

# Drought or Not?

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Colorado State University

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

Presented at Horticultural Art Society meeting,  
November 19, 2004, Colorado Springs, Colorado  
Prepared by Odie Bliss



# Our climate is great --



<http://www.lensflare.com/~doubt/pics/garden/>

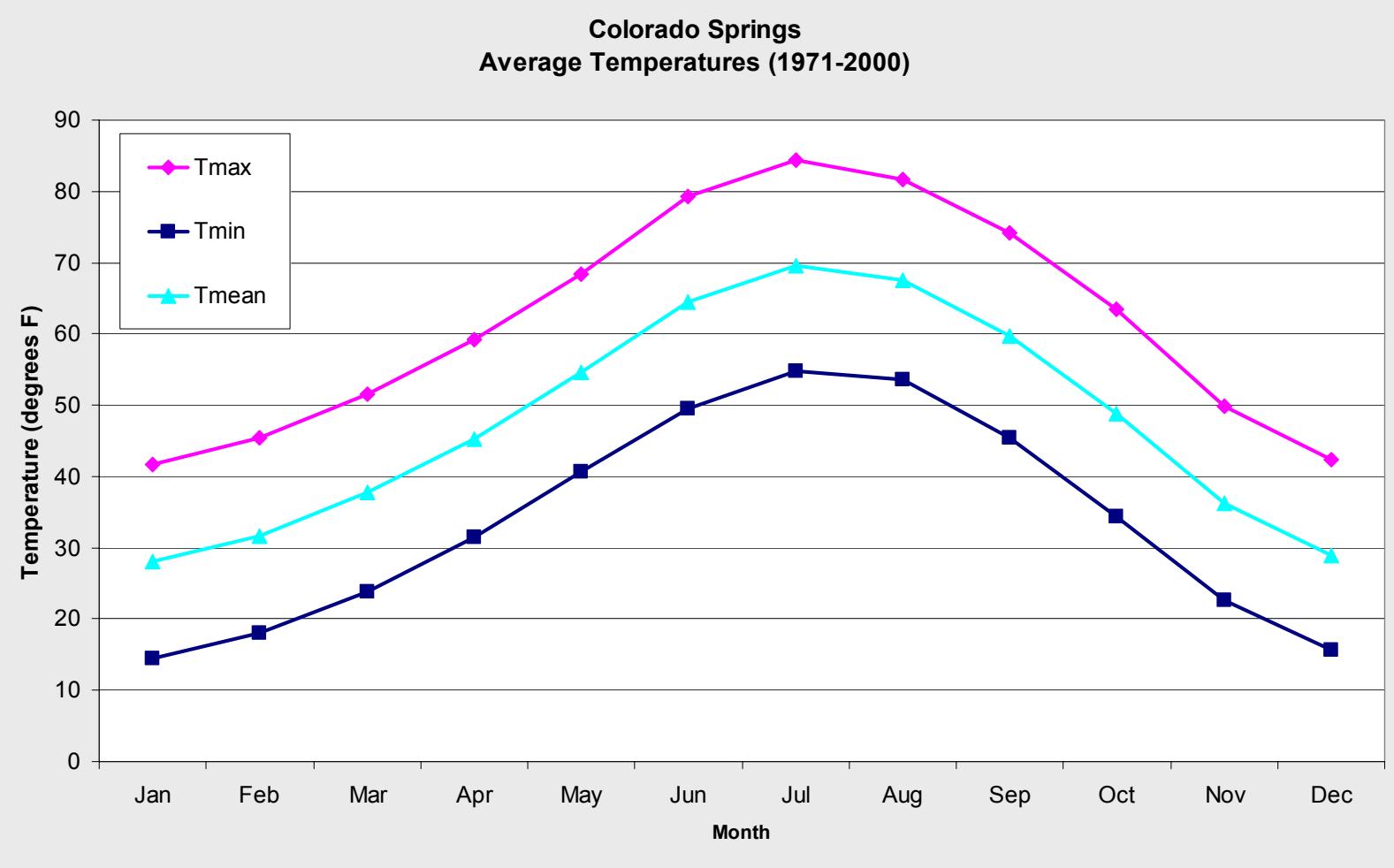
# But sometimes it's darn dry!



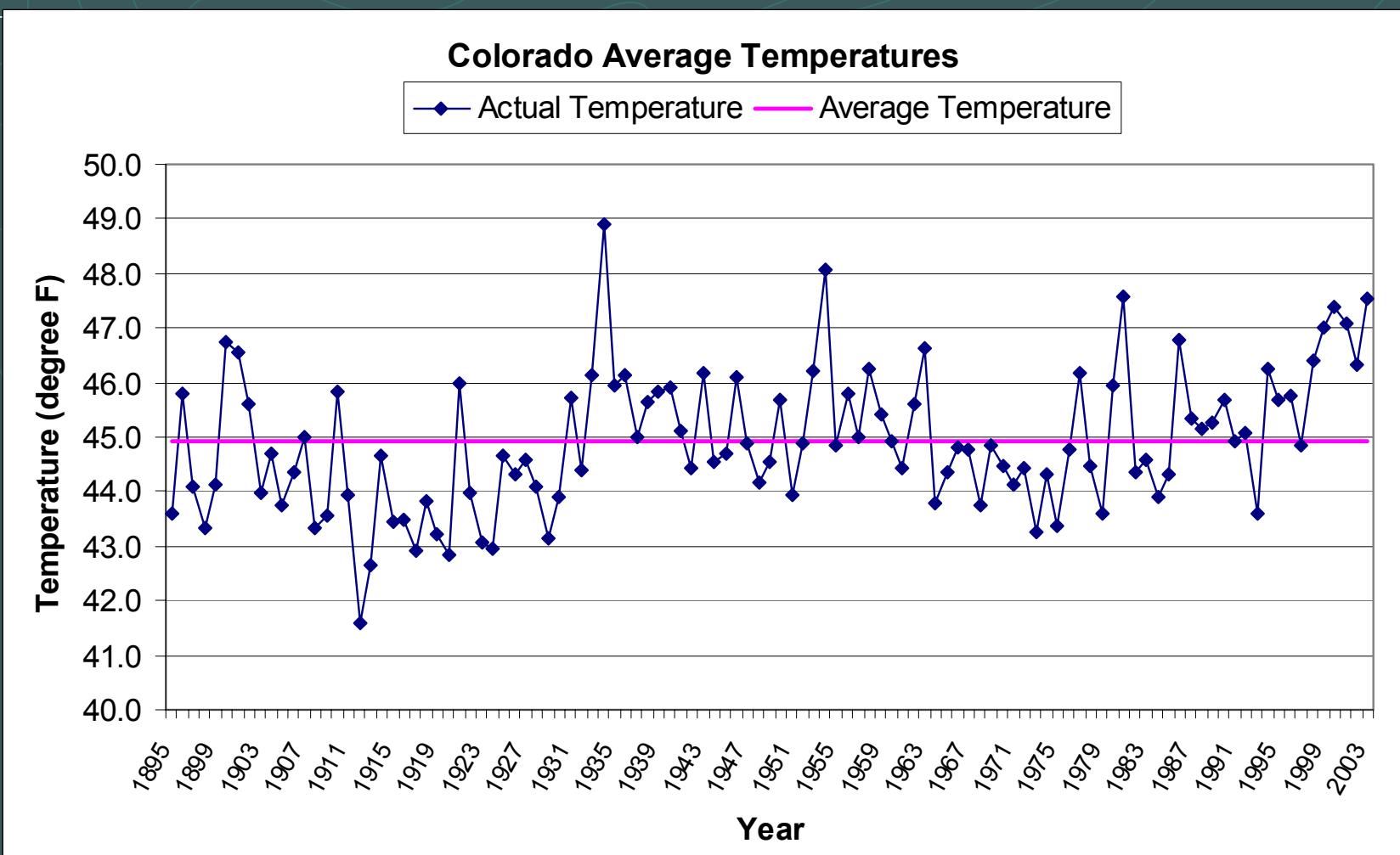
copyrighted by Steve Hodanish

<http://www.crh.noaa.gov/pub/gallery/wxpics.shtml>

# Colorado Springs Average Temperatures



# Statewide Mean Annual Temperature History

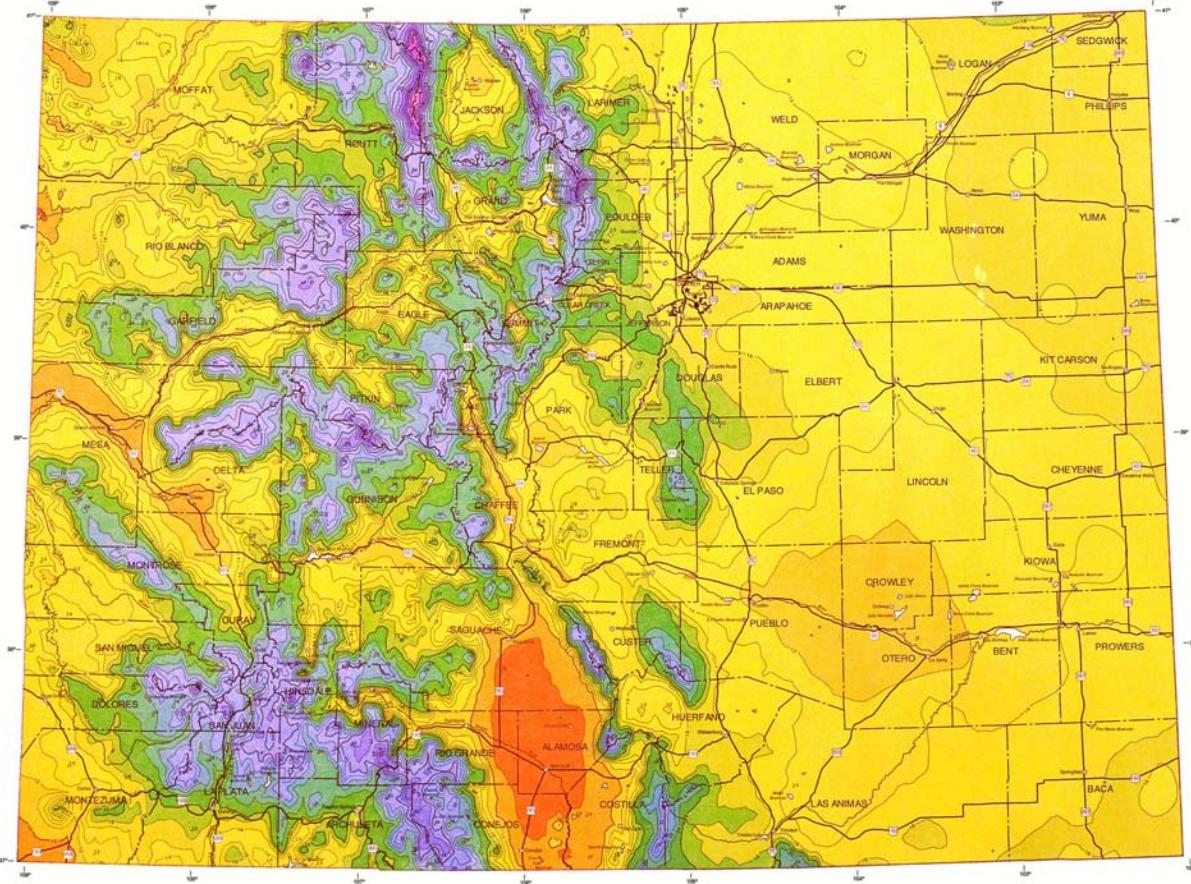


# Colorado Average Precipitation

U.S. DEPARTMENT OF AGRICULTURE

NATIONAL RESOURCES CONSERVATION SERVICE

## COLORADO ANNUAL PRECIPITATION



Map in cooperation with Oregon State University

Data Source: NRCS Cooperative Climate (1961-1990) climate observations, NRCS SHATEL station normals.

Map and contour lines provided by region and state climatologists and integrated resources.

Digital Elevation Model: The PRISM DEM is derived from a 10 arc second Defense Mapping Agency (DMA) Digital Terrain Elevation Dataset (DTED) obtained from the ERCC Data Center.

USDA NRCS National Cartography & Geospatial Center, Fort Worth, TX 1998

Estimation Technique: Gridded estimates were derived from station point values using the PRISM model developed at Oregon State University.

The modeled grid was approximately 1 km resolution and was resampled to 2 km using a Gaussian filter.

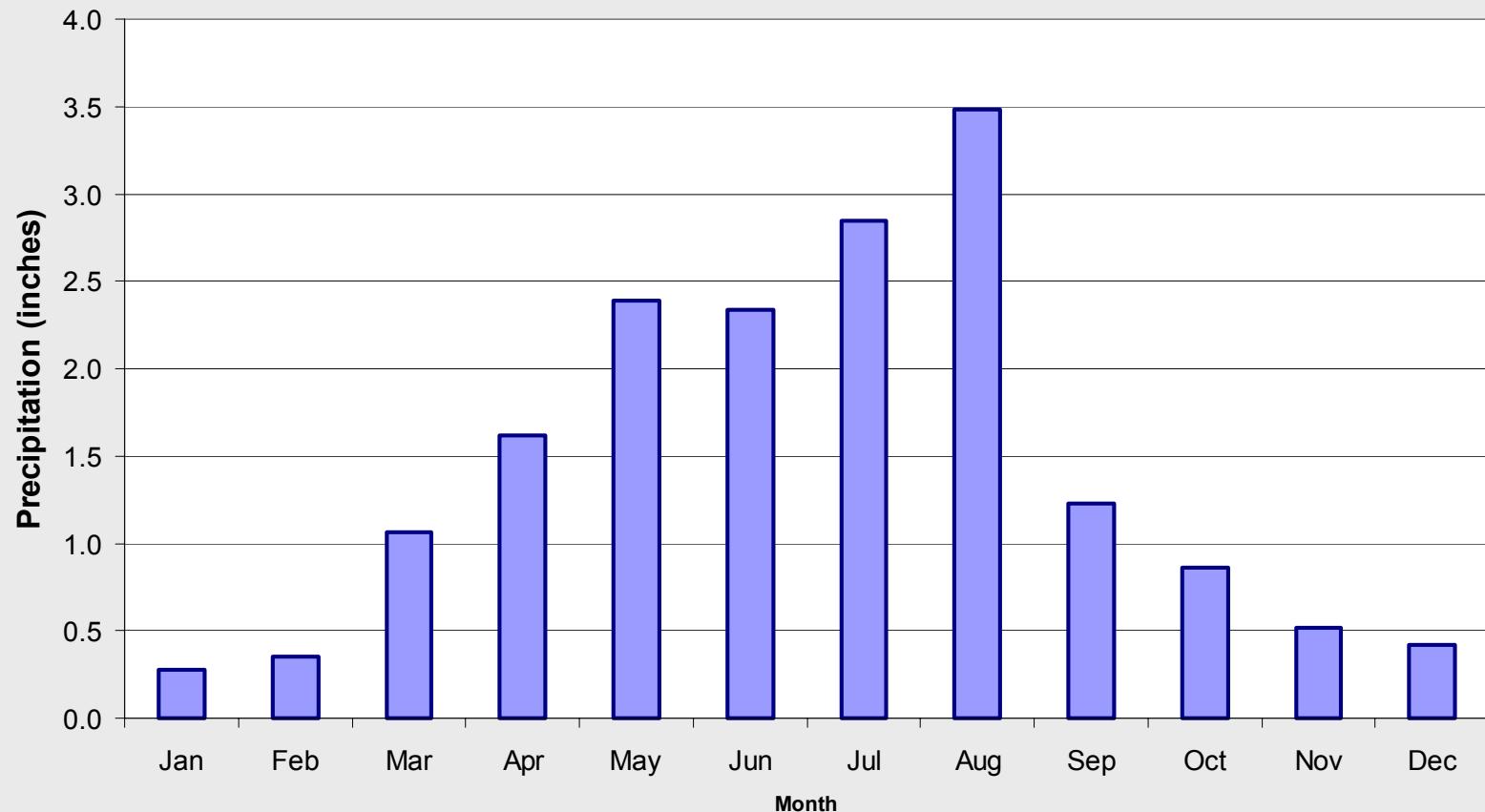
Climate Dataset: April 1998 Albers Equal Area Projection, NAD 27

SCALE 1:1,185,000

SOURCE NOTE:  
Users are cautioned that contours may not exactly match station-observed precipitation especially in regions with significant precipitation gradients and/or April 1998-1999

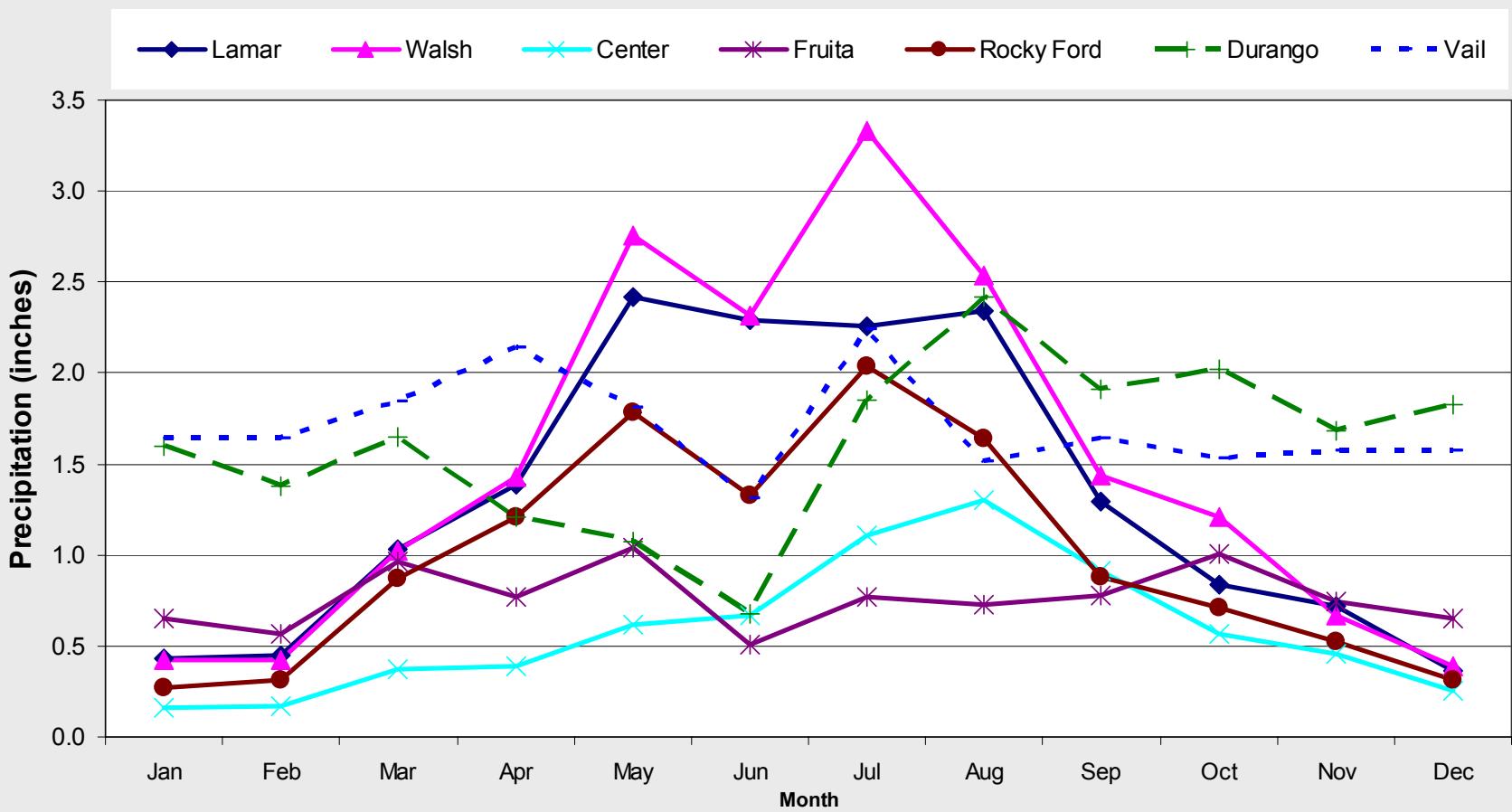
# Colorado Springs Monthly Average Precipitation (1971-2000)

**Colorado Springs Average Precipitation (1971-2000)**

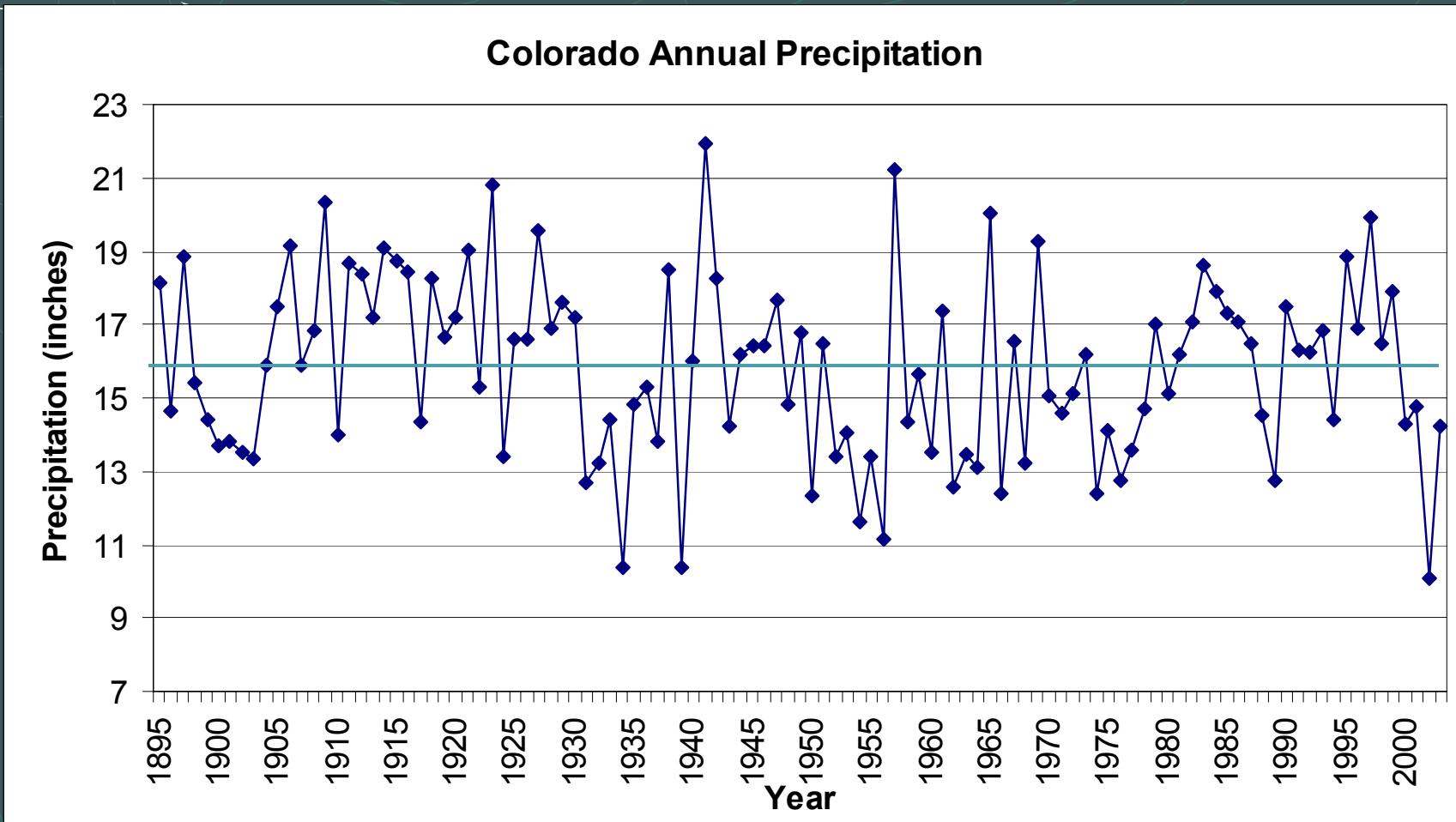


# Average Monthly Precipitation for Selected Sites

## Monthly Average Precipitation

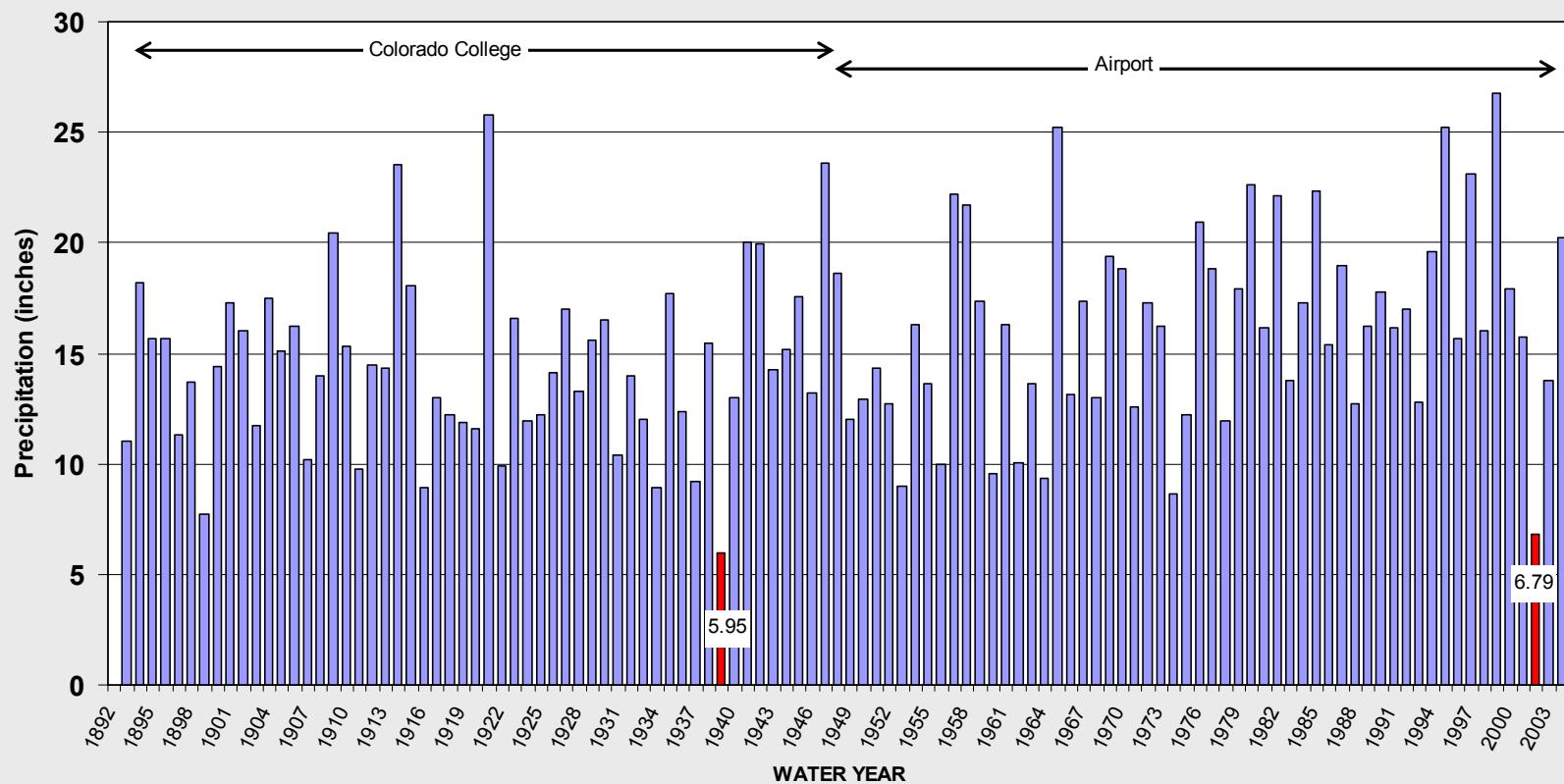


# Statewide Annual Precipitation History



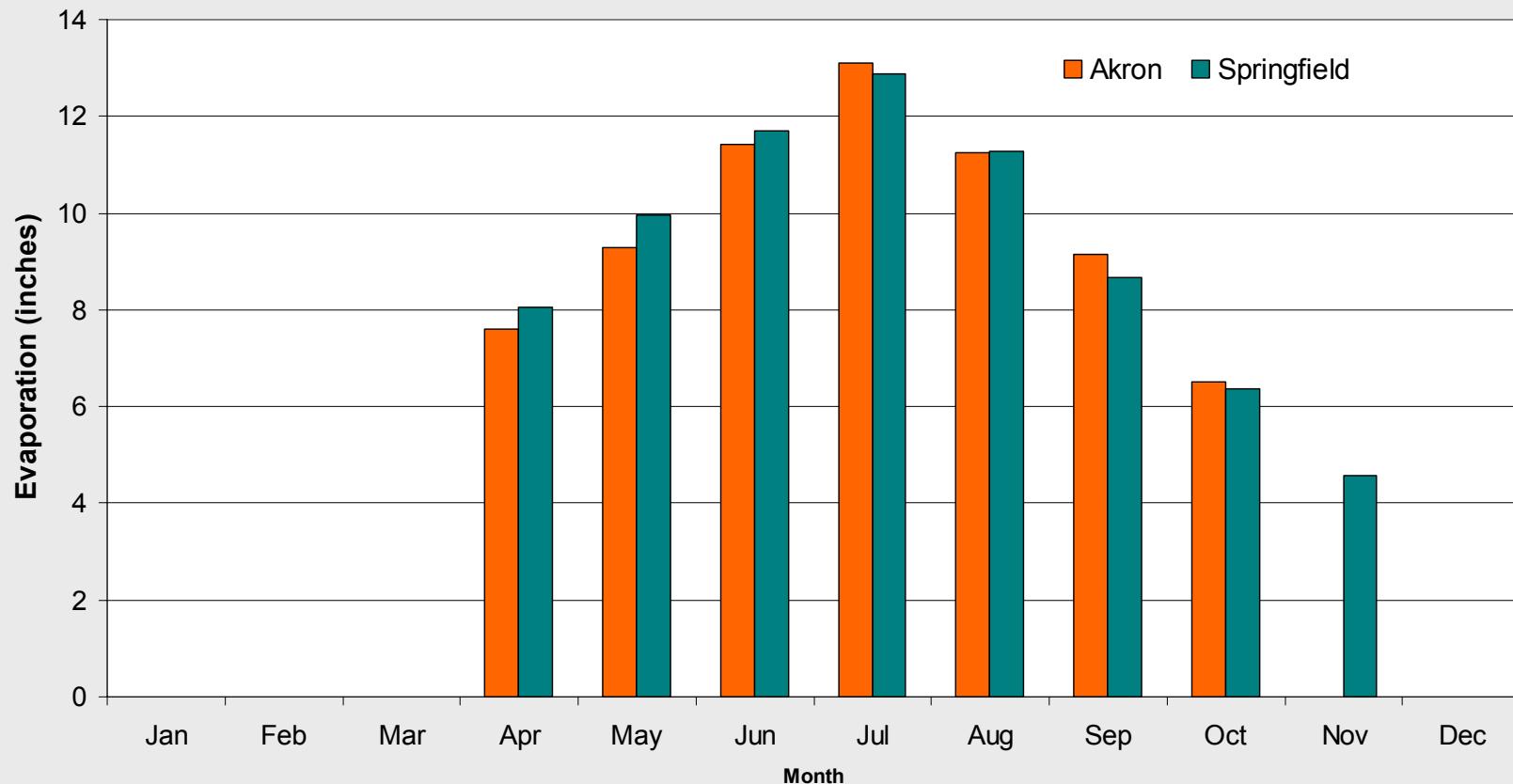
# Colorado Springs Precipitation History

## Colorado Springs Water Year Precipitation



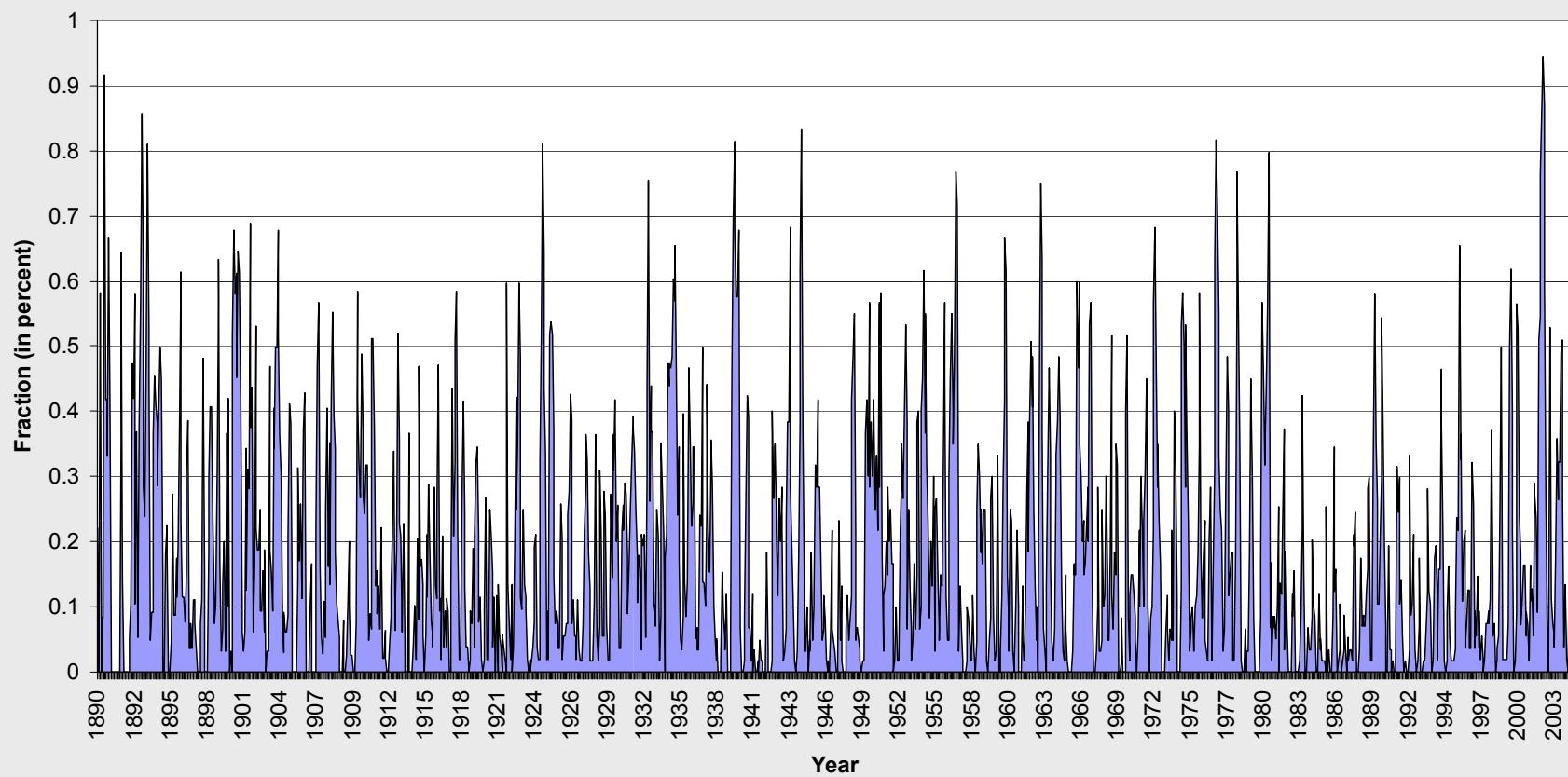
# Monthly Average Pan Evaporation

Average Monthly Pan Evaporation  
for Akron and Springfield, Colorado



# 3-Month SPI

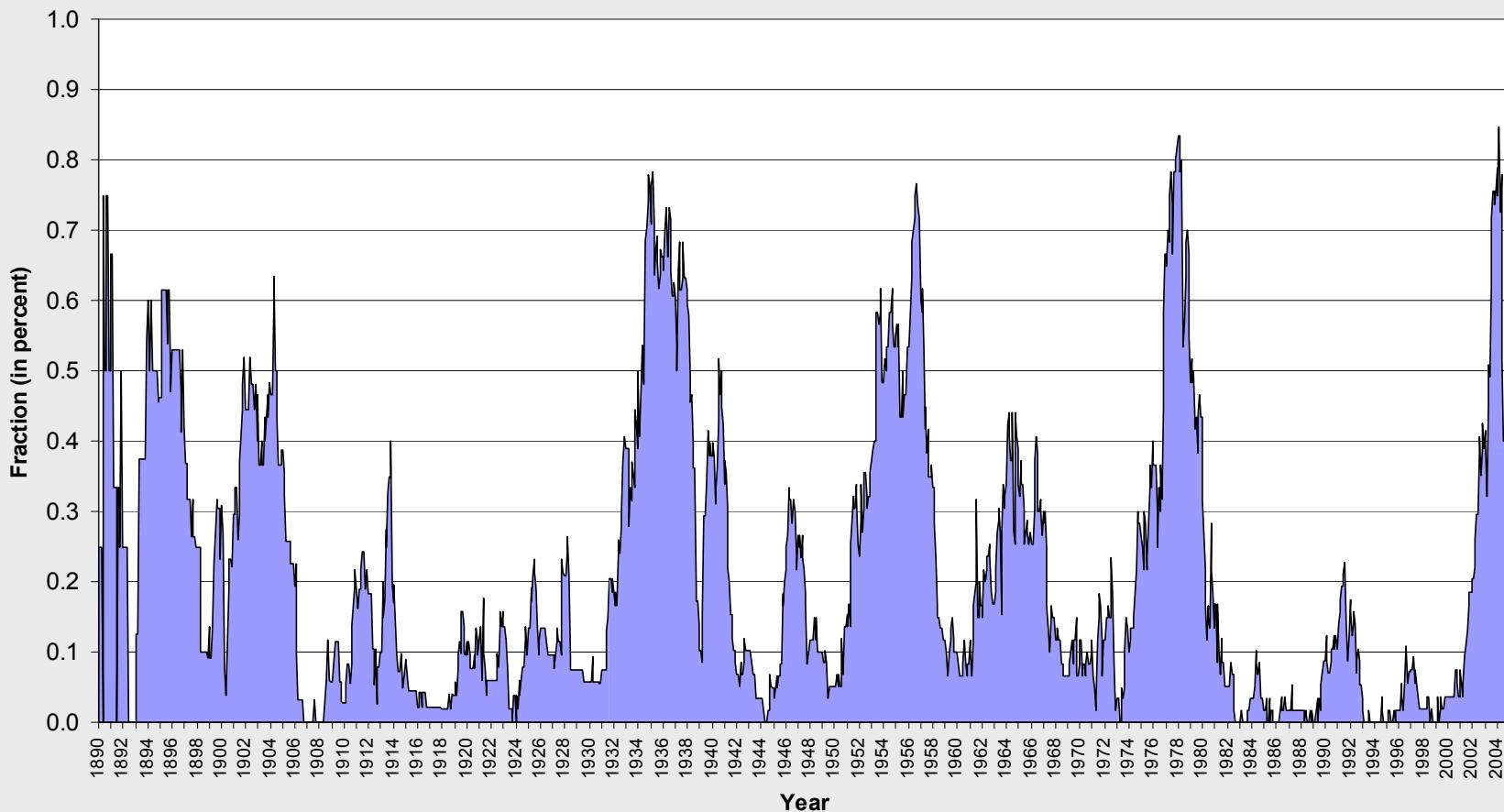
## Fraction of Colorado in Drought Based on 3 month SPI (1890 - September 2004)



# 48-Month SPI

## Fraction of Colorado in Drought

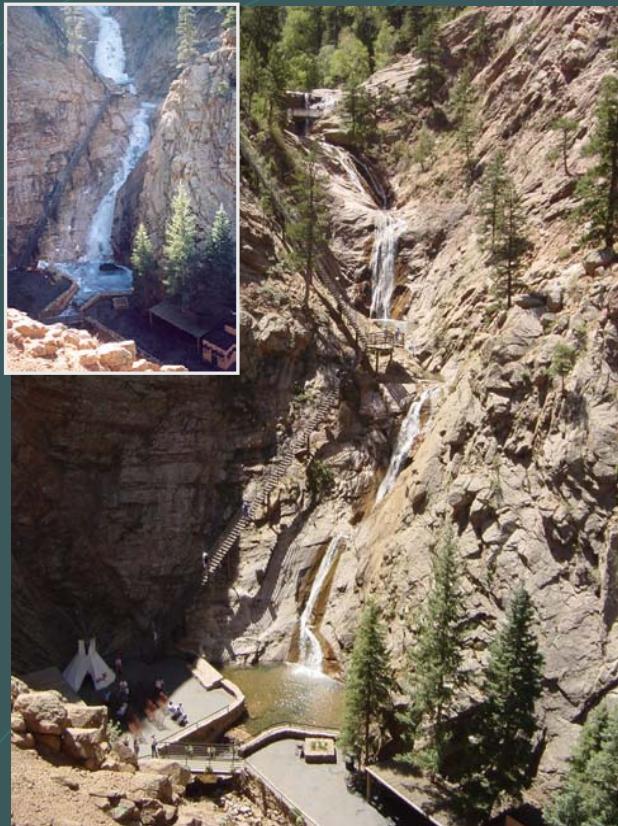
Based on 48 month SPI  
(1890 - September 2004)



# The Evolution of Our Recent Drought



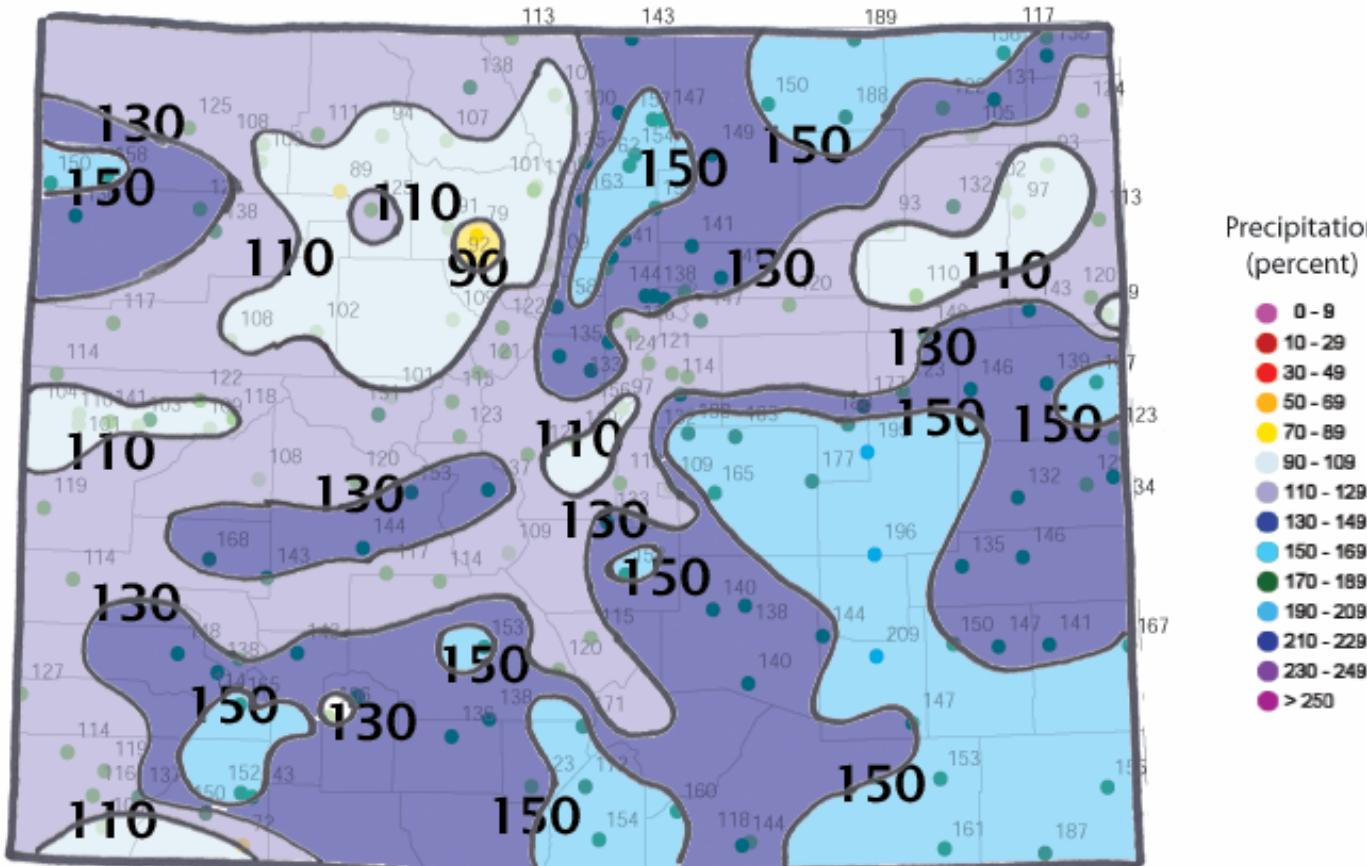
Crystal Lakes serves Colorado Springs,  
Sept 2002



Seven Falls, during the 2002 drought water was pumped to top.

# 1999 Water Year Precipitation

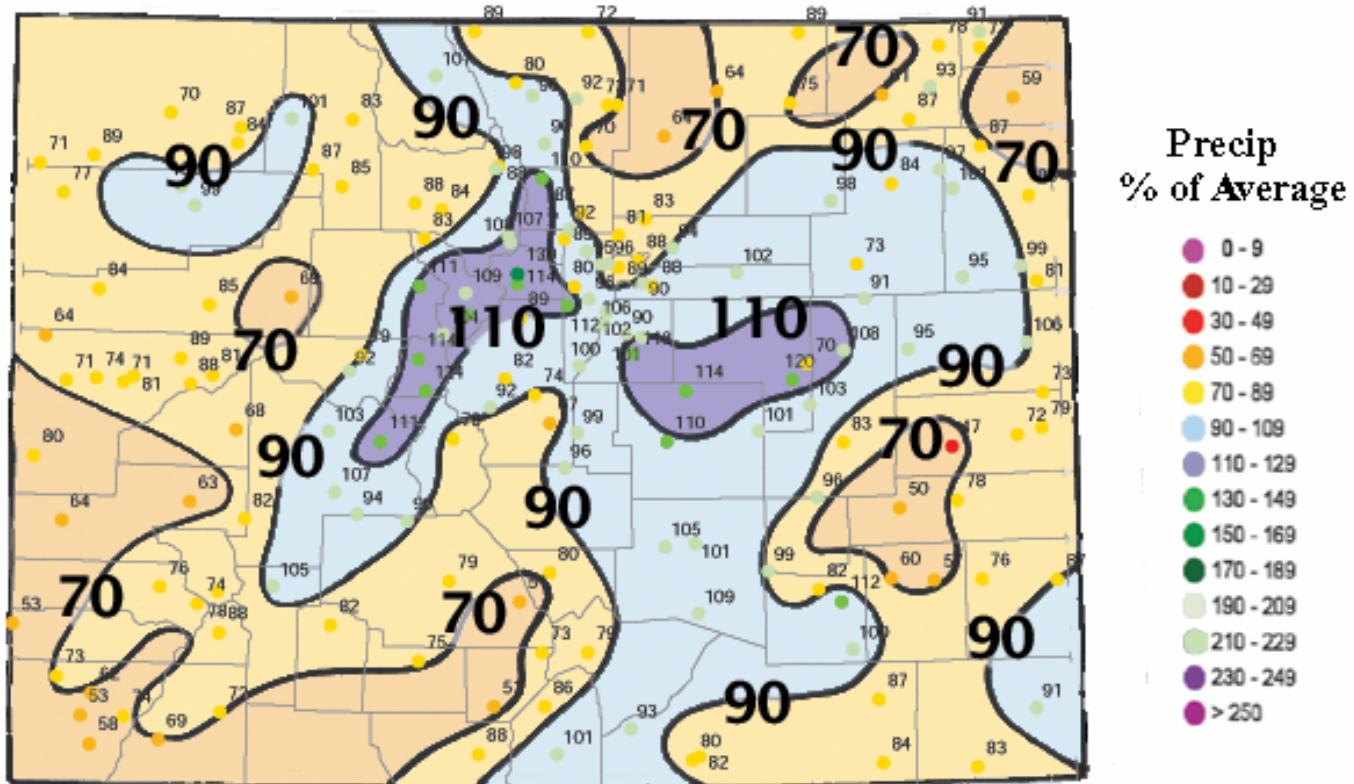
Water Year 1999  
(Oct. 1998-Sept. 1999)  
Precipitation Percent of Average for 1961-1990 Averages



# 2000 Water Year Precipitation

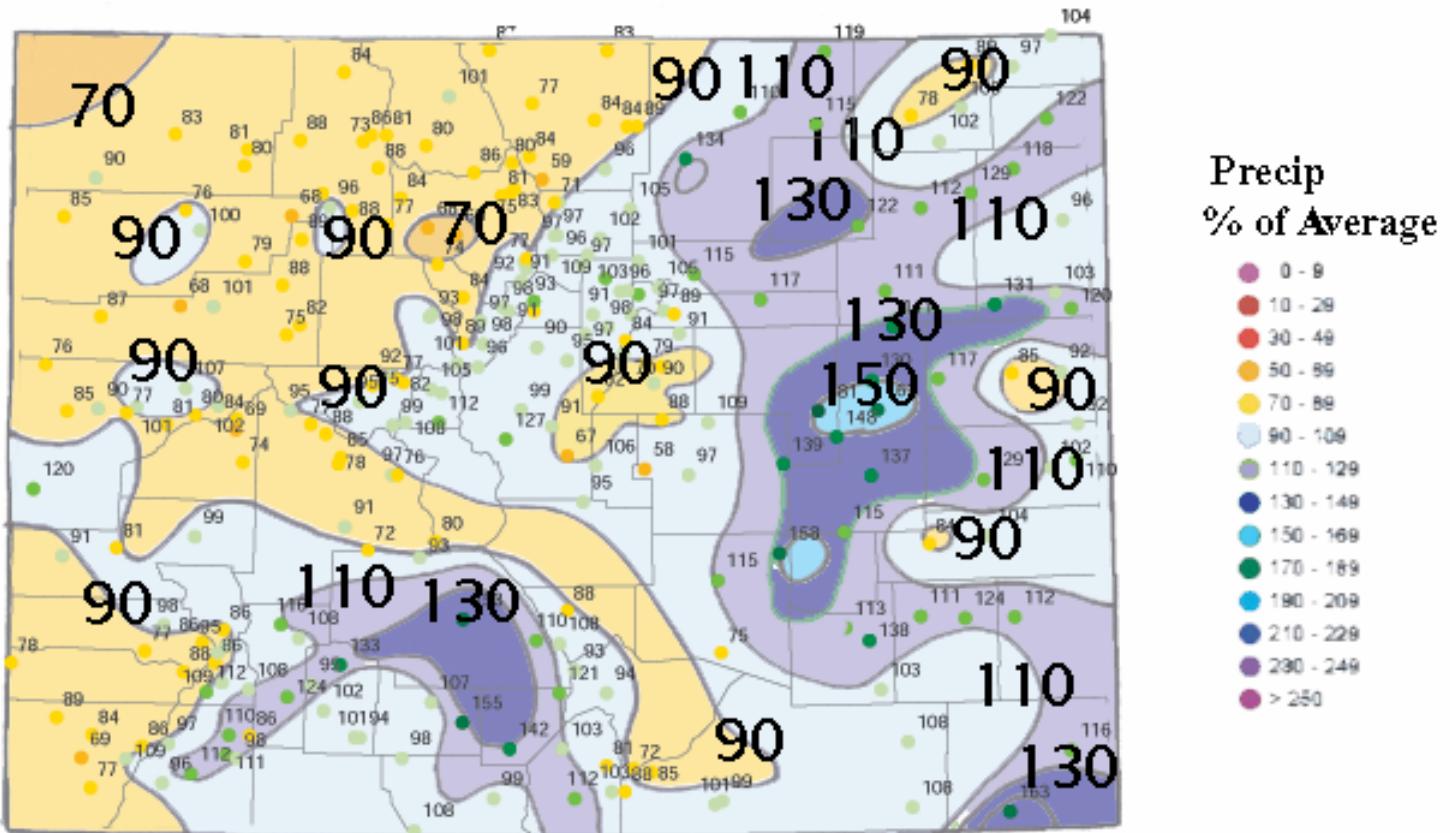
Water Year 2000  
(Oct. 1999 - Sept. 2000)

Precipitation Percent of Average for 1961-1990 Averages



# 2001 Water Year Precipitation

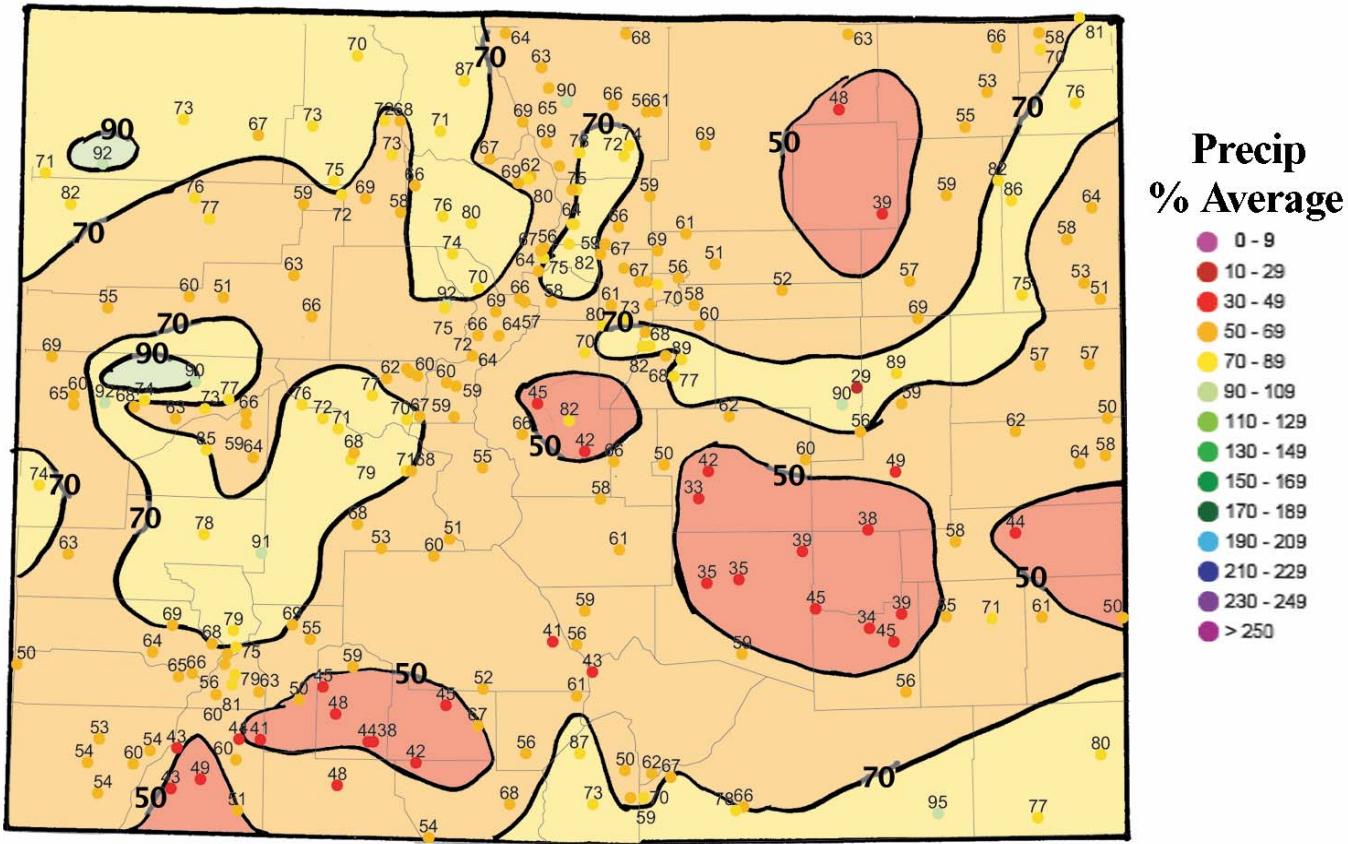
Water Year 2001  
(Oct. 2000 - Sept. 2001)  
Precipitation Percent of Average for 1961-1990 Averages



# 2002 Water Year Precipitation

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

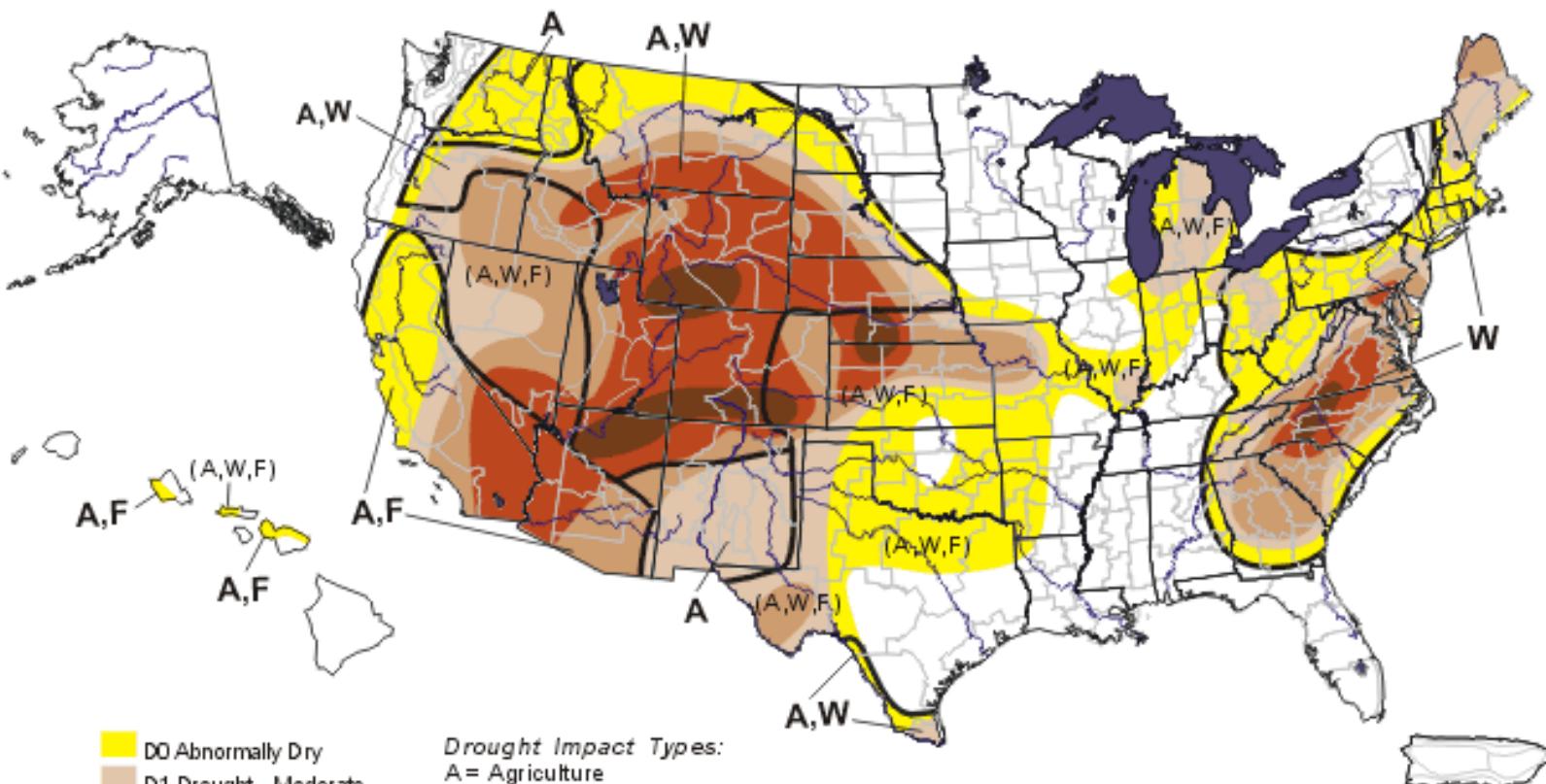
Precipitation Percent of Average for 1961-1990 Averages



# *U.S. Drought Monitor*

October 1, 2002

Valid 8 a.m. EDT



- A vertical legend consisting of five colored squares with corresponding labels: 
 
  - Yellow square: D0 Abnormally Dry
  - Peach square: D1 Drought—Moderate
  - Brown square: D2 Drought—Severe
  - Dark Red square: D3 Drought—Extreme
  - Dark Brown square: D4 Drought—Exceptional

*Drought Impact Types:*  
A = Agriculture  
W = Water (Hydrological)  
F = Fire danger (Wildfires)  
 Delineates dominant impacts  
(No type = All 3 impacts)

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

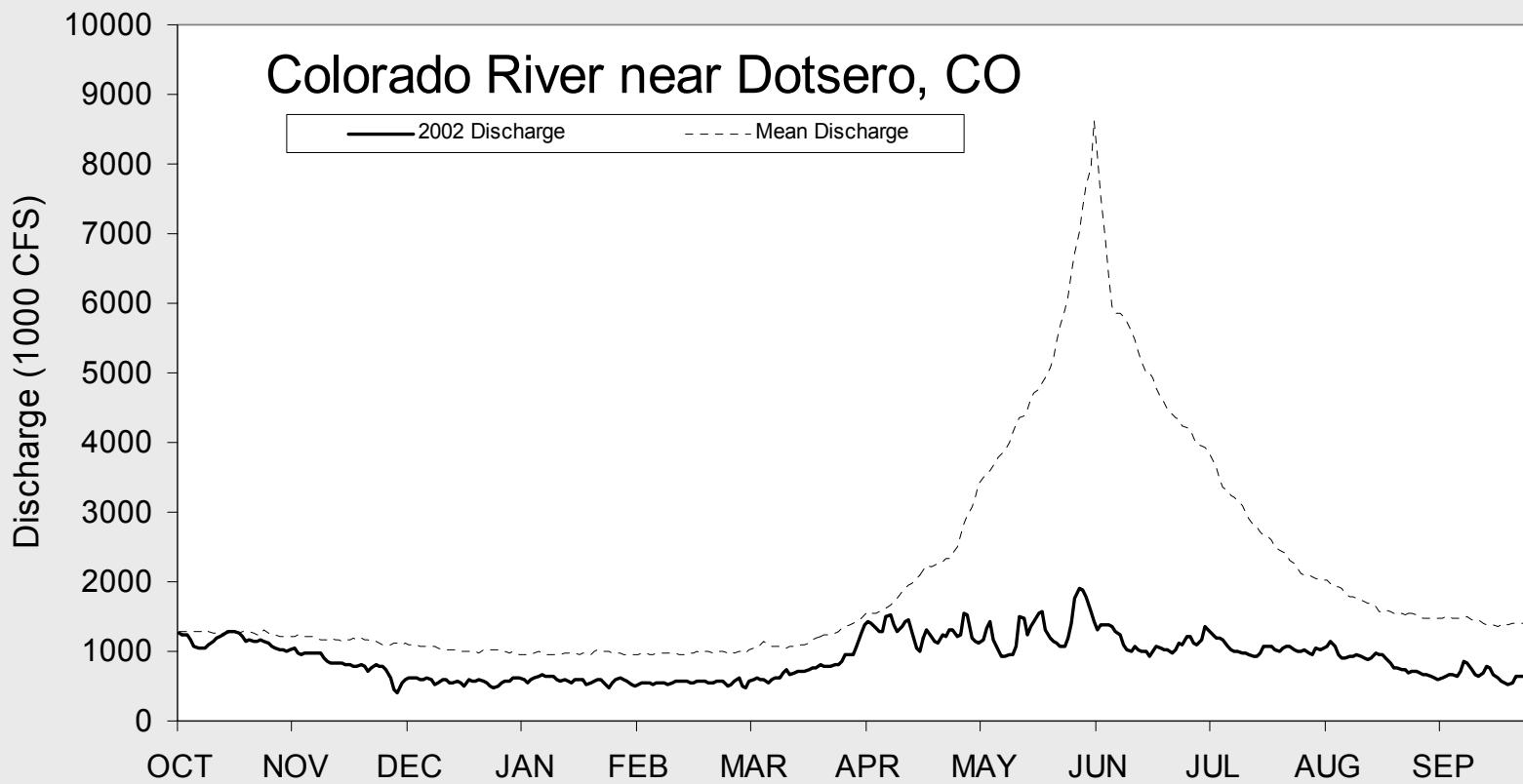
<http://drought.unl.edu/dm>



Released Thursday, October 3, 2002

**Author:** Rich Tinker, CPC/NCEP/NWS/NOAA

# 2002 Daily Streamflow

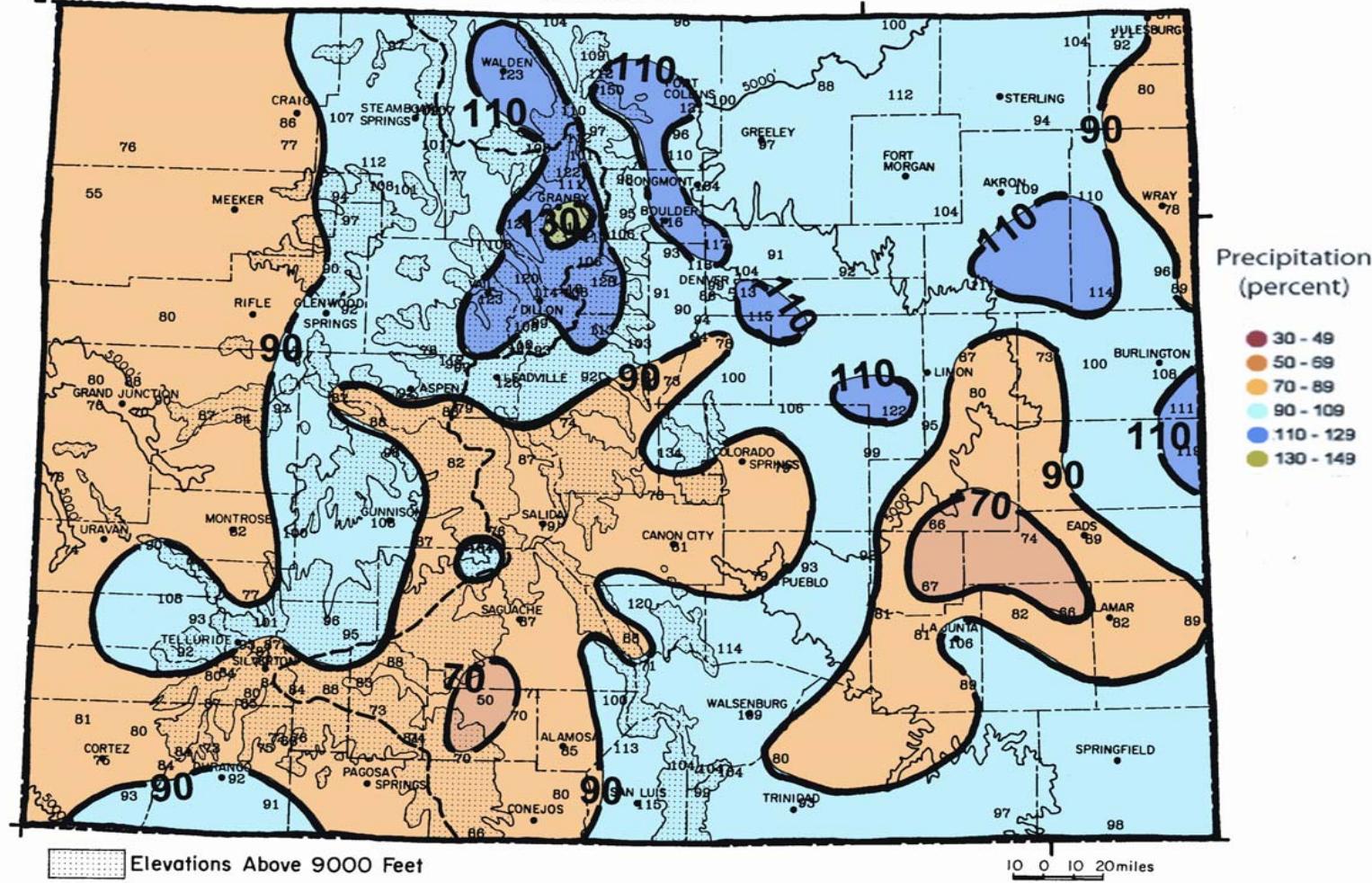


# 2003 Water Year Precipitation

## Water Year 2003

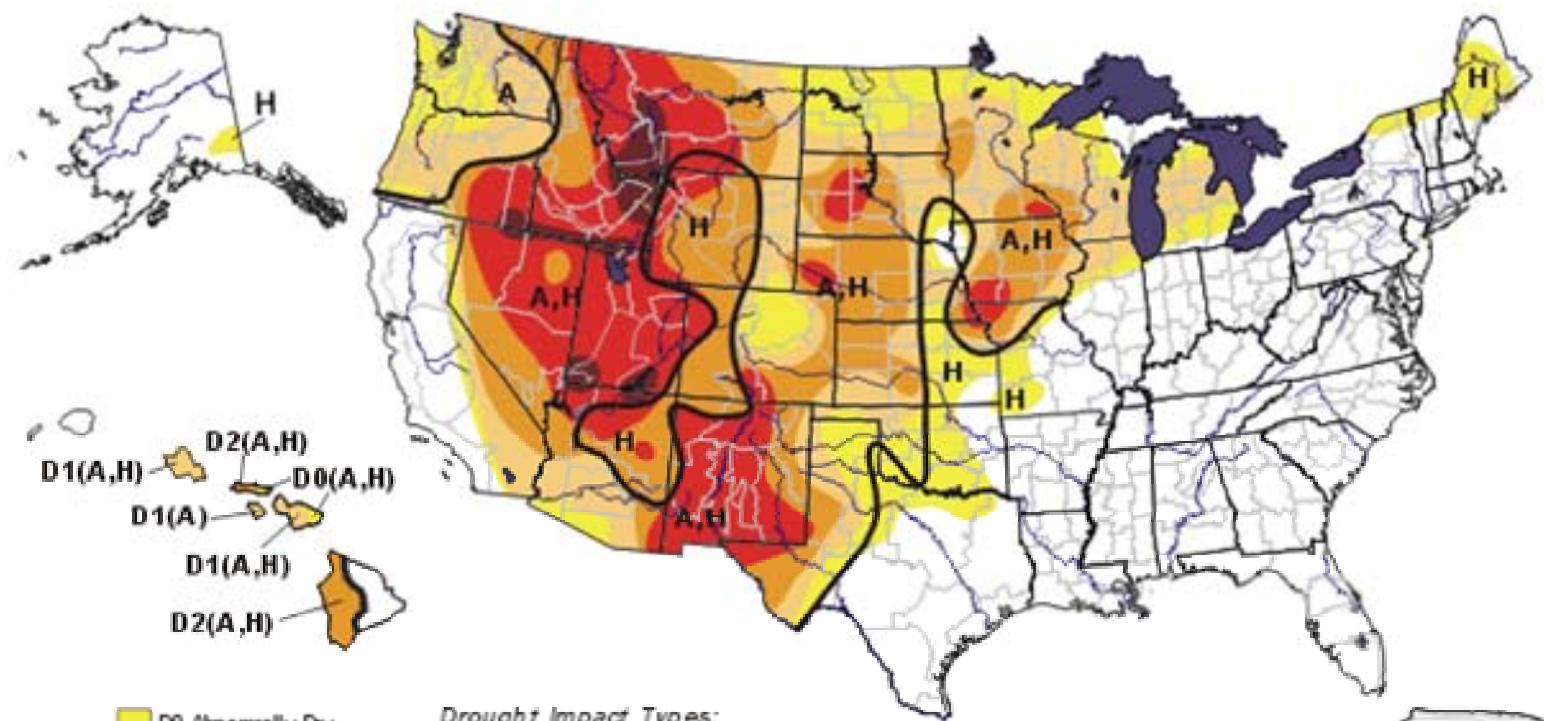
October 2002 - September 2003 precipitation  
as a percent of the 1971-2000 average.

### COLORADO



# U.S. Drought Monitor

September 30, 2003  
Valid 8 a.m. EDT



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

- Drought Impact Types:
- A= Agricultural (crops, pastures, grasslands)
  - H= Hydrological (water)
  - No type = both impacts
- ↗ Delineates dominant impacts

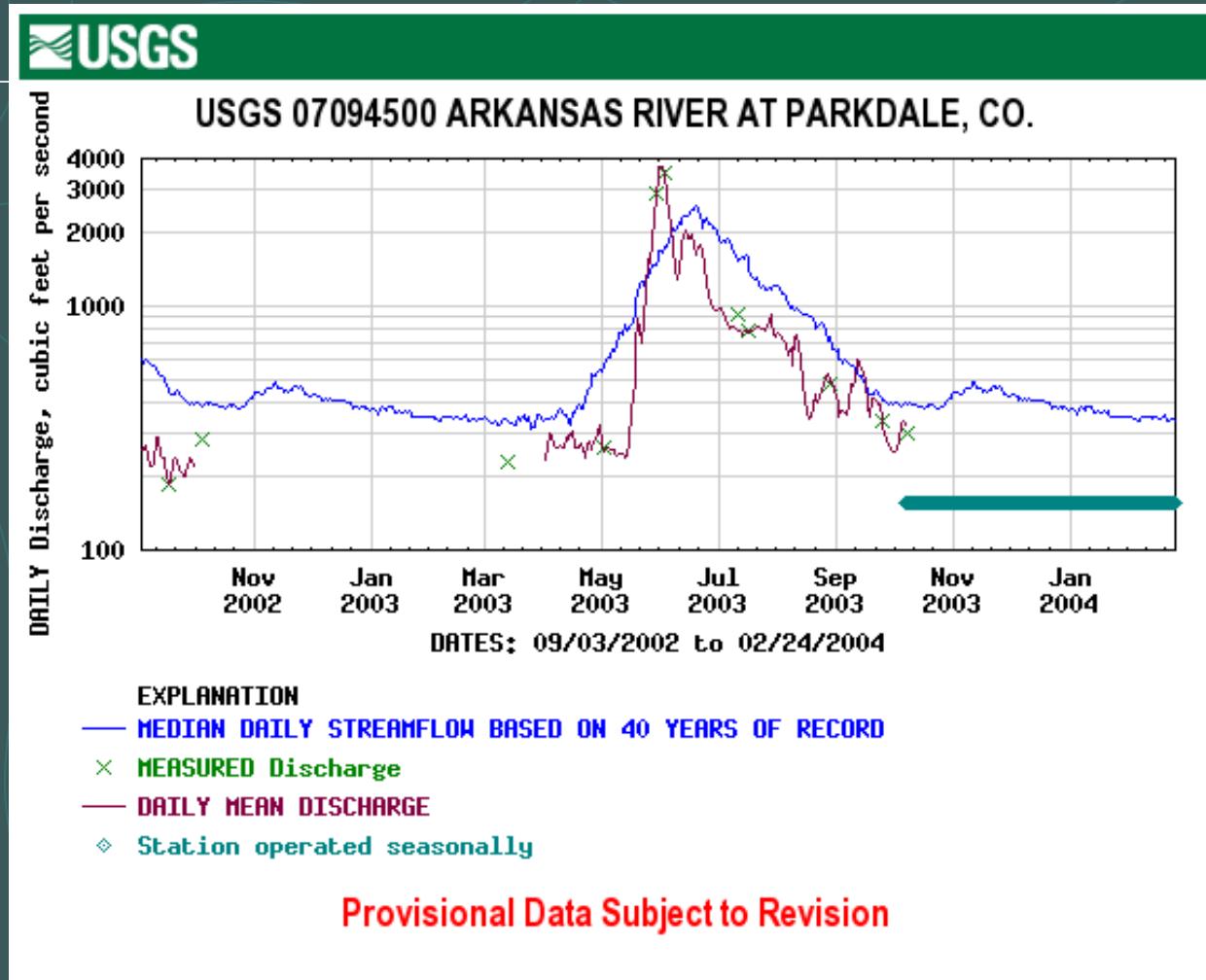
The Drought Monitor focuses on broad-scale conditions.  
Local conditions may vary. See accompanying text summary  
for forecast statements.

<http://drought.unl.edu/dm>



Released Thursday, October 2, 2003  
Author: Candace Tankersley/Scott Stephens, NOAA/NCDC

# 2003 Daily Streamflow

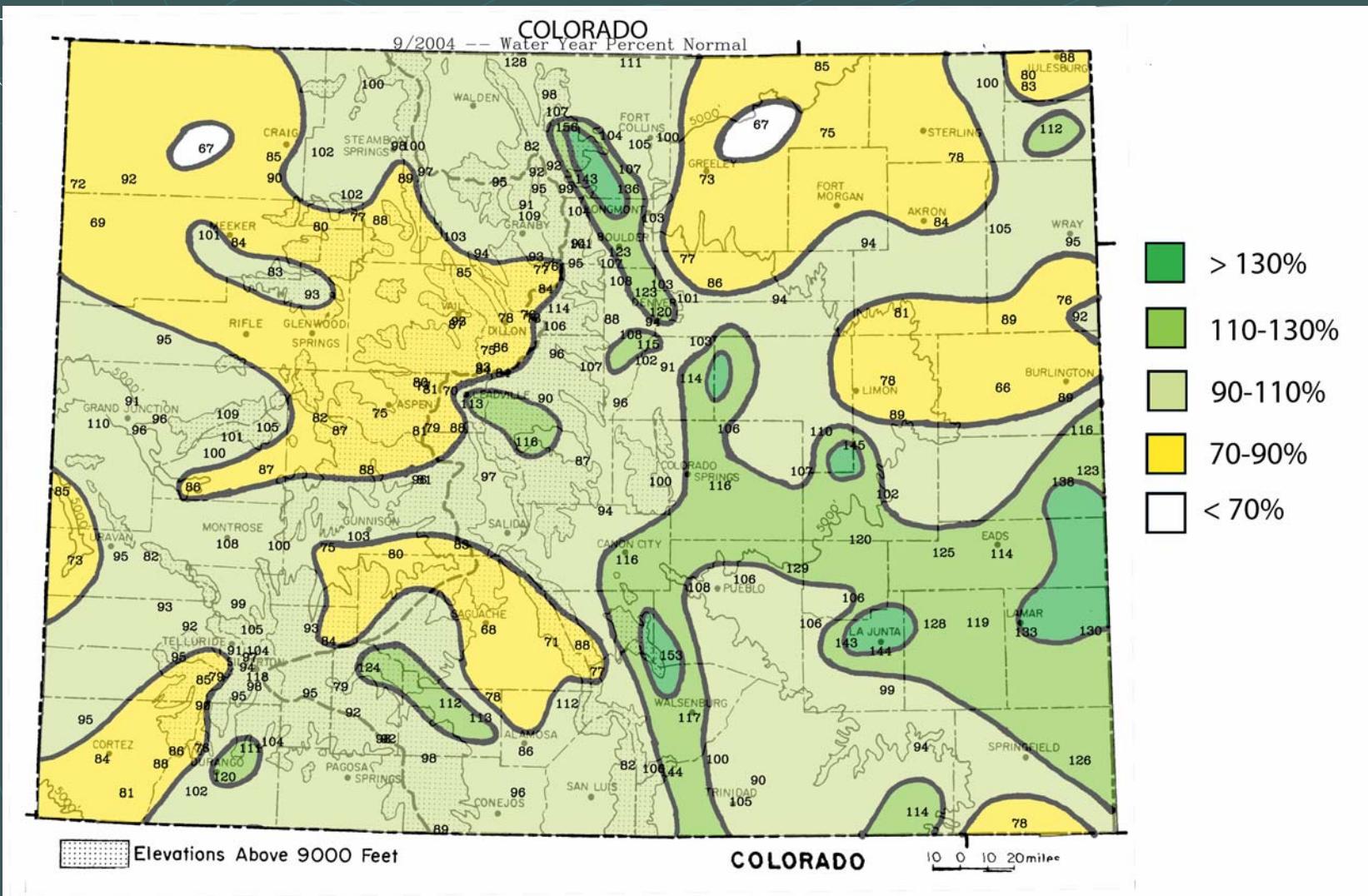


[http://water.usgs.gov/cgi-bin/daily\\_flow?co](http://water.usgs.gov/cgi-bin/daily_flow?co)

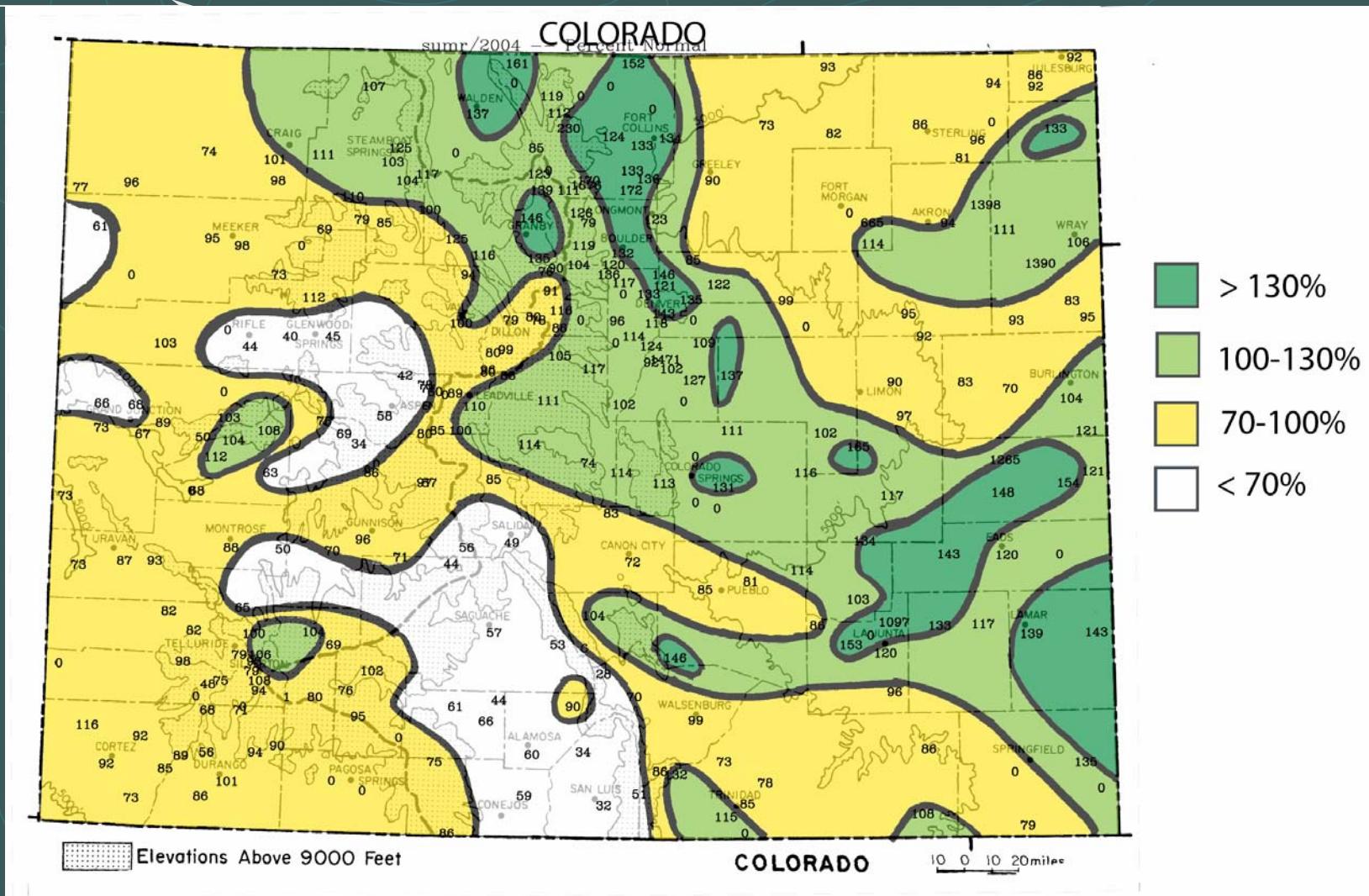
# Where Do We Stand Now?



# Water Year 2004 Precipitation as Percent of Average

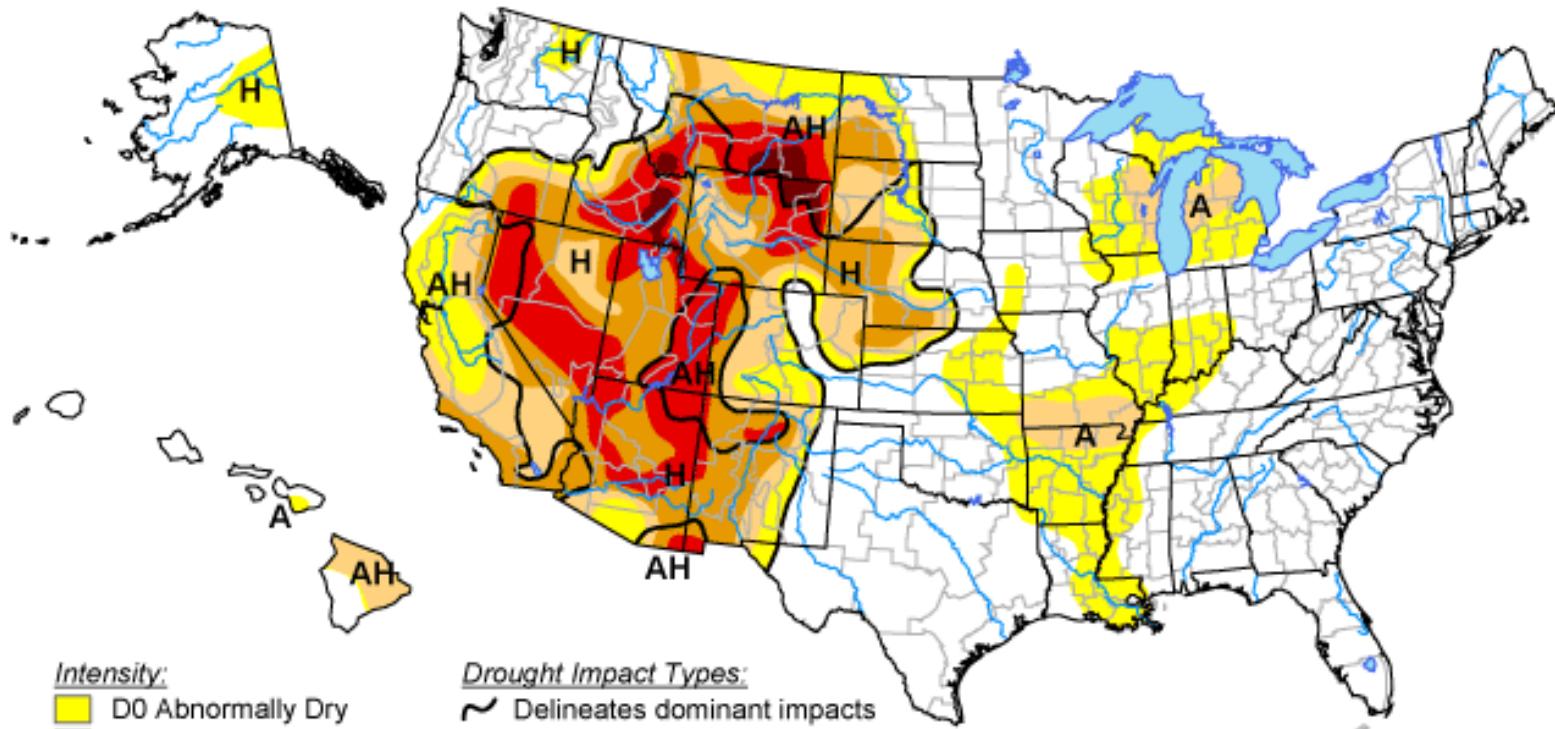


# Growing Season (May-Sep) 2004 Precipitation as Percent of Average



# U.S. Drought Monitor

October 5, 2004  
Valid 8 a.m. EDT



Intensity:

- [Yellow square] D0 Abnormally Dry
- [Orange square] D1 Drought - Moderate
- [Dark Orange square] D2 Drought - Severe
- [Red square] D3 Drought - Extreme
- [Dark Red square] D4 Drought - Exceptional

Drought Impact Types:

- [Wavy line symbol] Delineates dominant impacts
- [Plow symbol] A = Agricultural (crops, pastures, grasslands)
- [Both impacts symbol] H = Hydrological (water)  
(No type = Both impacts)

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

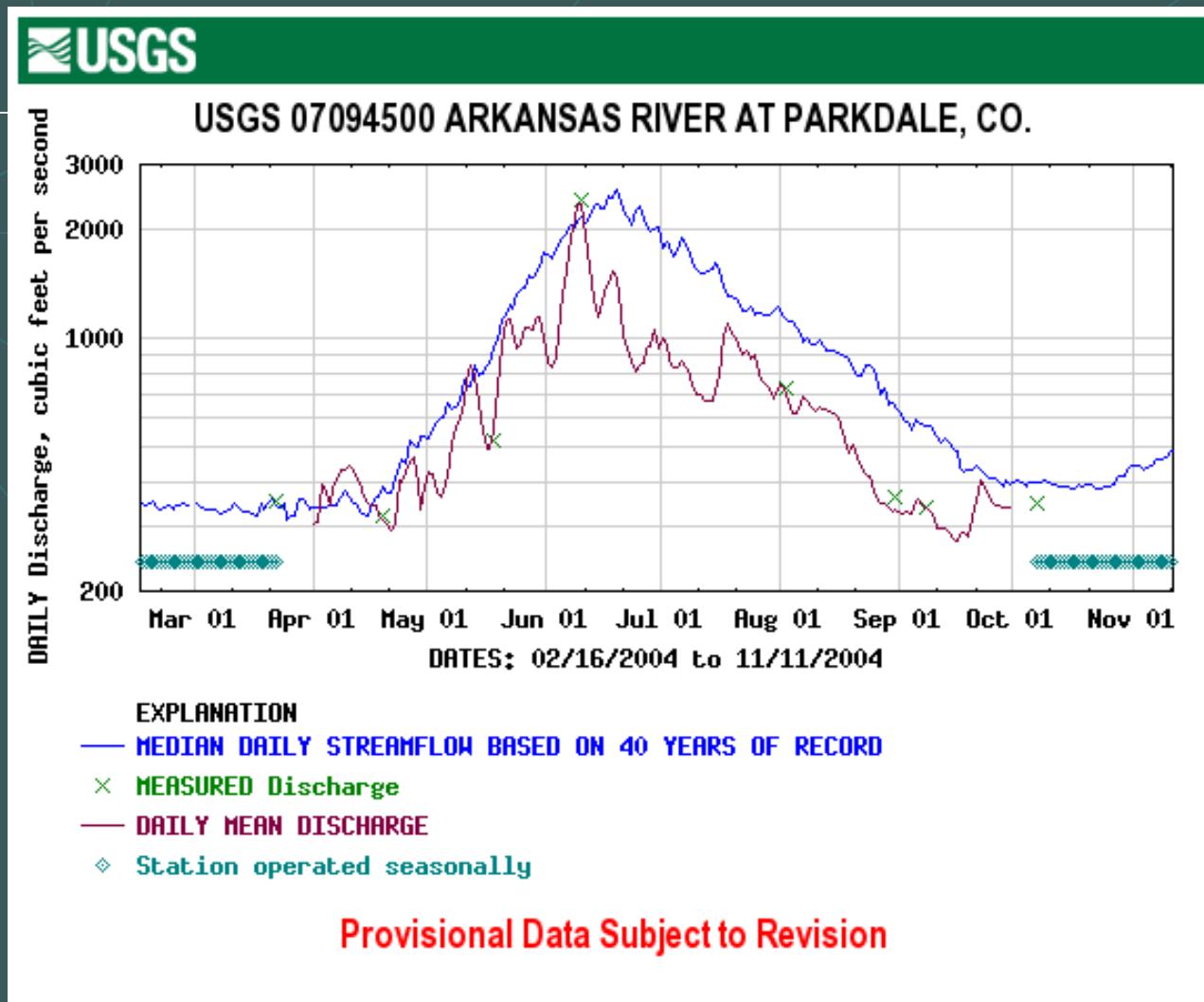
<http://drought.unl.edu/dm>



Released Thursday, October 7, 2004

Author: Michael Hayes, NDMC

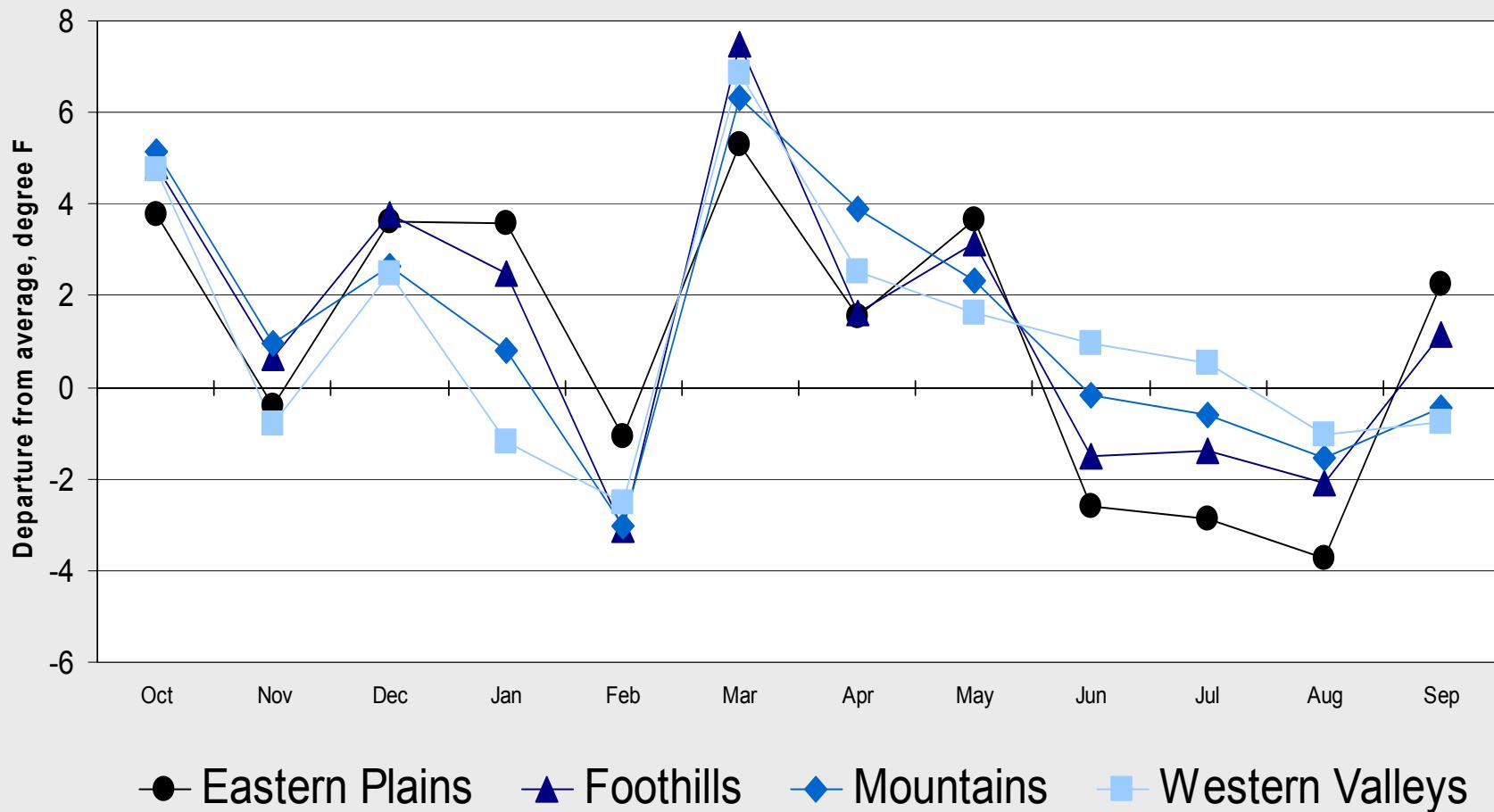
# 2004 Daily Streamflow



[http://water.usgs.gov/cgi-bin/daily\\_flow?co](http://water.usgs.gov/cgi-bin/daily_flow?co)

# WY2004 Temperature Departures

Water Year 2004



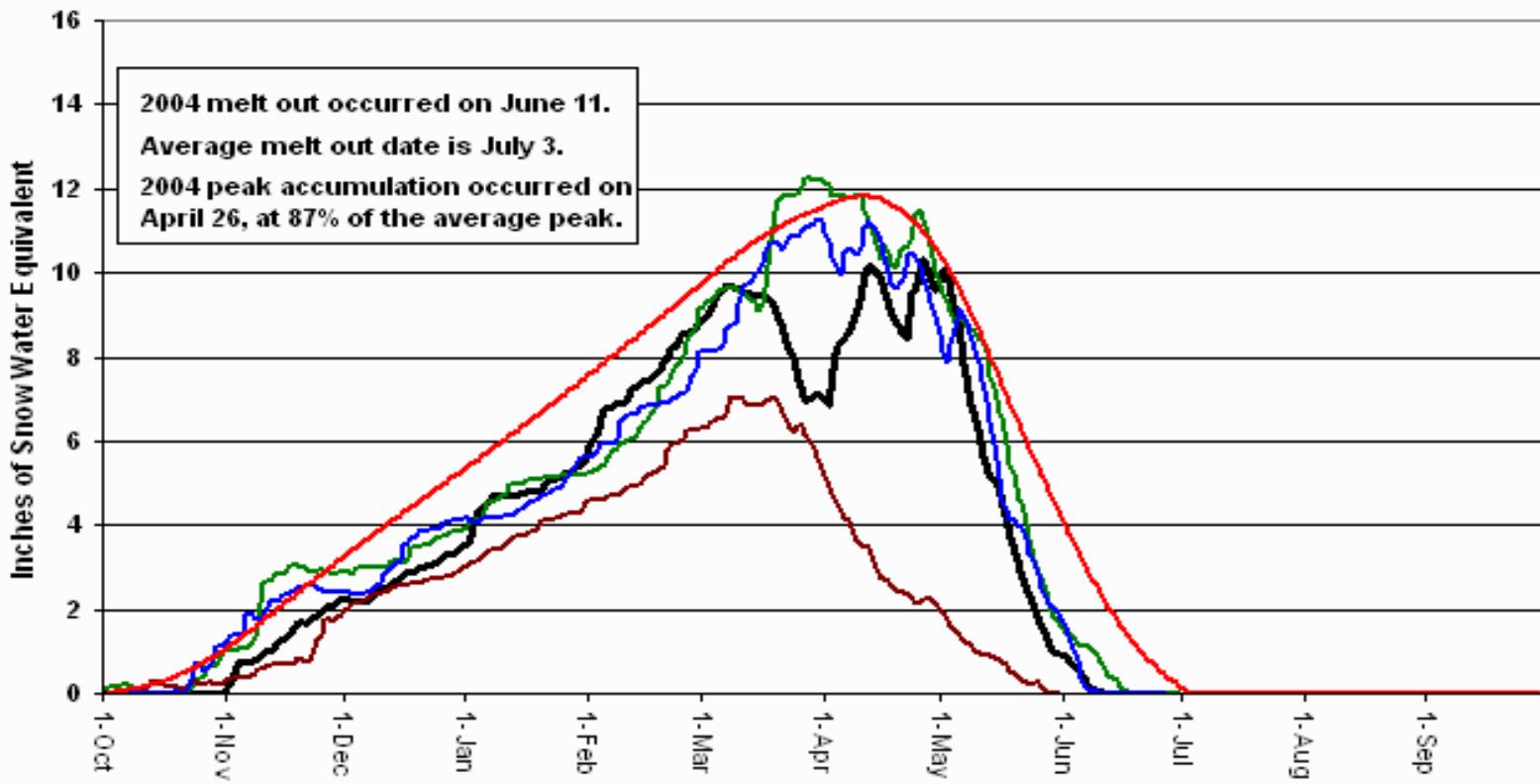
# Arkansas Basin Snowpack



## Arkansas Basin Snowpack

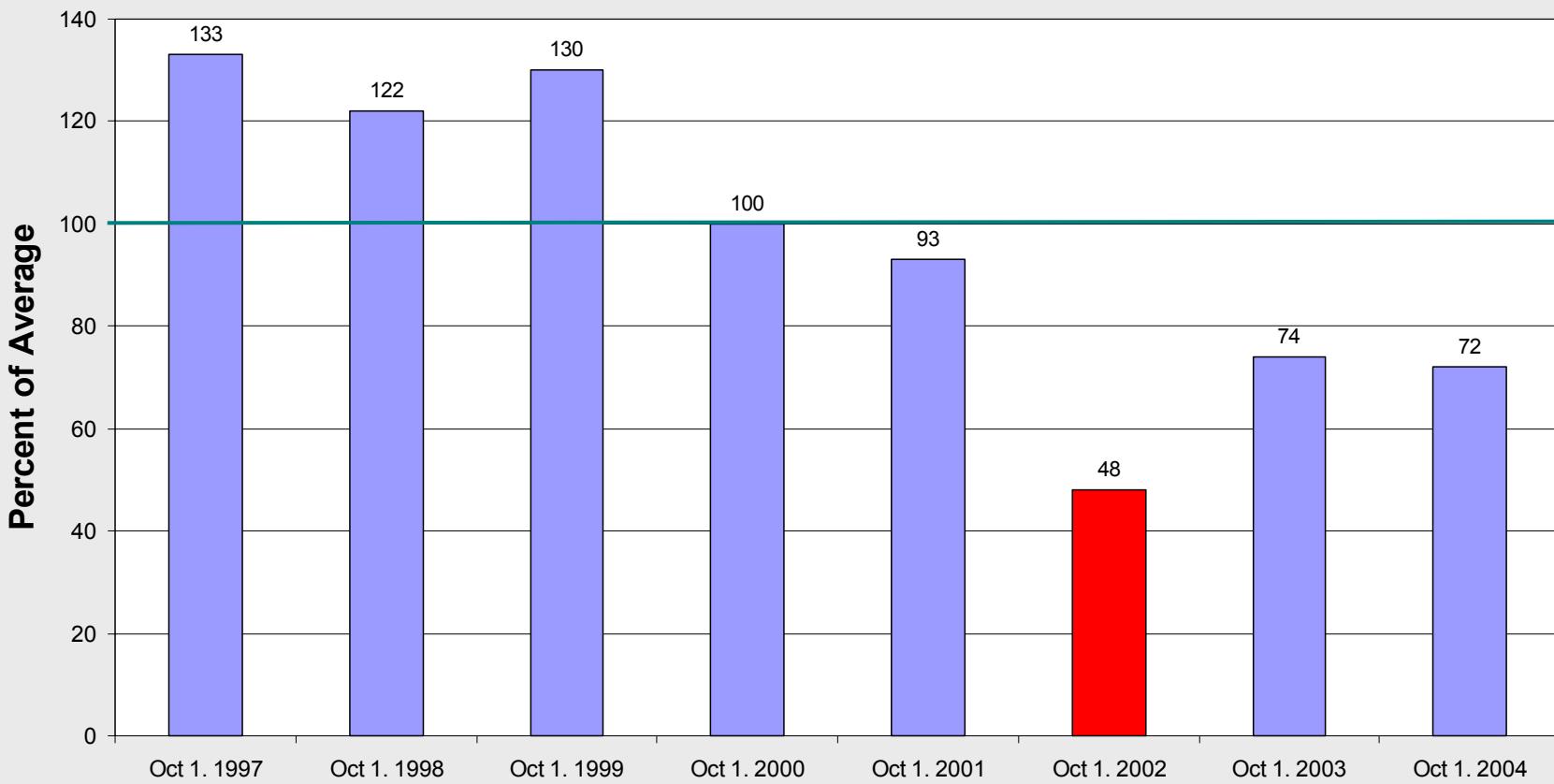
*Based on provisional SNOTEL data.*

— 2004 — 2003 — 2002 — 2001 — Average



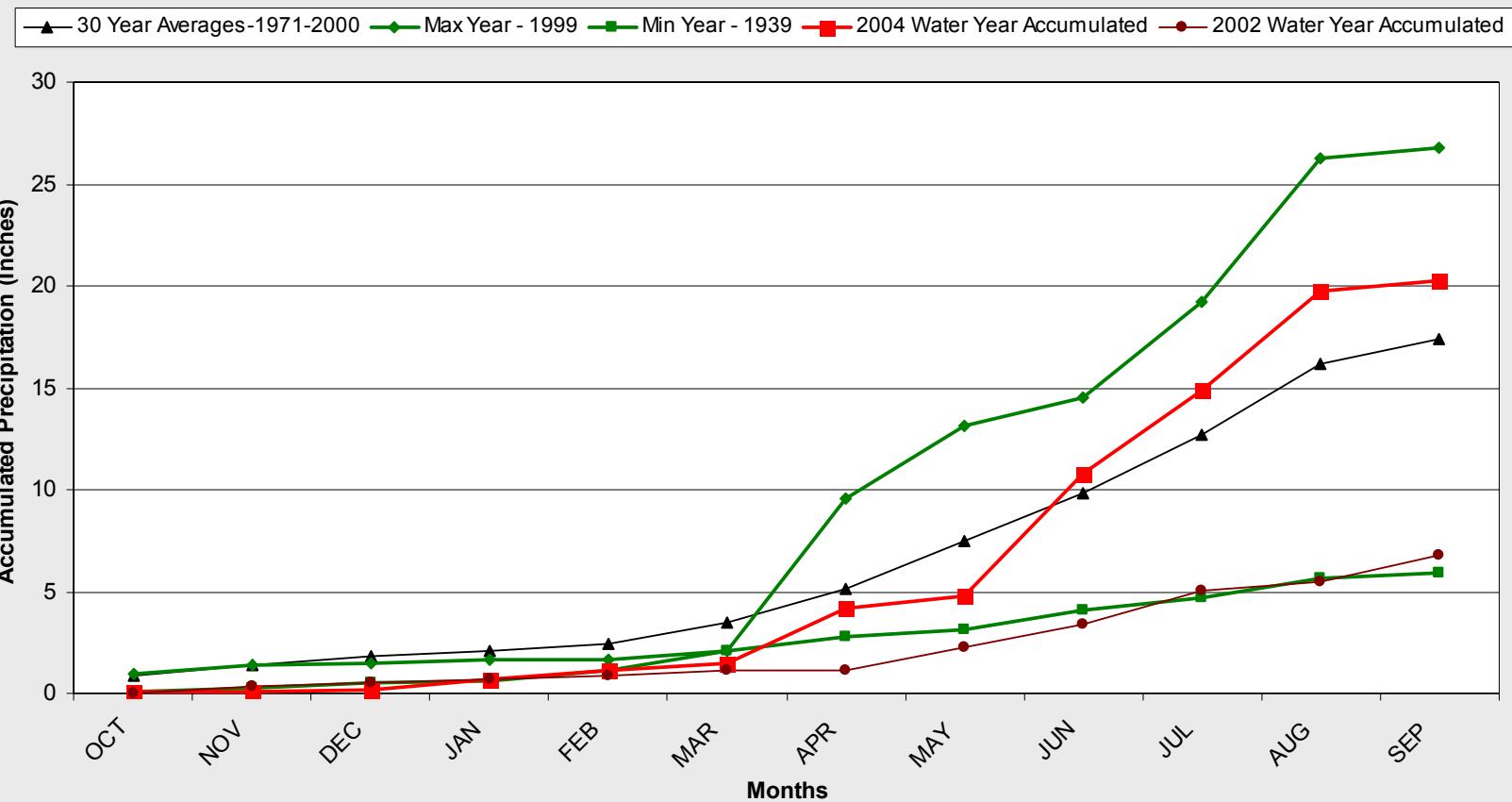
# Reservoir Levels

**Colorado Statewide Reservoir Levels on October 1st  
for Years 1997-2004**



# Colorado Springs 2004 Water Year Precipitation

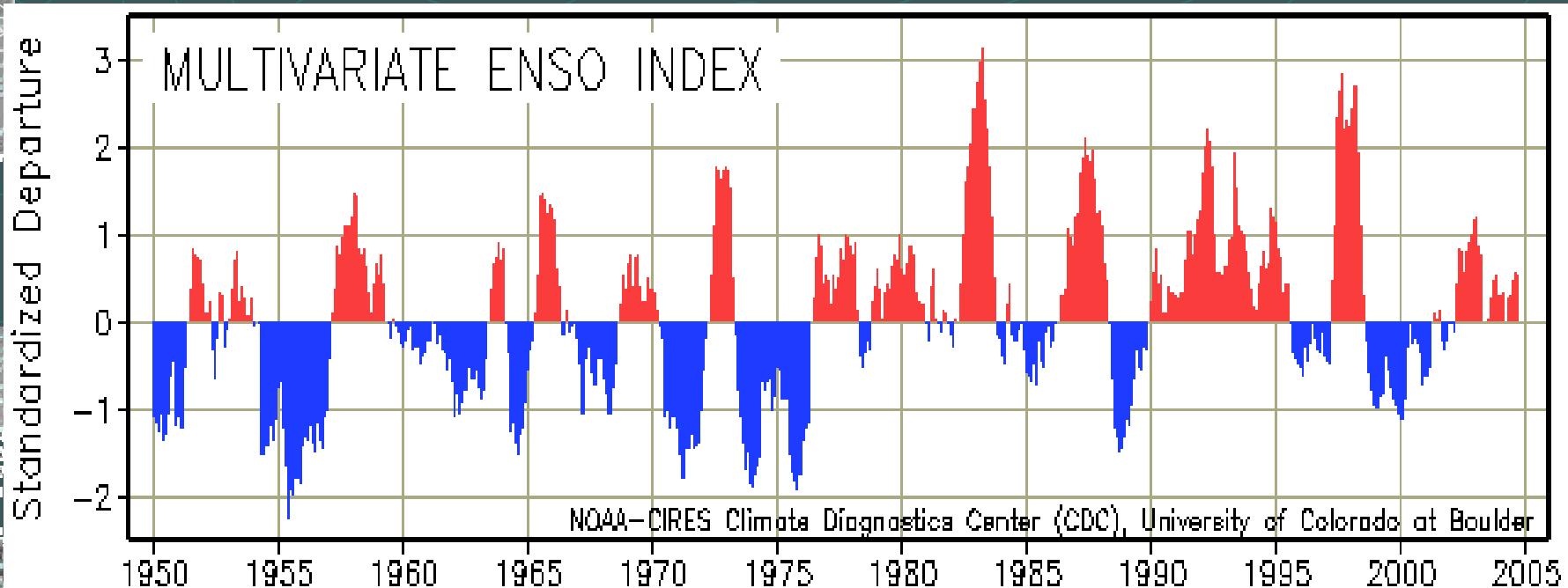
Colorado Springs  
2004 Water Year (Oct '03 - Sep '04)



# What Comes Next?



# Multivariate ENSO Index (MEI)

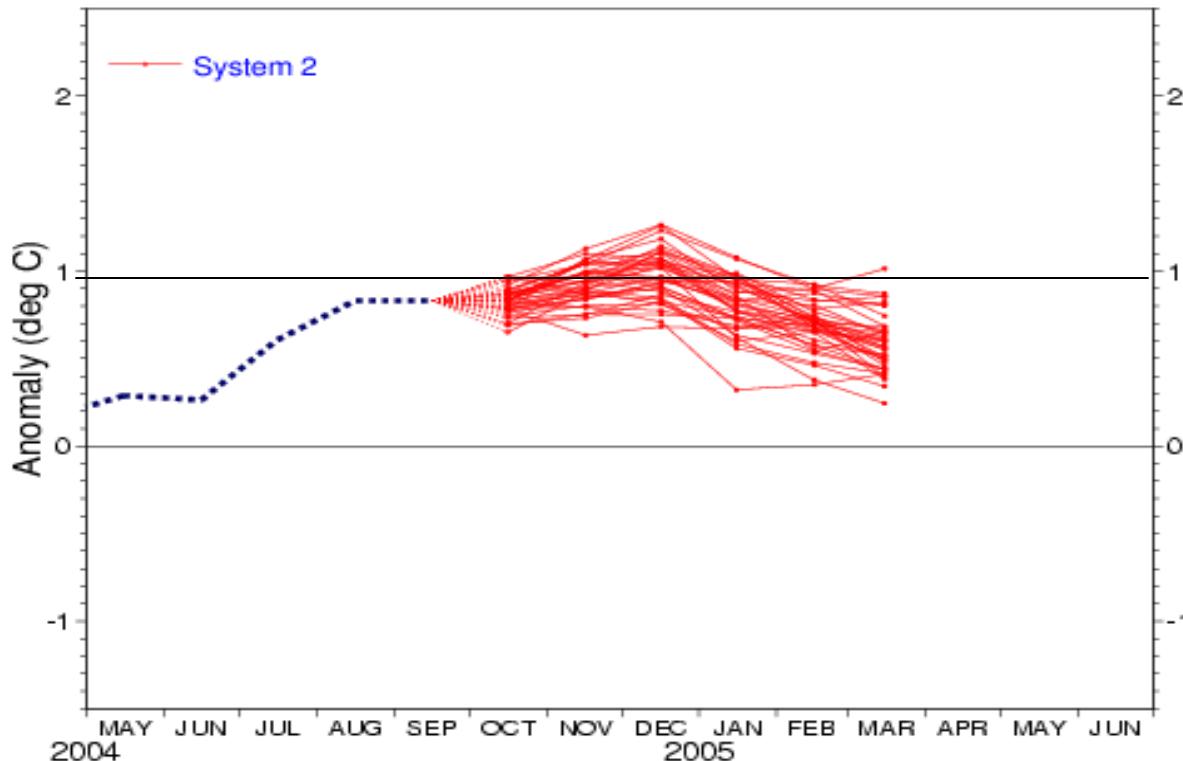


Last update: 10 November 2004

<http://www.cdc.noaa.gov/people/klaus.wolter/MEI/>

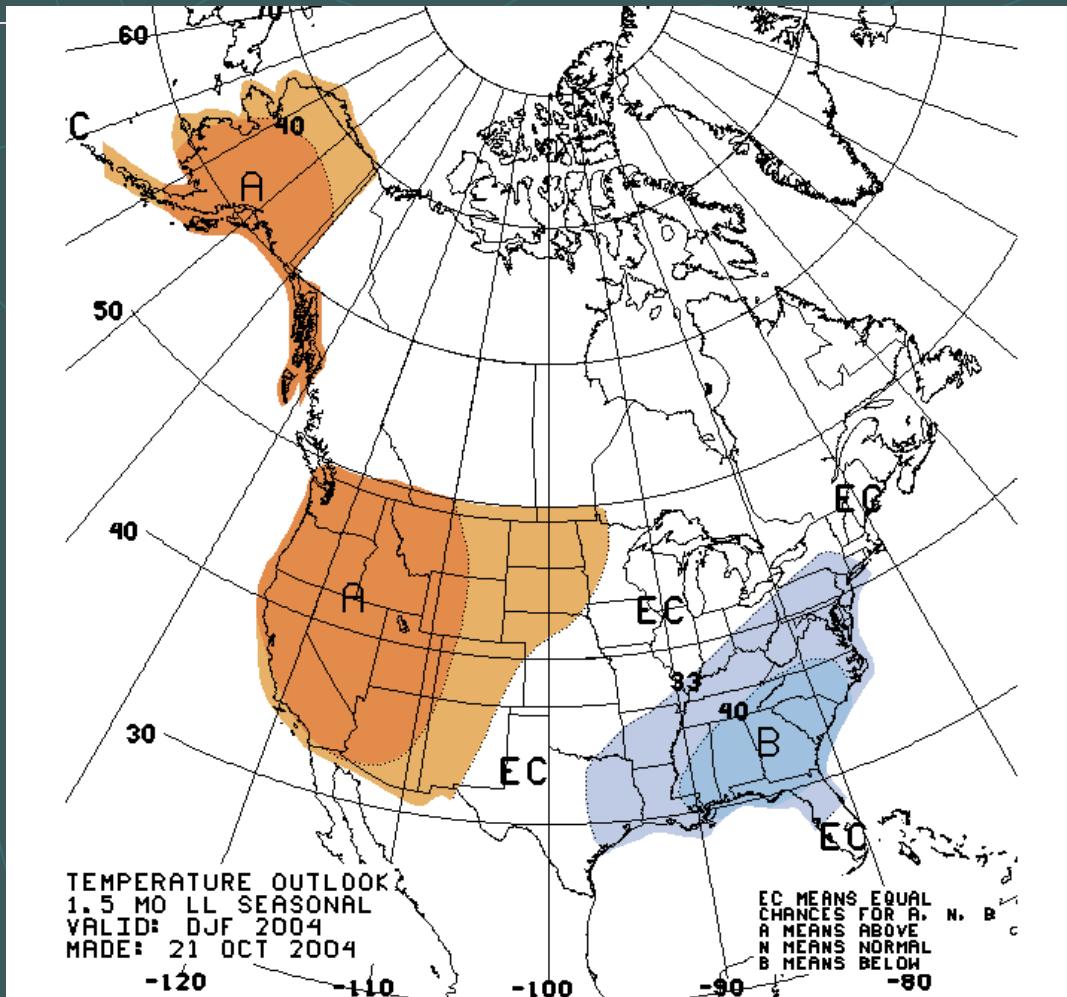
# El Nino Forecast

NINO3.4 SST anomaly plume  
ECMWF forecast from 1 Oct 2004  
Monthly means plotted using NCEP adjusted OIv2 1971-2000 climatology



<http://www.cdc.noaa.gov/people/klaus.wolter/SWcasts/>

# Temperature Dec-Feb 2004

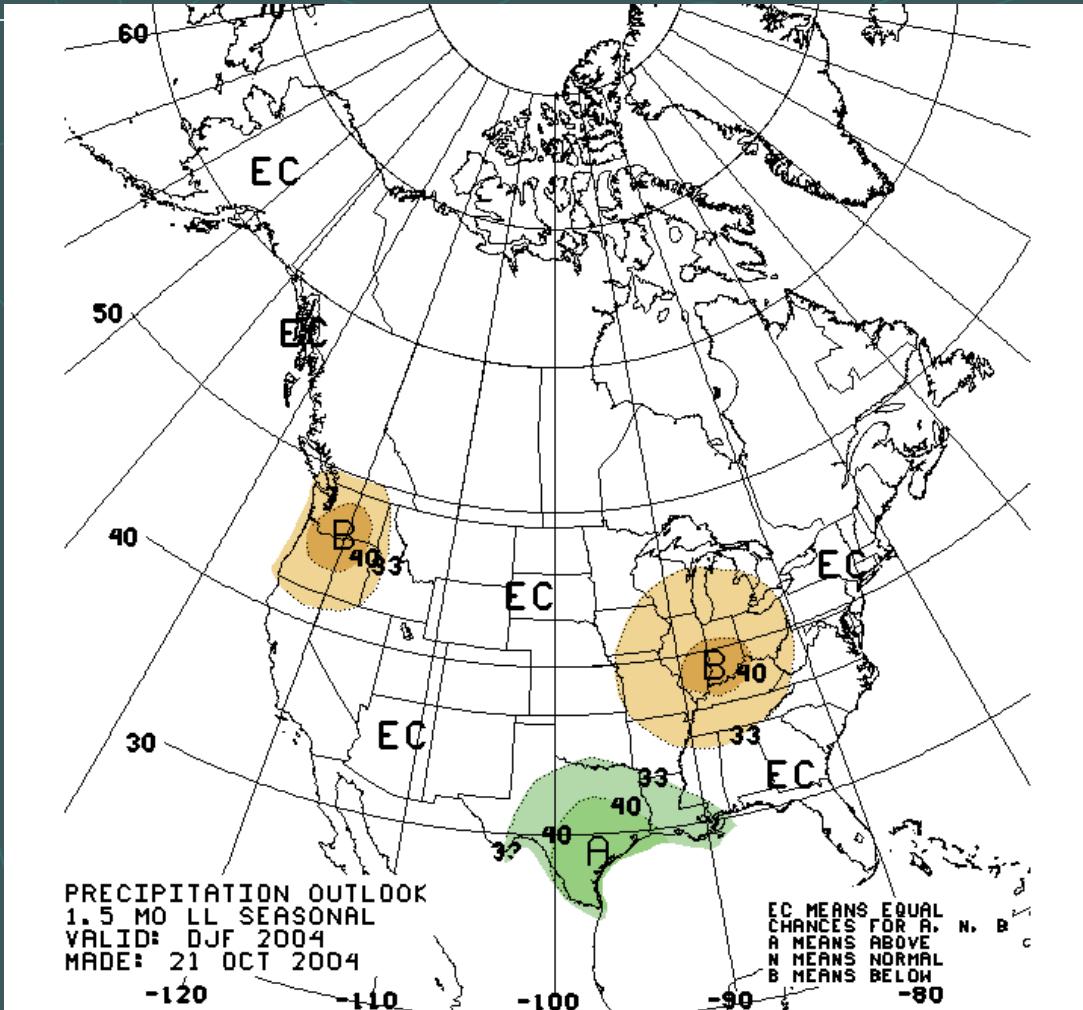


From the Colorado Prediction Center

[http://www.cpc.ncep.noaa.gov/products/predictions/multi\\_season/13\\_seasonal\\_outlooks/color/churchill.html](http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html)

# Precipitation

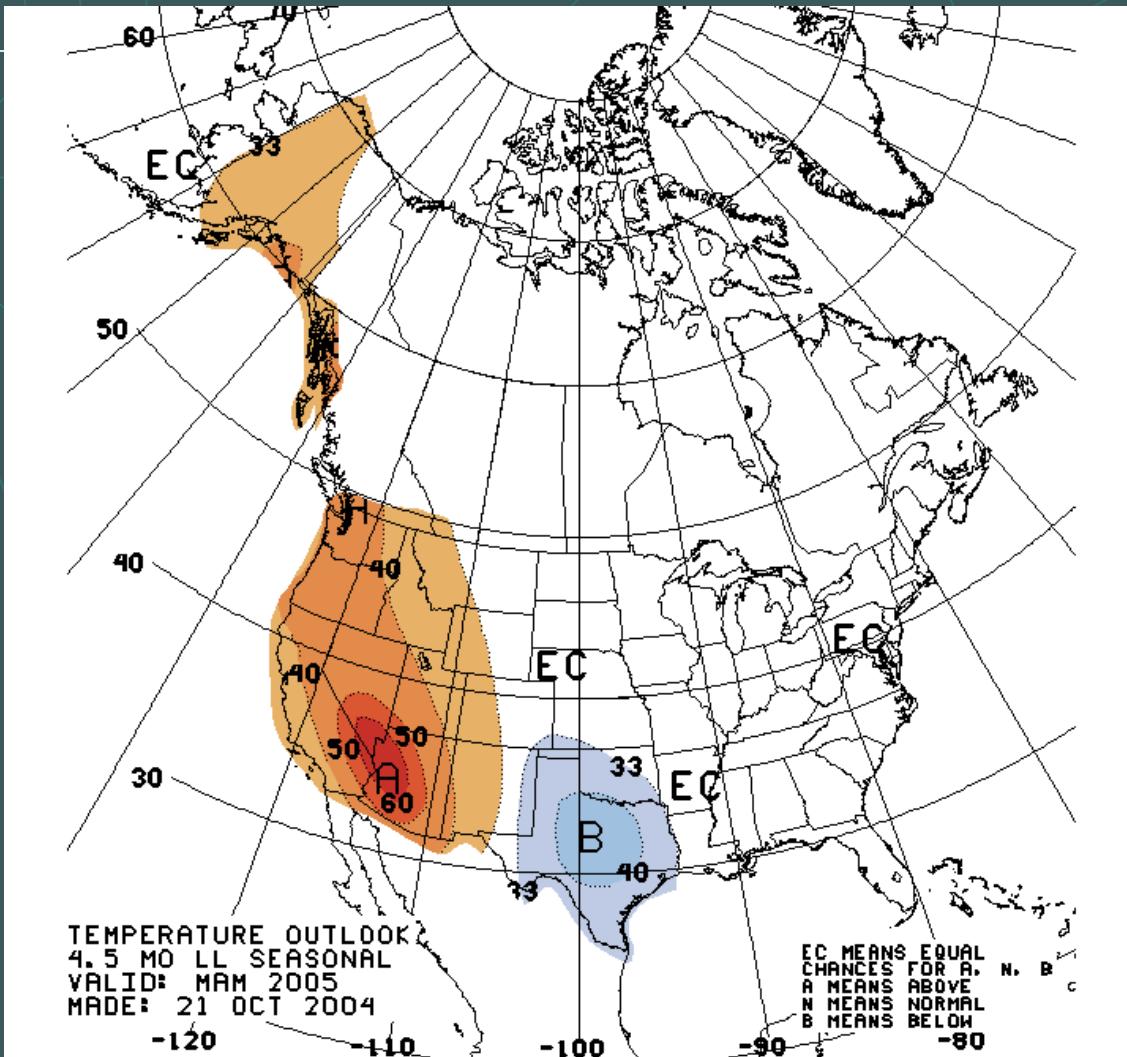
## Dec-Feb 2004



From the Colorado Prediction Center

[http://www.cpc.ncep.noaa.gov/products/predictions/multi\\_season/13\\_seasonal\\_outlooks/color/churchill.html](http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html)

# Temperature Mar-May 2005

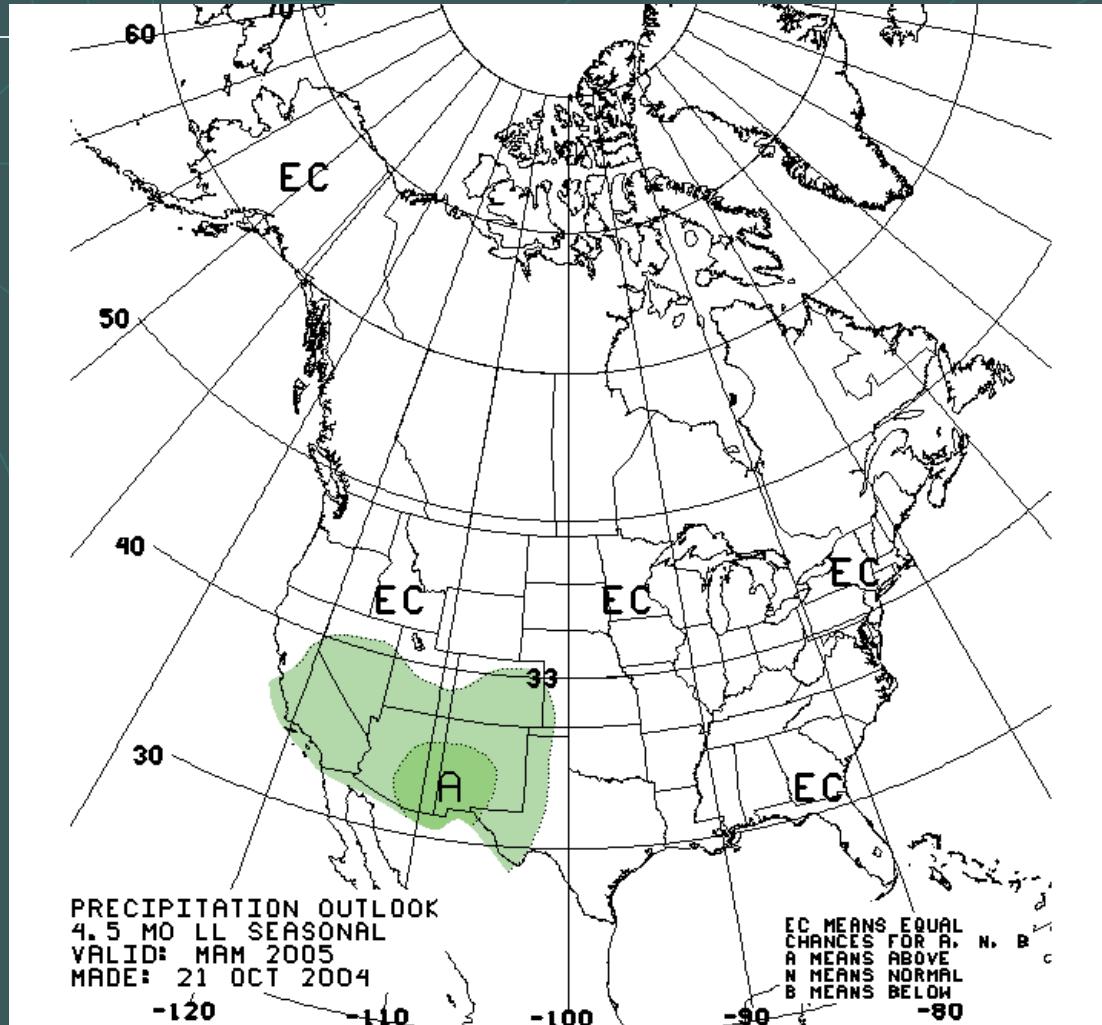


From the Colorado Prediction Center

[http://www.cpc.ncep.noaa.gov/products/predictions/multi\\_seasonal\\_outlooks/color/churchill.html](http://www.cpc.ncep.noaa.gov/products/predictions/multi_seasonal_outlooks/color/churchill.html)

# Precipitation

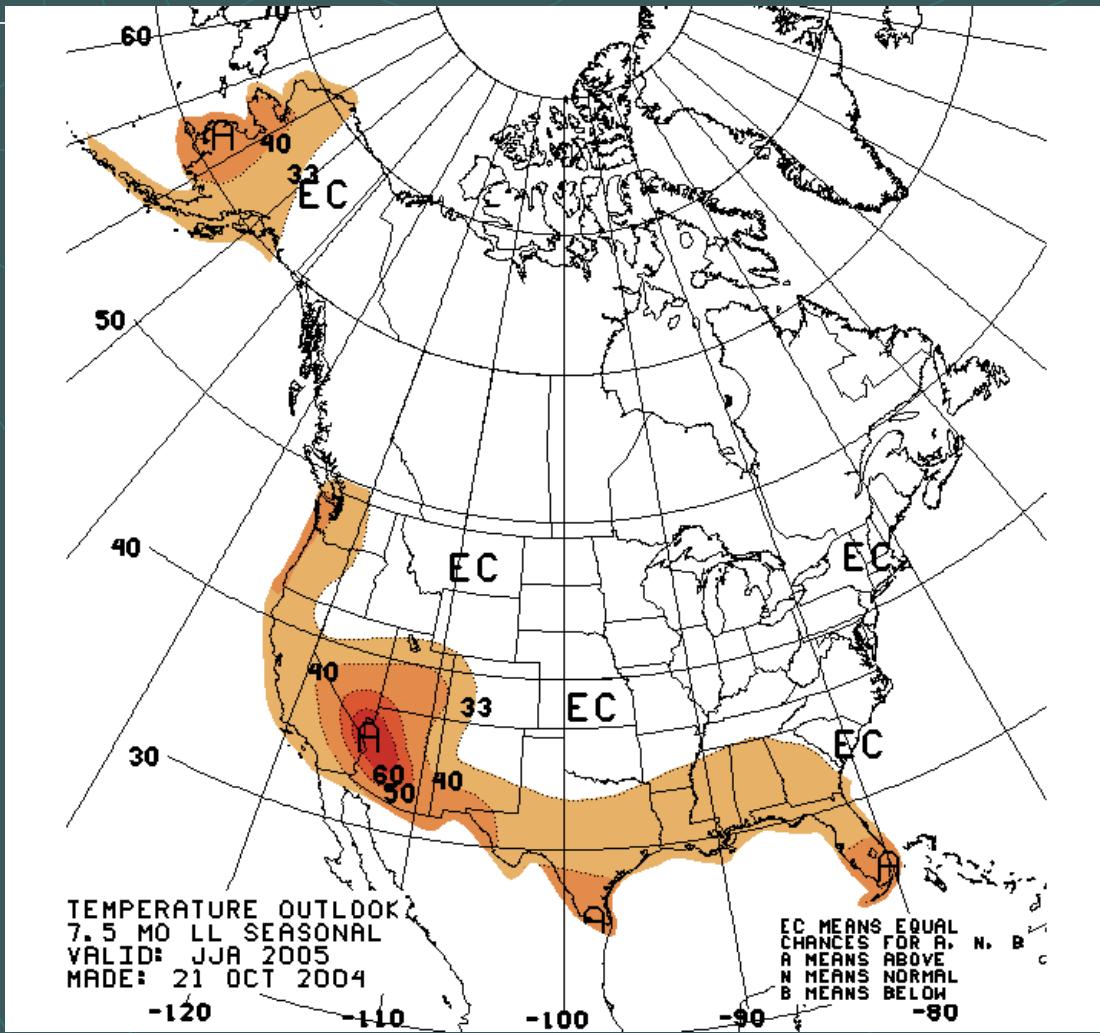
## Mar-May 2005



From the Colorado Prediction Center

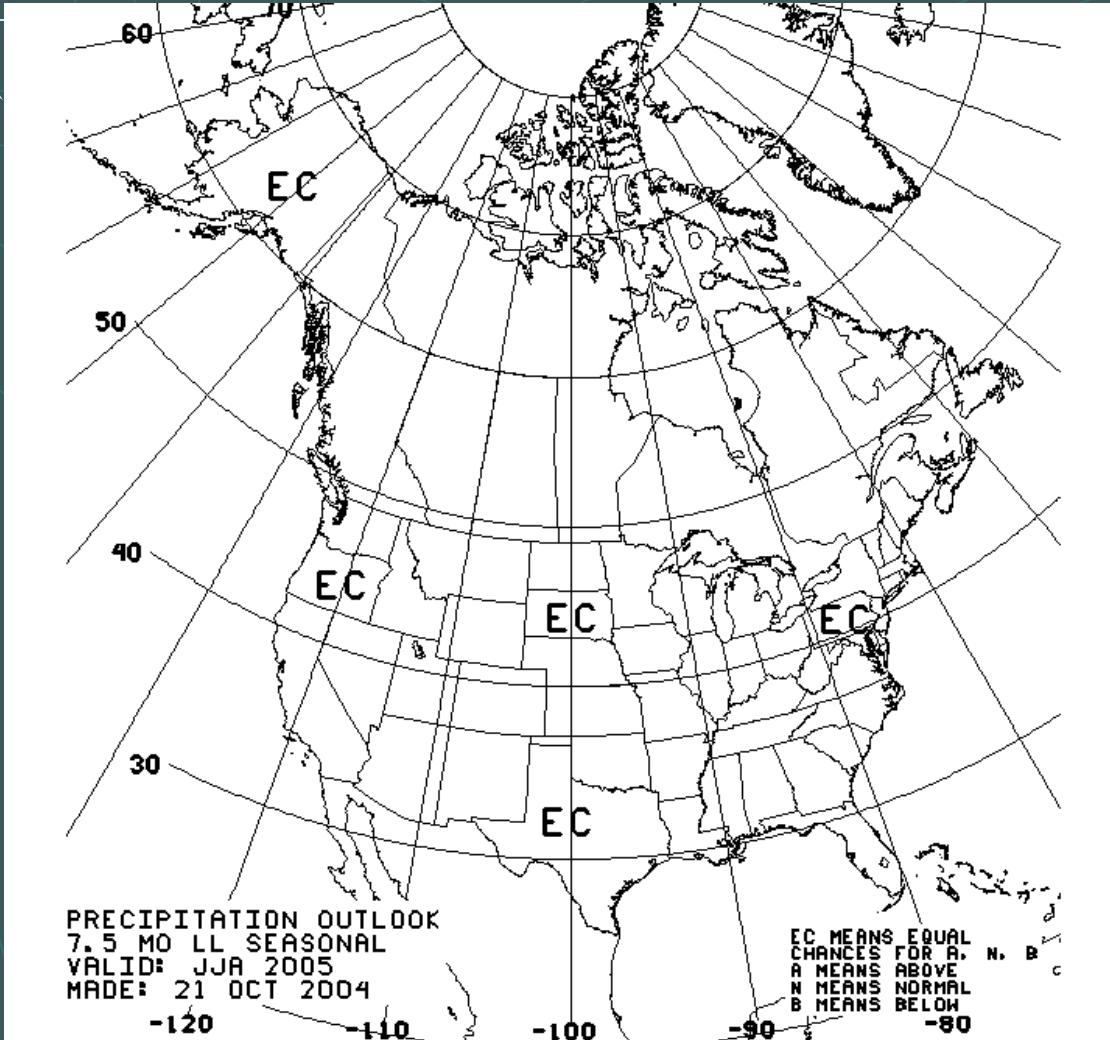
[http://www.cpc.ncep.noaa.gov/products/predictions/multi\\_season/13\\_seasonal\\_outlooks/color/churchill.html](http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html)

# Temperature Jun-Aug 2005



# Precipitation

## Jun-Aug 2005



# For Colorado Springs,

Average Precipitation = ~ 17 inches  
(WY2004 = 20.25 inches)

Average Evaporation = ~ > 24 inches

therefore,

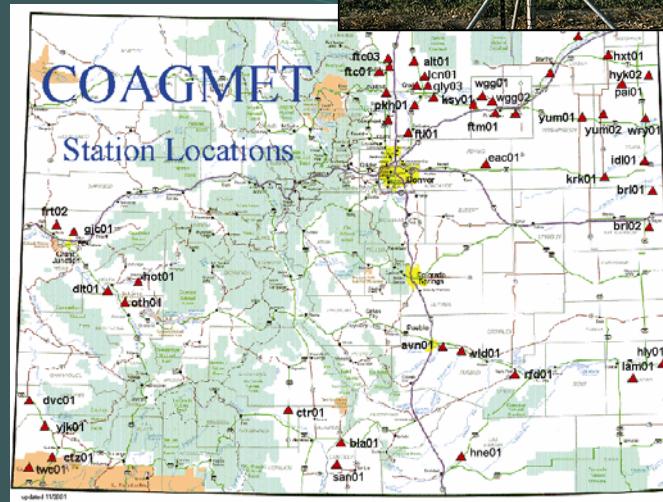
Drought is **NEVER** really over.



# CoAgMet

## Weather Data for Agriculture

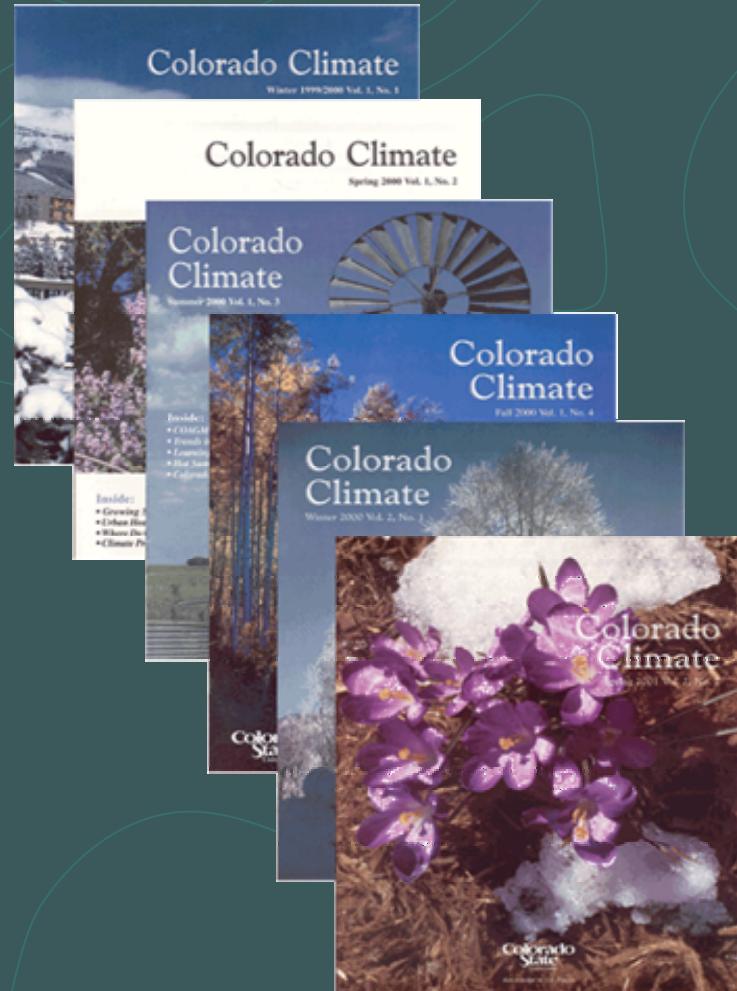
- Automated weather stations with daily and hourly readings of:
  - Temperature
  - Humidity
  - Wind
  - Precipitation
  - Solar energy
  - Evapotranspiration



<http://www.coagmet.com>

# Colorado Climate Magazine

- Good bedtime reading about the climate of Colorado -- recent and historic
- \$15/year subscription pays printing and mailing costs



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

# Colorado Climate Center

## Colorado State University

- Data and Power Point Presentations available for downloading
- <http://ccc.atmos.colostate.edu>  
*click on “Drought”  
then click on “Presentations”*





# CoCoRaHS

Community Collaborative Rain, Hail, and Snow Network



<http://www.cocorahs.org>

- Over 1,000 volunteers participate in rain, hail and snow measurements.
- More accurate maps, verifies forecasting, radar research, crop damage, drought/flooding, educational purposes.

# CoCo RaHS

Volunteers of all ages helping scientists study storms. The exploration begins in your back yard!



# What does it take to be a volunteer?

- Scientific curiosity.
- An interest in weather and an appreciation for water.
- Enough unobstructed space to install a rain gauge.
- Two minutes a day for a good cause.



Photograph by Gerry Pearson

# CoCo RaHS

## Simple Tools to Study Rain

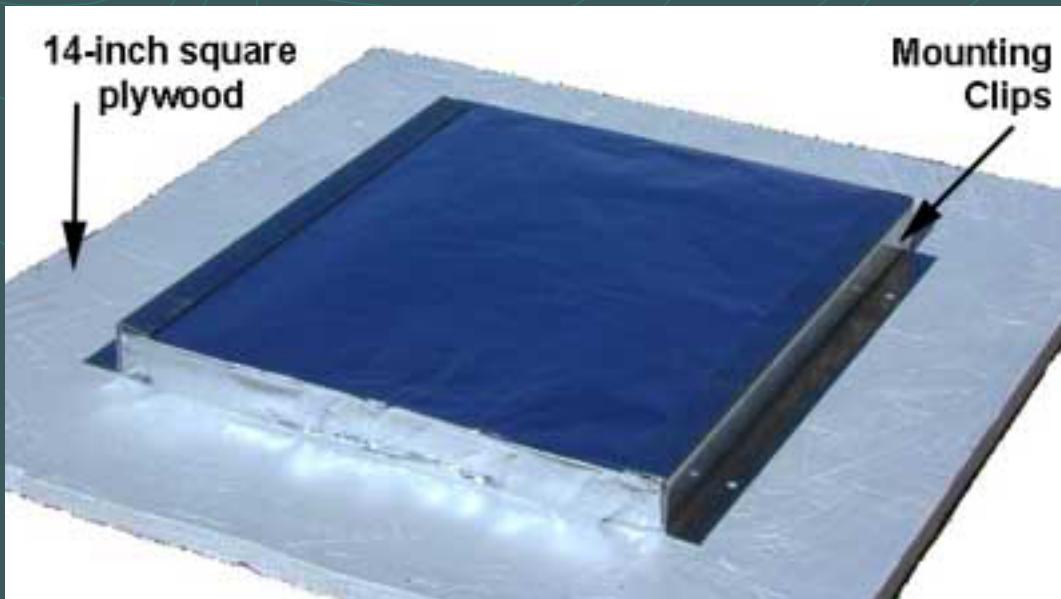
Rain Gauge



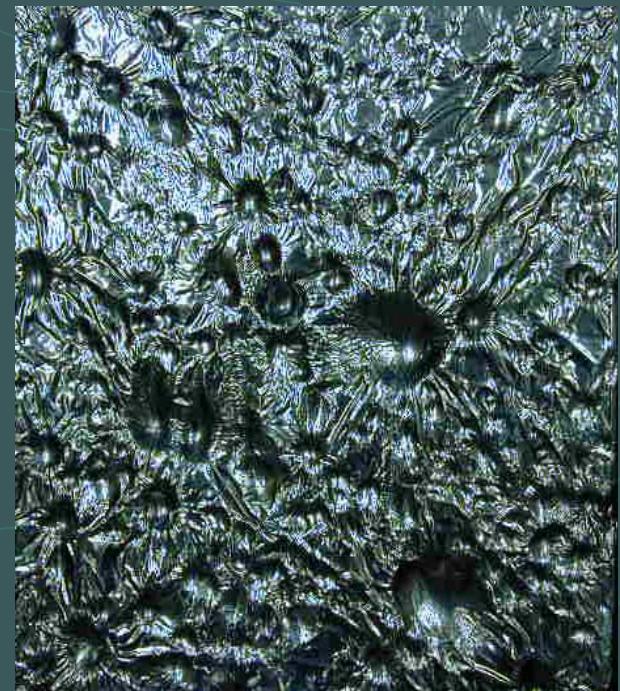
Example Station

# CoCo RaHS

## Simple tools to study hail

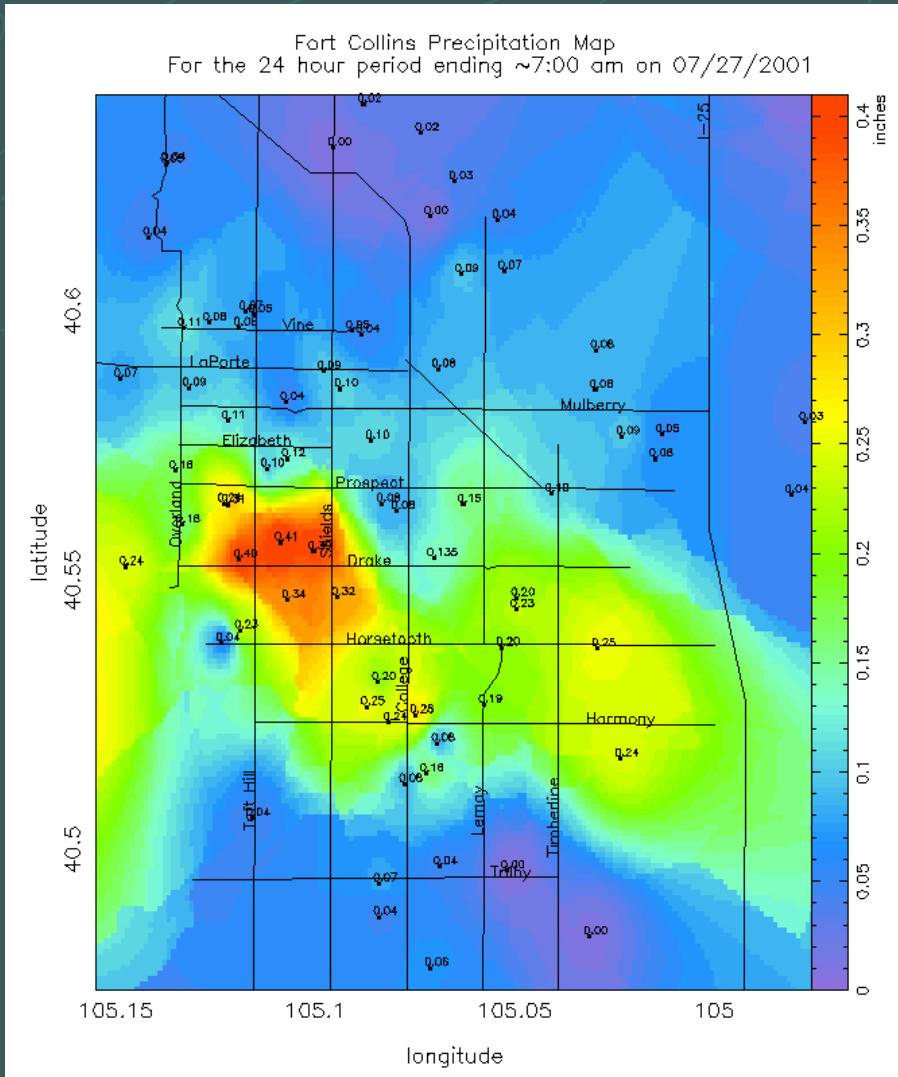
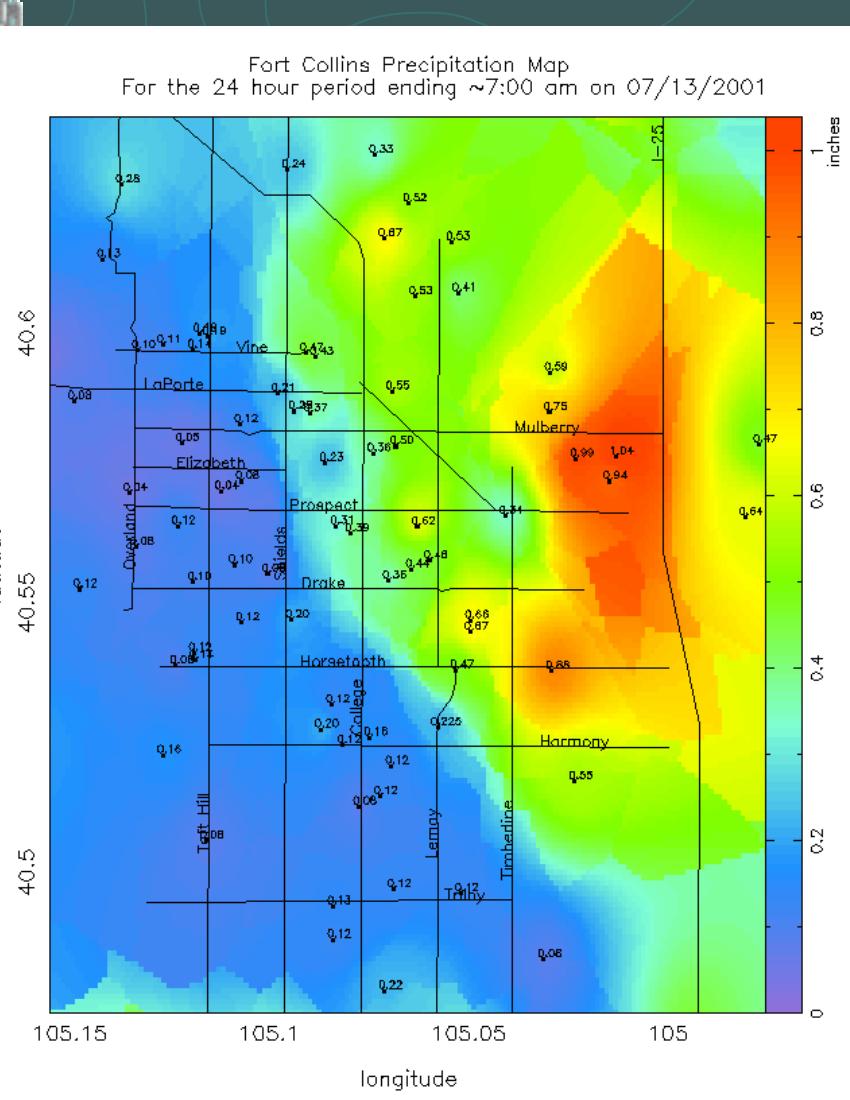


Hail Pad



Damaged Hail Pad

# Fort Collins daily rainfall examples



# Colorado Hailstorm

July 10, 2002, Parker, CO



Damaged Hailpad.



One of the culprits.

## COLORADO



# 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.

For more information visit the  
CoCoRaHS Web site

<http://www.cocorahs.org>



Support for this project provided by  
Informal Science Education Program,  
National Science Foundation  
and  
*many* local charter sponsors.