The Weather Is Our Water Supply:
Community Involvement in Monitoring Climate

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Atmospheric Science Department
Colorado State University

Presented at New Mexico State University
March 10, 2005, Las Cruces, NM.

Prepared by Odie Bliss and Henry Reges
Beginnings

- After the State Climatologist positions were abolished by the federal government in the early 1970s, many states gradually established state funded climate offices. Many were at land-grant universities.
- The Colorado Climate Center was established at Colorado State University in 1974 within the Colorado Agricultural Experiment Station.
Who Are We?

- **Roger A. Pielke, Sr.**
  Professor, Atmospheric Science and State Climatologist,
  pielke@atmos.colostate.edu

- **Nolan J. Doesken**
  Climatologist and Senior Research Associate,
  nolan@atmos.colostate.edu

- **Odie Bliss**
  Coordinator, odie@atmos.colostate.edu

- **Marty Osecky**
  System Administrator
What We Do....
Climatic Research

- Instrument Comparison Studies, Drought, Snow, Variability and Trends, Impacts and Modeling, etc.

Fraction of Colorado in Drought
Based on 48 month SPI
(1890 - May 2004)
Data Acquisition and Archive

- Elements: temperature, precipitation, snow, wind, solar, evaporation, soil temperatures, humidity, cloud cover
Monitor the Climate of Colorado

- Drought, flooding, blizzards, tornadoes, temperature extremes, Heating/Cooling Degree Data, etc.
Disseminate Information

- Farmers, ranchers, consultants, engineers, water resources, utilities, construction, lawyers, federal, state and local governments, schools, universities, and many others.

- HOW? Website, phone, fax, email

  http://ccc.atmos.colostate.edu

  (970) 491-8545 phone

  (970) 491-3314 fax
Welcome to the Colorado Climate Center!

The Colorado Climate Center is part of the Department of Atmospheric Science at Colorado State University. Our goal is to assist the state of Colorado in monitoring climate over time scales of weeks to years. We also recognize that climate involves complex interactions between the atmosphere, the oceans, continental glaciers, and the land. Vegetation processes are an important component of the climate system. This service should contribute to a reduction in the state's vulnerability to climate variability and change.

We provide links to regional climate centers and to the National Climate Data Center where detailed climate information is provided. Other valuable climate links are also listed as additional data resources.

Our publication, Colorado Climate, provides articles to the public on a variety of topics. Past issues are available online as electronically accessible files.

Colorado's climate is fascinating, and we hope you learn more concerning this subject through our website.

What's New

- You need Acrobat reader to view the links below.

2. Discussion forum: A Broader Perspective on Climate Change is Needed by Roger Peike Sr. in the September issue of Global Change Newsletter, No. 59.

http://ccc.atmos.colostate.edu
How Do We Monitor Our Climate?
National Weather Service Collaboration

Cooperative Weather Stations in Colorado

Typical Cooperative Weather Station
USDA, Natural Resources Conservation Service

Typical NRCS Snotel Site

NRCS Snotel Sites for Colorado
State Engineer’s Office
Colorado Climate Center Monitoring Activities

- Fort Collins Historic Weather Station – Continuous observations from 1889 to present
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
Center, Colo., CoAgMet Daily Values of Temperature and Solar Radiation
Applications of Climate Monitoring
Applications of Climate Monitoring

U.S. Drought Monitor

March 1, 2005
Valid 7 a.m. EST

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, March 3, 2005
Authors: Richard Heim/Candace Tankersley, NOAA/NESSIS/NCDC
Applications of Climate Monitoring

- Standardized Precipitation Index Map
Applications of Climate Monitoring

- Water Management and Irrigation Scheduling
Applications of Climate Monitoring

- Extreme Precipitation Study

Colorado Extreme Storm Precipitation Data Study

Summary of accomplishments and work performed
February 15, 1995 through October 31, 1996

Thomas B. McKee
Nolan J. Doesken

Climatology Report #97-1

DEPARTMENT OF ATMOSPHERIC SCIENCE
COLORADO STATE UNIVERSITY
FORT COLLINS, COLORADO
Applications of Climate Monitoring

- History of Extreme Rainfall

October 1996

Questionable Storm Precipitation Reports

<table>
<thead>
<tr>
<th>Storm No.</th>
<th>Storm Name</th>
<th>State</th>
<th>Storm Date</th>
<th>Region</th>
<th>Type</th>
<th>Lat</th>
<th>Long</th>
<th>Maximum Precipitation</th>
<th>Remarks</th>
<th>USBR Storm File</th>
<th>USBR Depth Area Dur. Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Gladstone - San Juan Range</td>
<td>CO</td>
<td>October 4-6, 1911</td>
<td>3</td>
<td>G</td>
<td>37 53</td>
<td>107 39</td>
<td>6.05&quot; 24 hrs, Gladstone, CO Definitely a big storm, but Gladstone precip in question</td>
<td>Large flood Durango and Animas River, many 3-4&quot; totals</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>48</td>
<td>Telluride</td>
<td>CO</td>
<td>July 27, 1914</td>
<td>3</td>
<td>LC</td>
<td>37 57</td>
<td>107 49</td>
<td>A storm definitely happened but date of reported heavy rain does not match with date of reported mudslide 3.50&quot; 1 day Telluride</td>
<td>Mudslide 7/27/1914 buried Telluride, precip reported on 8/25/14</td>
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<tr>
<td>114</td>
<td>Masonville</td>
<td>CO</td>
<td>September 10, 1938</td>
<td>2</td>
<td>LC</td>
<td>40 26</td>
<td>105 13</td>
<td>Local reports in SW Fort Collins of 5-7&quot; &lt;1 hr. reports suspect</td>
<td>No extreme precip, reports found in CO</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>158</td>
<td>Cimmaron</td>
<td>CO</td>
<td>June 3, 1952</td>
<td>3,5</td>
<td>GLC</td>
<td>38 24</td>
<td>107 31</td>
<td>5.25&quot; 1 day, Cimmaron</td>
<td>Did it really happen?</td>
<td></td>
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<tr>
<td>226</td>
<td>Eagle</td>
<td>CO</td>
<td>September 23, 1969</td>
<td>6</td>
<td></td>
<td>39 38</td>
<td>106 50</td>
<td>1.50&quot; 24 hrs Eagle</td>
<td>CD notes 10&quot; total precip for month</td>
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<tr>
<td>227</td>
<td>Crested Butte</td>
<td>CO</td>
<td>September 25, 1969</td>
<td>3</td>
<td></td>
<td>38 52</td>
<td>106 58</td>
<td>2.30&quot; 24 hrs, Crested Butte</td>
<td>No precip at Crested Butte (NWS) or in state on 25th, Incorrect?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>266</td>
<td>Whiskey Creek</td>
<td>CO</td>
<td>August 24, 1982</td>
<td>5</td>
<td>LC</td>
<td>37 13</td>
<td>105 07</td>
<td>3.70&quot; - Whiskey Creek (Snout site), elevation - 10,220 ft</td>
<td>Measurement suspect, heavy precip in SW CO - some local flooding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>296</td>
<td>Grand Lake</td>
<td>CO</td>
<td>September 26, 1985</td>
<td>4</td>
<td>G</td>
<td>40 16</td>
<td>105 50</td>
<td>3.20&quot; 24 hrs, Grand Lake</td>
<td>Measurement suspect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>295</td>
<td>Scotch Creek</td>
<td>CO</td>
<td>August 19, 1988</td>
<td>3</td>
<td>LC</td>
<td>37 39</td>
<td>106 01</td>
<td>4.10&quot; - Scotch Creek (Snout site), elevation - 9,100 ft</td>
<td>Storm occurred but max values of precipitation appear suspect.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>321</td>
<td>Colorado Springs</td>
<td>CO</td>
<td>September 2, 1994</td>
<td>2</td>
<td>LC</td>
<td>36 49</td>
<td>104 42</td>
<td>5-6&quot; between 9-10:30 pm with lots of hail</td>
<td>Storm occurred but max values of precipitation appear suspect.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>325</td>
<td>Wolf Creek Pass</td>
<td>CO</td>
<td>August 20, 1995</td>
<td>3</td>
<td>LC</td>
<td>37 29</td>
<td>106 47</td>
<td>4.03&quot; in 1 day</td>
<td>Measurement appears suspect</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Common Theme from Climate Monitoring Applications is –

Inadequate Spatial Density of Precipitation Data
?? How About Remote Sensing ??
Remote Sensing is Great – But Ground Calibration is Crucial

Red Arrow indicates location of CoCo RaHS observer. Resulting hailpad and retrieved hailstones. CoCo RaHS observations are also providing valuable spotter information to the National Weather Service.

Contour map of hail quadrature parameter (HQP) showing potential hail damage from a severe thunderstorm in Douglas County, CO, in July 2002. The data were produced from the CSU-CHILL Polametric Radar. CoCo RaHS data are being used as ground validation for the CSU-CHILL hail and rainfall products.
How can we gather more data without breaking the bank??
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).
“By using low-cost measurement tools, stressing training and education, and utilizing an interactive website, our aim is to provide the highest quality data for natural resource, education and research applications.”
CoCoRaHS: Simple tools to study rain

Rain Gauge

Example Station
CoCo RaHS Gauge in 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
CoCoRaHS -- Supplementing NWS Cooperative Program to Improve Precipitation Measurements.
Fort Collins Daily Rainfall Examples
Colorado Hailstorm
July 10, 2002, Parker, CO
Example Page from CoCoRaHS Web Site of Damaged Hail Pads

July 3, 2002

569  580  736  753  JF24

452  JF32
## Expanded Hail Information from Web Site

<table>
<thead>
<tr>
<th>Data: 7/3/2002</th>
<th>Station Number: 560</th>
<th>Common Stones: Pea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hail Began: 2:56pm</td>
<td>Name: Greeley 4.3</td>
<td>Largest Stones: Marble</td>
</tr>
<tr>
<td>Hail Lasted: 10 minutes</td>
<td>MMW</td>
<td>Smallest Stones: Pea</td>
</tr>
<tr>
<td></td>
<td>County: Weld</td>
<td></td>
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<td></td>
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<tr>
<td>Hailfall was: Intermittently</td>
<td>Hailstones were: Hard, Mixed</td>
<td>Hail started: same time as rain</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>Average distance between stones: 1/16 inches</td>
<td>Depth of hail:</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments: None</td>
<td></td>
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</tr>
</tbody>
</table>
The Quality of Our Data Comes Through the Extensive Training of Our Volunteers
Sample Training Materials

Setting up your equipment

Location! Location! Location!

This looks like a good spot!

It’s the key to good data
Measuring Rain

To measure this amount . . .

Pour out the first inch from the inner tube

Now pour the remaining water into the funnel & measure using the inner tube.
Measuring Snow

Snow measured in the open

6.5 inches has fallen in the open
Reporting Hail

As hail is falling . . .

fill out your CoCoRaHS Hail Report Card. After the storm is over attach it the back of the pad.
Using the Web Site

Enter your report

Here you will enter the total precipitation measured in your gauge.

Record your measurement in hundredths (0.00)
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.
CoCo RaHS is Growing!!

- More states,
- More staff,
- More collaboration,
- More science,
- More education,

and

- Many more participants.
Participating CoCoRaHS States
The Benefits of CoCoRaHS

Learning Together

Great Local Data
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.
Colorado Climate Center

Data and Power Point Presentations available for downloading

http://ccc.atmos.colostate.edu

- click on “Drought”
- then click on “Presentations”