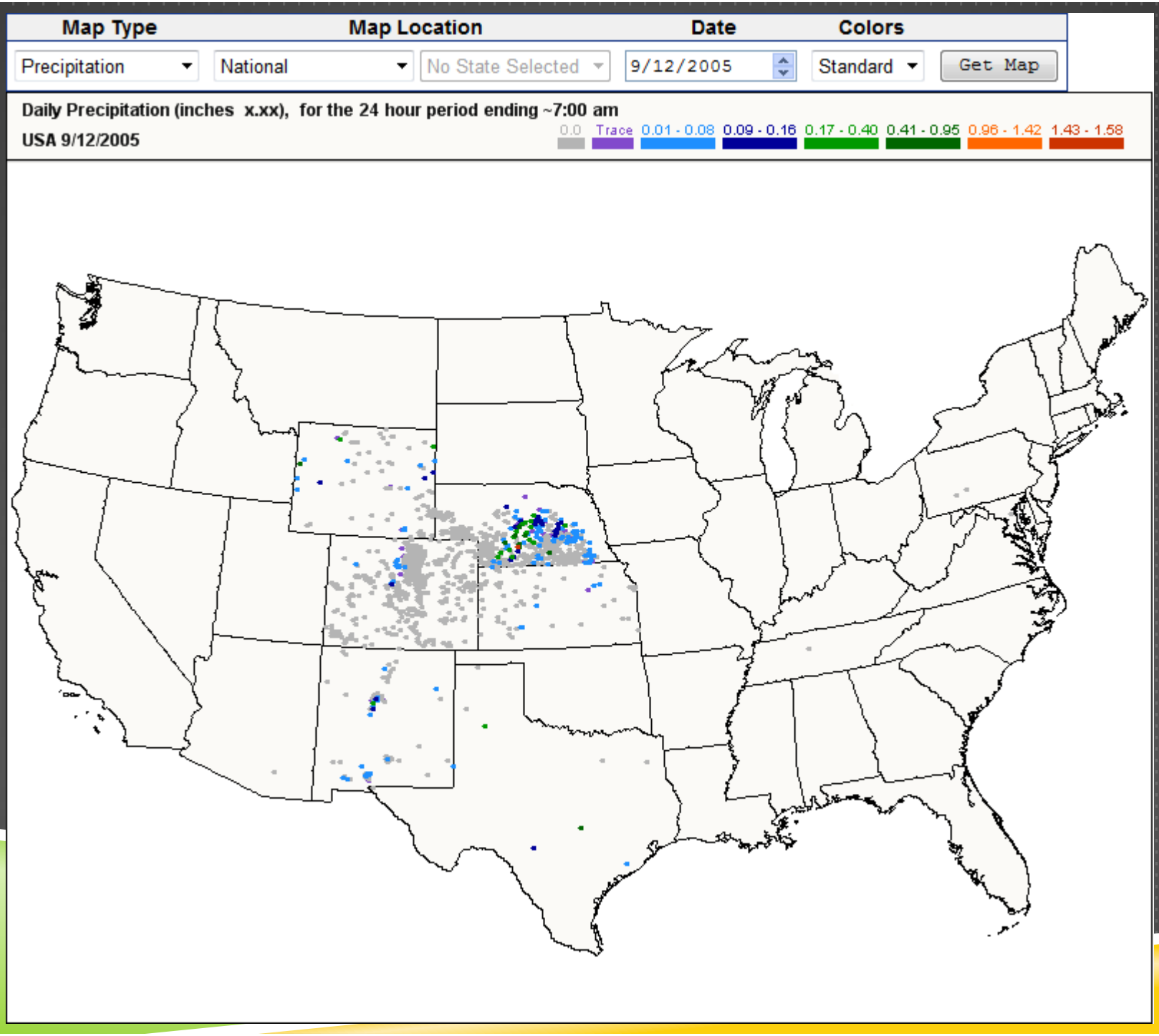
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Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 9/12/2005
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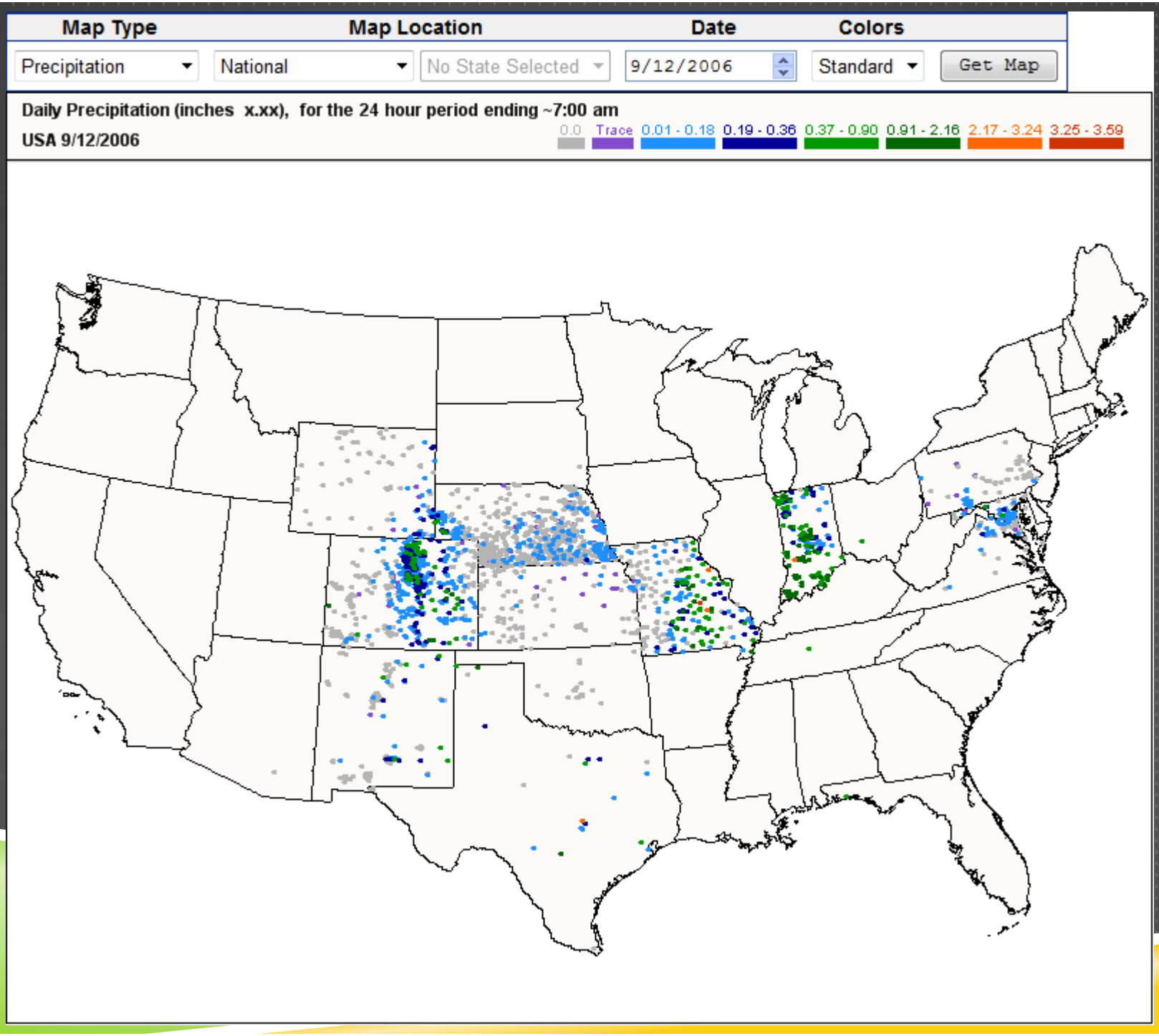
0.17 - 0.40
0.41 - 0.95
0.96 - 1.42
1.43 - 1.58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Date
Colors
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Get Map
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USA 9/12/2006
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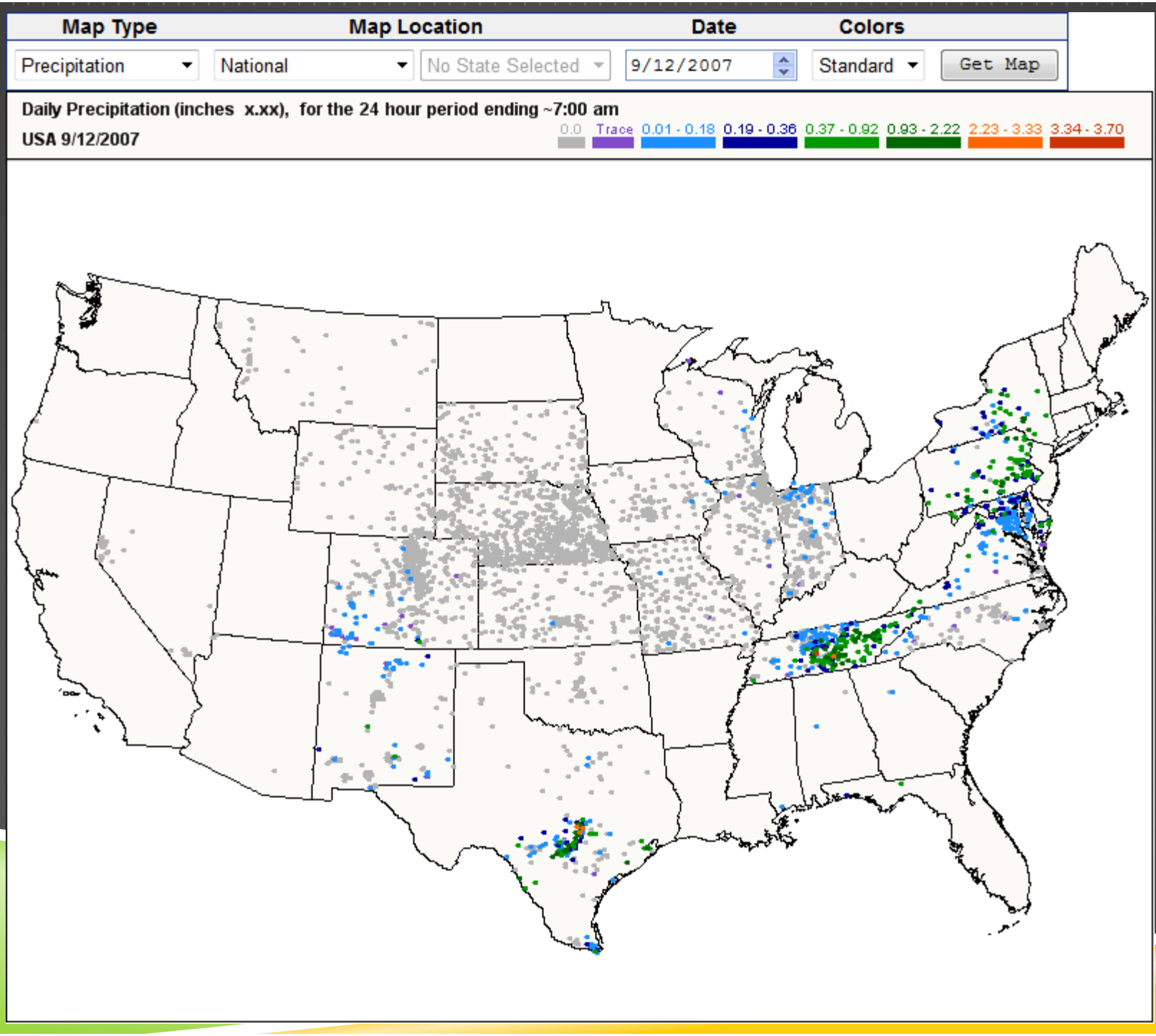
0.37 - 0.90
0.91 - 2.16
2.17 - 3.24
3.25 - 3.59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Colors
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National
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Standard
Get Map
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USA 9/12/2007
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Trace
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0.19 - 0.36
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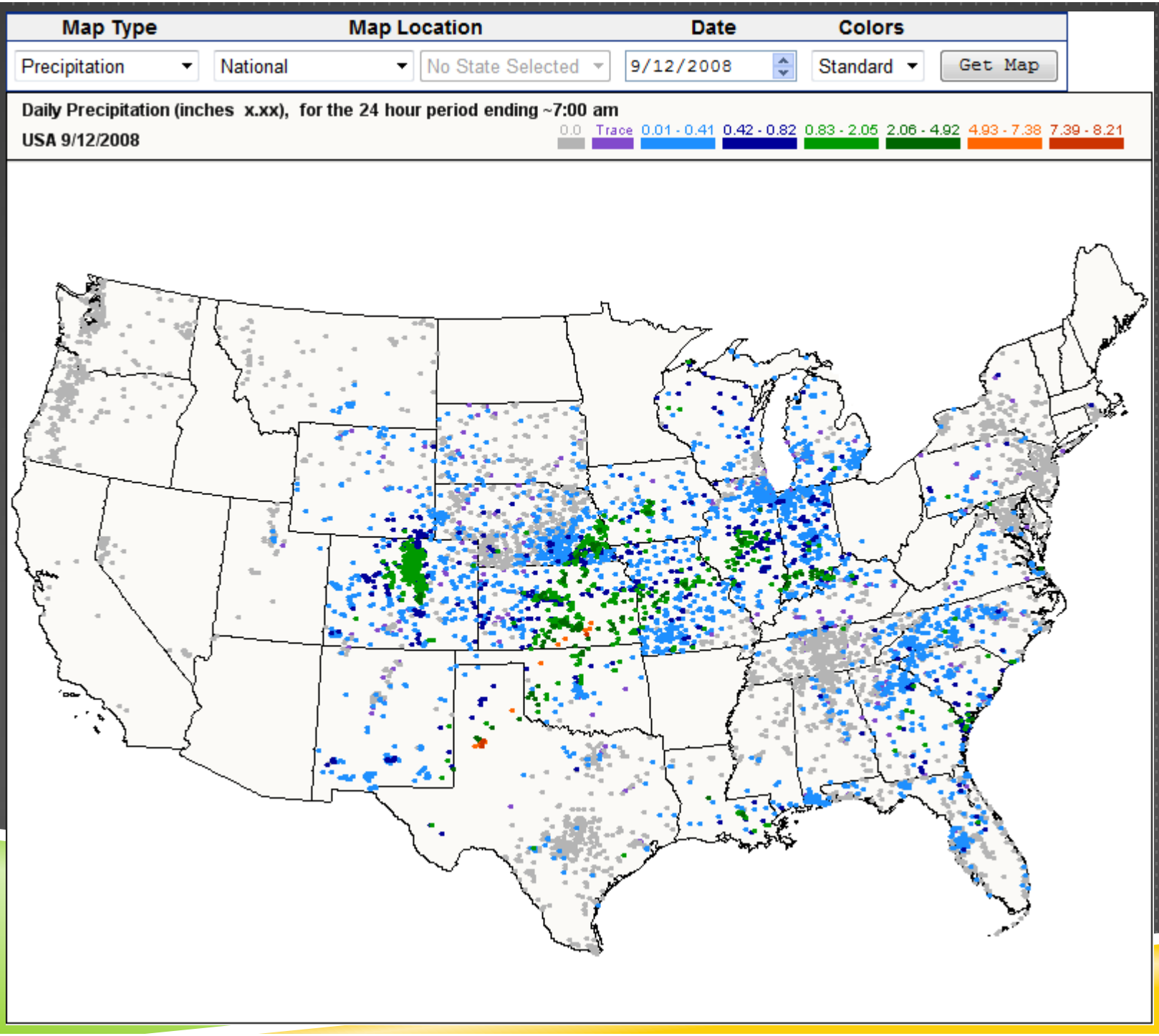
2.23 - 3.33
3.34 - 3.70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Date
Colors
Precipitation
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0.42 - 0.82
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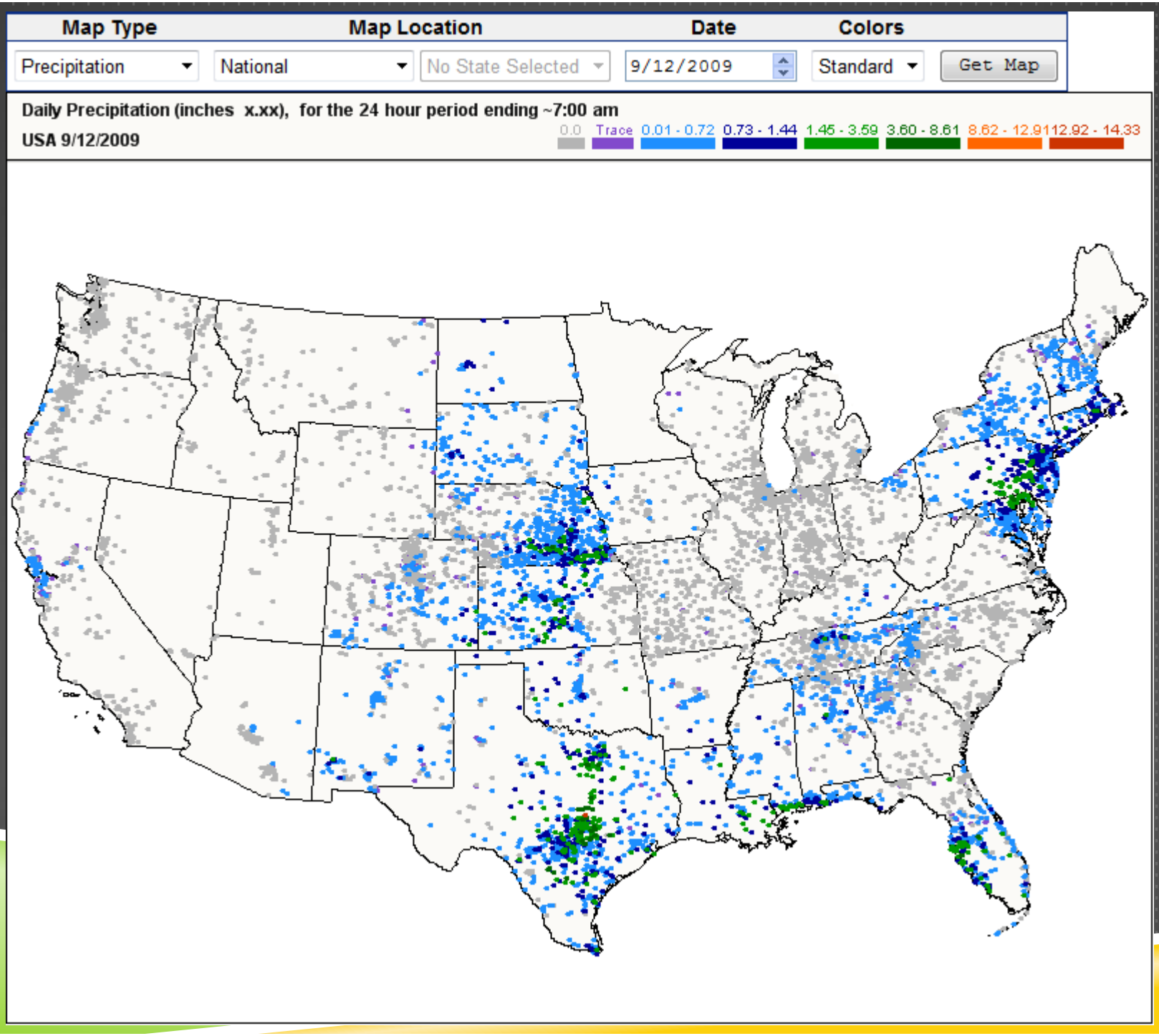
2.06 - 4.92
4.93 - 7.38
7.39 - 8.21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Colors
Precipitation
National
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Get Map
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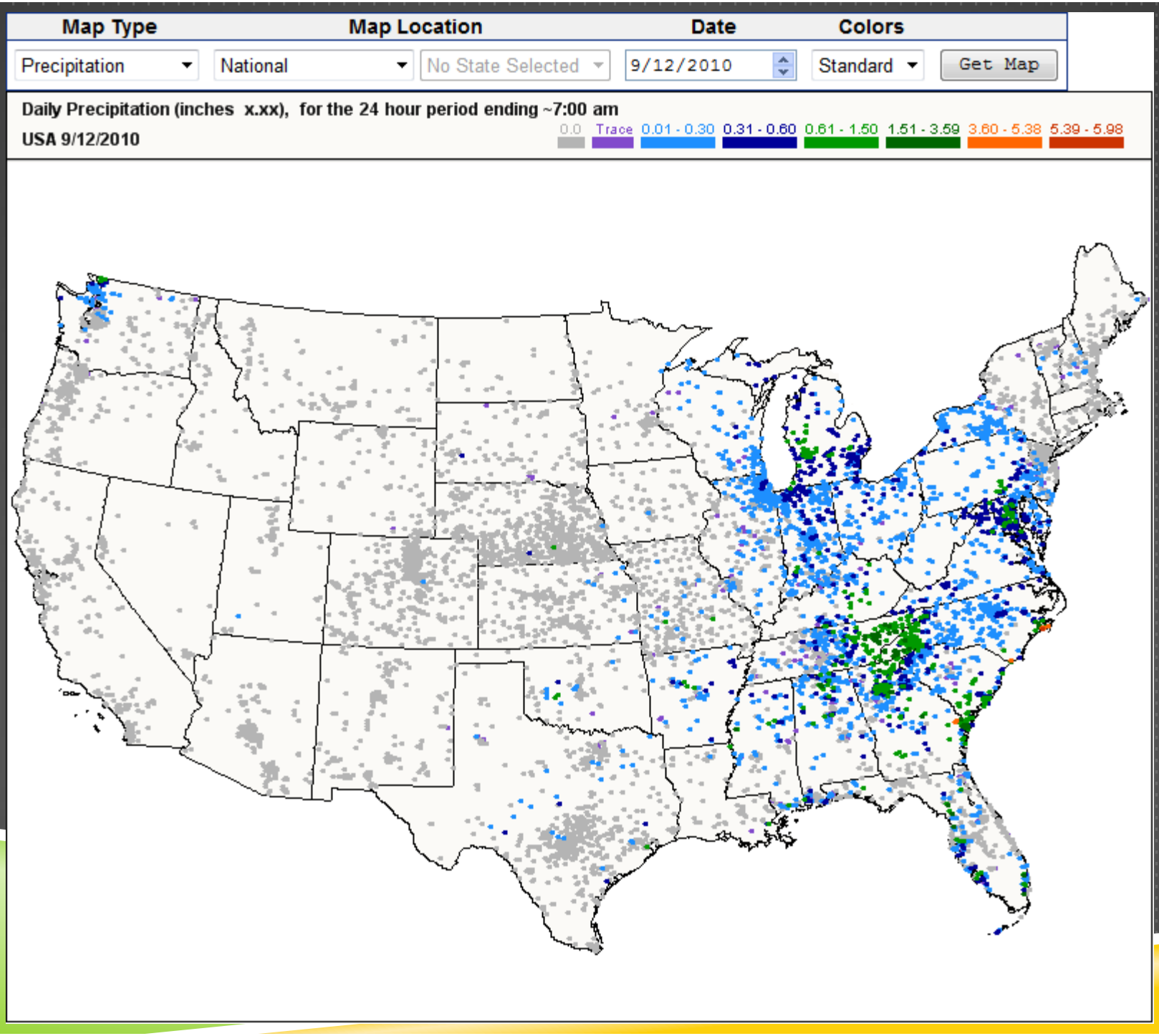
3.60 - 8.61
8.62 - 12.91
12.92 - 14.33


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
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Trace
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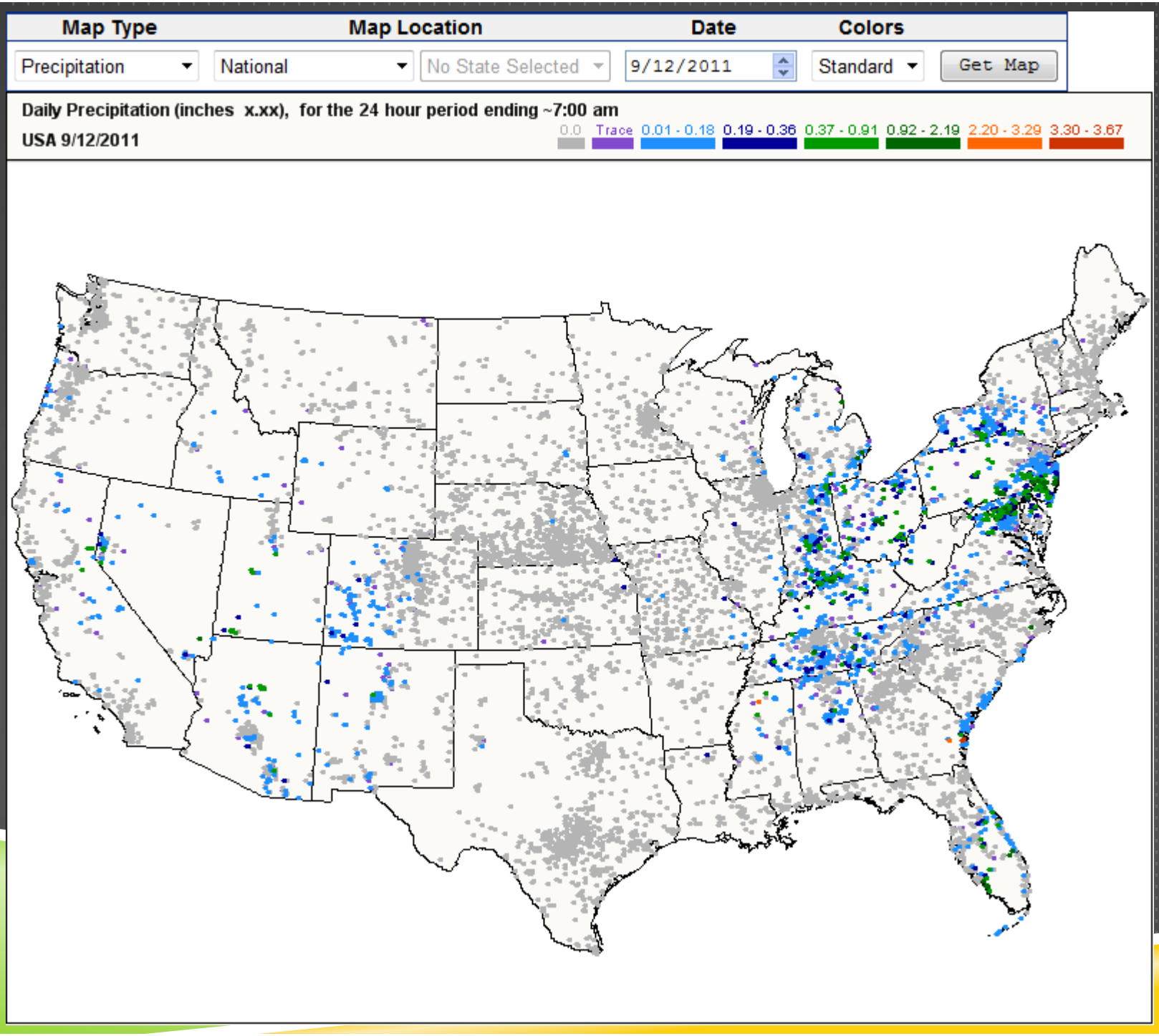
1.51 - 3.59
3.60 - 5.38
5.39 - 5.98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Precipitation
National
No State Selected
9/12/2011
Standard
Get Map
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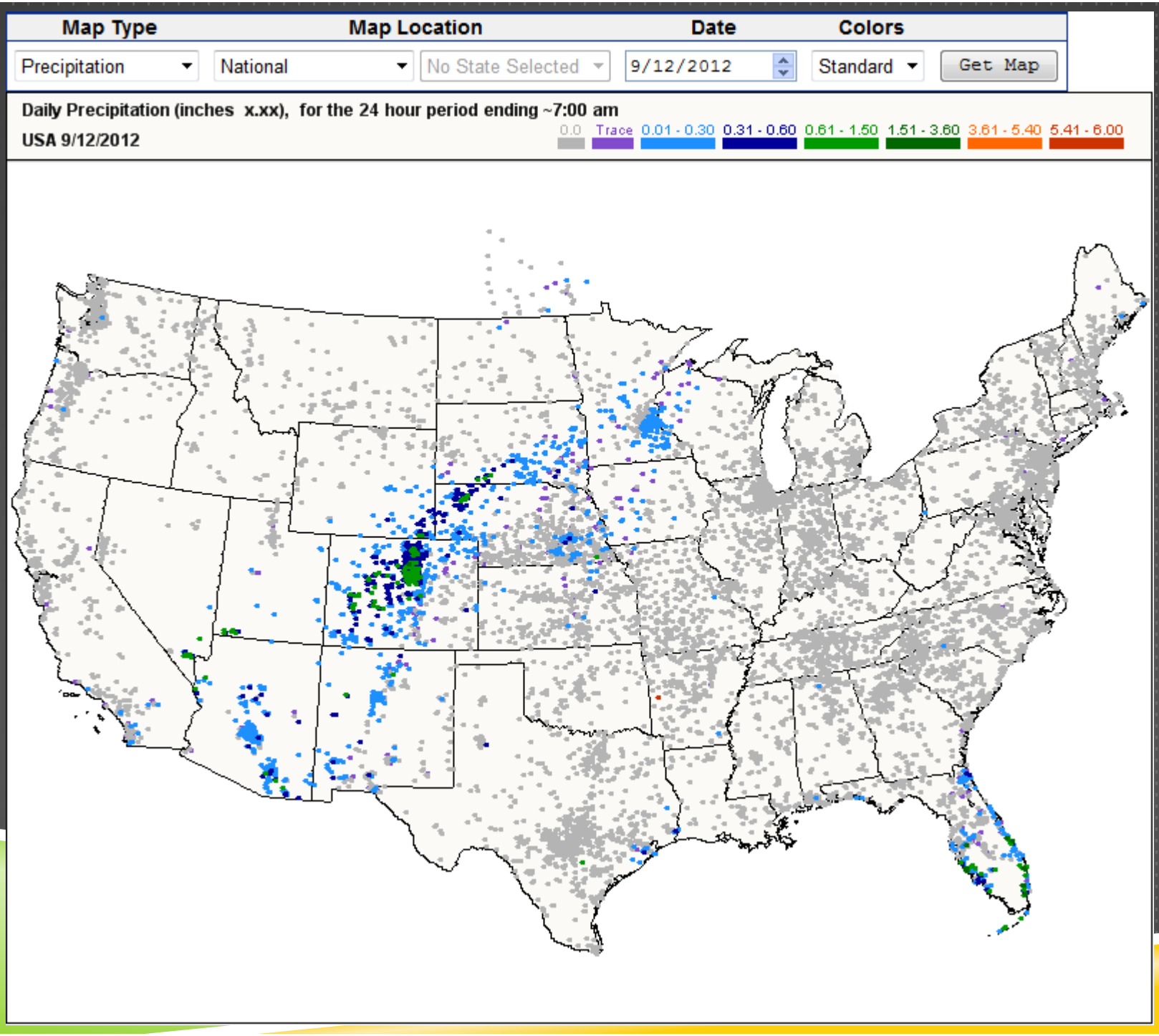
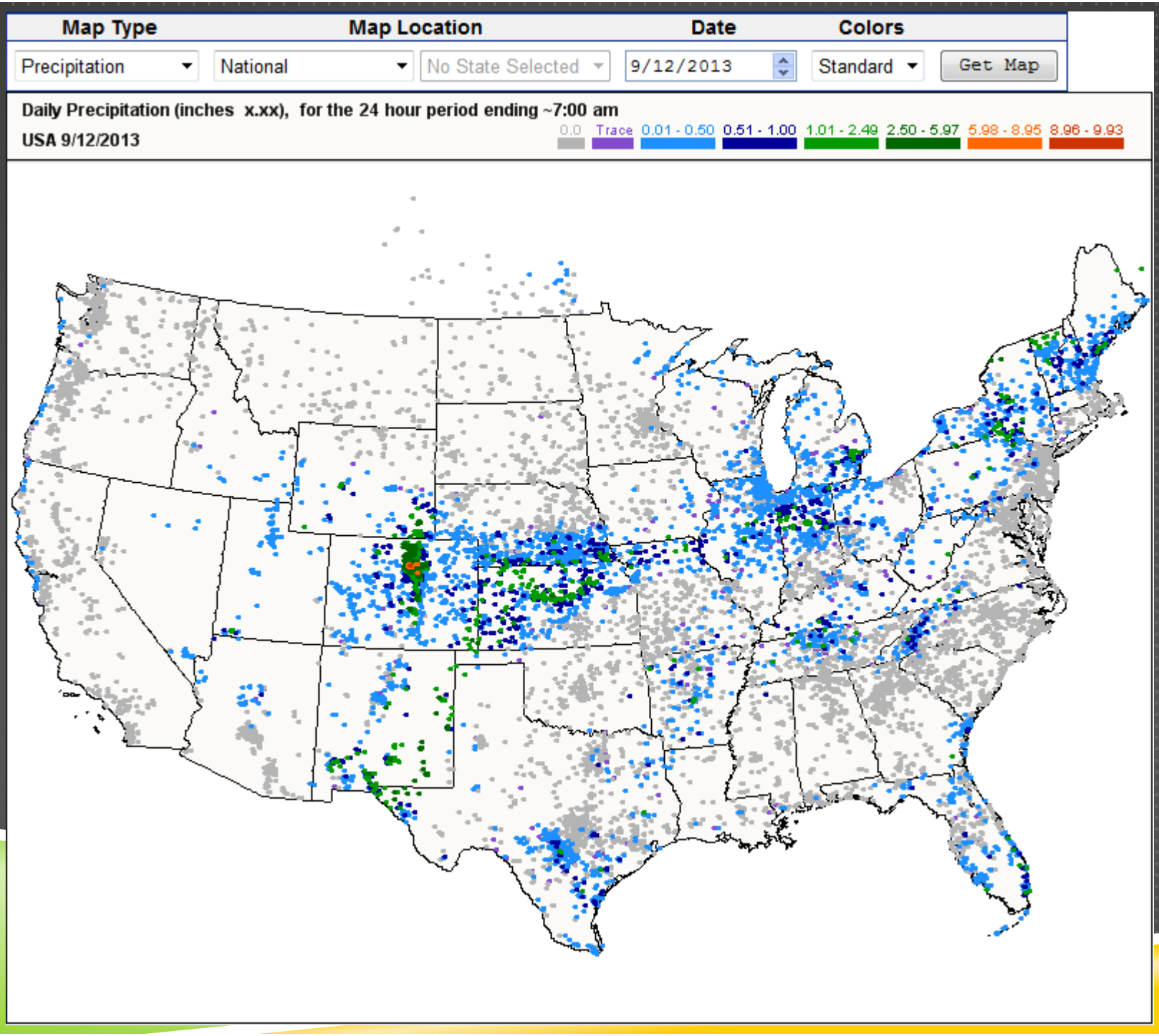
USA 9/12/2011
0.0
Trace
0.01 - 0.18
0.19 - 0.36
0.37 - 0.91
0.92 - 2.19
2.20 - 3.29
3.30 - 3.67


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
0.0
Trace
0.01 - 0.30
0.31 - 0.60
0.61 - 1.50
1.51 - 3.60
3.61 - 5.40
5.41 - 6.00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Map Location
Date
Colors
Precipitation
National
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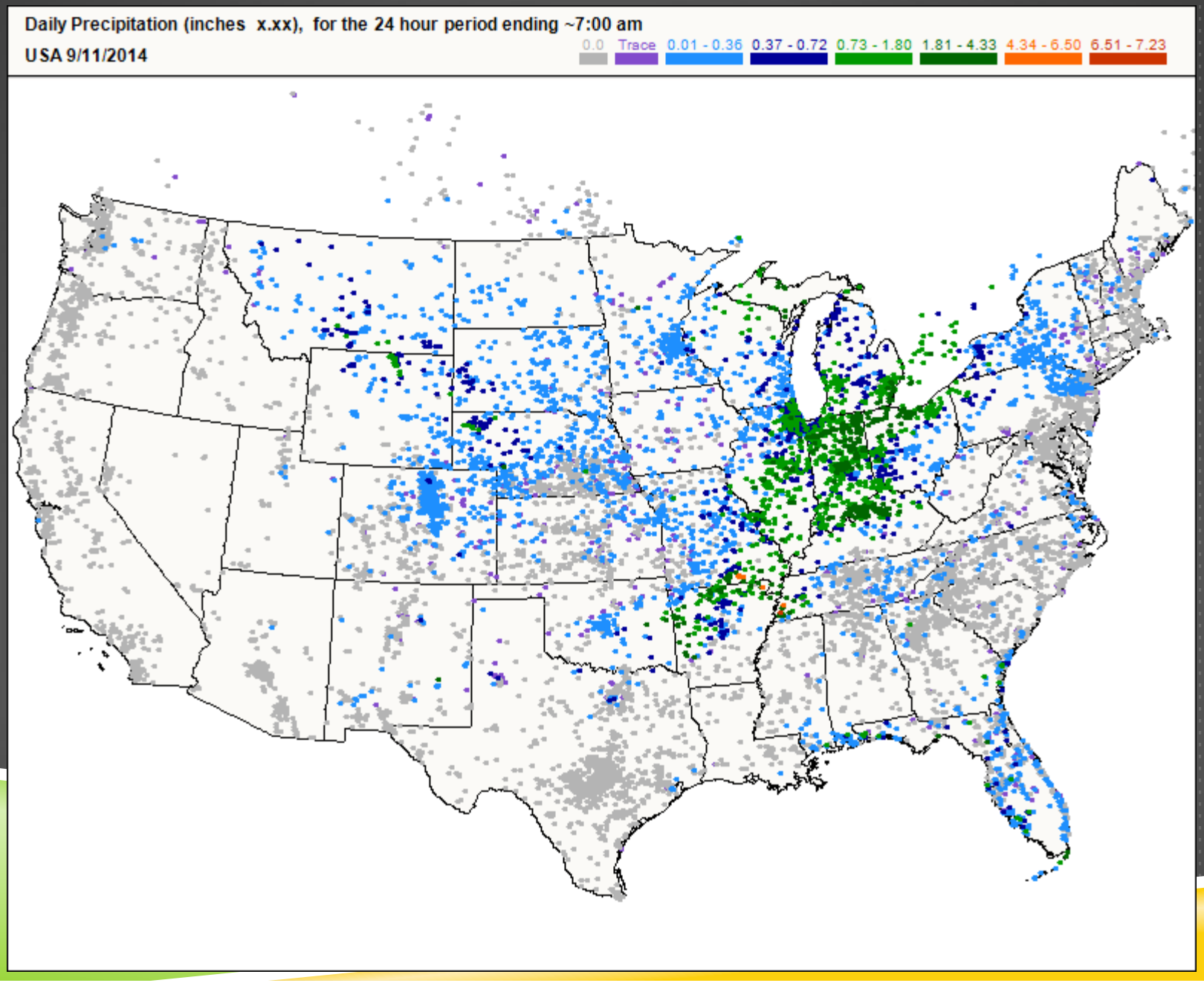
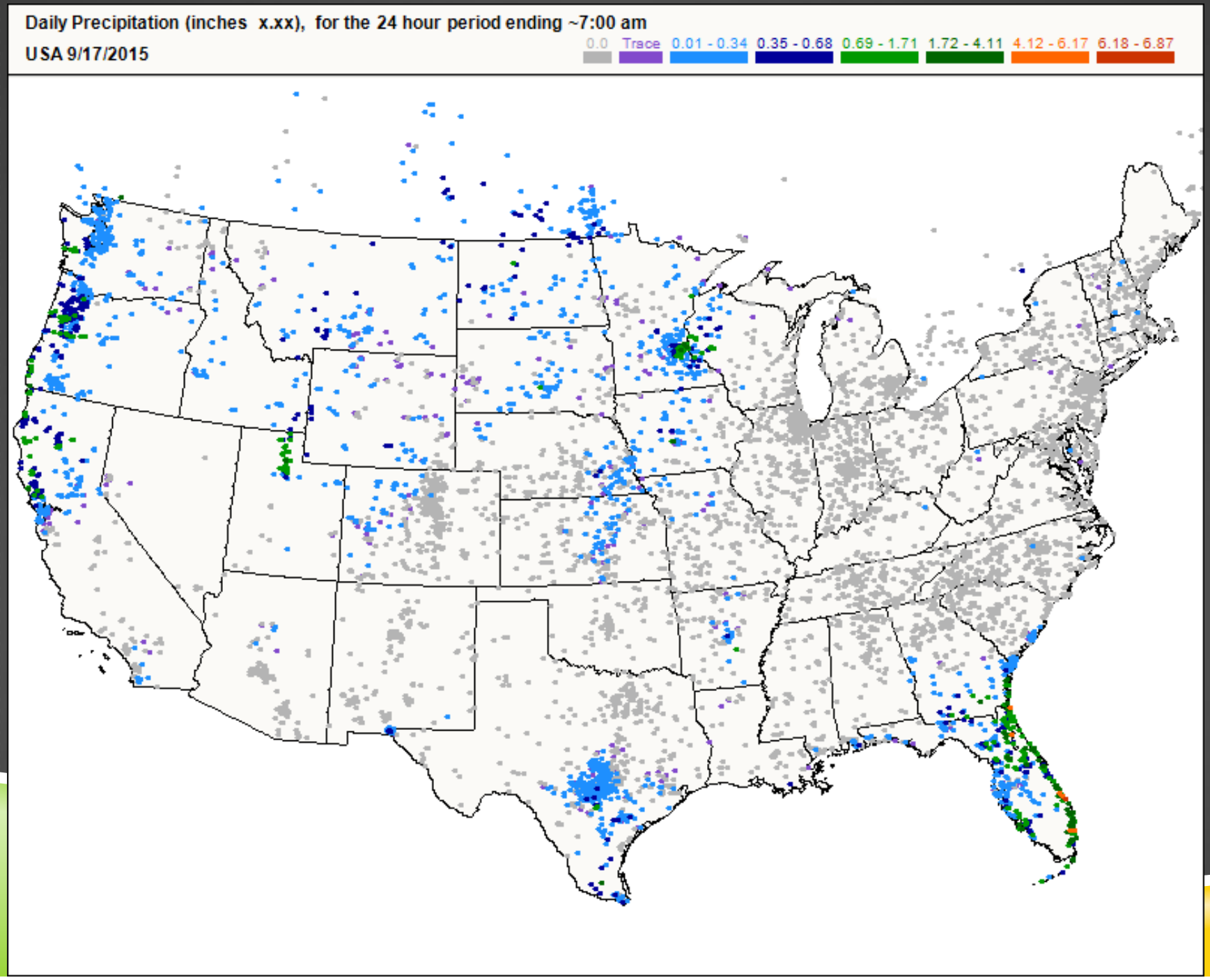
9/12/2013
Standard
Get Map
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 9/12/2013
0.0
Trace
0.01 - 0.50
0.51 - 1.00
1.01 - 2.49
2.50 - 5.97
5.98 - 8.95
8.96 - 9.93

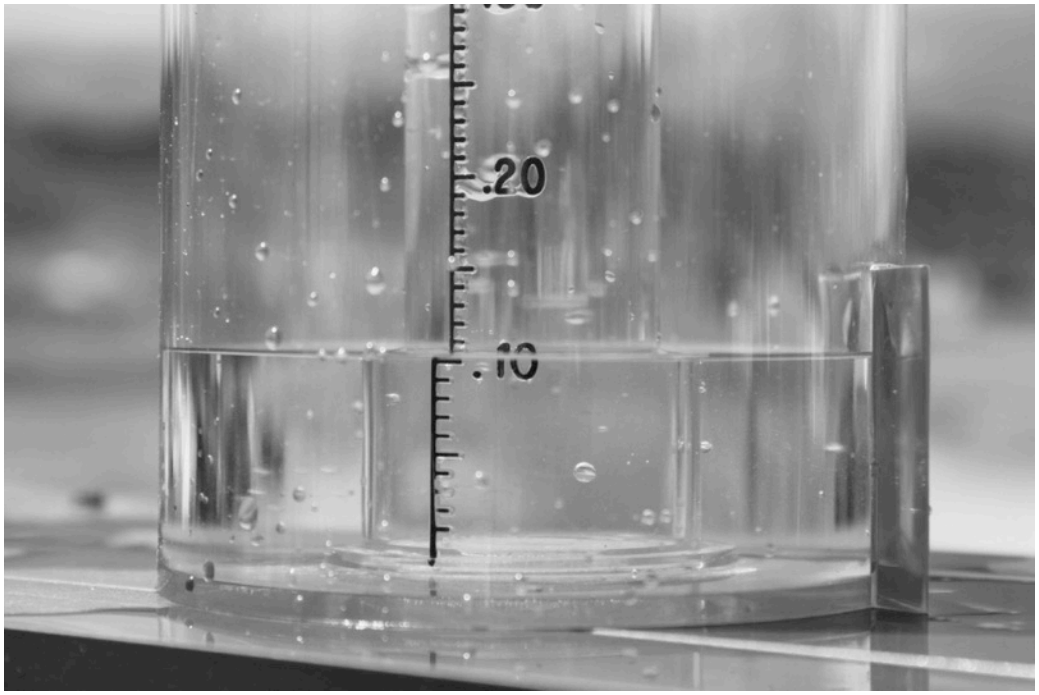

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 9/11/2014
0.0
Trace
0.01 - 0.36
0.37 - 0.72
0.73 - 1.80
1.81 - 4.33
4.34 - 6.50
6.51 - 7.23


Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 9/17/2015
0.0
Trace
0.01 - 0.34
0.35 - 0.68
0.69 - 1.71
1.72 - 4.11
4.12 - 6.17
6.18 - 6.87

YES, VOLUNTEER WEATHER OBSERVATIONS ARE NEEDED AND UTILIZED

BOTTOM LINE

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*

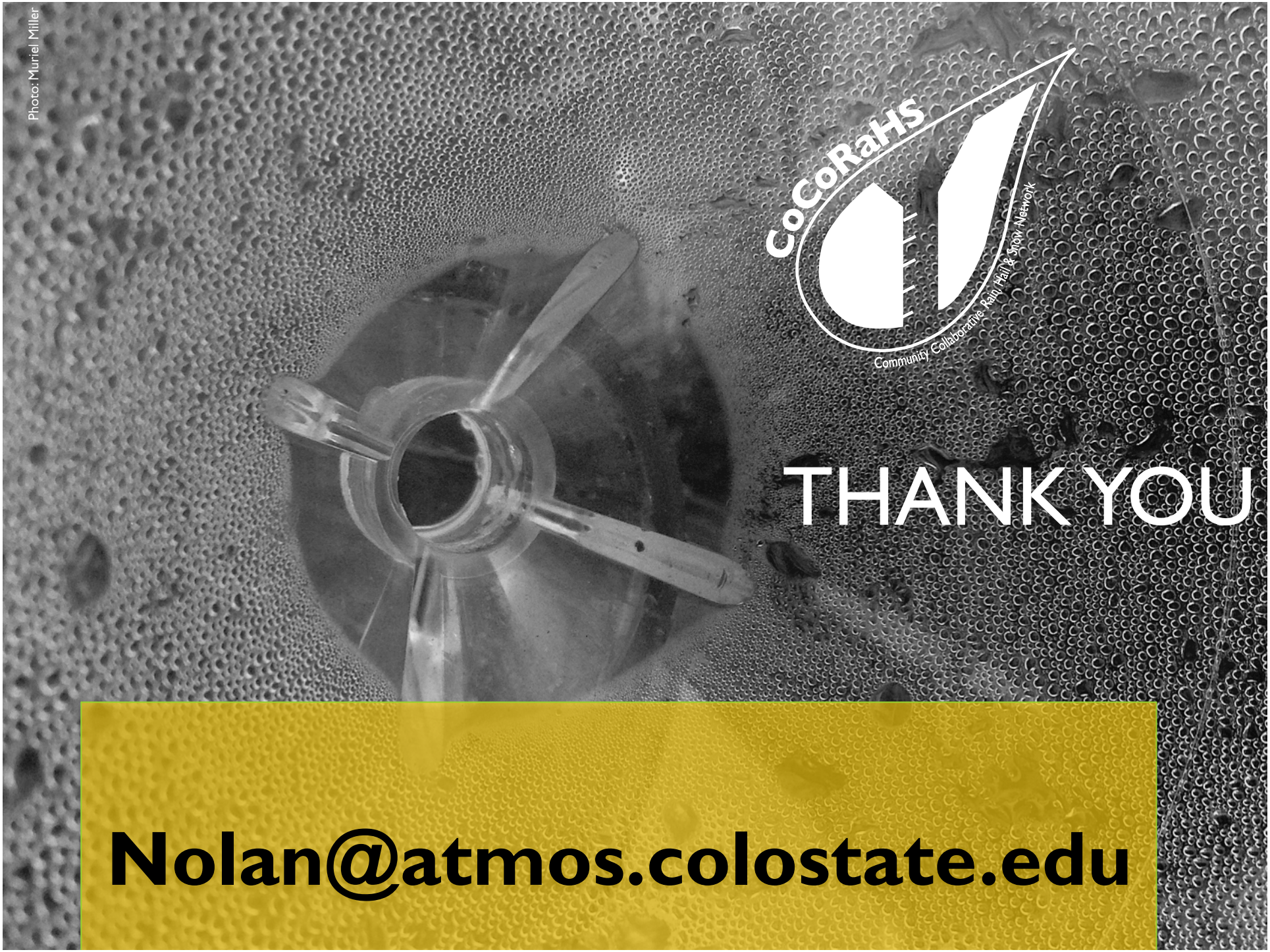


Photo: Muriel Miller
CoCoRaHS
Community Collaborative Rain, Hail & Snow Network
THANK YOU
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