Drought and the Climate of Colorado: An Overview

Nolan J. Doesken
Colorado Climate Center
Colorado State University

http://ccc.atmos.colostate.edu

Presented to the Ditch and Reservoir Company Alliance,
February 26, 2004, Greeley, Colorado
Prepared by Odie Bliss
The Evolution of Our Recent Drought

Lake Granby, 2002 drought

Grand Ditch, 2002 drought
3-Month SPI

Fraction of Colorado in Drought Based on 3-month SPI Through 1999

Year

Fraction

Fraction of Colorado in Drought Based on 48-month SPI

Through 1999
1999 Water Year Precipitation

Water Year 1999
Precipitation Percent of Average for 1961-1990 Averages
2000 Water Year Precipitation

Water Year 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

[Map showing precipitation percent of average with various regions marked by numbers and color-coding]

Precip
% of Average

Legend:
- 0 - 9
- 10 - 29
- 30 - 49
- 50 - 99
- 70 - 89
- 90 - 109
- 110 - 129
- 130 - 149
- 150 - 169
- 170 - 189
- 190 - 209
- 210 - 229
- 230 - 249
- > 250
Negative Indicators

- Little late winter snow
- Missed opportunities
- Warm spring
- Brief, sporadic precipitation
- High intensity rainfall
- Frequent, strong winds
- Low humidity
- Abundant sunshine
2002 Snow Water Equivalent

Wolf Creek Summit SNOTEL

Water Year 2002
2002 Water Year Precipitation

Water Year 2002
Precipitation Percent of Average for 1961-1990 Averages
WY2002 Temperature Departures

Water Year 2002

Departure from average, degree F

-6 -4 -2 0 2 4 6 8

Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

- Eastern Plains - Foothills - Mountains - Western Valleys
2002 Daily Streamflow

Colorado River near Dotsero, CO

Discharge (1000 CFS)

2002 Discharge
Mean Discharge
2002 Daily Streamflow

Cache La Poudre River at Mouth of Canyon

Discharge, (1000 CFS)

- 2002 Discharge
- Mean Discharge
Rio Grande Streamflow near Del Norte

Year

Streamflow (cubic feet per second)

RIO GRANDE
7-yr running mean
2003 Water Year Precipitation

Water Year 2003

COLORADO

Precipitation (percent)
- Dark blue: 110-129
- Light blue: 90-109
- Medium blue: 70-89
- Orange: 50-69
- Brown: 30-49

Elevations Above 9000 Feet

10 0 10 20 miles
March 2003 Snowstorm
March 2003 Snowfall Totals

March 17-20, 2003 Snowfall Totals

COOP/CAST Observers

[Map showing snowfall totals with contour lines and color coding for different amounts.]
2003 SWE Porphyry Creek

PORPHYRY CREEK SNOTEL for Water Year 2003

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

Inches

Date (mm/dd)


Precip WY2003
SWE WY2003
Precip Avg 71-00
SWE Avg 71-00
WY2003 Temperature Departures

Water Year 2003

Departure from average, degree F

Eastern Plains  Foothills  Mountains  Western Valleys

Oct  Nov  Dec  Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep

-6  -4  -2  0  2  4  6  8  10
Fort Collins Summer Temperatures

Fort Collins Summer Average Temperature
(June - August)

- Summer Total
- 7-yr running mean

Temperature (Deg. F)

Years

2003 Daily Streamflow

USGS 07094500 ARKANSAS RIVER AT PARKDALE, CO.

**EXPLANATION**
- **MEDIAN DAILY STREAMFLOW BASED ON 40 YEARS OF RECORD**
- **MEASURED Discharge**
- **DAILY MEAN DISCHARGE**
- Station operated seasonally

Provisional Data Subject to Revision

http://water.usgs.gov/cgi-bin/daily_flow?co
Fort Collins Daily Accumulated Precipitation for WY2002 and WY2003

Fort Collins Daily Accumulated Precipitation

Precipitation (inches)

Day

Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

WY2002

WY2003
Where Do We Stand Now?
Water Year 2004 (Oct 03-Jan 04) Precipitation as Percent of Average

Temperature Departures

Water Year 2004

Departure from average, degree F

Eastern Plains
Foothills
Mountains
Western Valleys
Colorado Statewide Snowpack

As of Tuesday, February 24, 2004
90% of average
112% of last year's snowpack
67% of average peak accumulation
South Platte Snowpack

South Platte Basin Snowpack
Based on provisional SNOTEL data.

As of Tuesday, February 24, 2004
69% of average
92% of last year’s snowpack
48% of average peak accumulation
San Juan-Dolores-Animas Snowpack

As of Tuesday, February 24, 2004
98% of average
153% of last year's snowpack
75% of average peak accumulation
Reservoir Levels

Colorado Statewide Reservoir Levels on October 1st for Years 1997-2003 and Feb 1, 2004
What Comes Next?
Colorado Average Precipitation
Average Precipitation for Selected Sites

Monthly Average Precipitation

<table>
<thead>
<tr>
<th>Month</th>
<th>Precipitation (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td></td>
</tr>
<tr>
<td>Feb</td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td></td>
</tr>
<tr>
<td>Apr</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td></td>
</tr>
<tr>
<td>Jun</td>
<td></td>
</tr>
<tr>
<td>Jul</td>
<td></td>
</tr>
<tr>
<td>Aug</td>
<td></td>
</tr>
<tr>
<td>Sep</td>
<td></td>
</tr>
<tr>
<td>Oct</td>
<td></td>
</tr>
<tr>
<td>Nov</td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td></td>
</tr>
</tbody>
</table>

- Lamar
- Cheyenne Wells
- Walsh
- Fruita
- Rocky Ford
- Center
- Durango
- Vail
Statewide Annual Precipitation History

Statewide Mean Annual Temperature

Monthly Average Pan Evaporation

Average Monthly Pan Evaporation for Akron and Springfield, Colorado

Evaporation (inches)

Month

Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec

Akron  |  Springfield

0   | 2    | 4    | 6    | 8    | 10   | 12   | 14
Positive Indicators

- Late winter snows
- Cool spring
- Multi-day precipitation
- Wet Snow
- Low intensity rainfall
- Light winds
- High humidity
- Abundant cloud cover
Negative Indicators

- Little late winter snow
- Missed opportunities
- Warm spring
- Brief, sporadic precipitation
- High intensity rainfall
- Frequent, strong winds
- Low humidity
- Abundant sunshine
Multivariate ENSO Index (MEI)

http://www.cdc.noaa.gov/~kew/MEI/
El Nino Forecast

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

Forecast production date: 14 Feb 2004

http://www.cdc.noaa.gov/~kew/SWcasts/
Precipitation
March – May 2004

From the Colorado Prediction Center
Temperature
June – August 2004

From the Colorado Prediction Center
Precipitation
June – August 2004

From the Colorado Prediction Center
8-14 Day Temperature Forecast

http://www.cpc.ncep.noaa.gov/products/predictions/814day/
8-14 Day Precipitation Forecast

http://www.cpc.ncep.noaa.gov/products/predictions/814day/
CoCo RaHS
Community Collaborative Rain and Hail Study
YOU CAN HELP!

http://www.cocorahs.org

Sponsored in part by National Science Foundation
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](http://ccc.atmos.colostate.edu) click on “Drought” then click on “Presentations”