

CoCoRaHS – Monitoring Colorado's Water Resources through Community Collaborations

Nolan Doesken

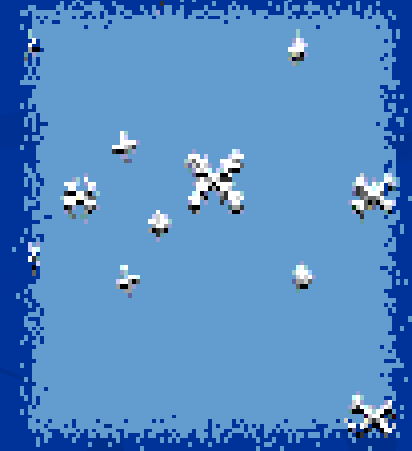
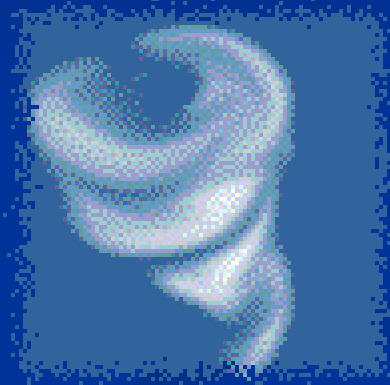
Colorado Climate Center
Atmospheric Science Department
Colorado State University

Presented at Sustaining Colorado Watersheds
Conference, Breckenridge, CO, October 5, 2006



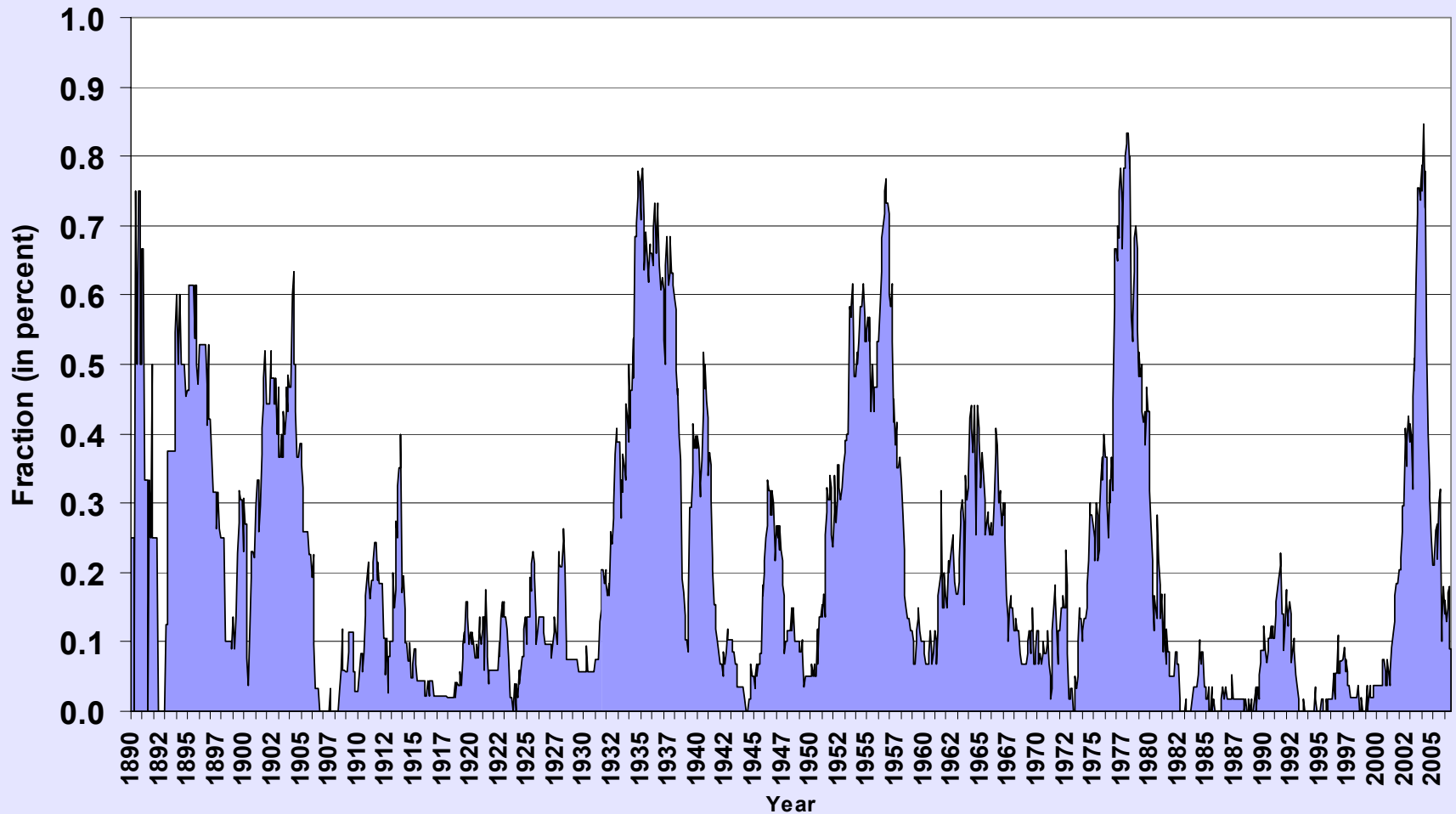
Prepared by Odie Bliss

Why Do We Monitor Our Climate?



Because Climate is Variable

Fraction of Colorado in Drought Based on 48 month SPI (1890 - Aug 2006)



Climate Variations Affect Water Resources

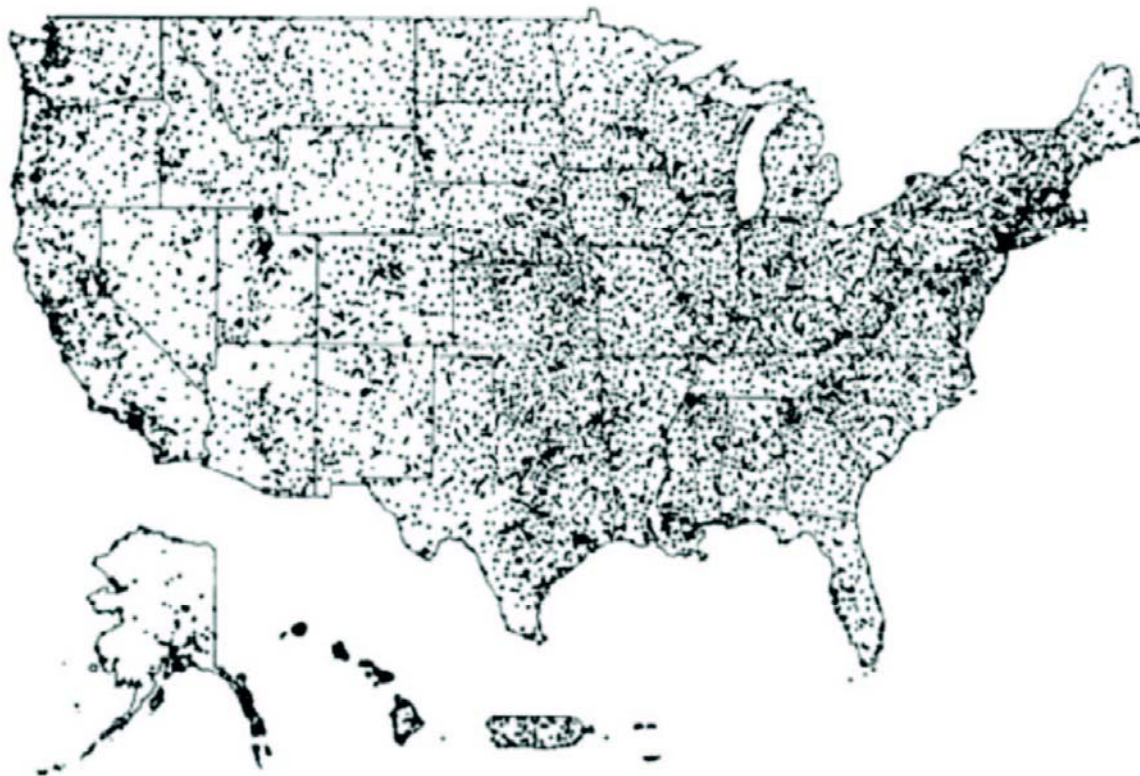


How Do We Monitor Colorado's Climate?



By Collecting Data Over Time and At Many Places

National Weather Service Cooperative Network



From Kelly Redmond, WRCC

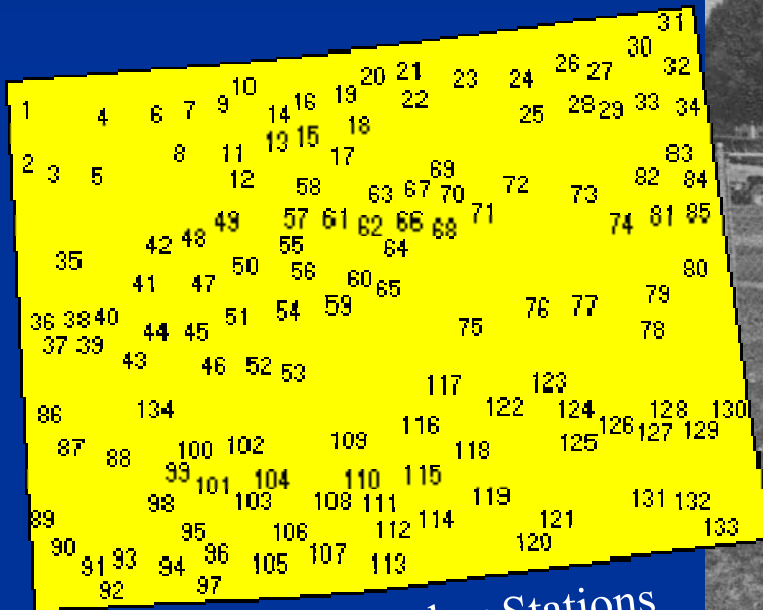
Approximately 5000 daily max/min temperature stations, 8000 daily precipitation stations, 3000 automated hourly precipitation stations.

Climate Monitoring – A Long History

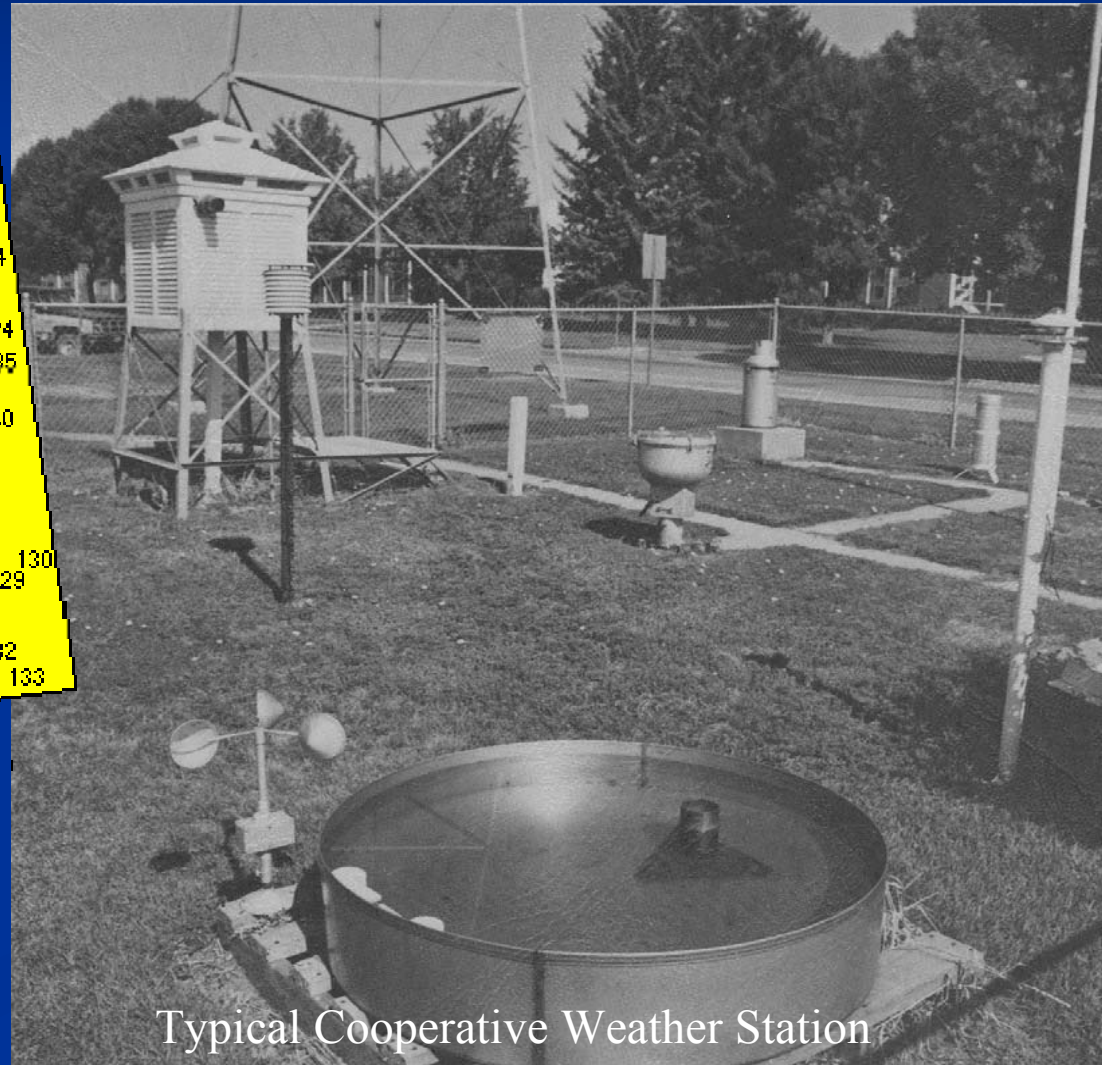
- Elements: Temperature, Precipitation, Snow, Wind, Solar, Evaporation, Soil temperatures, Humidity, Cloud cover



National Weather Service Collaboration

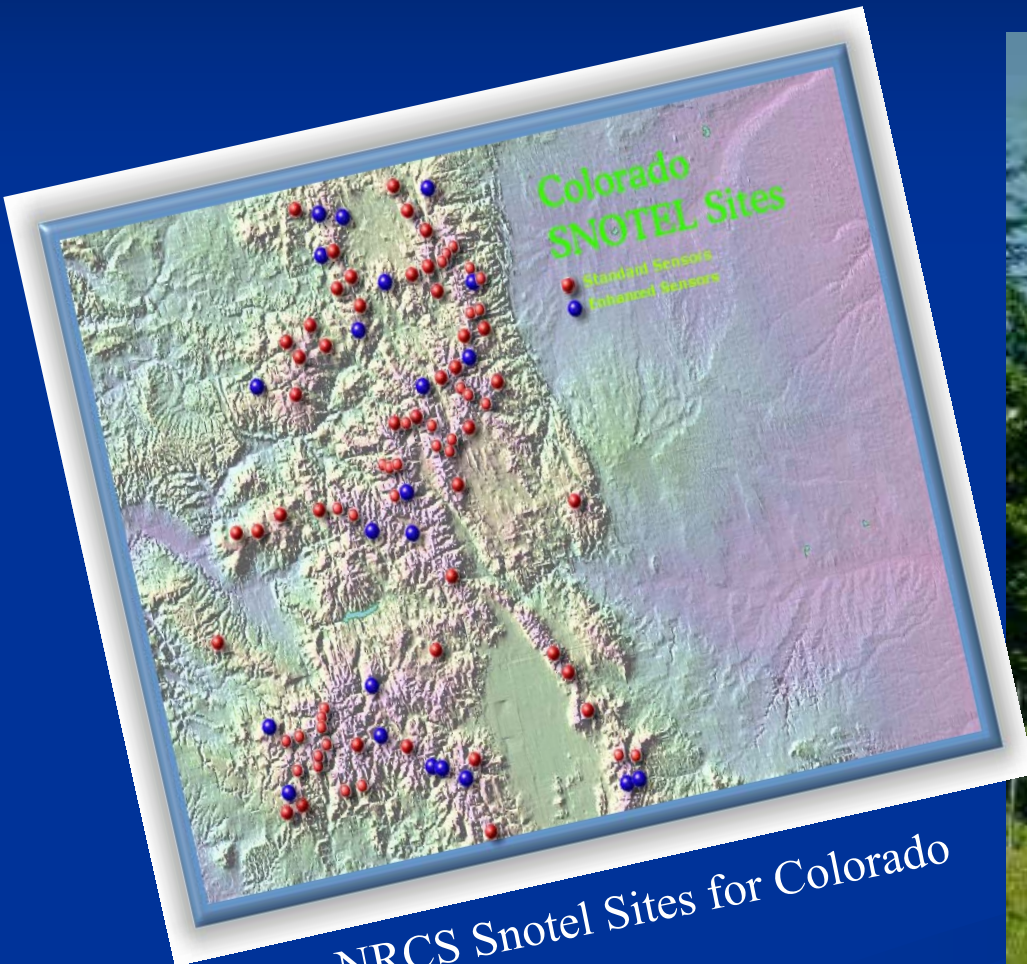


Cooperative Weather Stations
in Colorado



Typical Cooperative Weather Station

USDA, Natural Resources Conservation Service

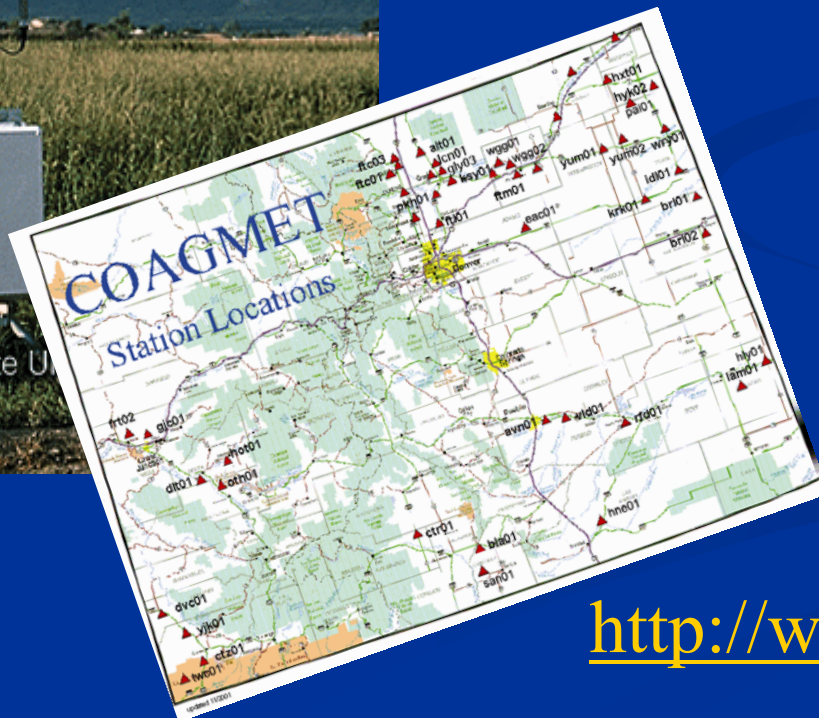


NRCS Snotel Sites for Colorado



Typical NRCS Snotel Site

CoAgMet – Weather Data for Agriculture



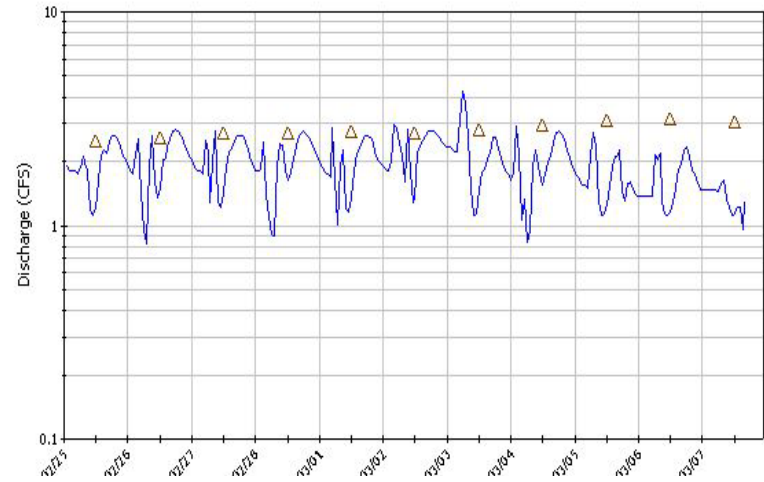
- Automated weather stations with daily and hourly readings of:
 - Temperature
 - Humidity
 - Wind
 - Precipitation
 - Solar energy
 - Evapotranspiration

<http://www.coagmet.com>

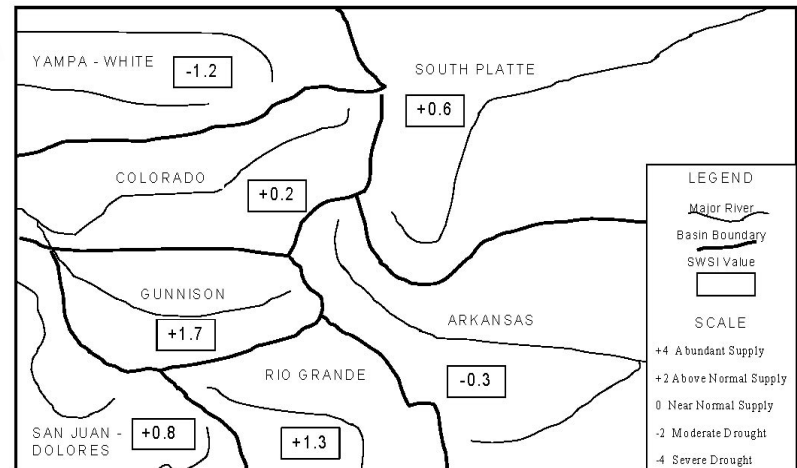
State Engineer's Office



NORDSCCO Discharge Graph (Hourly Average)

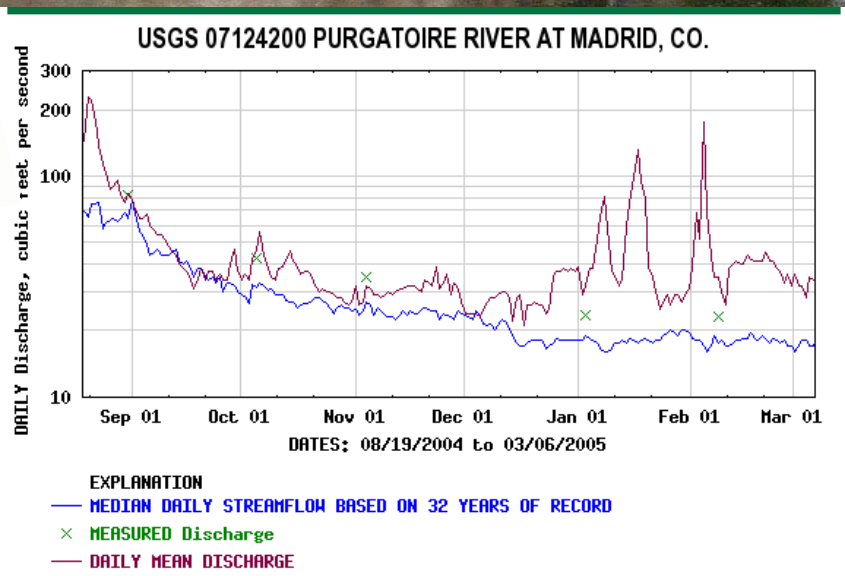
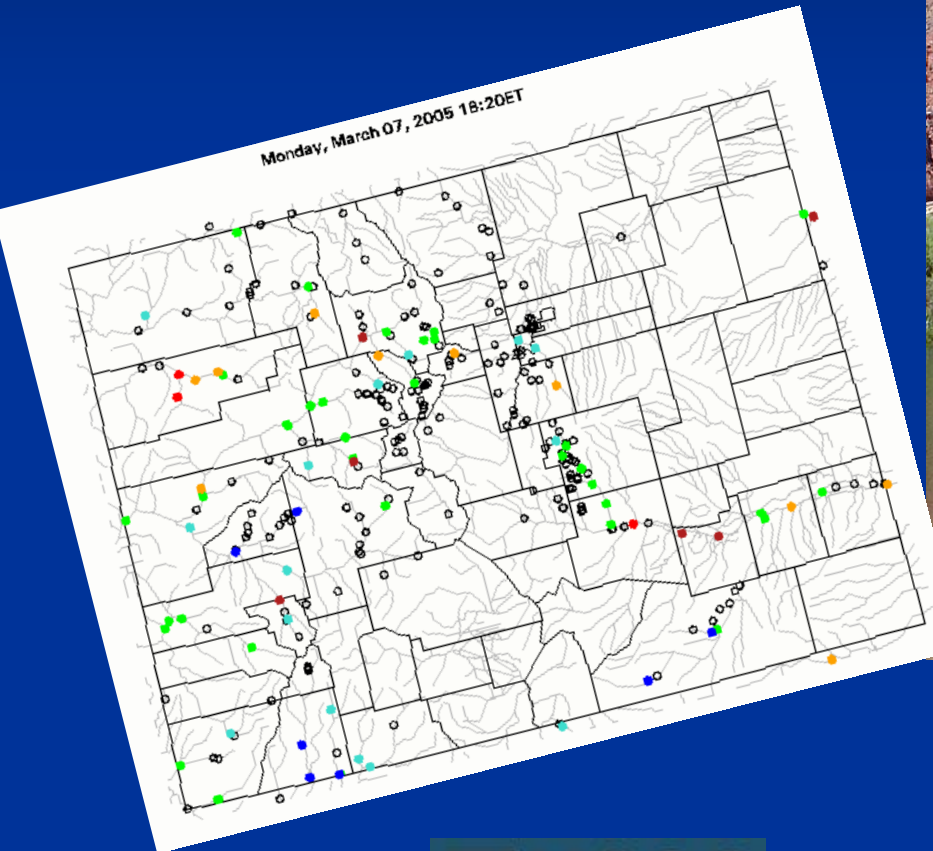
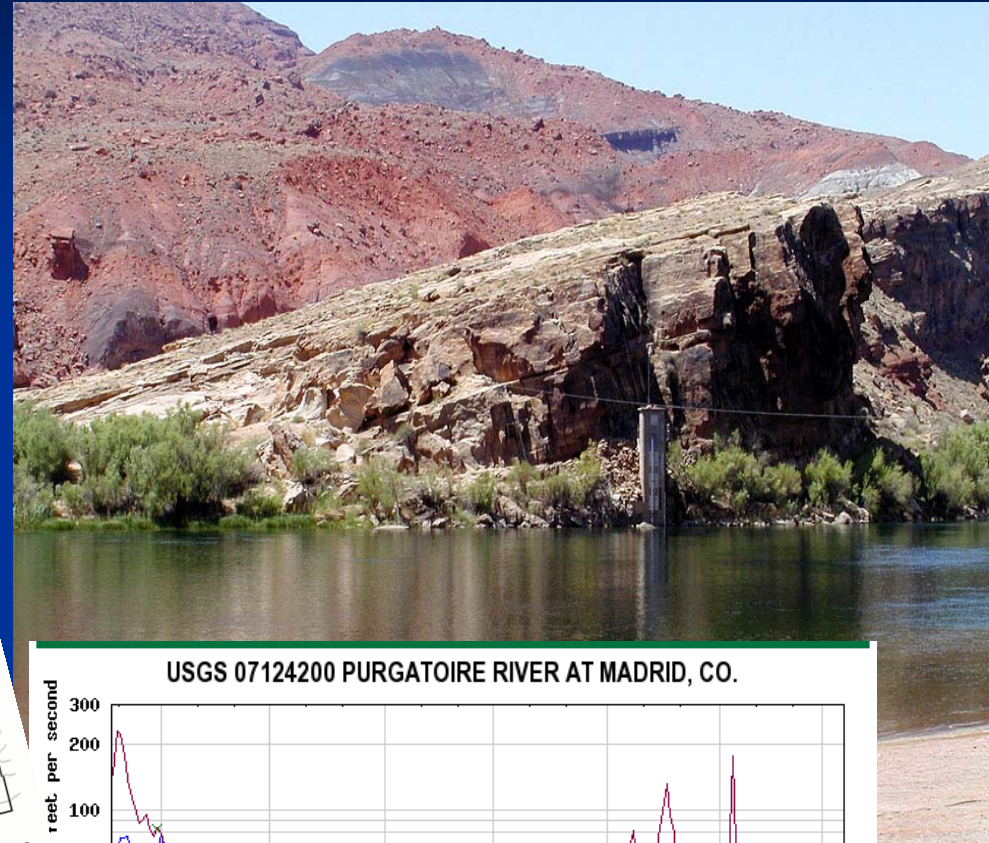


SURFACE WATER SUPPLY INDEX FOR COLORADO

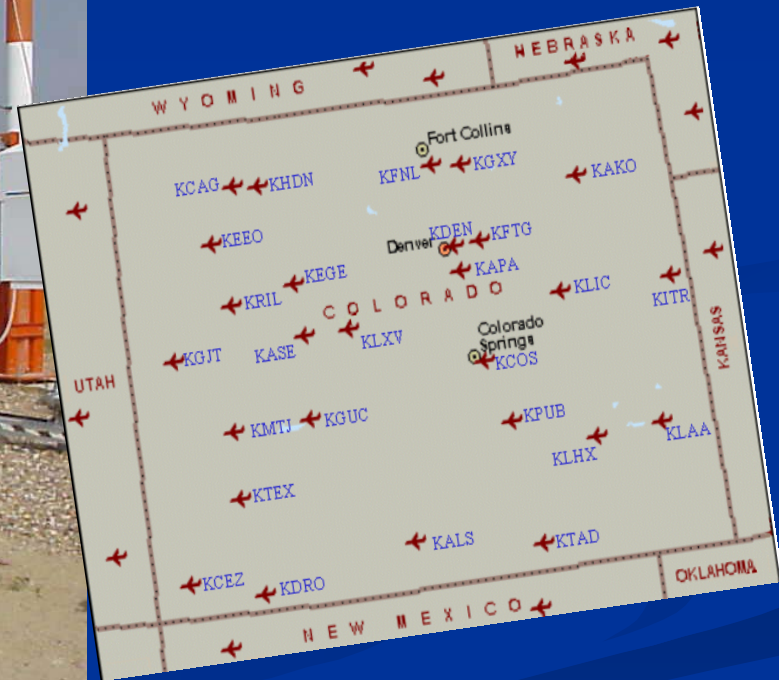


JANUARY 1, 2005

U.S. Geological Survey



Automated Surface Observing System (ASOS)

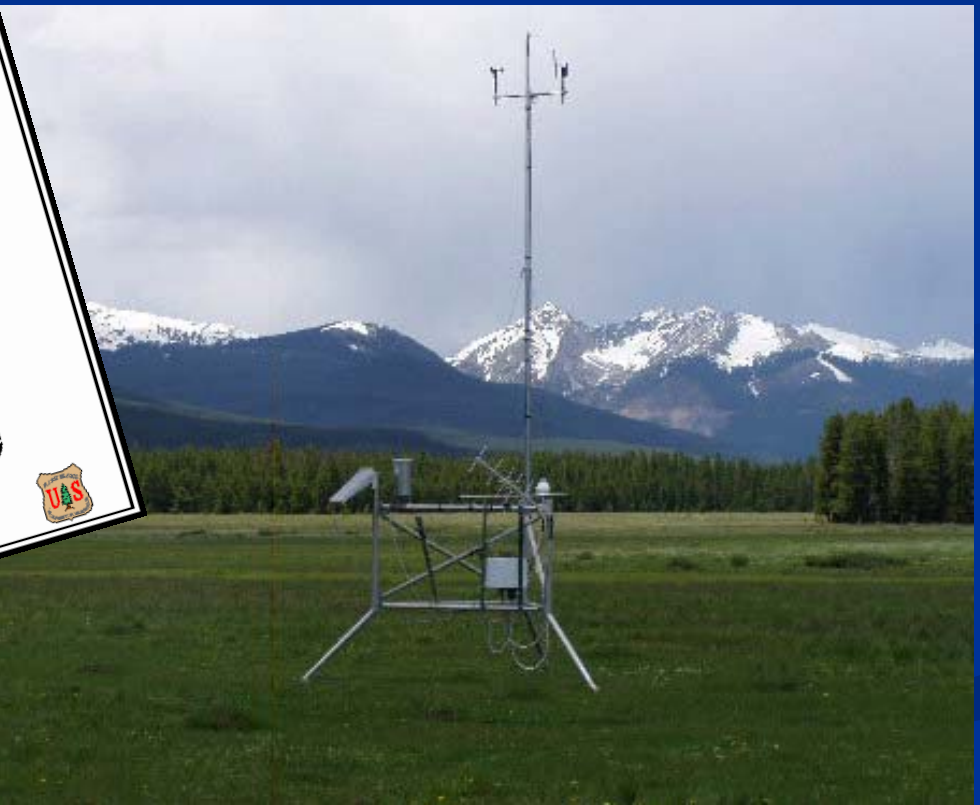
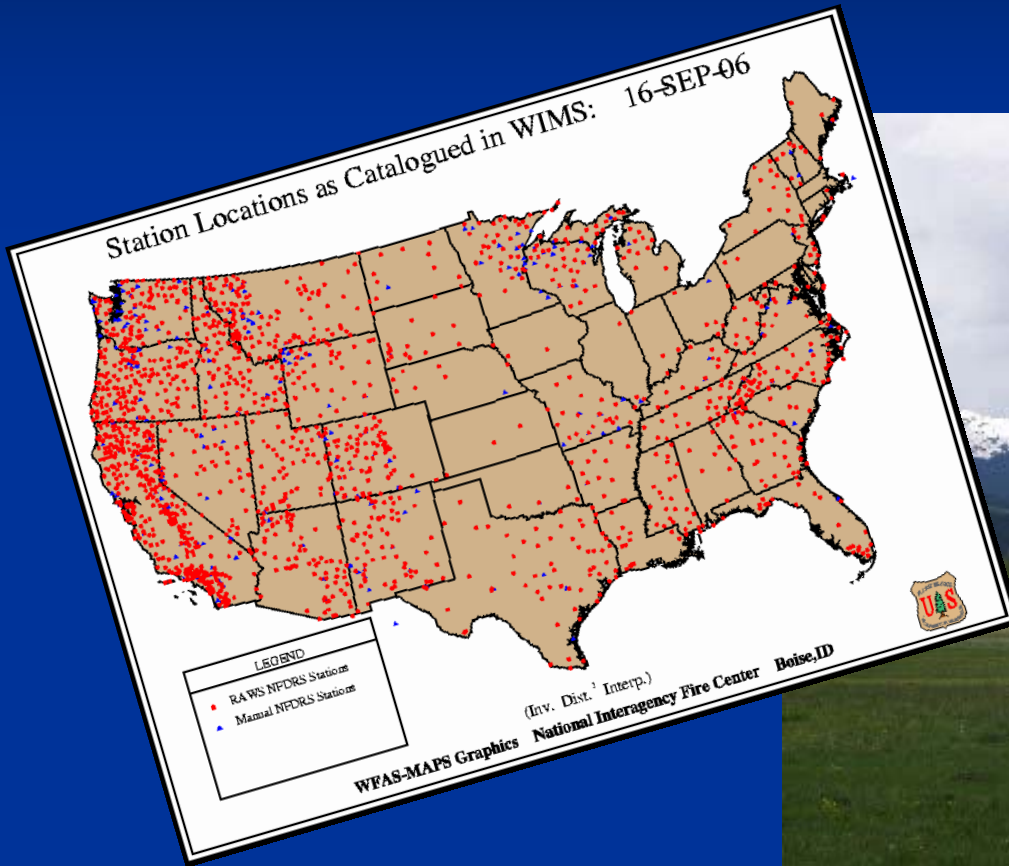


Denver International Airport ASOS, Photo courtesy of the National Weather Service

Automated Weather Observing System (AWOS)



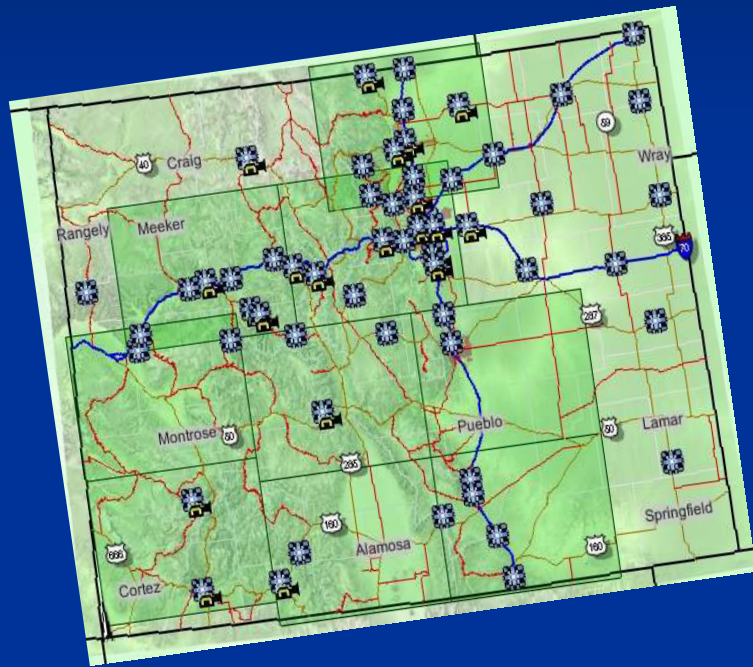
Remote Automated Weather Stations (RAWS)



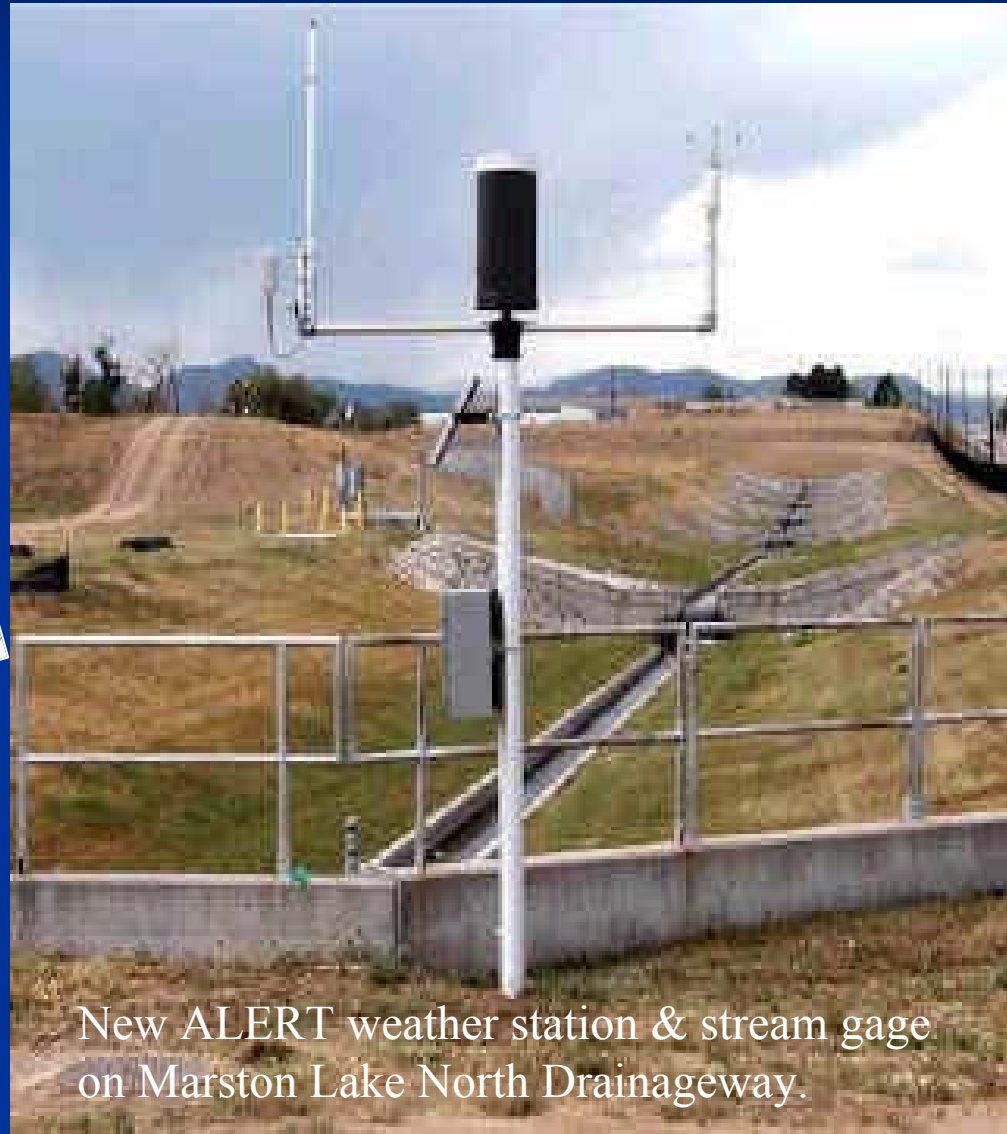
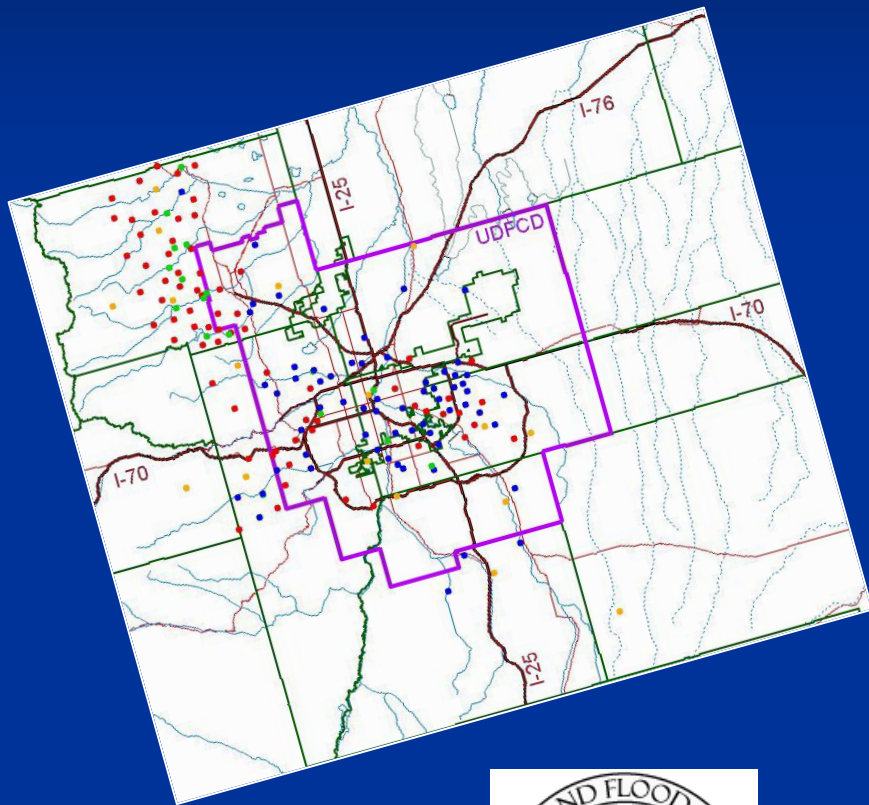
School Weather Stations



Colorado Department of Transportation (CDOT)



Urban Drainage and Flood Control District (UDFCD) ALERT system



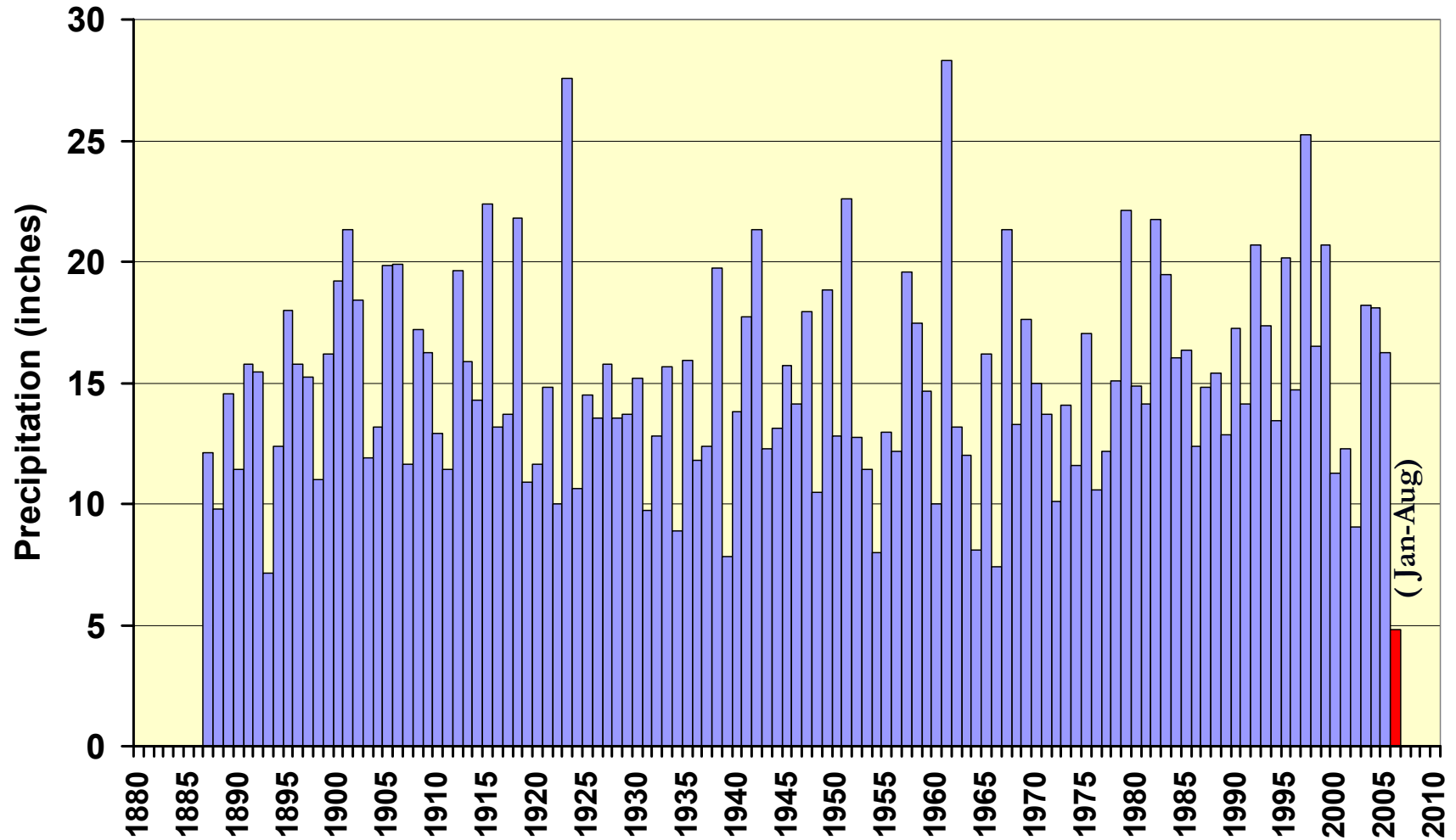
New ALERT weather station & stream gage on Marston Lake North Drainageway.

And Other Local Sources



What Do We Learn From Climate Monitoring?

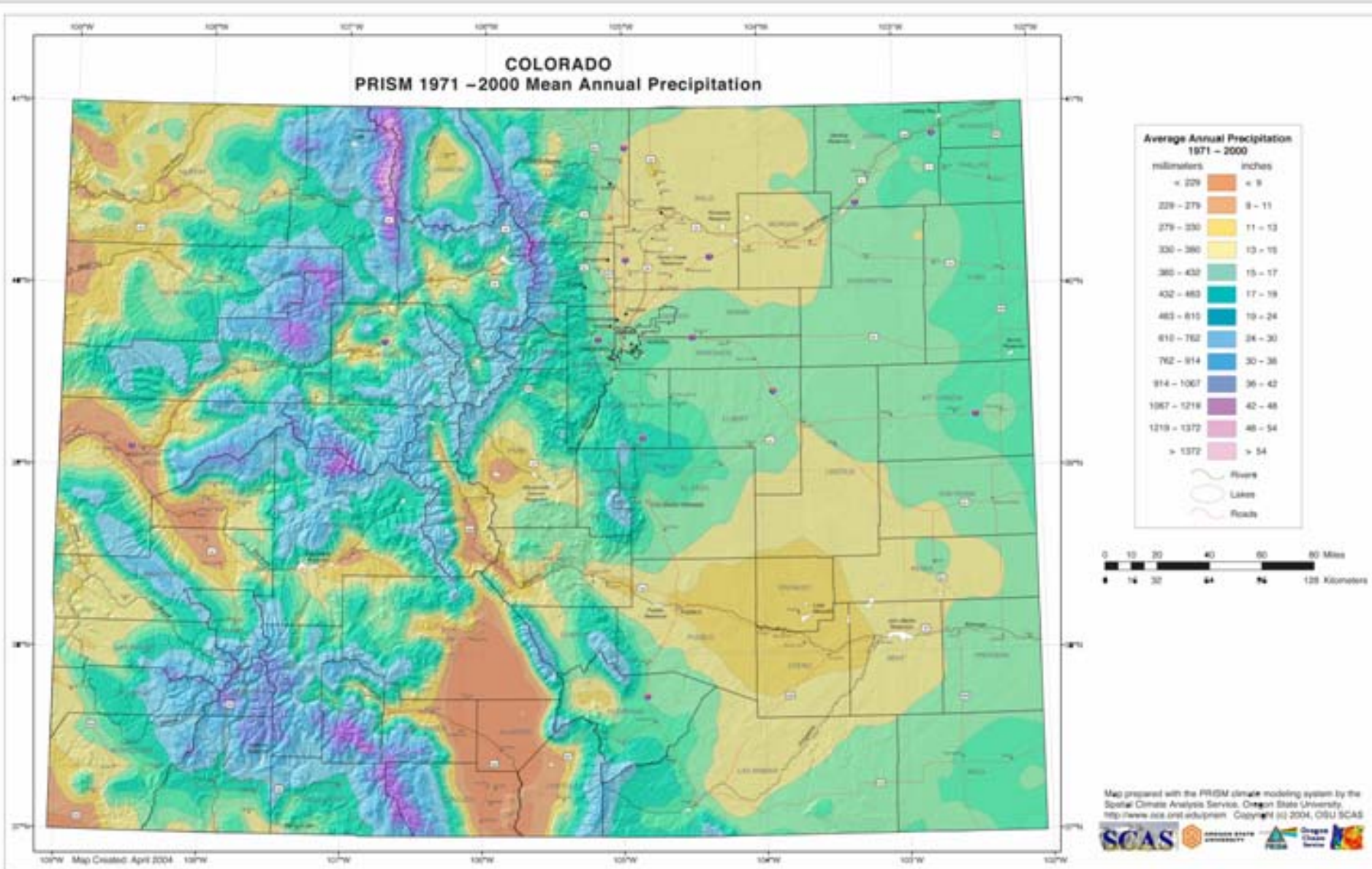
Fort Collins Annual Precipitation



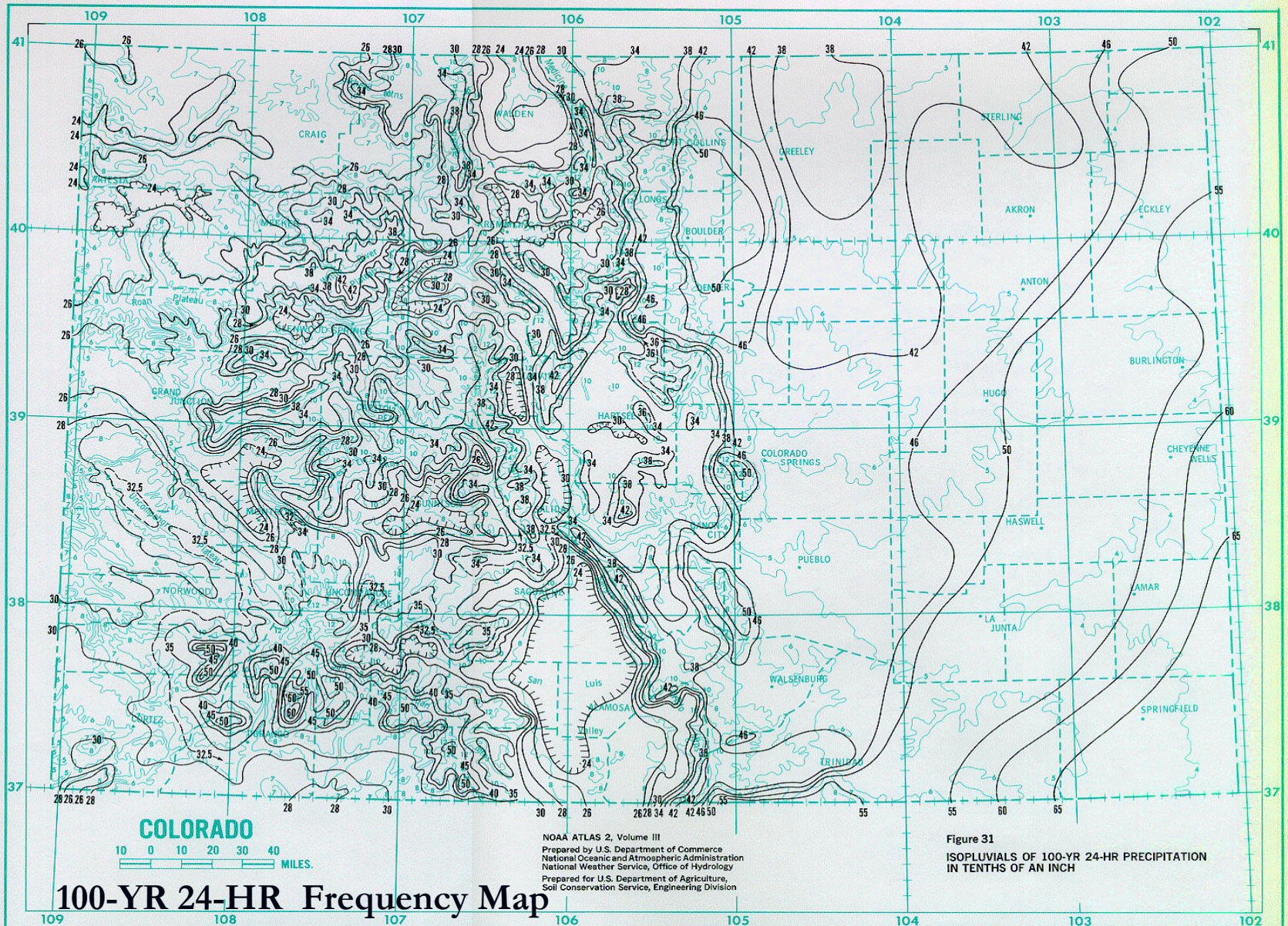
Precipitation Is The Most Variable and Critical Climate Element in Colorado



Colorado Average Annual Precipitation

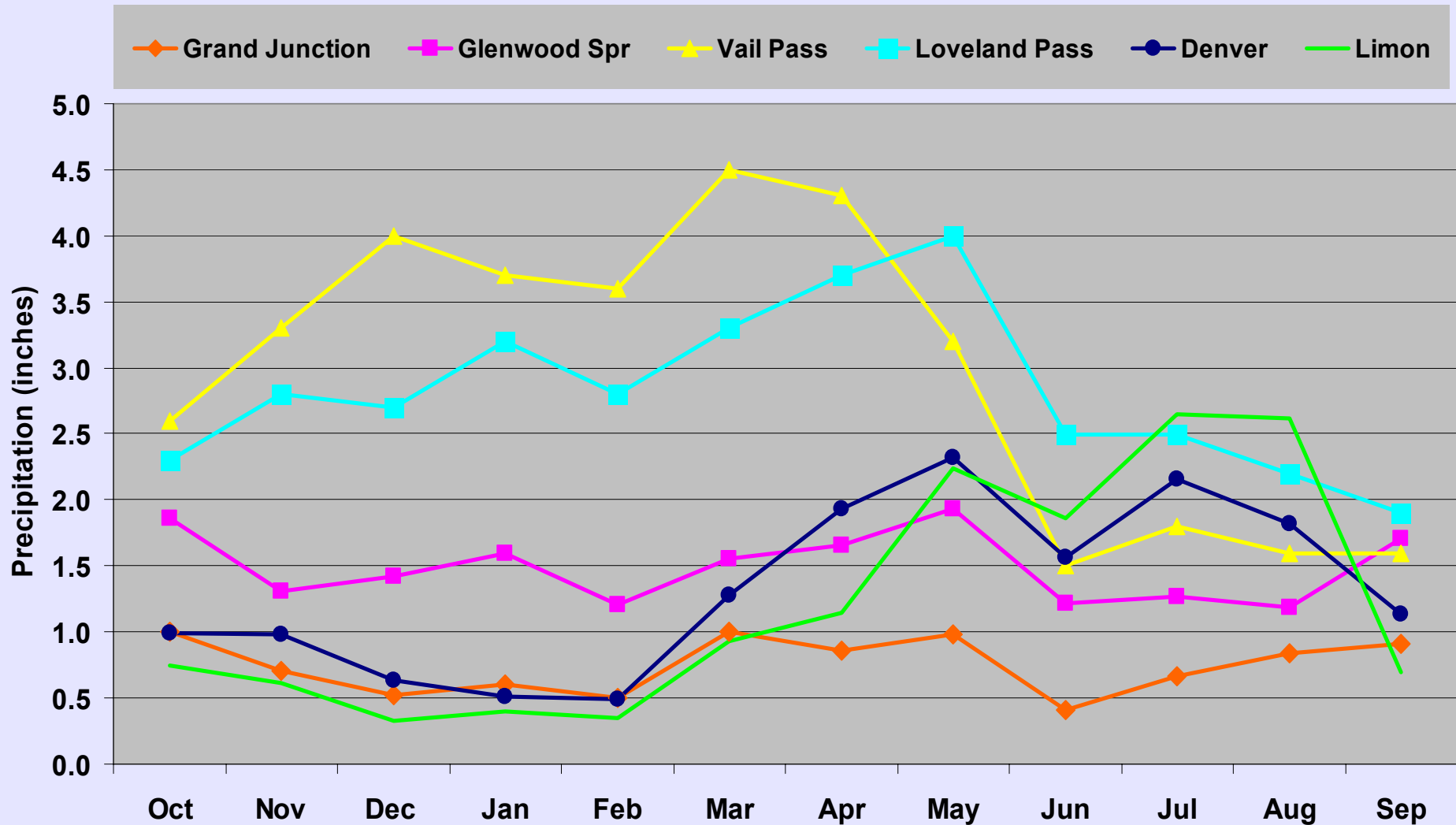


Rainfall Intensity and Duration



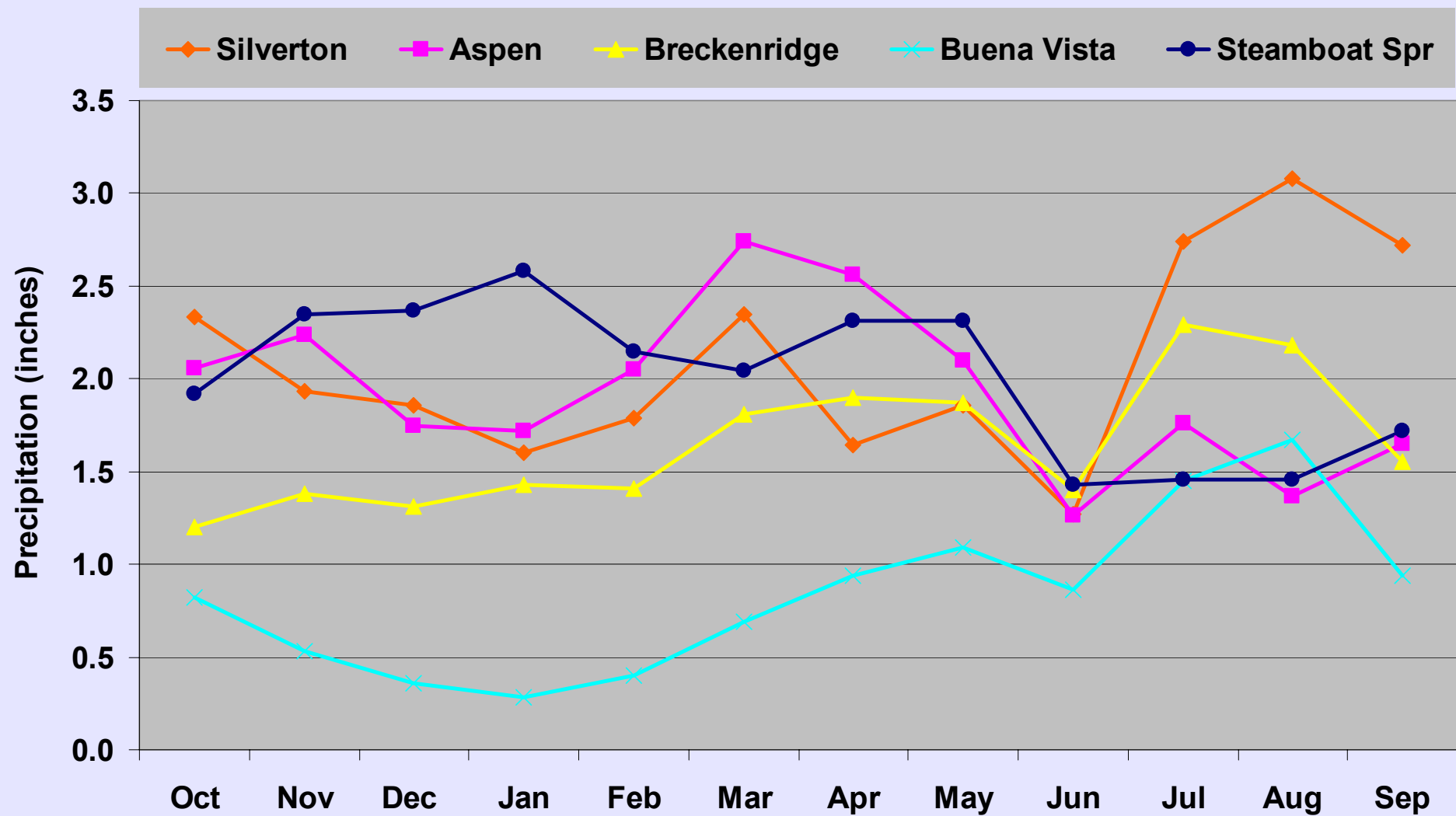
Average Monthly Precipitation – I-70 Transect

Water Year Average Precipitation for Selected Stations



Average Monthly Precipitation – Mountain Communities

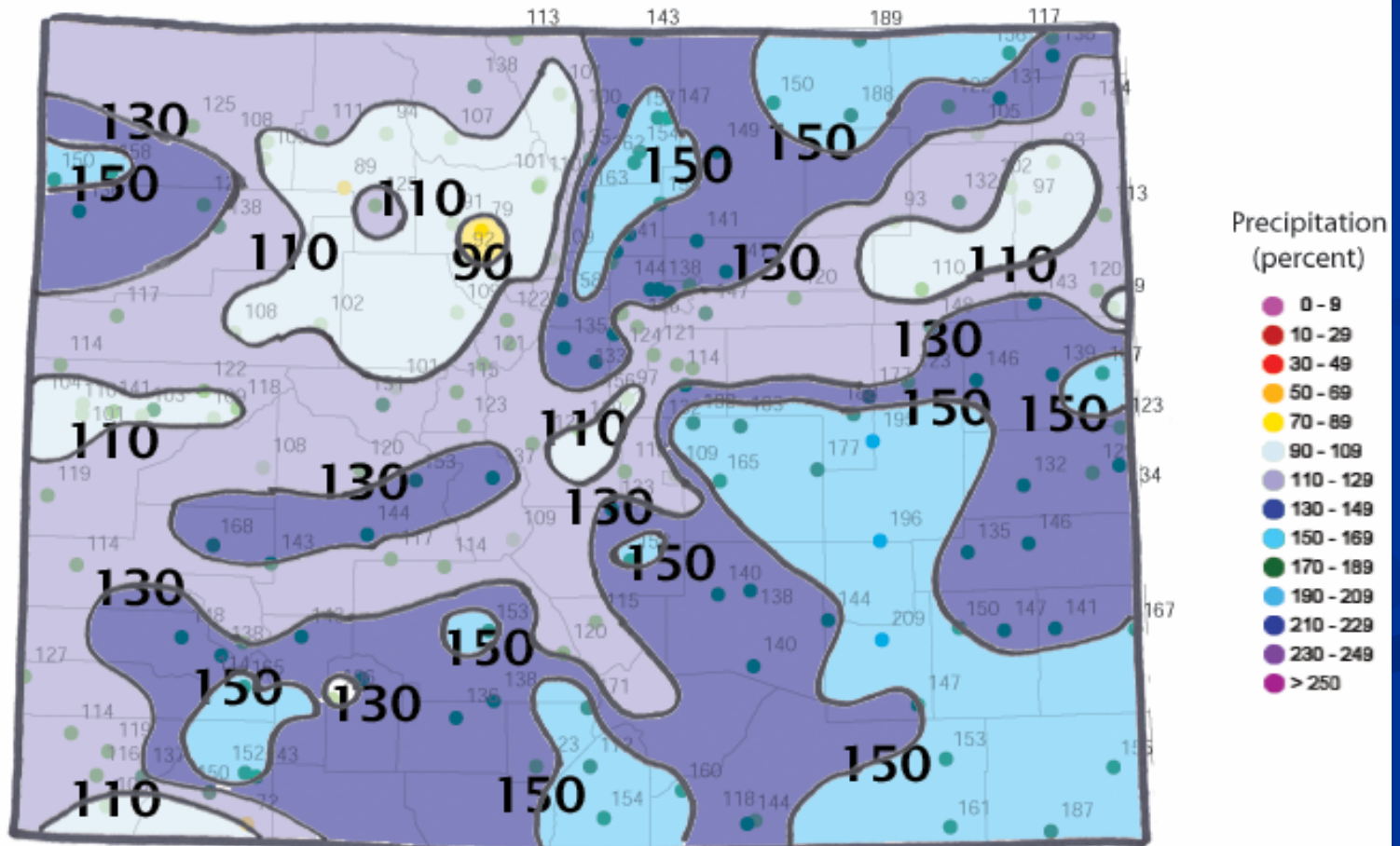
Water Year Average Precipitation for Selected Stations



1999 Water Year Precipitation

Water Year 1999
(Oct. 1998-Sept. 1999)

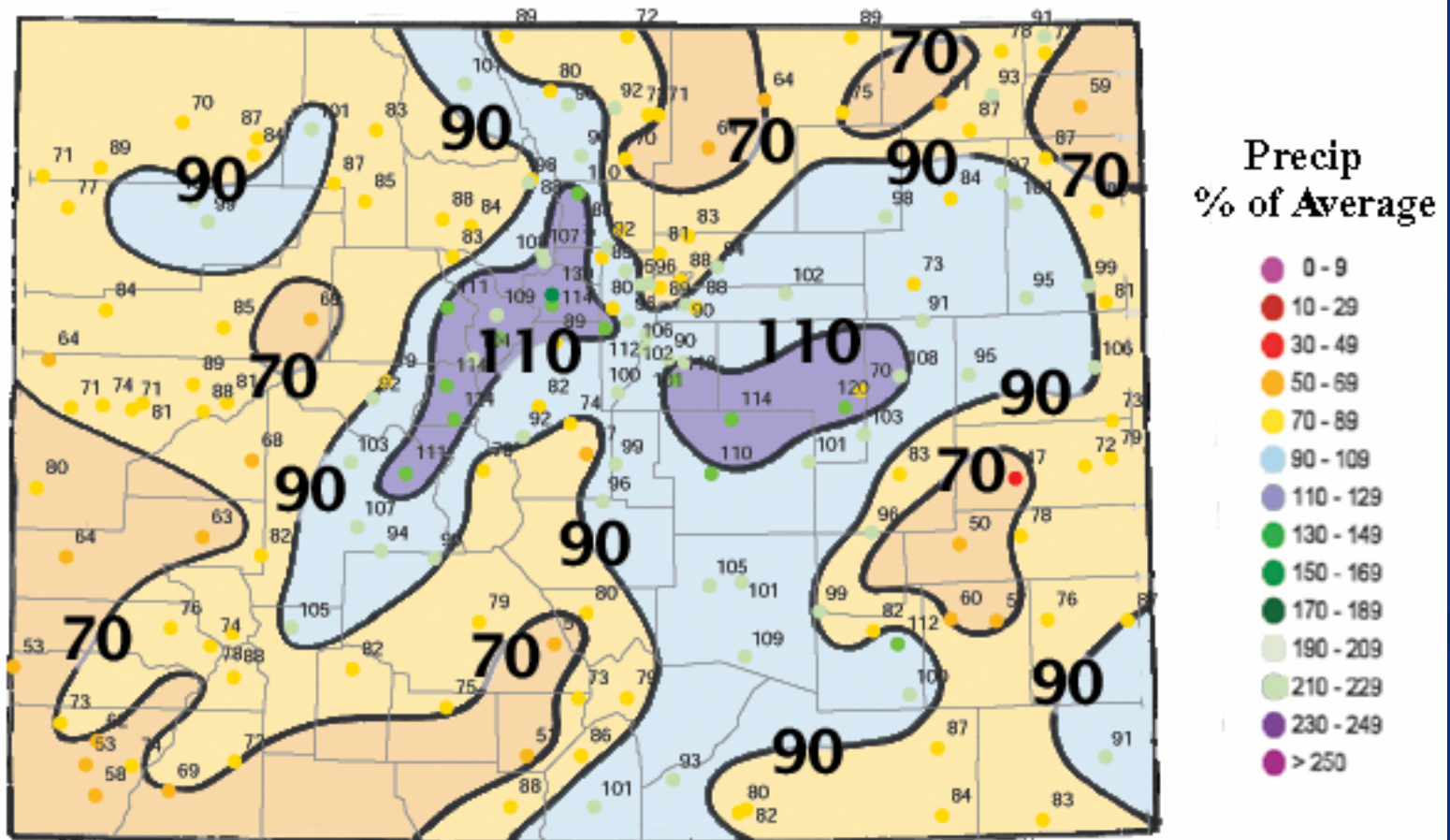
Precipitation Percent of Average for 1961-1990 Averages



2000 Water Year Precipitation

Water Year 2000
(Oct. 1999 - Sept. 2000)

Precipitation Percent of Average for 1961-1990 Averages

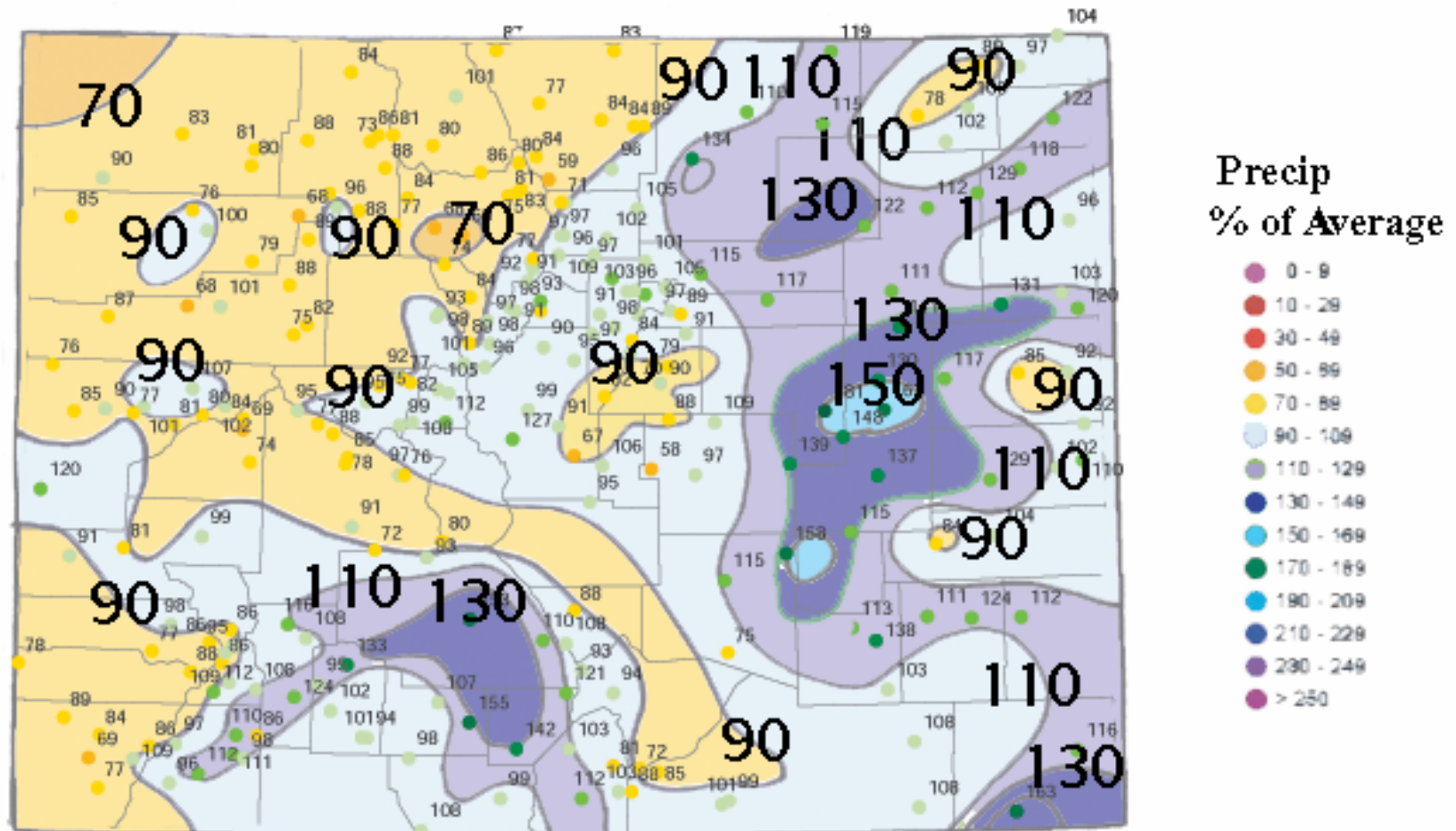


2001 Water Year Precipitation

Water Year 2001

(Oct. 2000 - Sept. 2001)

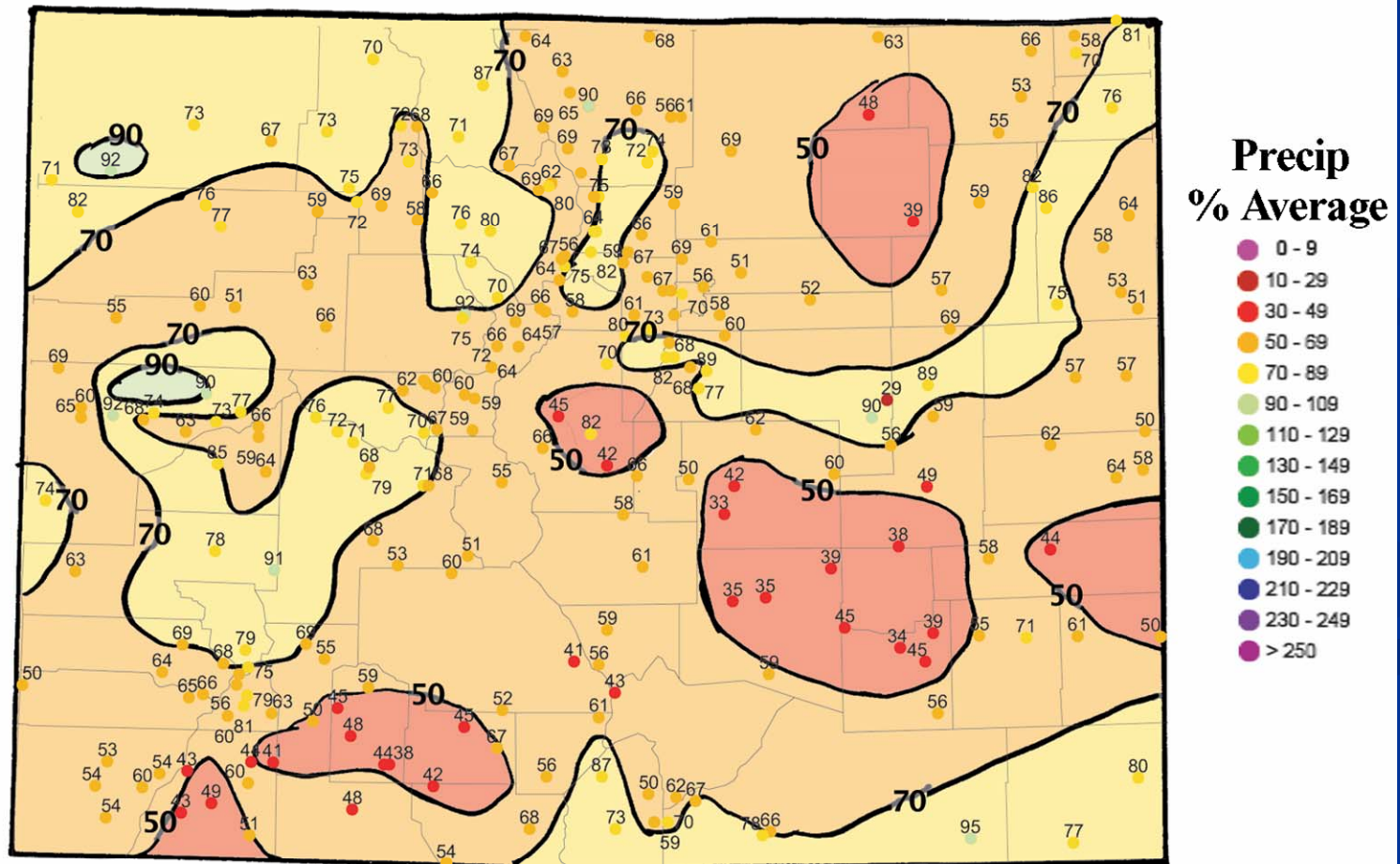
Precipitation Percent of Average for 1961-1990 Averages



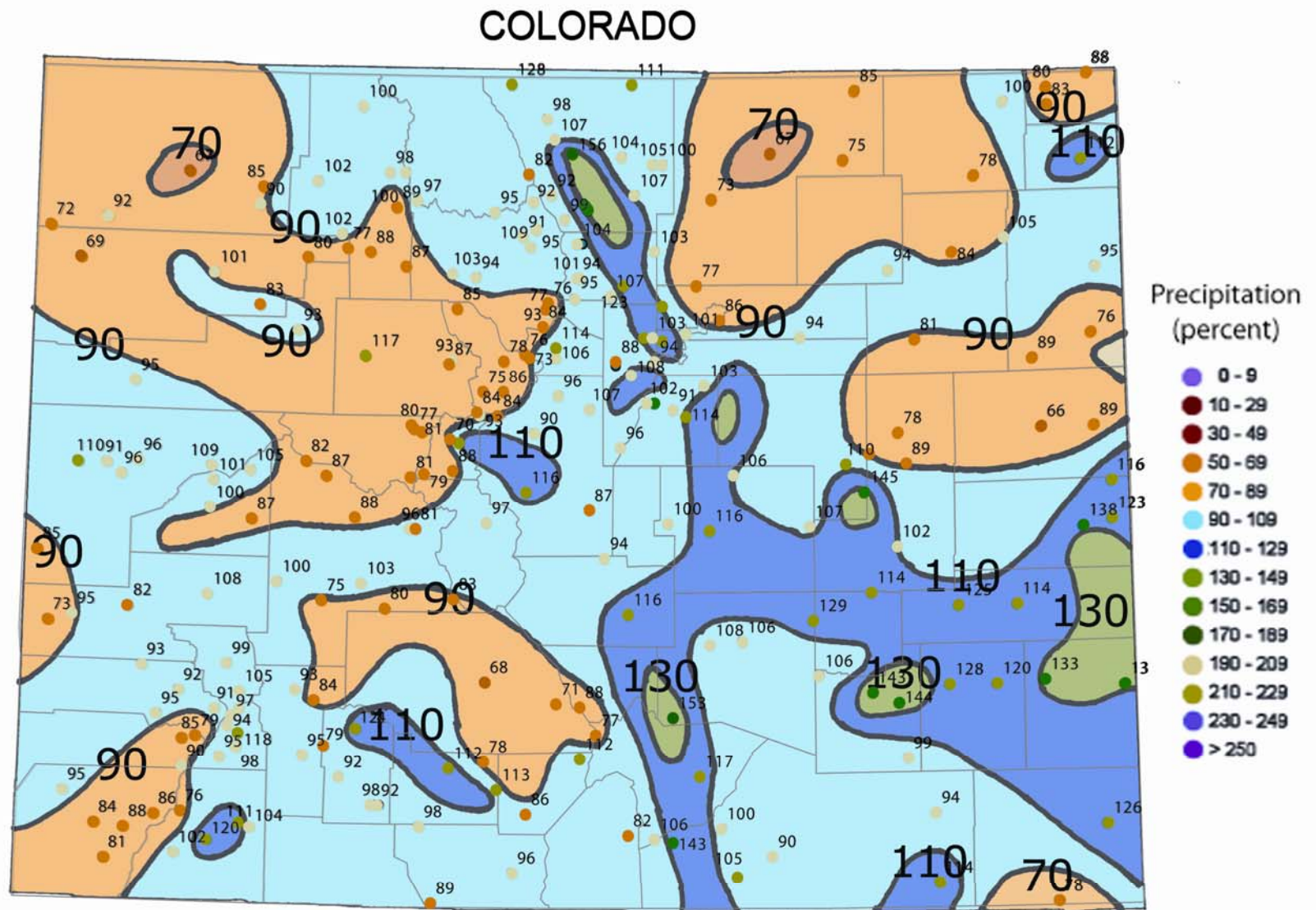
2002 Water Year Precipitation

Water Year 2002
(Oct. 2001 - Sept. 2002)

Precipitation Percent of Average for 1961-1990 Averages

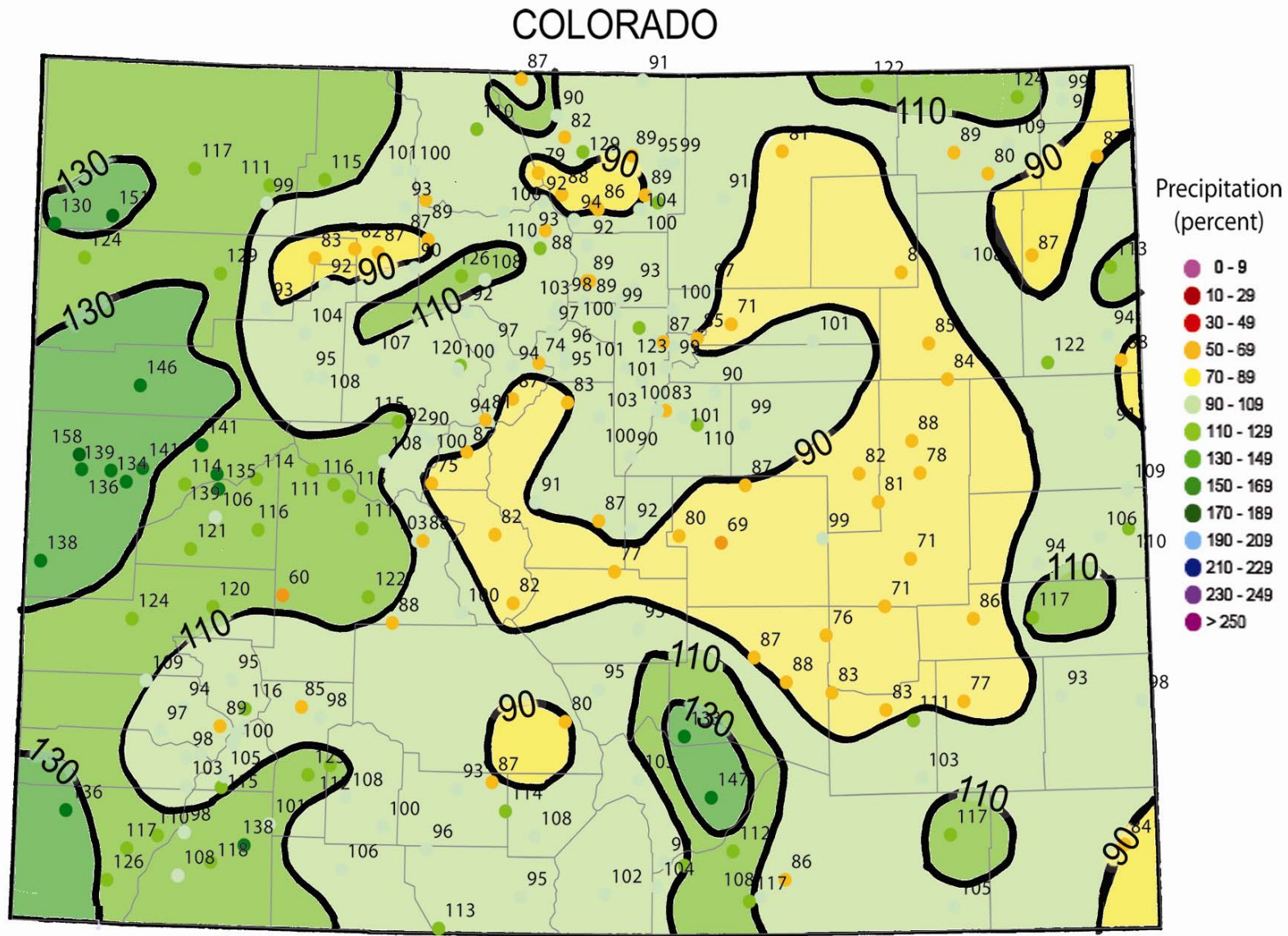


2004 Water Year Precipitation



Water Year 2004 (October 2003 through September 2004) precipitation as a percent of the 1971-2000 average.

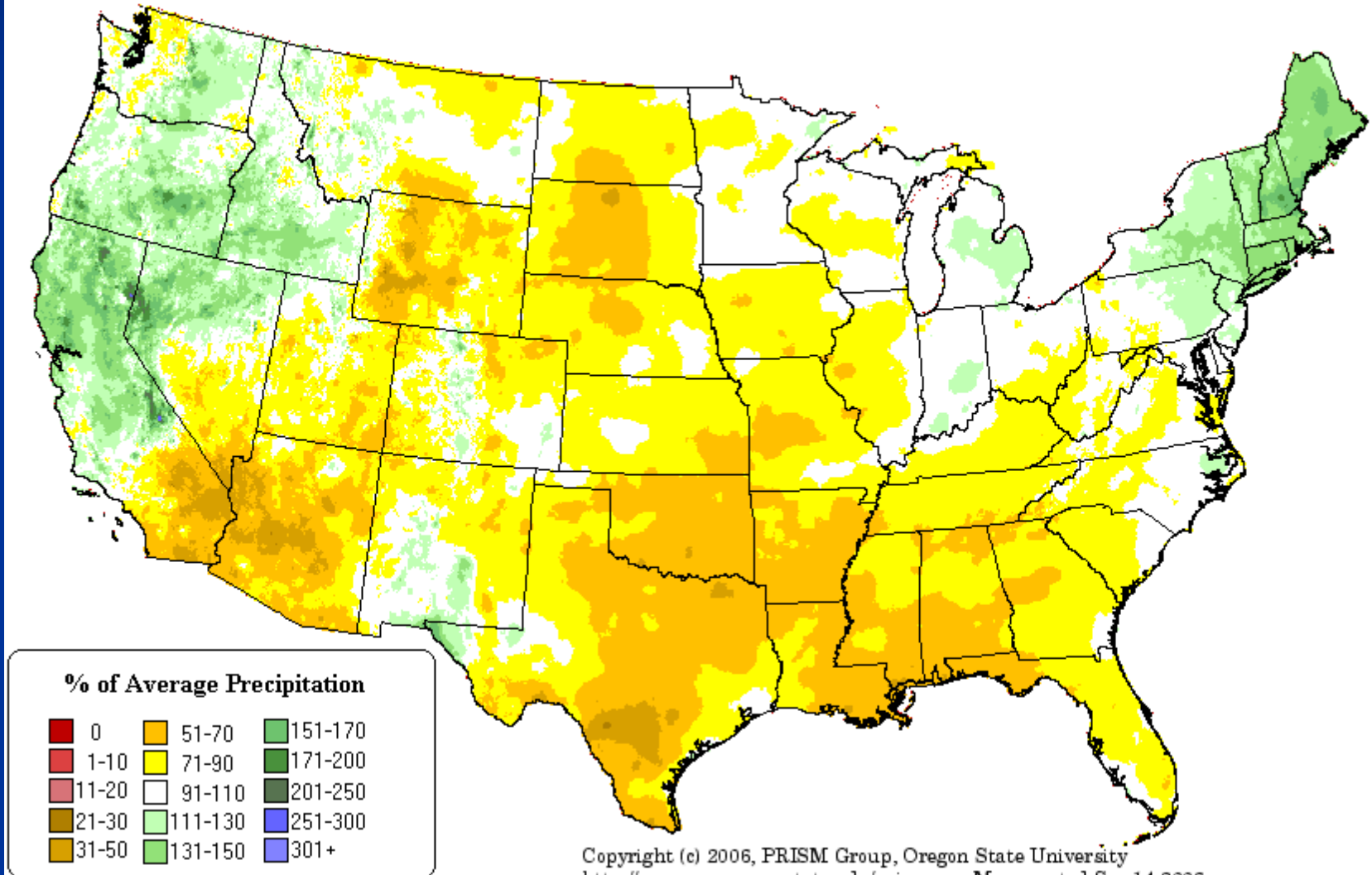
2005 Water Year Precipitation



Water Year 2005 (Oct 04 - Sep 05) precipitation as a percent of the 1971-2000 average.

2006 Water Year Through August

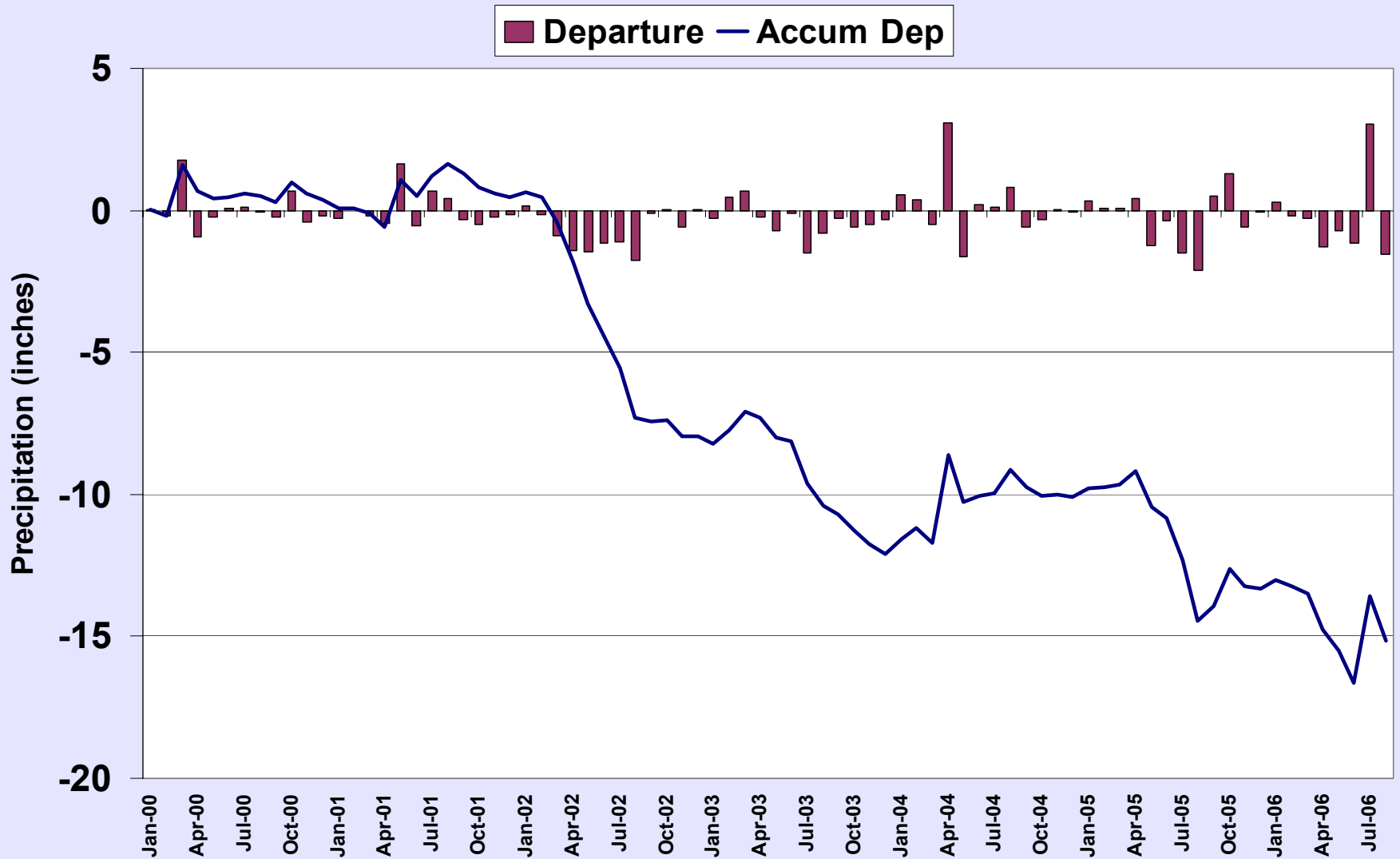
11-month Percent of Average Precipitation: Aug 2006
Provisional Data



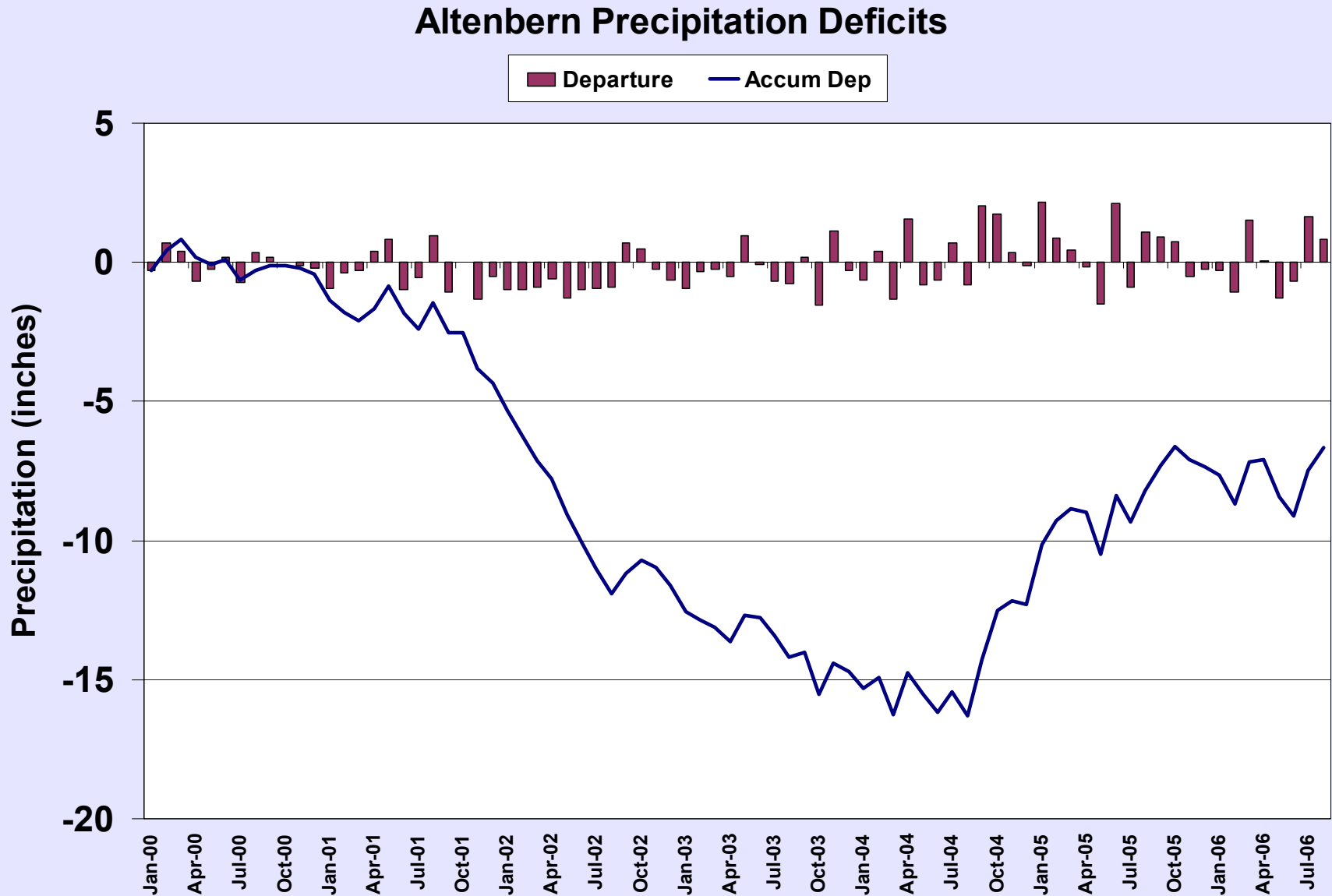
Copyright (c) 2006, PRISM Group, Oregon State University
<http://www.ocs.oregonstate.edu/prism> - Map created Sep 14 2006

Pueblo Reservoir Precipitation Deficits

Pueblo Reservoir Precipitation Deficits



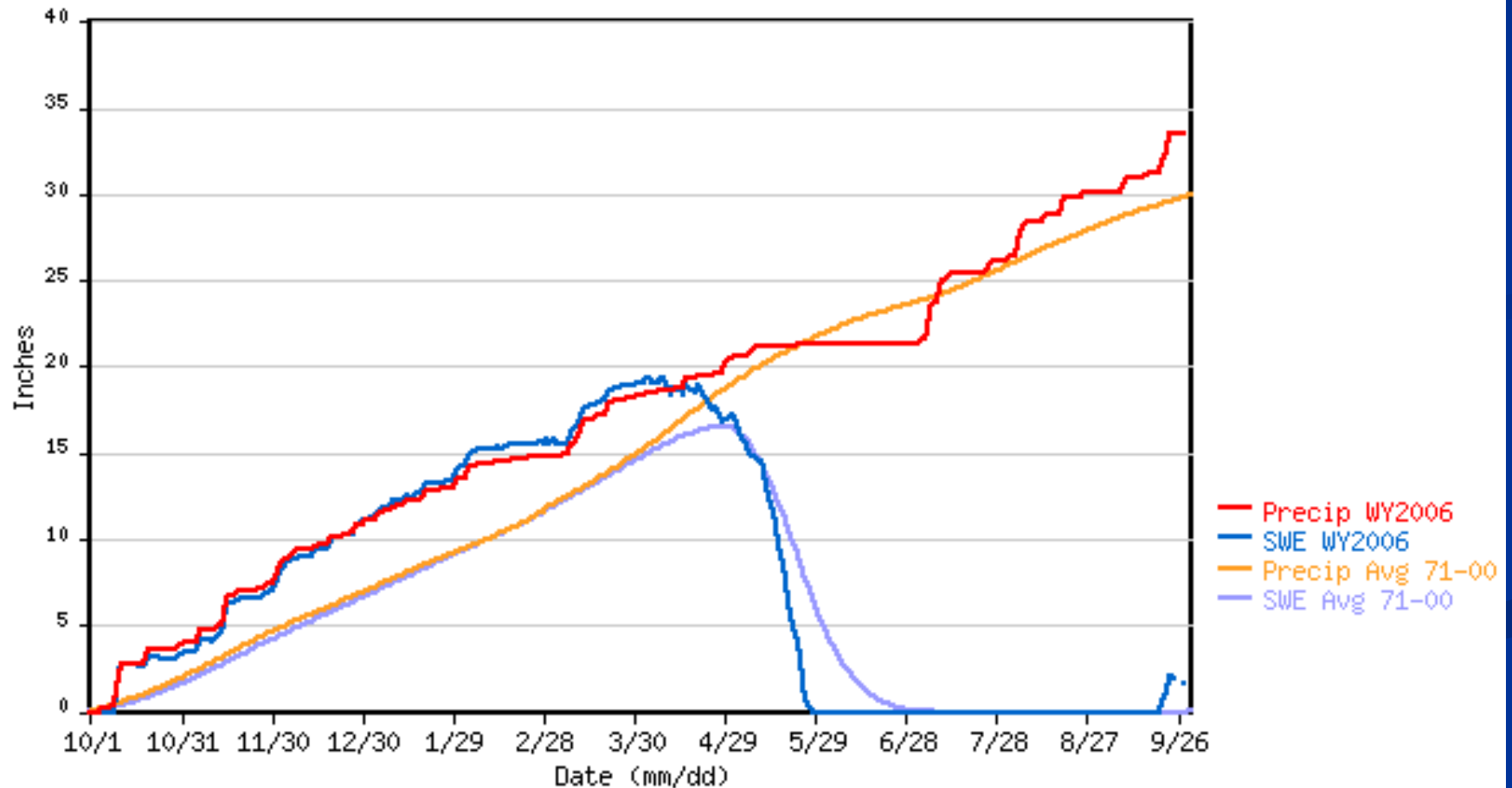
Altenbern Precipitation Deficits



Hoosier Pass WY2006 Precipitation

HOOSIER PASS SNOTEL for Water Year 2006

*** Provisional Data, Subject to Change ***

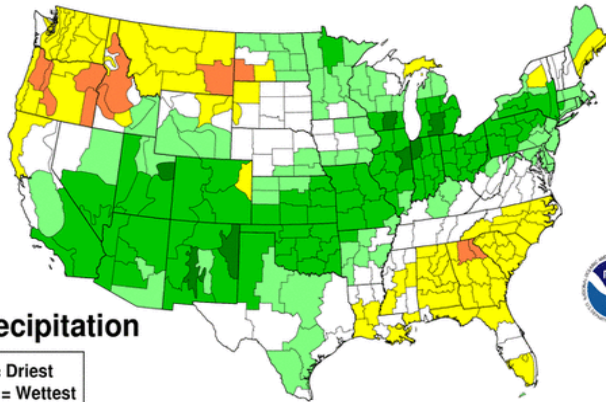


Common Theme from Monitoring –

“Inadequate Spatial Density of Rain and Snow Data”

Jan 2005 Divisional Ranks

National Climatic Data Center/NESDIS/NOAA



2005 Precipitation

Totals
in Inches



How can we gather more data without breaking the bank??



Photo by Henry Reges

Community Collaborative Rain, Hail and Snow Network



The Origin of CoCoRaHS

The Fort Collins Flood of July 28, 1997



What is CoCoRaHS?

CoCoRaHS is a unique, non-profit community based network of volunteers of all ages and backgrounds working together to measure and map precipitation (rain, hail and snow).

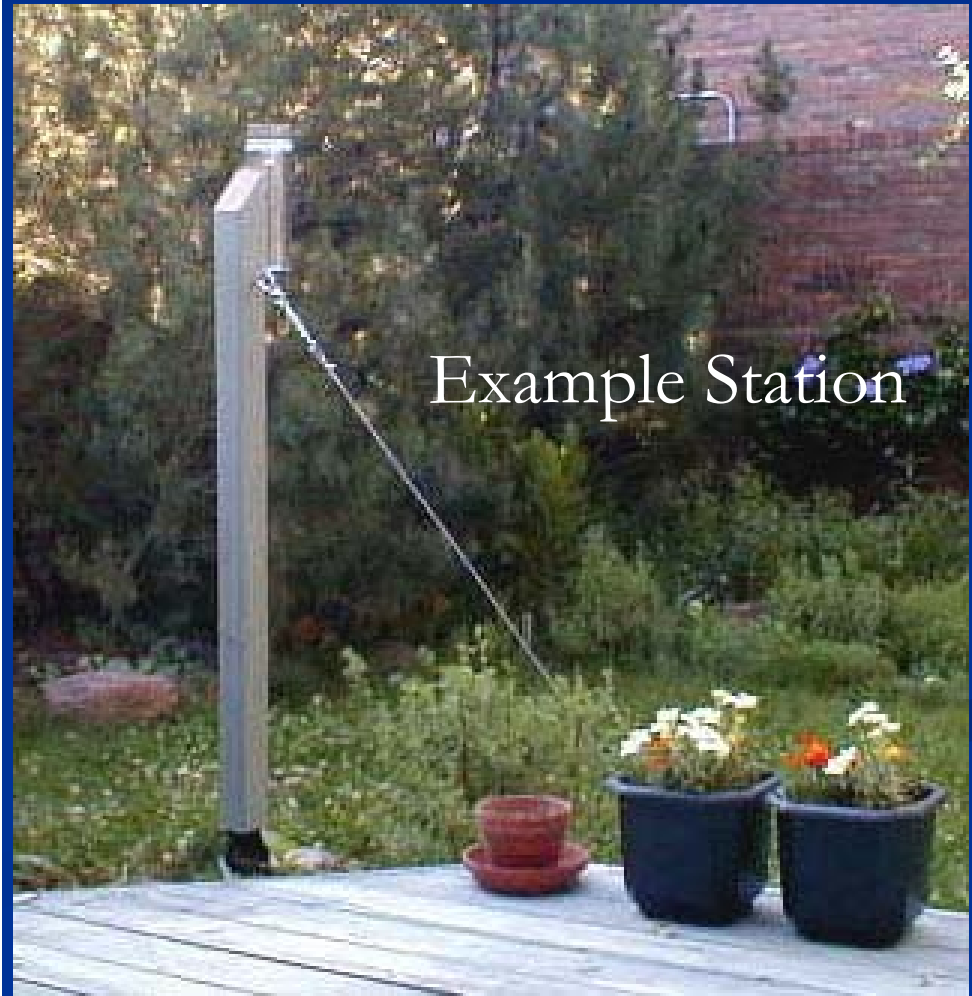


Photo by Henry Reges

CoCoRaHS: Simple tools to study rain

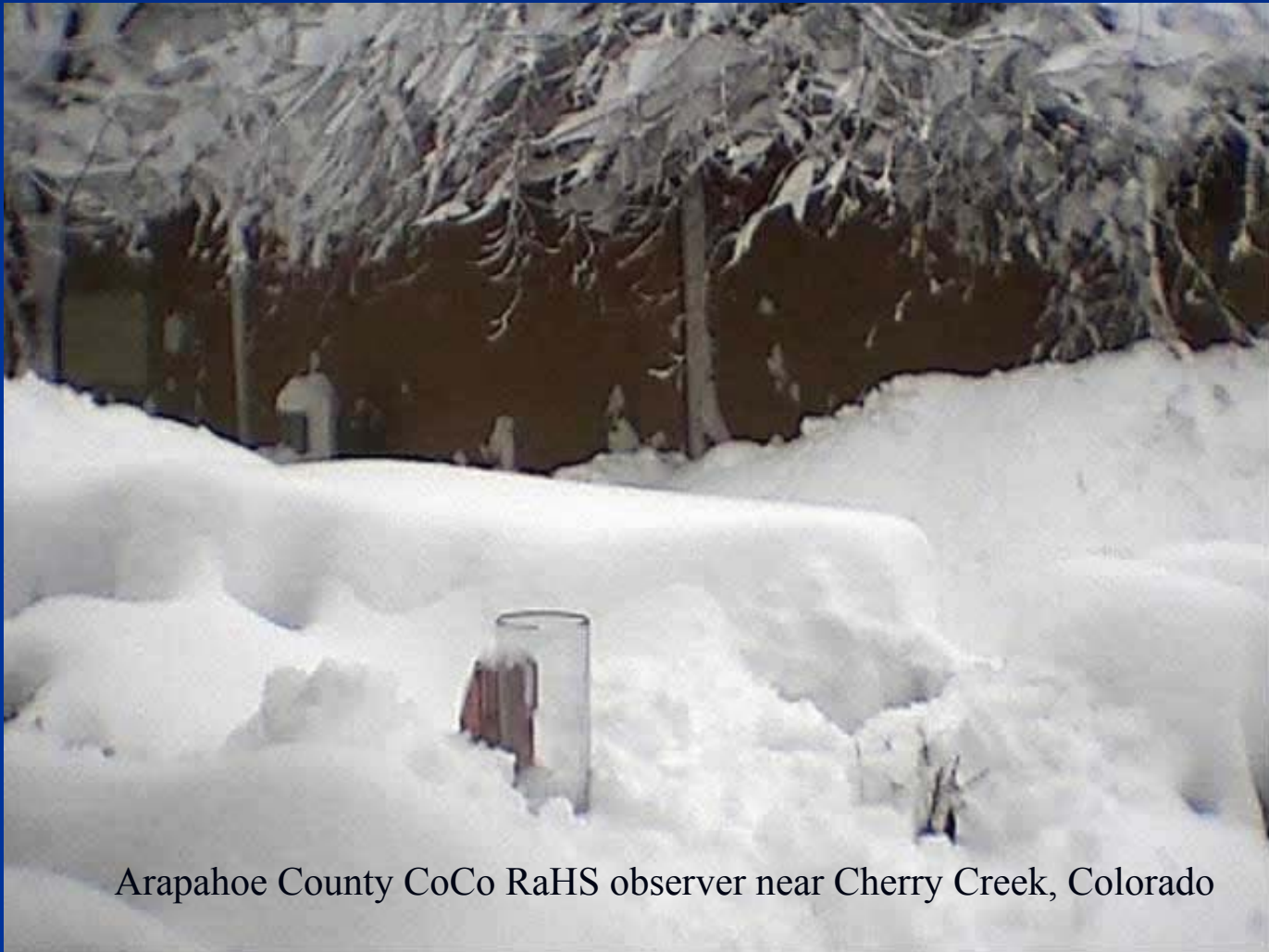


Rain Gauge



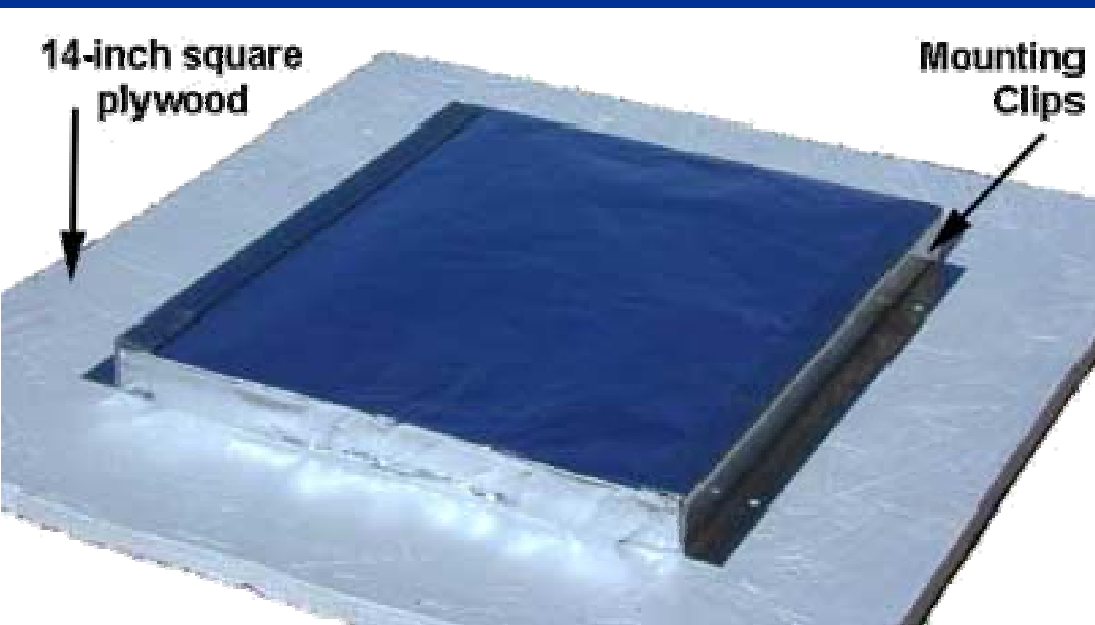
Example Station

CoCo RaHS Gauge March 2003 Snowstorm



Arapahoe County CoCo RaHS observer near Cherry Creek, Colorado

CoCoRaHS: Simple Tools to Study Hail



Hail Pad



Damaged Hail Pad

Example Hail Pad Stands



Photograph by Gerry Pearson

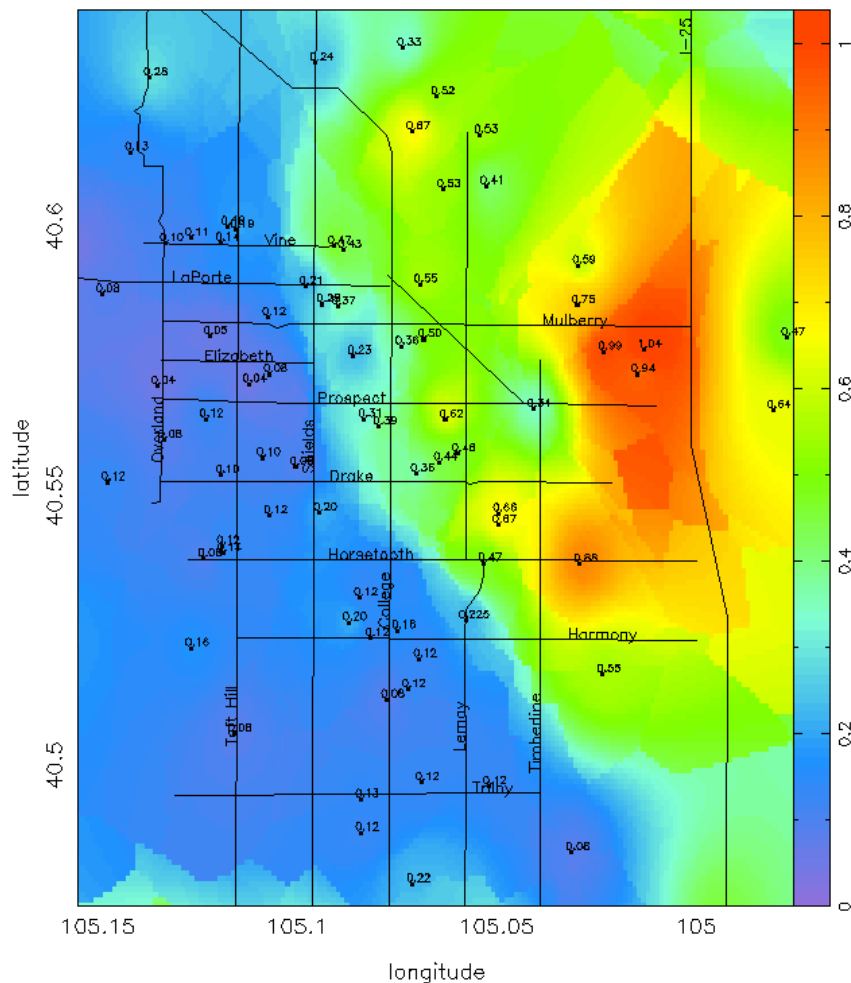
CoCoRaHS – Supplementing NWS Cooperative Program to Improve Precipitation Measurements



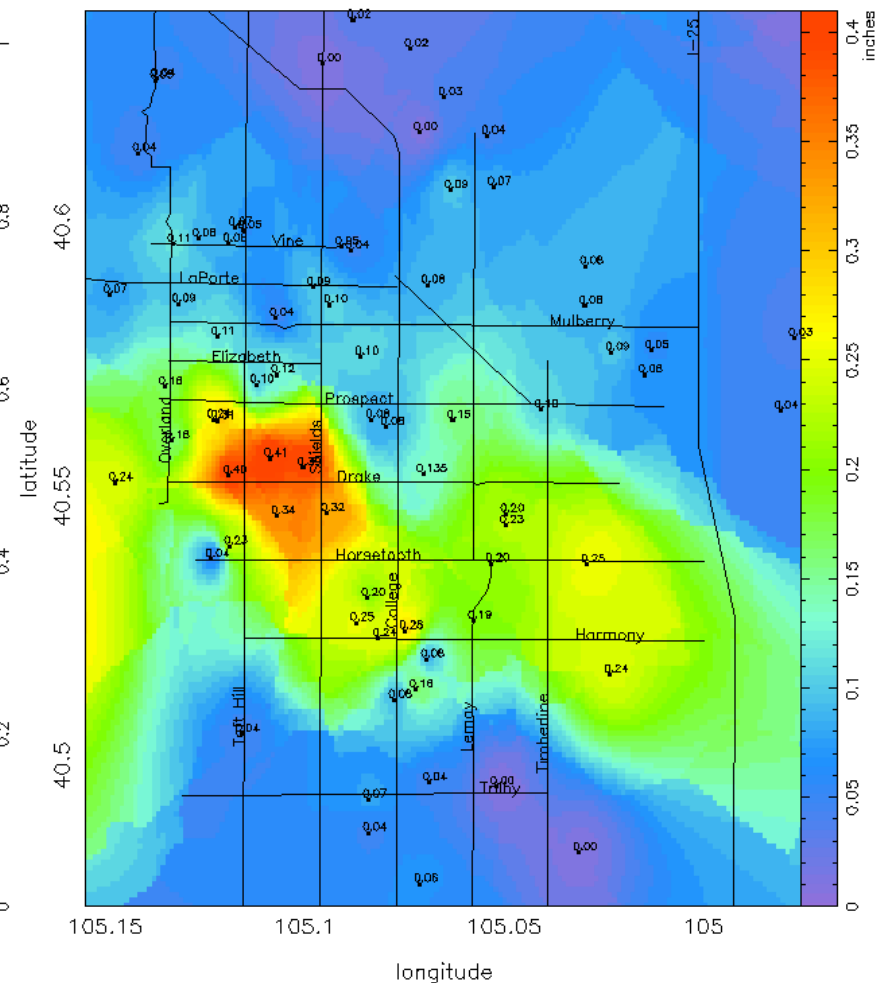
Photo by Henry Reges

Fort Collins Daily Rainfall Examples

Fort Collins Precipitation Map
For the 24 hour period ending ~7:00 am on 07/13/2001

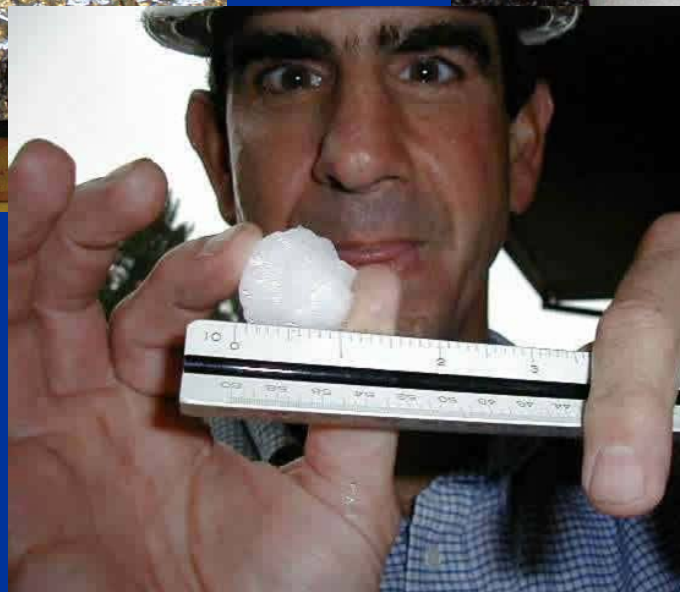
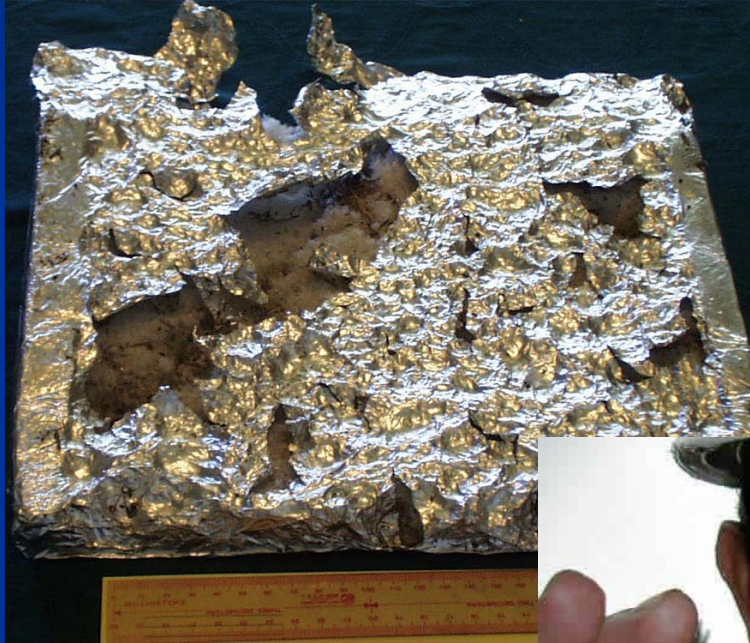


Fort Collins Precipitation Map
For the 24 hour period ending ~7:00 am on 07/27/2001



Colorado Hailstorm

July 10, 2002, Parker, CO



Expanded Hail Information from Web Site



Date: 7/3/2002
Hail Began: 2:56pm
Hail Lasted: 10
minutes

Station Number:
560
Name: Greeley 4.3
NNW
County: Weld

Common Stones:
Pea
Largest Stones:
Marble
Smallest Stones:
Pea

Hailfall was:
Intermittently

Hailstones were:
Hard, Mixed

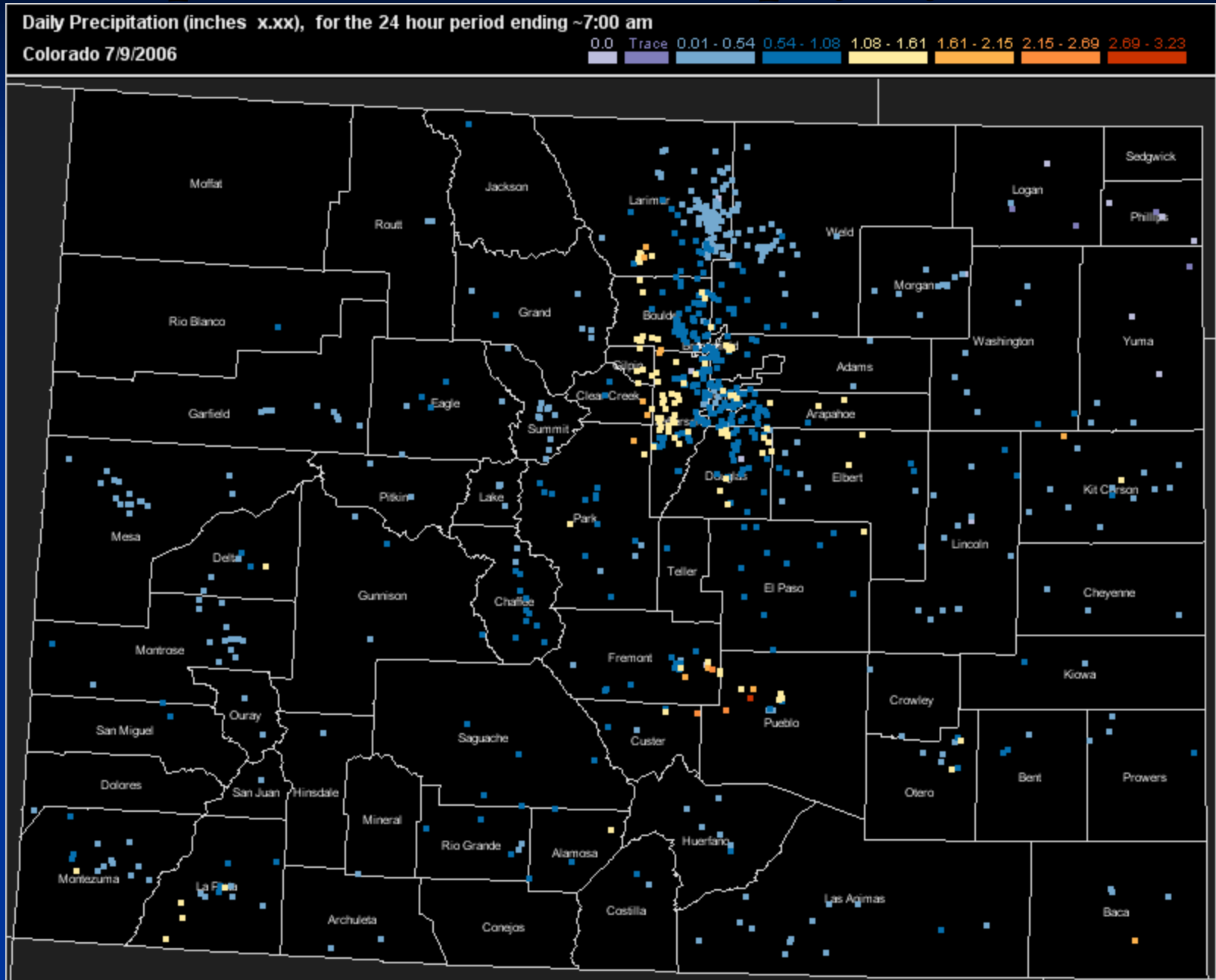
Hail started: same
time as rain

Average distance
between stones: 1/16
inches

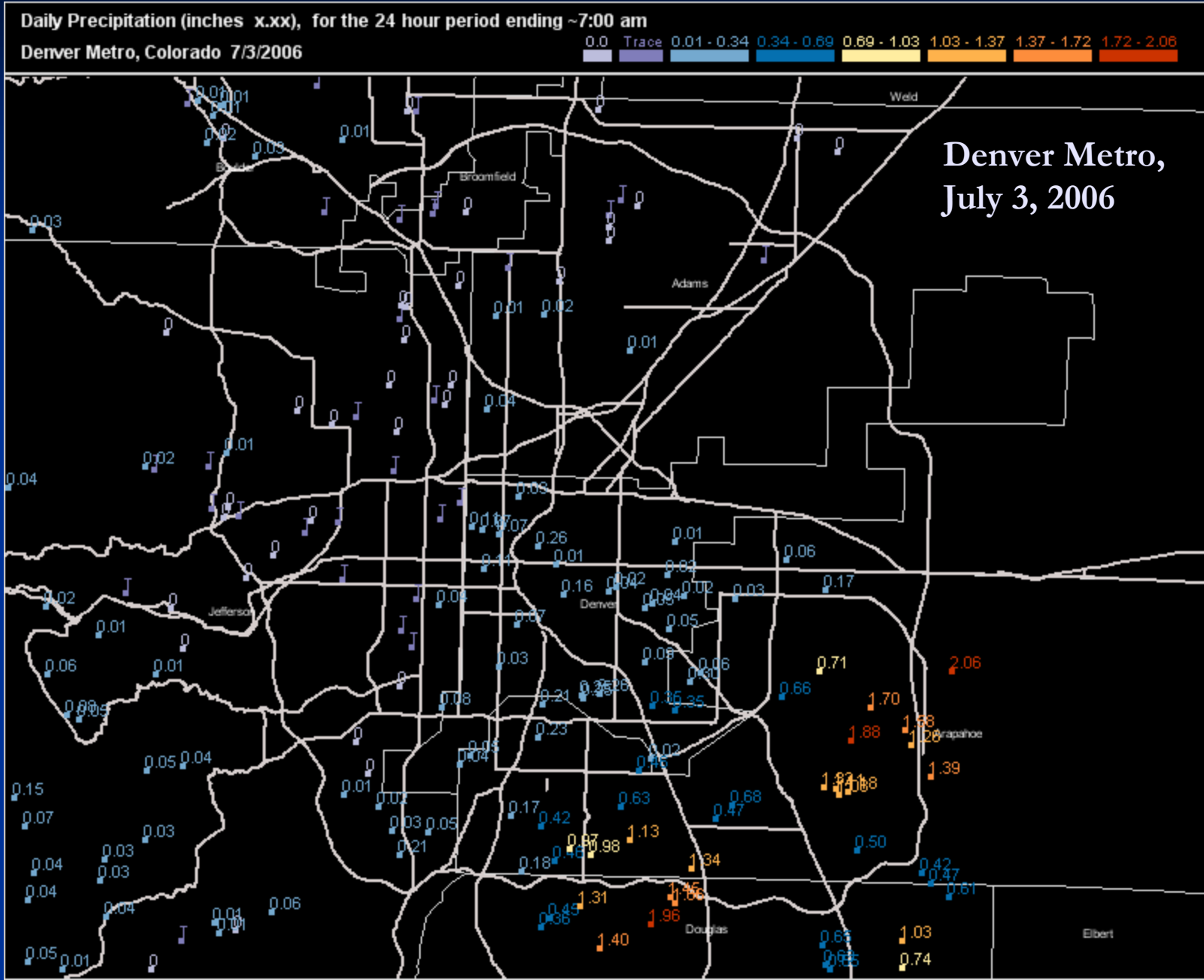
Depth of hail:

Comments: None

Example CoCoRaHS Map, July 9, 2006



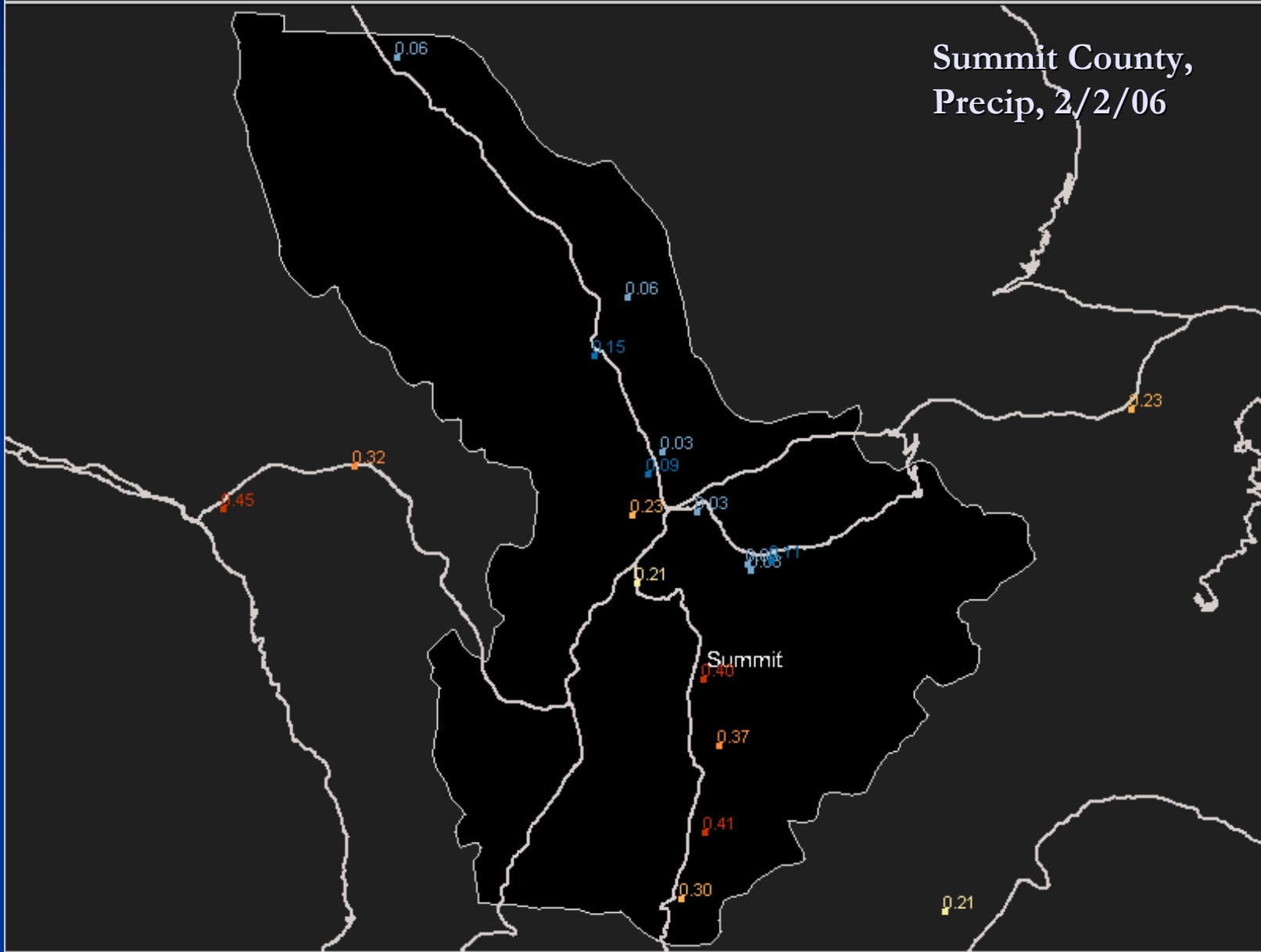
Example CoCoRaHS Map, July 3, 2006



Example CoCoRaHS Map, Feb 2, 2006

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
Summit County, Colorado 2/2/2006

0.0	Trace	0.01 - 0.08	0.08 - 0.15	0.15 - 0.23	0.23 - 0.30	0.30 - 0.38	0.38 - 0.45
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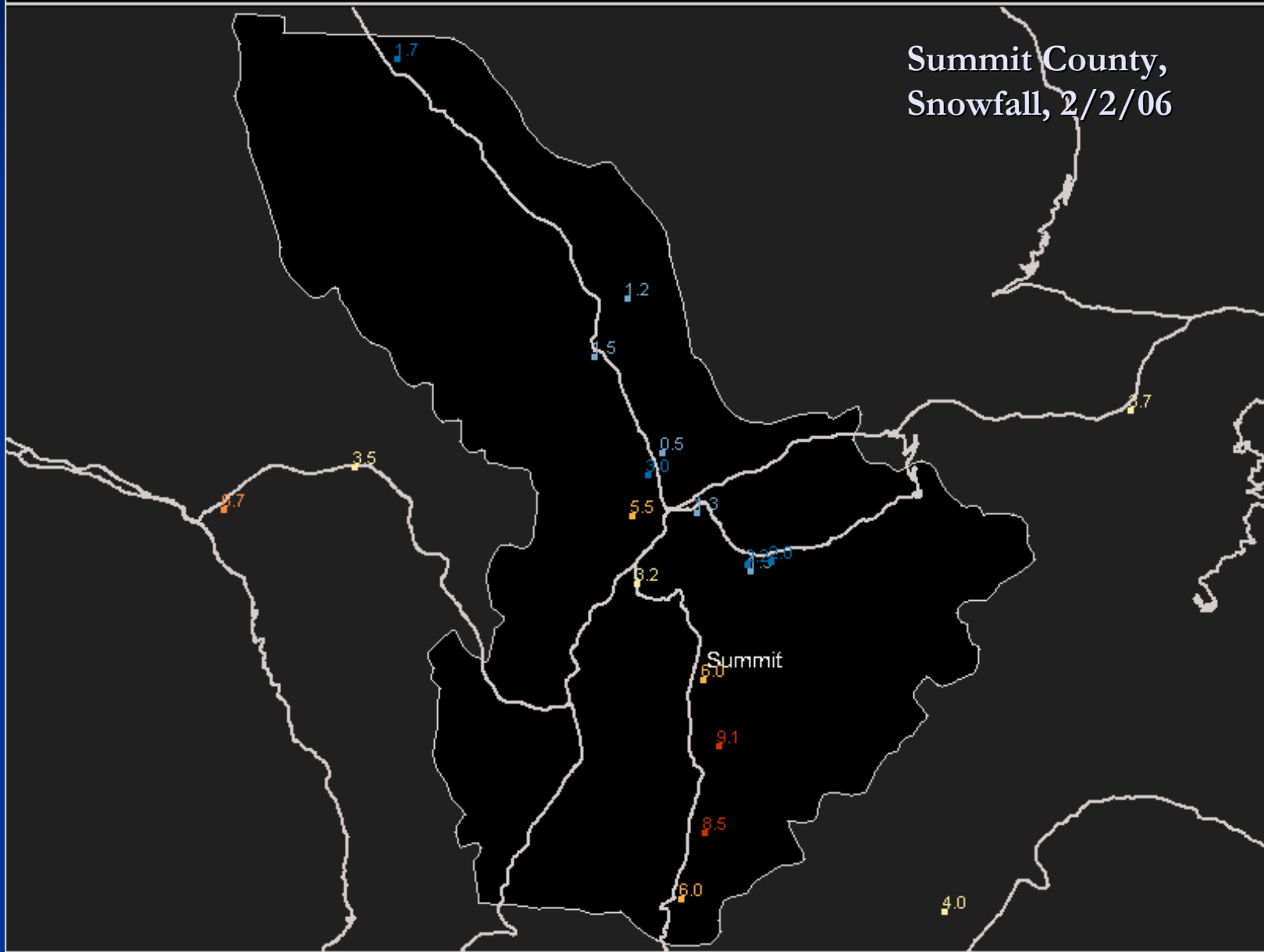
Example CoCoRaHS Map, Feb 2, 2006

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

Summit County, Colorado 2/2/2006



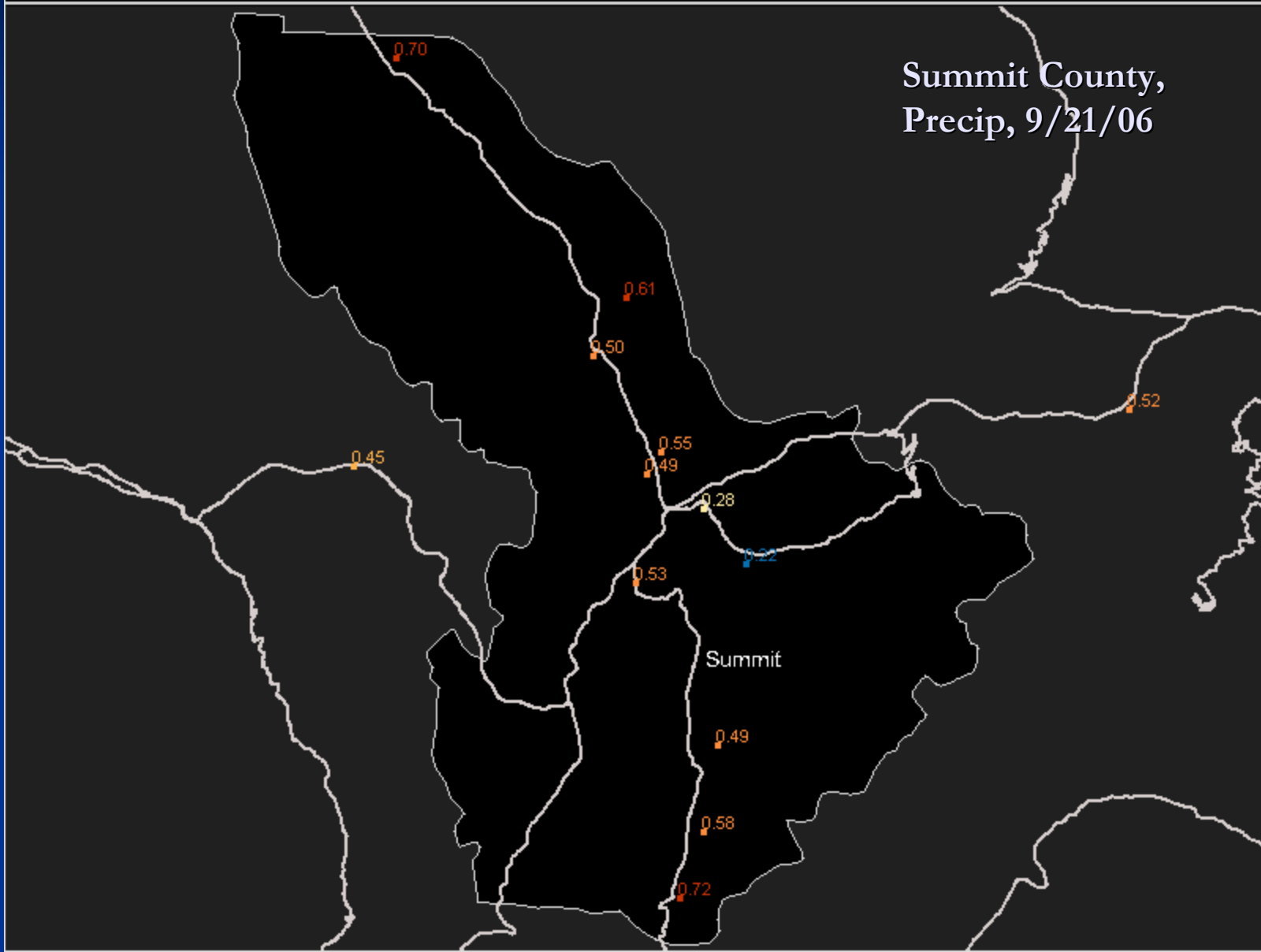
Summit County,
Snowfall, 2/2/06



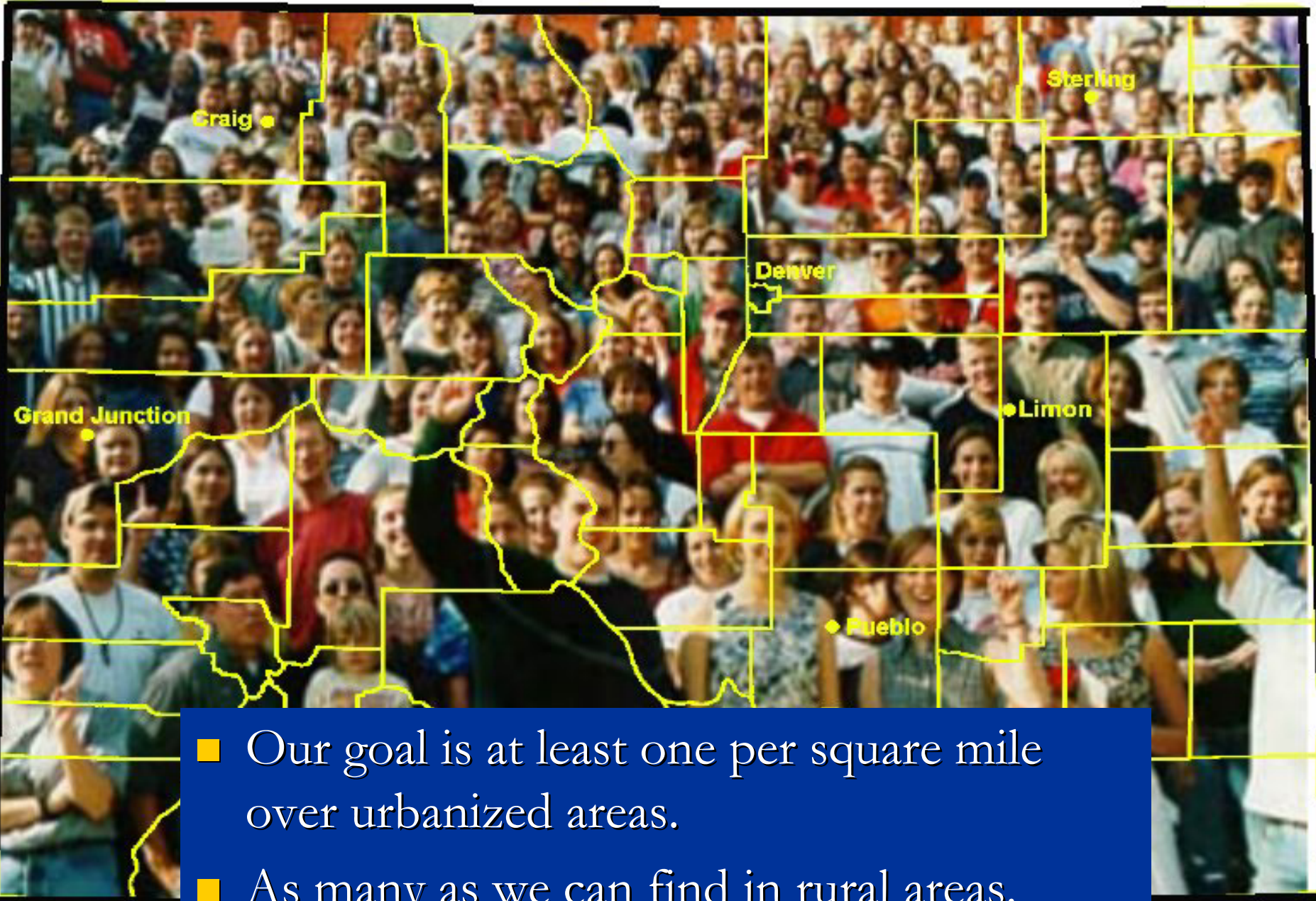
Example CoCoRaHS Map, Sep 21, 2006

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

Summit County, Colorado 9/21/2006

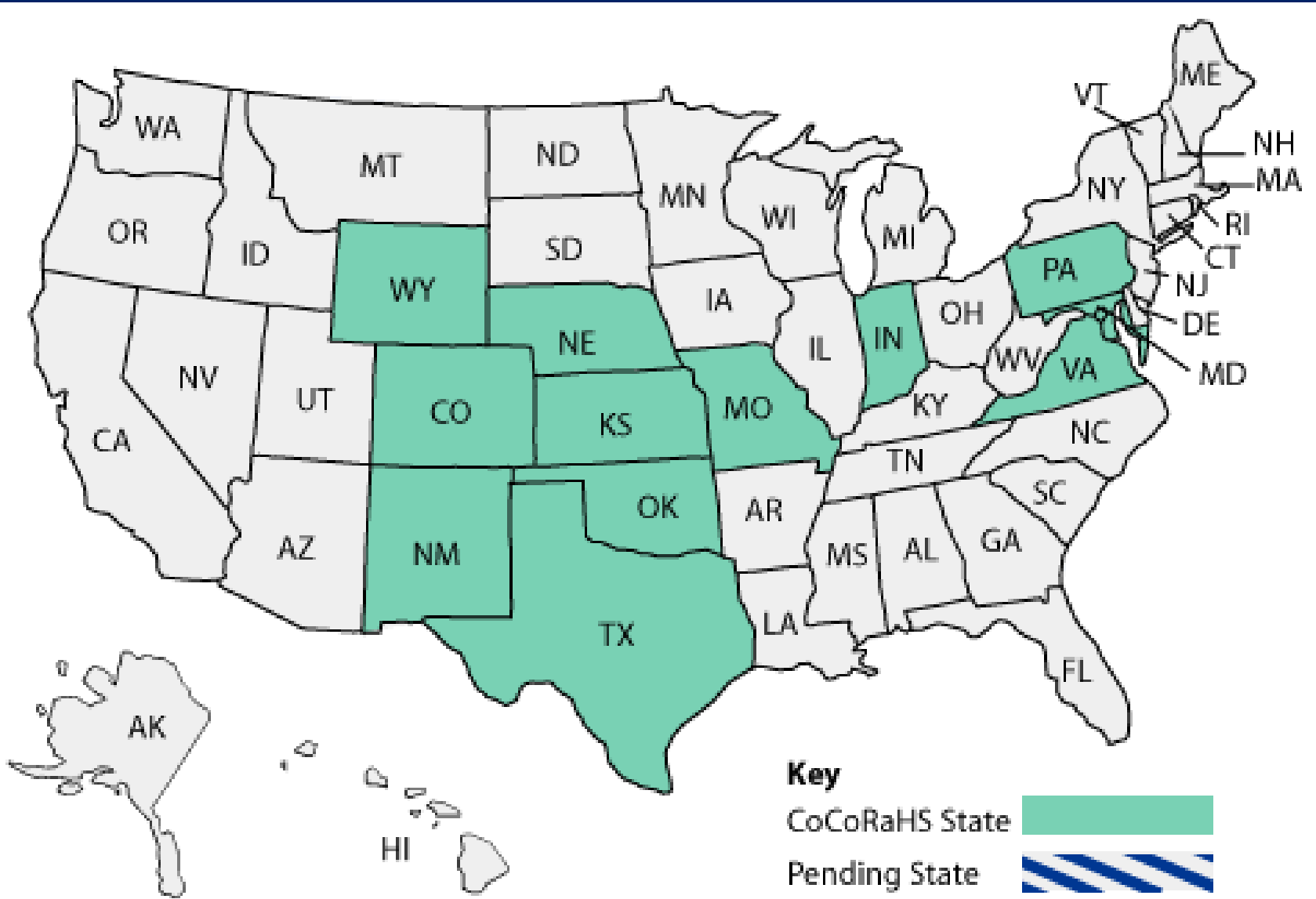


How many volunteers do we need?



- Our goal is at least one per square mile over urbanized areas.
- As many as we can find in rural areas.

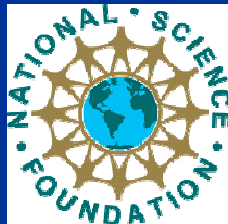
Participating CoCoRaHS States



For More Information, Visit the CoCoRaHS Web Site



<http://www.cocorahs.org>



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

Colorado Climate Center

Data and Power Point Presentations available for downloading

<http://ccc.atmos.colostate.edu>

Colorado
State
University

Knowledge to Go Places

