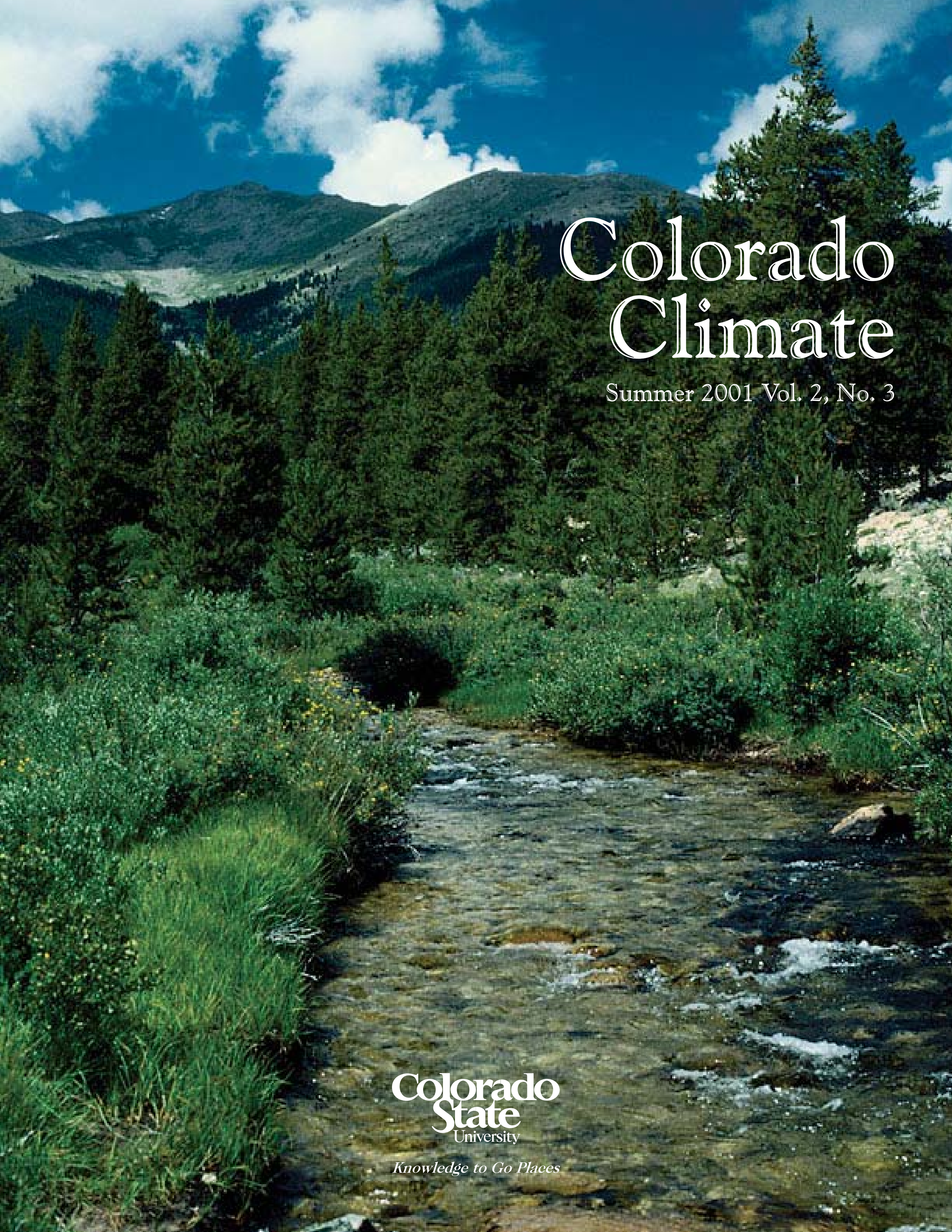
Colorado Climate

Summer 2001 Vol. 2, No. 3



Colorado State University

Knowledge to Go Places

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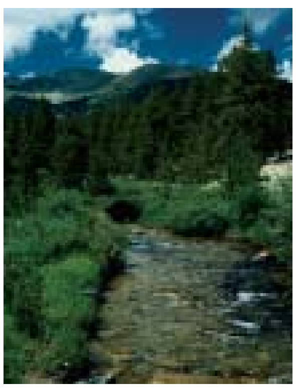

Cover Photo: Taylor Park, Colorado, in early August. Photo by © Ronald L. Holle, used with permission.

If you have a photo or slide that you would like considered for the cover of *Colorado Climate,* please submit it to the address at right. Enclose a note describing the contents and circumstances including location and date it was taken. Digital photographs can also be considered. Submit digital imagery via attached files to: odie@atmos.colostate.edu. Unless otherwise arranged in advanced, photos cannot be returned.

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To our Readers:

With this issue, we will bring our magazine quickly back to its scheduled publication timetable. Over the next few months, you will receive several issues! We hope you enjoy the articles and recollections of Colorado weather.

Roger A. Pielke, Sr., Chief Editor
Odie Bliss, Technical Editor

Roger A. Pielke, Sr.
Professor and State Climatologist

Nolan J. Doesken
Research Associate

Colorado State University
Knowledge to Go Places

Colorado Climate Center
Atmospheric Science Department
Fort Collins, CO 80523-1371

Phone: (970) 491-8545
Phone and fax: (970) 491-8293

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Production Staff: Odilia Bliss and Clara Chaffin, Colorado Climate Center
Barbara Dennis, Lisa Schmitz, and Sandy Thode, Publications and Printing

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Web: http://ccc.atmos.colostate.edu

Nocturnal Tornado Hits Eastern Colorado

Ian Wittmeyer, Atmospheric Science Department, Colorado State University

The severe weather season in Eastern Colorado typically peaks in June although late season storms in July are not uncommon. A large, long-lived thunderstorm complex over Nebraska early in the morning of July 5, 2000 played an important role in producing a significant tornadic supercell thunderstorm later that day. I was aware of the potential for storms in Northeast Colorado that morning and decided it was worth a drive out east to see what developed.

I went through my usual review of our regional surface weather observations which showed a westward push of very moist air from that large thunderstorm complex into Western Nebraska. Upper air charts revealed jet stream winds that were strong enough to support tornado-producing storms, usually a limiting factor this late in the season. A few other factors also pointed toward the southwestern Nebraska panhandle area as a target area, including a surface boundary which separated warm and dry air in Colorado with somewhat cooler and very moist air to its east. Dewpoint temperatures approaching 70 degrees Fahrenheit were present in southwest Nebraska, indicating potentially extreme levels of atmospheric instability present there. Easterly surface winds were pushing the highly unstable low-level air westward underneath unseasonably strong westerly winds at jet stream level. Strong shear and extreme instability are a recipe for damaging thunderstorms on the high plains.

I found two graduate students who were also interested in a storm chase, as my usual chase partners were unavailable to go out. The three of us departed Fort Collins at 3:30pm and headed north to Cheyenne, Wyoming where cumulus clouds were forming and gradually growing taller. Two towering cumulus grew stronger east of Cheyenne and we chose to target the southern-most one since it was in a more favorable location; closer to the northwest-to-southeast oriented surface boundary. We drove east on I-80 and got ahead of this developing thunderstorm just as it slowed its forward movement and made a southward turn. The storm rapidly intensified near Sidney, Nebraska, developing an intense rainshaft on its west side, and a lowered cloud base formed below the strong updraft.

Knowing that very moist conditions were feeding into the storm from the east, we expected this storm to intensify further. We were able to repeatedly drive south a few miles and stop the car to watch this storm develop into one of the most impressive supercells I've ever seen. A striated, corkscrew updraft dominated the sky just to our west as we watched from just south of Crook, Colorado at around 8:00 pm. Indications of potential tornado formation were seen before sunset, but we did not observe any touchdowns from our perspective. We decided to let the storm pass to our east since it was now dark and I wanted to avoid the large and damaging hail occurring just to our north. The back side of the storm was illuminated by continuous lightning high up in the updraft, which exhibited

(continued on page 2)

Left: Tornado damage to 100 foot Harvestore on July 5, 2000. Photo taken by Jim Bliss.

Below: Photo of July 8, 2000 supercell thunderstorm taken by Ian Wittmeyer.

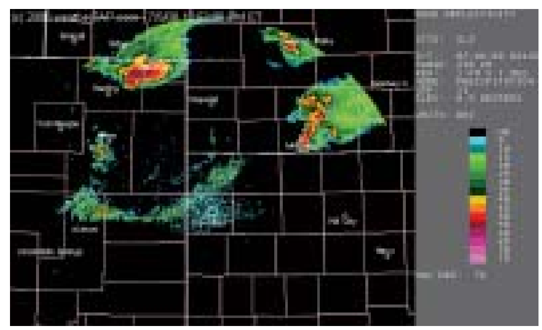
Nocturnal Tornado *(continued from page 1)*

smooth, collared-shaped bulges. It was about this time that an F3 tornado touched down near Dailey, Colorado causing damage to a number of structures, including the farmstead of an elderly couple. Miraculously nobody was killed, as strong nocturnal tornadoes are especially dangerous and fairly rare in Colorado.

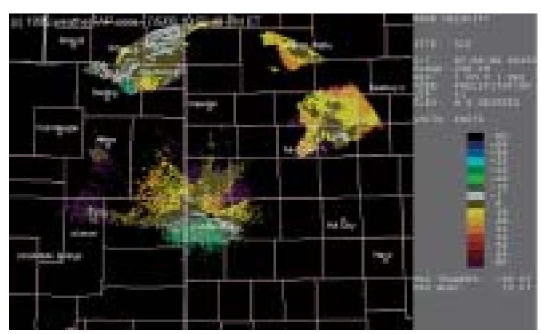
The storm's incredible lightning display continued to illuminate the eastern sky behind us as we headed back to Fort Collins, arriving home around 11:30pm.

excerpt from Storm Data publication, July 2000, Volume 42, Number 7							
Logan County	Date	Time	Length	Width	Number Injured	Damage	Storm
Dailey, 2 mi NNE to 4 mi S	July 5	2010 MST	6 Mile	1320 yds	2	$750 K	Tornado (F3)
A large and destructive tornado accompanied with hail, up to softball size, ripped through eastern Logan county. An 88-year old farmer and his wife received minor injuries when the tornado flattened their home. The elderly man spared from serious injury when the recliner he was sitting in flipped upside down; just before a wall caved in on top of him. The farmer suffered a cracked vertebra and a lacerated hand. In all, five farmsteads were either damaged or destroyed. Several structures were destroyed, including three homes and numerous outbuildings. One modular was lifted up and dropped 50 feet away from its foundation. Numerous pieces of farm equipment including, machinery, stock trailers and vehicles were damaged or destroyed. Some livestock were also killed. The tornado snapped power poles and downed electrical lines between Holyoke and Fleming. Initial damage estimates to two properties alone were around $750,000.							

Location of Dailey, Colorado (star).



Radar reflectivity image from Goodland showing the classic "hook-echo" structure just east of Sterling, Colorado. Image courtesy of weatherTAP.com.

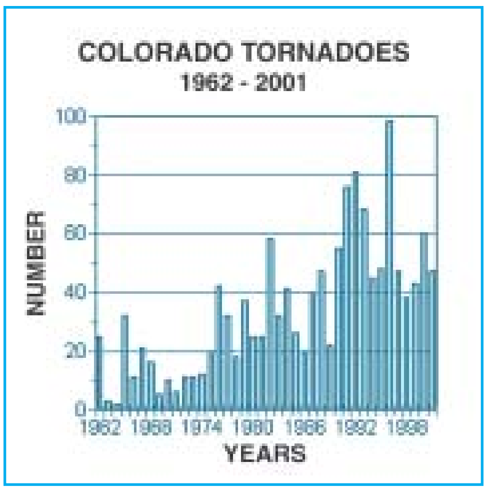


Doppler velocity image which shows motion in the storm toward the radar (green/blue) and motion away (yellow/red) indicating storm-scale rotation. Image courtesy of weatherTAP.com.

Colorado Tornado Facts

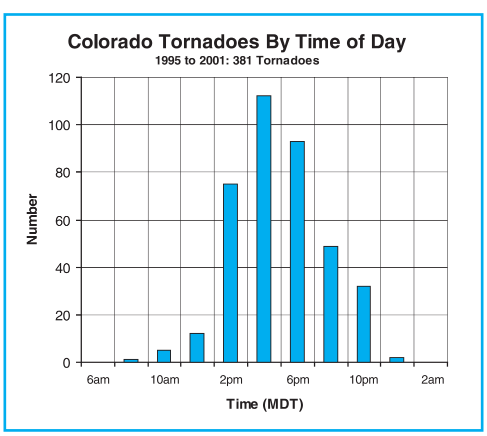
Bob Glancy, Denver-Boulder National Weather Service

In the past 10 years Colorado has averaged around 60 tornadoes a year. The numbers have varied greatly, from a record 98 tornadoes reported in 1996, to 38 tornadoes in 1998. There were 60 tornadoes during 1999 and 47 reported for 2001. The graph below shows that variability and the increasing number of reported tornadoes since the 1970s. Increasing population, improved communications, and more trained spotters have all resulted in more reported tornadoes each decade since the 1960s.

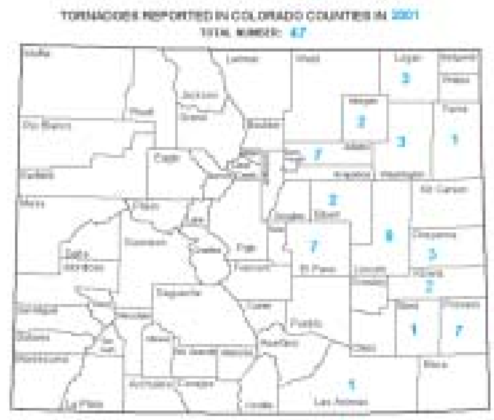


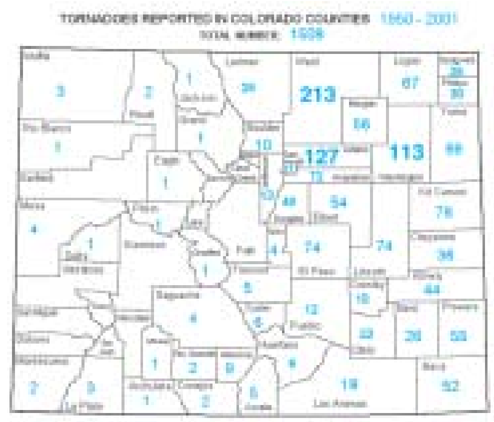
Most of our tornadoes in Colorado are weak, with wind speeds of less than 110 mph. But Colorado is occasionally visited by strong tornadoes. Six tornadoes in 1996 were comparable to the Limon tornadoes of 1990 in strength, with winds of 150 - 200 mph.

Tornadoes have been reported 9 months of the year, and the peak season for tornadoes extends from mid May through mid August. Two thirds of Colorado's tornadoes develop in May and June. Tornadoes occur statewide, but the largest number develop over eastern Colorado to the east of Interstate 25. Tornadoes strongly favor the afternoon and evening hours. Over half of them develop between 3 p.m. and 6 p.m. and approximately 90 percent occurr between 1 p.m. and 9 p.m. The chart below shows tornadoes by time of day for 1995 - 2001.



Since 1950 the two counties with the most tornadoes have been Weld and Adams. In fact, Weld County has reported one of the highest frequencies of tornadoes across the country. This is mainly due to the size of the county. Weld is two to three times the size of most counties across the nation. The two maps to the right show the county-by-county tally for 2001 and the 1950 - 2001 totals.





The most unusual tornado occurred in Lincoln County, November 4, 1922, during the unusual time of 5 - 7 a.m. It was one mile wide and several miles long with four fatalities and caused $130,000 damage. Twenty-six people have been killed by tornadoes since 1916. The last tornado death in Colorado occurred on June 27, 1960 in Sedgwick County. The most witnessed and well-photographed tornado outbreak occurred in metro Denver on June 15, 1988 during rush hour. Five tornadoes resulted in seven injuries and damage in excess of $15 million. The most well-known recent tornado is the Limon tornado, which occurred June 6, 1990 after 8 p.m. This tornado caused $12 million in damages, destroyed most of the town's businesses, left 117 families homeless, and injured 14 people. Another notable tornado combined with downbursts on May 28, 2001, to cause eight million dollars of damage to the high school in Ellicott. Nearly 100 mobile homes were also damaged or destroyed.

Tornado near Lamar, Colorado. Photo by Ian Wittmeyer.

Tornado Tips

Tornado Watches and Warning

The National Weather Service uses specific terminology to relay the tornado weather threat to the public. Here is the definition of tornado watches and warnings you need to understand in order to be prepared.

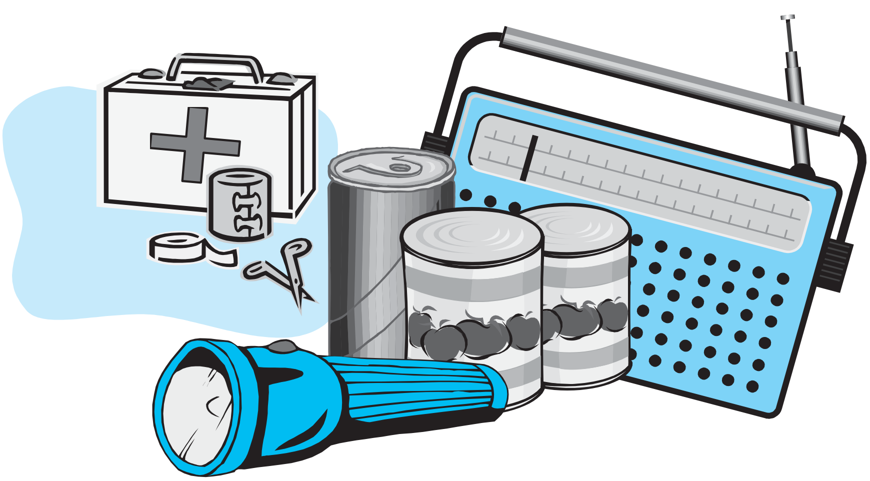
- Tornado Watch: Means that conditions are favorable for tornadoes to develop. It is normally issued for 4 to 6 hours and includes many counties. If you are in or near the tornado watch area, stay informed via NOAA Weather Radio, commercial radio or television. Keep your eye on the sky and be prepared to take cover at short notice, as tornadoes can occur with little or no warning.
- Tornado Warning: Means that a tornado has been sighted or a developing tornado is reported by trained spotters or indicated on Doppler radar. A warning is typically issued for a small area for less than an hour. If a tornado warning is issued for your area, take cover immediately!

Tornado Safety

Do you know what to do if a tornado is moving your way? These safety guidelines are from the National Weather Service for use at home, work, school or when traveling. Remember: the greatest threat from tornadoes is windblown debris!

In Homes:

- The safest spot is in your basement if you have one. Get under a sturdy workbench, table or under the staircase. Stay out of the corners, as that is where debris will collect.
- If you do not have a basement, seek shelter on the lowest floor in an interior small room or hallway. Bathrooms and closets are good examples of rooms to go to for shelter.
- Get away from your windows! Strong winds with a tornadic thunderstorm can shatter your windows and severely injure you.



In your Vehicle:

- If a tornado is bearing down on you, abandon your vehicle. Seek shelter in a sturdy building, if available, or a dry ditch, ravine or low spot. Crouch low and cover your head with your hands. You can safely view a tornado in Colorado from a distance, but NEVER try to outrun a tornado with your vehicle. Some tornadoes can travel 60 mph!

In Mobile Homes:

- Leave your mobile home and seek shelter in a sturdy building. If one is not available, crouch low in a dry ditch, ravine or culvert and cover your head with your hands.

In High Rise Buildings:

- You may not have time to go to the lowest floor, so seek shelter in a hallway or small room at the center of the building. Stay away from the windows and out of elevators!

In Nursing Homes, Schools, Hospitals and Shopping Centers:

- Go to your pre-designated shelter. Interior hallways or small rooms on the lowest floor are usually your best choice. Be sure to stay away from large windows or glassed areas.
- Do not seek shelter in dining halls, gyms or other large rooms, as roofs in these parts of a building are usually weaker since the walls are far apart.

All Areas:

- Prepare a tornado plan. Make sure everyone knows where to go in the event of a tornado. Conduct periodic tornado drills.
- Assemble a disaster supply kit for emergencies. Include a first aid kit, battery-powered radio and flashlight with extra batteries, canned food and can opener, and bottled water.
- Learn where to get weather information and the meaning of tornado watches and warnings!

Colorado Climate in Review

April 2001

Climate in Perspective

April weather produced two costly blizzards eleven days apart across portions of eastern Colorado. Both storms disrupted travel and ripped down miles of power lines but brought beneficial moisture. Some areas of northeastern Colorado were without power for many days during the month in the aftermath of these intense storms. Between storms, Colorado enjoyed some very pleasant and mild weather during the remainder of the month.

Precipitation

Three storms, two of which developed into Great Plains blizzards were responsible for most April precipitation across Colorado. Total precipitation for the month ended up near to well above average from the Four Corners area northeastward across South Park and up the South Platte Valley. More than 150% of average April precipitation fell at Silverton and other parts of the southwestern mountains, in the Sangre de Cristo range, near Fairplay, and in three areas of northeastern Colorado hit hard by the blizzards. The Flattops east of Meeker also received generous precipitation. Wolf Creek Pass measured nearly 8 inches of snow water equivalent. Meanwhile, much of northwestern Colorado ended up drier than average. The driest areas of the state were the San Luis Valley and much of southeastern Colorado. Lamar, for example, only picked up 0.10" of moisture in April, their driest April since 1992, as the storms passed just to their north. Eckley, Holyoke and Julesburg, on the other side of the storm axis, got more than 3 inches of moisture.

Temperature

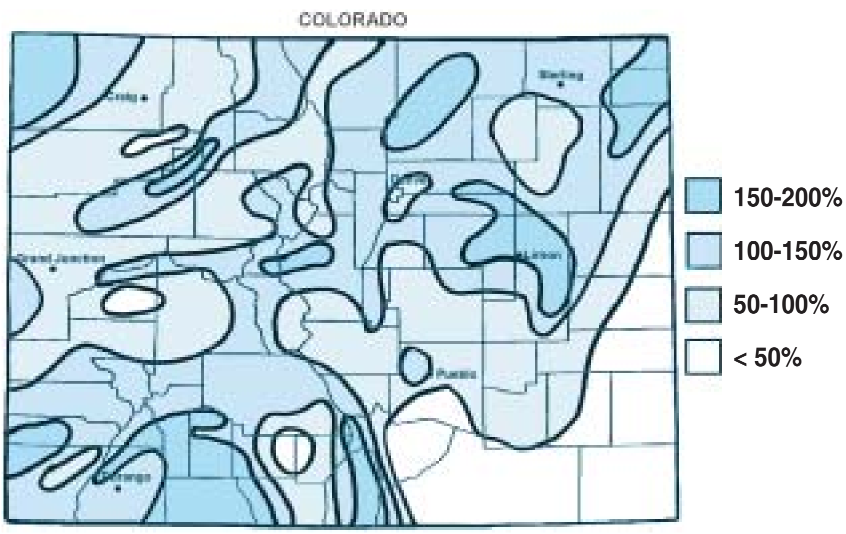
Warmer than average temperatures were the rule across the state in April. Cold weather accompanied each major storm system, but temperatures rebounded between storms, and many very warm days were reported, especially in the Arkansas Valley. The mercury reached or exceeded 80 degrees on 11 days in April at Rocky Ford. For the month as a whole, most of the state ended up three to four degrees F above average. The one exception was northeastern Colorado hard hit by two blizzards. Here, temperatures were only one degree above the 1961-1990 averages.

April Daily Highlights

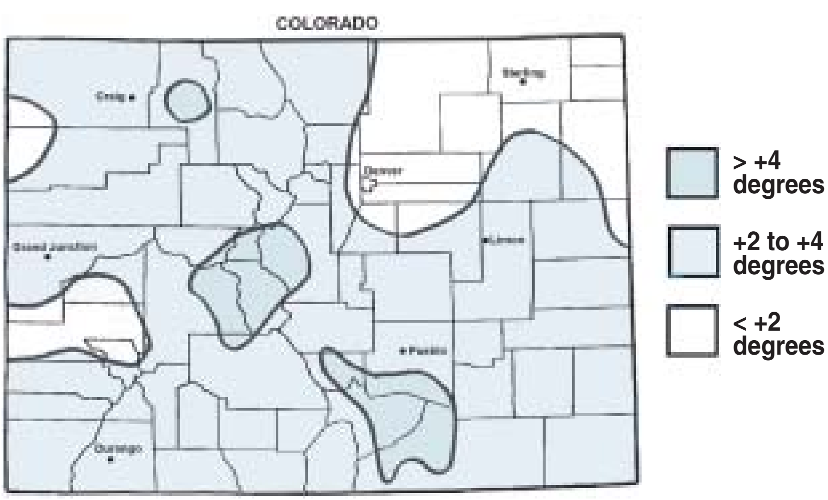
1-4 Southwesterly winds aloft developed and strengthened over Colorado as a large trough of low pressure dropped southward from the Pacific Northwest to just off the coast of California. At the same time, a massive high pressure area pushed southward out of Canada over the Great Lakes, eventually pushing cool, damp air into eastern Colorado from the east, especially on the 3rd and 4th. For most of Colorado, temperatures were well above average each day with occasionally gusty southwesterly winds and no precipitation. But east of the mountains fog and low clouds developed on the 3rd and 4th, and a few thundershowers brought light precipitation to northeastern Colorado beginning late on the 2nd.

5-8 The storm aloft over California began moving eastward on the 5th and accelerated rapidly on the 6th. Another fast moving storm followed 7-8th. Clouds and local fog lingered east of the mountains early on the 5th while western Colorado enjoyed one more warm day. Valley rains and mountain snows developed later on the 5th over western Colorado and became heavy over the southwestern mountains. Lemon Reservoir reported 1.14" of precipitation by the morning of the 6th, while Wolf Creek Pass totaled more than two inches of water content from wet snow. Very little precipitation reached central or eastern Colorado as the storm raced eastward, but winds gusted as high as 40-60 miles per hour across portions of the eastern plains. Conditions remained cool and unsettled on the 7th with a few convective showers and more gusty winds. Another disturbance crossed the state on the 8th accompanied by a period of rain and mountain snows over western Colorado with only a few sprinkles east of the mountains.

9-12 The 9th was cool but pleasant over western Colorado and mild across eastern Colorado as another spring storm system began to take shape over Arizona. “Upslope” precipitation began overnight along the Front Range as easterly winds developed ahead of the strengthening storm. Rains spread across much of eastern Colorado on the 10th and changed to snow in the mountains and on the northeast plains later in the day. By the morning of the 11th, a Great Plains blizzard situation developed as a very deep low pressure center over southeastern Colorado tracked quickly northeastward. Several hours of blizzard conditions paralyzed portions of eastern Colorado. Denver International Airport was shut down for several hours on the 11th as winds gusting to at least 60 miles per hour dropped visibilities to zero and left snow in drifts more than 5 feet high. At least a foot of snow fell at Monument, Northglenn, and Aurora with blizzard conditions extending nearly to Kansas. Schools and roads were closed on the 11th across much of northeastern Colorado. Power was knocked out in some areas. Winds diminished on the 12th and the snow soon began melting. While the blizzard conditions were not welcomed, the moisture was. Precipitation totals for the storm ranged from none at all in the Trinidad area to 0.86" at Colorado Springs, 1.13" at Greeley, 1.53" at Byers and 1.60" at Longmont.

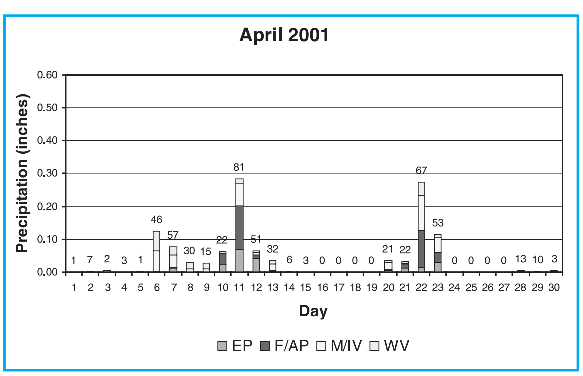


April 2001 precipitation as a percent of the 1961-1990 average.



April 2001 temperature departure from the 1961-1990 average, degree F.

Statewide average daily precipitation graph(s) (above and throughout this article) shows relative amounts of precipitation for each region. Label on each column indicates percent of station with measurable precipitation for each day.



13-19 Dry weather returned to Colorado with a statewide warming trend. Westerly flow from the Pacific brought some clouds and a little high elevation snow on the 13th. Clouds and fairly cool temperatures lingered on the14th as another weak upper air disturbance crossed the region. Westerly winds also carried layers of fine dust that made skies hazy across the state for five days. Satellite pictures revealed that this haze 13-17th originated from a giant dust storm over Mongolia a few days earlier. Except for the haze, skies were clear 15-17th over western Colorado as temperatures climbed each day. Meanwhile, a Canadian high pressure area pushed a shallow layer of chilly air and stratus clouds into eastern Colorado keeping temperatures on the 16th in the 40s moderating a bit on the 17th. Winds aloft strengthened 18-19th from the southwest. Clouds and winds increased, and snow melted in the mountains as temperatures soared into the 80s at lower elevations with 60s all the way up to 9,000 feet. Las Animas hit 90°F on the 19th, the first 90 degree reading of the season.

20-22 A complex spring storm attacked Colorado. The first phase of the storm brought only a little precipitation, mostly to southwestern Colorado, but blasted much of the state with very strong winds on the 20th. Gusts over 50 mph were measured at Alamosa and over 60 mph at Pueblo. The 21st was cloudy and threatening as the second phase of the storm strengthened over Arizona. Precipitation (rains east and west, with snow in the mountains) spread over much of the state by late on the 21st with some thunder. Temperatures plummeted during the evening over northeastern Colorado and rains became heavy changing to snow early on the 22nd as an intense low pressure center moved northeastward out of southern Colorado. Blizzard conditions developed quickly on the 22nd over portions of northeastern Colorado. The combination of very strong winds and heavy wet snows damaged many trees and tore down miles of power lines from Greeley to Nebraska. Heavy snow was also reported in the northern and central mountains and eastern foothills. Buckhorn Mountain in Larimer County picked up 20 inches of new snow.

23-27 Much quieter weather returned to Colorado. Very cold temperatures were measured the morning of the 23rd. The temperature dipped to 20°F at Longmont. Then temperatures warmed each day under mostly sunny skies with low elevation temperatures in the 70s and low 80s by the 26th. Afternoon thunderheads dropped a few sprinkles on the 27th humidities increased a bit.

28-30 Summer-like weather with melting snow in the mountains. A few light showers developed on the 29th. Gusty winds on the 29th accompanied hot temperatures, especially east of the mountains. Lamar and Las Animas each hit 91°F. The month ended with partly cloudy, dry and warm weather on the 30th.

April 2001 Monthly Extremes

Description	Station	Extreme	Date
Precipitation (day):	Vail	2.67"	April 11
Precipitation (total):	Wolf Creek Pass 1 E	7.87"	
High Temperature:	Lamar	91°F	April 30
	Las Animas	91°F	April 29
Low Temperature:	Silverton	-2°F	April 13

May 2001

Climate in Perspective

A single storm system in early May delivered a statewide average of 1.50" of precipitation to the state. This one storm and the several days of cold, cloudy weather that went with it single-handedly reduced the threat of early season wildfires along the Front Range and had a huge effect on statewide water supplies. This storm improved crop and soil moisture conditions, and helped Colorado's rangelands immensely. After another dry and warm winter for Colorado's northern and central mountains, it was just what the state needed to be optimistic about summer water supplies and recreation opportunities. Later in the month, severe weather in the form of tornadoes did considerable damage to the small town of Ellicott east of Colorado Springs.

Precipitation

May precipitation totals were above average over most of Colorado. From Montrose to Alamosa eastward to Walsenburg, La Junta and Lamar and northward to Limon and Fort Morgan, May precipitation exceeded 150% of average. The wettest locations included Salida (271% of average), Ridgway (278%), Rush (292%), Westcliffe (300%) and Fowler (308%). The storm of May 2-6th accounted for 2/3 of total statewide May precipitation. But, as usual, there were some areas that ended up on the short end of the stick. May moisture was a little below average in extreme northeastern Colorado and over southwestern. Paonia and Grand Junction were also drier than average. The largest areas receiving less precipitation than average were found in the northern mountains and extreme northwestern Colorado. The Steamboat Springs and Grand Lake areas, both with downwind exposures during typical "Four Corners" storms, each received only half of their average precipitation.

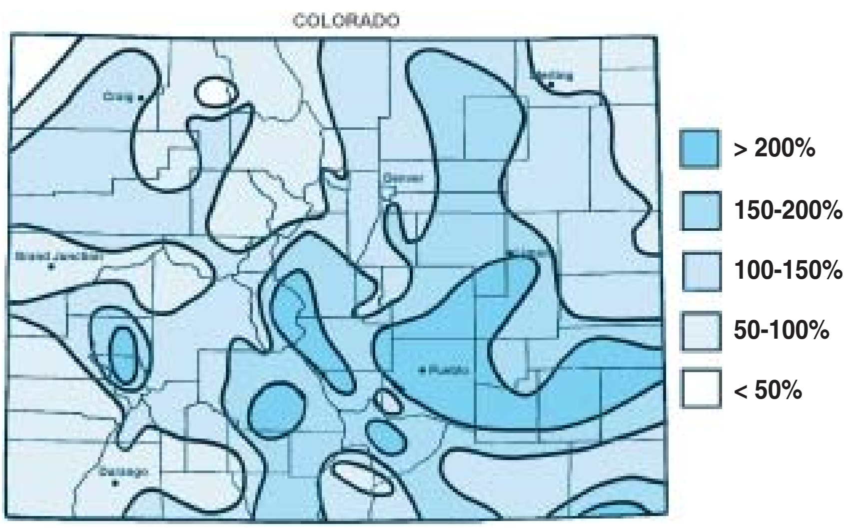
Temperature

For the month as a whole, May temperatures were near average over eastern Colorado but above average over the mountains and western valleys. Leadville, Taylor Park, Durango and Alamosa all ended the month more than four degrees F above average. The coolest area of Colorado with respect to the 1961-1990 averages, was the South Platte valley from Denver to Julesburg where temperatures were slightly below average.

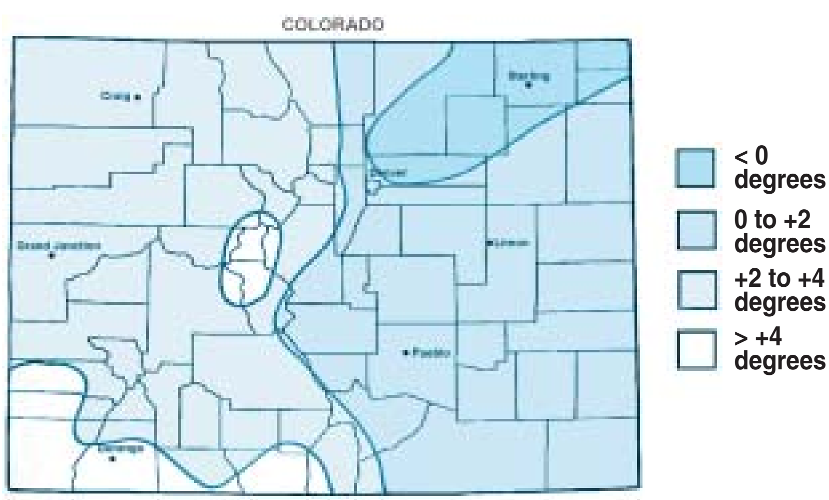
May Daily Highlights

1-6 May got off to a real bang. May 1st was hot and windy as temperatures soared into the 80s and 90s at lower elevations with 70s reaching as high as 9000 feet. From Trinidad to Wray, highs reached into the 90s – unusually hot for so early in the season. Las Animas, Colorado's traditional hot spot, was the hottest in the state at 98°F. But clouds increased during the day as a rapidly developing storm system took shape. A strong cold front pushed southward across the state overnight and by early on the 2nd snow was falling over portions of northern Colorado. Temperatures plummeted by as much as 50 degrees F. Precipitation became quite heavy during the day along the northern Front Range with much of the precipitation falling as snow in the foothills and mountains with mixed rain and snow along the Front Range urban corridor. Nearly an inch of water from rain and wet snow accumulated in Fort Collins by evening. Southwestern Colorado remained warm but very windy for one more day. Southerly winds gusted to nearly 50 mph at Alamosa. The storm gradually encompassed the entire state and by the 3rd precipitation was falling statewide. A large "Four Corners" upper level low then moved very slowly eastward bringing nearly continuous precipitation to southern and eastern Colorado until late on the 5th when the storm system finally headed into Kansas and Nebraska. A period of very heavy snow targeted the upper Arkansas valley from Salida to Buena Vista 3-4th. More than 3 feet of snow accumulated in some areas breaking tree branches and power lines. The storm had one last gasp before exiting the state on the 6th as severe thunderstorms rumbled across parts of southeastern Colorado. When it was finally over on the 6th, impressive precipitation totals were tallied at many locations. One to two inch totals were common over eastern Colorado and much of the mountains. More than 2.50" inches of precipitation fell along the northern Front Range. Statewide, this one storm system contributed nearly 10% of the precipitation for the entire year.

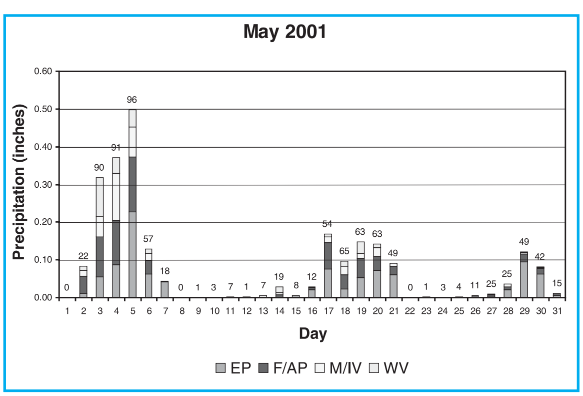
7-15 A prolonged period of quiet, lovely spring weather followed the early May storm. Daytime temperatures were generally in the 70s and 80s at lower elevations. Grass grew abundantly with the long days and adequate soil moisture.



May 2001 precipitation as a percent of the 1961-1990 average.



May 2001 temperature departure from the 1961-1990 average, degree F.



The only significant weather changes during the period was a cold front that brought cooler air to northeastern Colorado on the 11th and some scattered afternoon and evening thunderstorms on the 13th and 14th, especially over western Colorado, resulting from some moisture moving into the state from the south. Most showers were light, but Paonia reported 0.52" early on the 16th from a storm the previous evening.

16-19 Some minor upper level disturbances combined with adequate low level moisture and some cooler air to trigger scattered thunderstorms, some of which were severe. Heavy storms with generous rains were widespread over southeast Colorado late on the 16th. Several locations received well over an inch of rain. Rocky Ford reported 1.85". Numerous storms developed on the 17th, especially east of the mountains. Thunderstorms were also frequent on the 19th as an upper level low-pressure trough crossed southern Colorado. Walsenburg reported 1.20".

20-22 Sunday the 20th appeared to be a lovely spring day with blue skies and comfortable temperatures. However, a well-anticipated cold front (forecasters warned of this event two days in advance), pushed by winds between 40 and 70 miles per hour, raced across the state during the afternoon dropping temperatures by as much as 40 degrees in less than two hours. Thunderstorms with hail formed rapidly in southeastern Colorado. Snow quickly developed in the mountains catching some hikers off guard. Snow also developed along the I-25 corridor. Most snow melted as it landed, from Fort Collins to Pueblo, but from Boulder to Monument several inches of snow accumulated that evening. Parts of Lakewood and Golden received as much as 6 inches from this sudden spring storm. Skies then cleared overnight, and residents of the state awoke to some very chilly temperatures on the 21st. The low in Boulder was 26°F, while Georgetown recorded 17°F. Many areas of eastern Colorado and the Western Slope flirted with frost. The +6°F report from Climax was the coldest in the state. Temperatures were cold again early on the 22nd, and then began to moderate with plentiful sunshine.

23-25 Very warm and dry over western Colorado, but cool and quite windy east of the mountains. A very large and nearly stationary low pressure area over the Midwest was responsible for the chilly northerly winds sweeping across the plains each day. Wray reported a low temperature of 29°F on the morning of the 25th.

26-30 High pressure covered the area 26-27th, but increasing low level moisture helped fuel scattered high based thundershowers. An upper level disturbance then approached from the southwest on the 28th and helped trigger severe thunderstorms with large hail over portions of eastern Colorado on the 28th (Memorial Day). Hard hit was the small town of Ellicott east of Colorado Springs where a tornado ripped roofs off of their school buildings causing millions of dollars in damages. Heavy rains were reported in northeastern Colorado. Holyoke, for example, reported 1.41" while Brush added 1.68". Cool showery weather continued 29-30th, but with mostly light amounts reported. As is often the case at this time of year, the majority of precipitation fell east of the mountains with only very light showers in the mountains and western valleys.

31 Dry and warmer air with northwesterly winds aloft returning to Colorado. A few storms out near the Kansas border.

May 2001 Monthly Extremes

Description	Station	Extreme	Date
Precipitation (day):	Campo 7 S	2.20"	May 20
Precipitation (total):	Rush 1 N	6.30"	
High Temperature:	Las Animas	98°F	May 1
Low Temperature:	Climax	6°F	May 21

June 2001

Climate in Perspective

June delivered some noteworthy episodes of severe weather to Colorado such as the disastrous hailstorm that pummeled aircraft and parked cars at Denver International Airport on June 20th. But for the state as a whole, June was both drier and with fewer severe storms than what we have come to expect most years. Persistent hot and dry June weather in western Colorado for the past several months and most of June seemed to be setting us up for a bad wild fire season, but a brief blast of cold and snow in mid June and a period of humid air with some showers late in the month brought timely relief.

Precipitation

There were plenty of opportunities for precipitation in June, particularly east of the mountains. However, most storms that developed were fairly localized with no widespread heavy precipitation. As a result, June was drier than average for much of Colorado. Much of the Western Slope totaled less than 50% of average. Grand Junction got only a trace of precipitation all month. The northern mountains, mountain valleys and the northern Front Range urban corridor also were dry. Walden reported just 0.10", 10% of average. Fort Collins only accumulated 0.42", 22% of average. Portions of south central and northeastern Colorado were also much drier than average. There were a number of small wet areas, however, scattered throughout the state. The wettest location, compared to average was the Hass Ranch south of Limon where precipitation was more than 200% of average. Creede, Gunnison, Las Animas and Rocky Ford also ended the month much wetter than average.

Temperatures

The heat of summer came on strong during June, particularly west of the mountains. Daily maximum temperatures climbed into the 90s or higher at Grand Junction on 21 days during the month. But squeezed between hot temperatures early and late in the month was a brief, strong cold front that dropped temperatures in the mountains down into the 20s. Temperatures for the month as a whole ended up 2-3 degrees F above average over the western 2/3rds of the state. The coolest areas, compared to average, were found over eastern Colorado where some locations were within one degree of average.

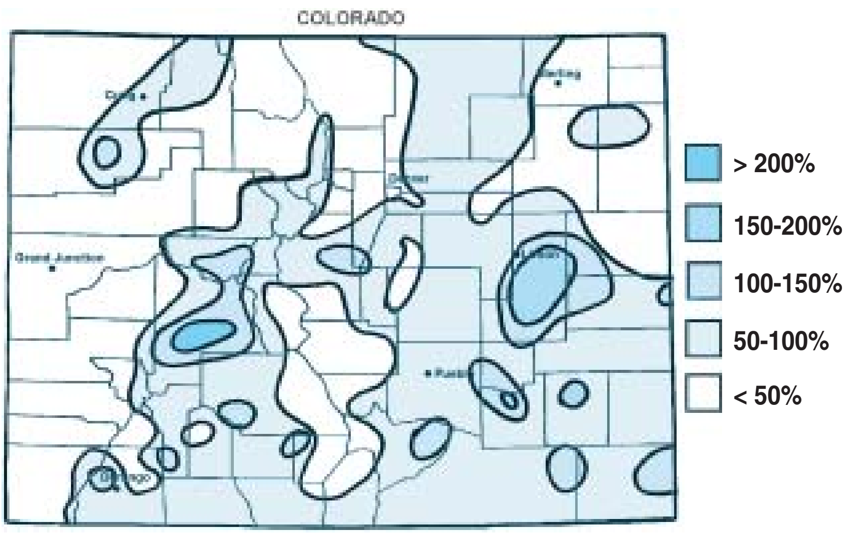
June Daily Highlights

1-2 Pleasantly warm east, hot and dry on the Western Slope. Some afternoon clouds, especially on the 2nd.

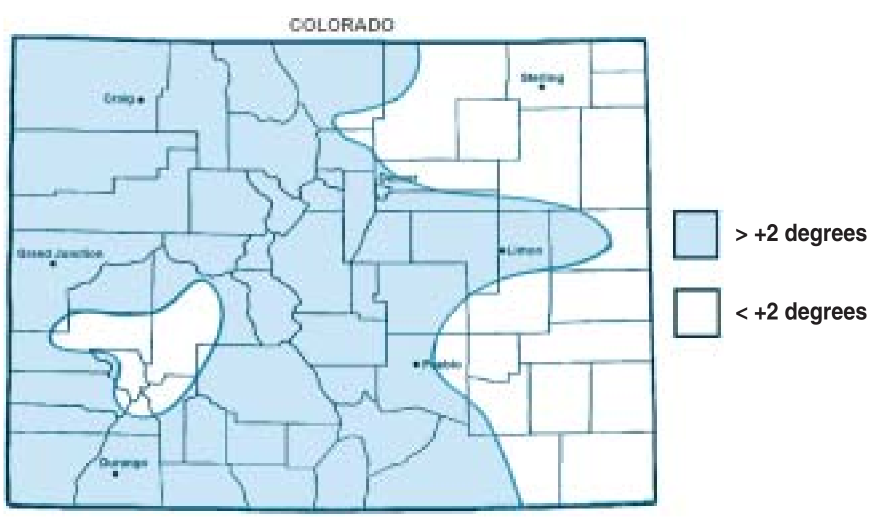
3-5 A vigorous storm system for so late in the spring approached from the northwest. Much cooler air with low clouds, fog and drizzle arrived in northeastern Colorado early on the 3rd. Highs only reached into the 50s and 60s 3-4th in the northeast, while southwestern Colorado remained dry and warm. A few large thunderstorms erupted. Rocky Ford picked up 0.93" of rain and hail on the 3rd. More locally severe storms developed on the 4th. Portions of Adams and southern Weld Counties had damaging hail. Akron reported a high temperature of just 54°F. Very chilly temperatures for this time of year were reported on the morning of the 5th. Grand Junction dropped to 38°F. Many locations in the mountains were in the 20s. A few light thundershowers popped up over northeast Colorado later on the 5th, as temperatures warmed.

6-7 Clear, dry and warm statewide on the 6th but moist air slipped back into eastern Colorado on the 7th as evidenced by patchy morning fog. Some ferocious late evening thunderstorms exploded over eastern Colorado on the 7th. There were numerous reports of hail, especially in southeast Colorado. The Las Animas weather station received 2.60" of rain along with hail and damaging winds. Numerous locations from Limon to Walsh reported at least one inch of rain.

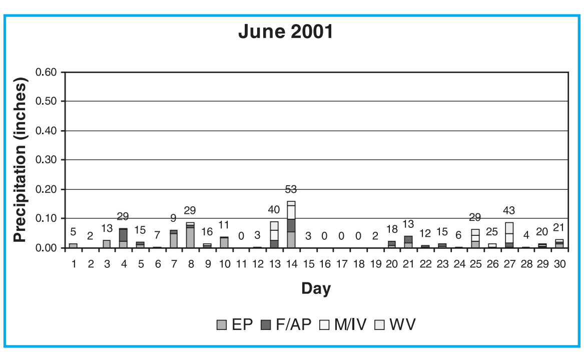
8-11 A high pressure ridge set up over the Southwest initiating the first heat wave of the summer. Temperatures soared into the mid and upper 90s each day at Grand Junction. The first 100 degree readings of the season were reported at several locations in the Arkansas Valley on the 11th. Enough low level moisture remained to fuel some scattered high-based thundershowers on the 8-9th. The weather observer south of Lindon (northeast of Limon) got a close-up



June 2001 precipitation as a percent of the 1961-1990 average.



June 2001 temperature departure from the 1961-1990 average, degree F.



look at a tornado on the 9th. Most of the state was just hot and dry 10-11th.

12-15 The heat wave was short lived as a very strong cold front approached and crossed Colorado on the 13th. Temperatures were still hot on the 12th in advance of the front, but strong winds developed over western Colorado and spread eastward. Some late night thunder accompanied the cold front over northwestern Colorado. The front then swept across eastern Colorado early on the 13th. Snow began in the mountains early on the 13th and spread southeastward. Most totals were light, but Aspen and Crested Butte both reported 4 inches of new snow during the day on the 13th. Aspen received a total water content of 1.13". Campers at Great Sand Dunes National Monument were shocked with 2 inches of snow. Temperatures had been in the mid 80s the previous day. Snow made it as far east as the top of the Palmer Divide near Monument where up to 4 inches of snow accumulated for a time. Climax reported 8 inches of new snow. Areas east of the mountains experienced a very windy, threatening day with falling temperatures. A few areas picked up significant rains and some hail. Brighton picked up 0.88" of moisture. Strong winds continued into the morning of the 14th and then diminished. Coloradans awoke to very chilly temperatures on the 14th and 15th. Climax dropped to a 17°F reading and the Meredith weather station slipped to 19°F. Readings in the 20s were widespread throughout the mountains both mornings. The Pueblo airport even saw a low of 36°F on the 15th.

16-17 Hot, dry weather returned quickly and all signs and thoughts of snow vanished. Pueblo's temperatures were back up to 100°F by the afternoon of the 17th.

18-22 A dry, Pacific cool front crossed Colorado on the 18th accompanied by gusty winds. Little change was noted west of the mountains, but cool temperatures were welcomed across the Front Range and plains with highs mostly in the 70s 19th-21st. High pressure north of Colorado carried some low-level moisture into eastern Colorado on the 20th just as an upper level disturbance moved in from the northwest. These factors combined to trigger scattered severe storms. Especially noteworthy was a brief but ferocious hailstorm that moved across Adams County from northwest to southeast on the 20th. Denver International Airport took a direct hit from wind-driven golf-ball sized hail (see story, page 12). Other areas of the county were also hard hit. These storms moved into southeastern Colorado later in the evening. Walsenburg reported 1.31" of rain with hail. Walsh totaled 1.32" of rainfall. Drier air returned on the 21st with pleasant temperatures in and east of the mountains but hot temperatures well up in the 90s on the Western Slope. Temperatures warmed east of the mountains on the 22nd with just a few late-day thundershowers.

23-26 Hot weather dominated all of Colorado as winds aloft shifted from northwesterly to southwesterly. Low and mid level moisture, like an early onset of the Southwest Monsoon, began moving up across Arizona and helped fuel widespread showers and thunderstorms over western Colorado that peaked on the 26th. Crested Butte measured 0.87" of precipitation early on the 25th. Gould reported an inch of hail accumulation on the ground that same day. Meeker received 0.96" late on the 26th, and Como (near Fairplay) got 1.10". Some storms also erupted east of the mountains. Cheyenne Wells and Arapahoe reported 1.33" and 1.75", respectively, from a storm late on the 25th.

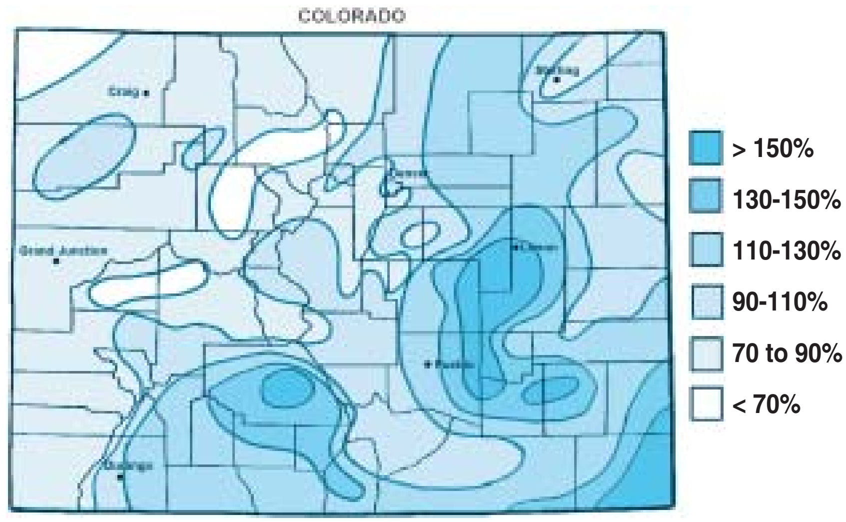
27-30 The early surge of moisture from the south ended. The 27th was fairly cool over western Colorado. Then hot weather returned statewide. Grand Junction topped out at 101°F on the 30th. Greeley baked at 103°F. While most of the state was dry, a few isolated thunderstorms developed. Sheridan Lake in southeastern Colorado reported 0.65" from a storm late on the 29th.

June 2001 Monthly Extremes

Description	Station	Extreme	Date
Precipitation (day):	Las Animas	2.60"	Jun 7
Precipitation (total):	Limon Hass Ranch	3.52"	
High Temperature:	Ordway 2 ENE	104°F	Jun 28
Low Temperature:	Climax	17°F	Jun 14

Colorado's Drought and Water Supply Status – October 2000 through June 2001

Studies have shown that at any given time, some areas of Colorado are usually experiencing or approaching drought. At any given location, drought conditions (defined as accumulated precipitation for three months or longer at least one standard deviation below the mean for that period) begin to emerge an average of 9 times in every 10-year period. Fortunately, seasonal precipitation patterns in Colorado tend to work in our favor. Wet springs can help make up for dry winters, wet summers can help cover for dry springs. About the time it looks really bleak, even fall can come through to provide some relief. Wet winters, especially in the mountains, are just plain a good thing for almost everyone who cares about water. Furthermore, with our many ranges of mountains it



Water Year 2001 (Oct 2000 - June 2001) as a percent of the 1961-1990 average.

seems that for most drought situations, someone on the other side of the mountain range is much wetter. It is really unusual for all of Colorado to be dry at the same time.

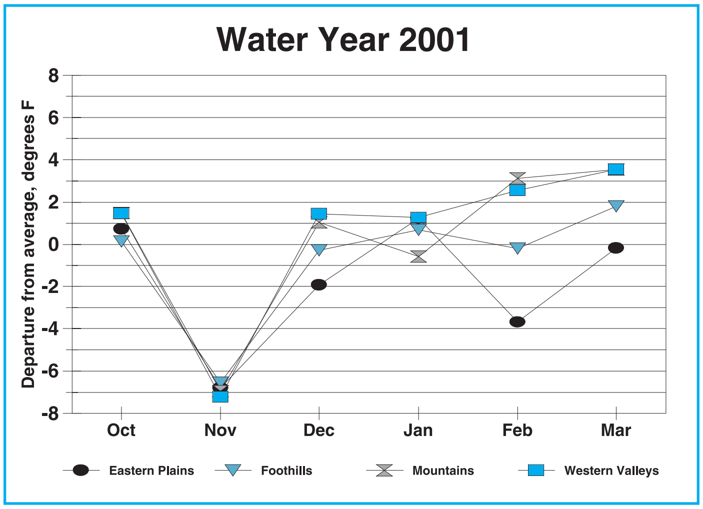
As we move through the summer of 2001, the northwestern 1/3 of the state has been on the short end of the stick consistently since last fall. Dry conditions serious enough to be considered drought have been teasing many areas. From Cortez and Telluride northward and northeastward through Delta, Grand Junction, Glenwood Springs, Craig, Steamboat Springs, Summit County, and all the way to Estes Park, October-June precipitation has been less than 90% of average. A few locations including Cedaredge, Paonia, Kremmling, and Granby only totaled 55-70% of average. Less than 80% of average for this time of year generally leads to significantly less streamflow and much drier soils and vegetation than average. These areas of western Colorado are adjacent to a large area suffering from severe precipitation deficits from central Utah northward to the Pacific Northwest. Some areas along the Front Range foothills from Manitou Springs to Evergreen and northward to Wyoming have also been considerably drier than usual. But at the same time, south central and portions of eastern Colorado have enjoyed abundant precipitation. From Durango, Wolf Creek Pass and Alamosa eastward and northeastward to Pueblo, La Junta and Lamar, Limon, Fort Morgan and Yuma, 9-month precipitation totals have been from 110 to 150% of average. A few locations have even been wetter. Saguache, hard hit by several storms since last fall, has received 171% of their average. That sounds impressive but still only adds up to a 9-month total of 7.24" compared to an average for October through June of 4.23". Las Animas stands at 162% of average (12.17" compared to an average of 7.51"). Locations in southeastern Elbert and western

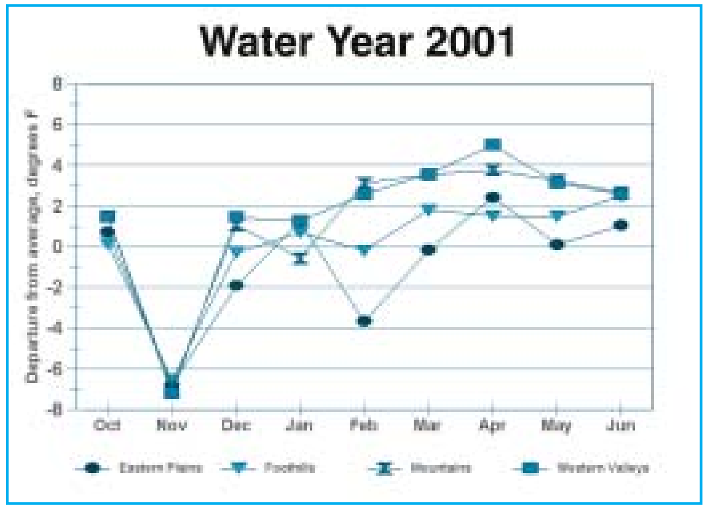
Below on the left is a reprint of the Water Year 2001 chart from the Spring 2001 issue of Colorado Climate which printed incorrectly due to technical difficulties. On the right is the Water Year 2001 chart for this issue.

Lincoln counties have received at least 170% of their long-term October-June averages. This moisture has been very welcome after the very dry weather that much of Colorado experienced last year.

Above average temperatures have begun to prevail once again. November stood out as extremely cold and the mid-winter months were near average. However, since February the mountains and western valleys have been consistently above average by several degrees. Above average temperatures typically translate to more evaporation and drier soils and vegetation. Eastern Colorado, where precipitation has been more generous, has been much closer to average temperatures this spring.

In summary, we continue to dry out. After many years of adequate moisture in the 1980s and 1990s culminating with 30% more precipitation than average statewide for the 1999 water year, we seem to be saying "farewell" to those good moisture years.





Denver International Airport Takes a Huge Hail Hit

Photos taken by Greg Shelton, West Gulf River Forecast Center, National Weather Service.

June 20, 2001 at approximately 1833 MST large hail (approximately 2 inch in diameter) punched at least 14,000 holes and cracks in the flat roofs of several buildings at Denver International Airport. In addition, 93 planes and hundreds of cars were damaged. Approximately 100 flights were canceled, stranding numerous travelers. The airport was completely shut down for approximately 20 minutes. The storm also damaged a radar instrument used to monitor planes on the ground to avoid runway collisions. Damage was estimated to be in the $10 million range. No estimate for the damage done to the 93 airliners was released.

Excerpt from Storm Data publication.

Drought Threat to Colorado Water

Roger Pielke, Sr., Nolan Doesken and Jose Salas (Civil Engineering Dept, CSU)

Appeared in Colorado Water (Vol. 18, No. 4), August 2001, Colorado Water Resources Research Institute

McKee et al. (1999) has developed the standardized precipitation index (SPI) in order to monitor total rainfall over time periods from 1 month to 4 years and more with respect to average rainfall conditions. SPI can be interpreted as normalized standard deviations with respect to the average conditions. For time periods longer than 1 year, the rainfall distributions can be interpreted as represented by a normal probability distribution.

Figure 1 illustrates their analysis of four-year SPI values when averaged across the state of Colorado. As clearly evident from the figure, the 1930s and 1950s included time periods of long-term drought. One question that arises is the consequences to Colorado's water resources if similar droughts occurred today.

Historic climate data were surveyed to identify Colorado's five driest years during the past century.

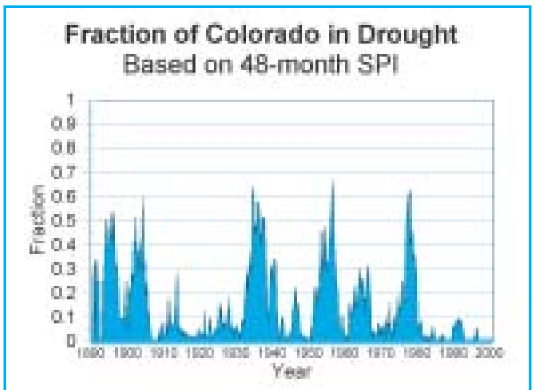


Figure 1. Fraction of Colorado in drought, based on 48-month Standardized Precipitation Index (SPI) from McKee et al (1999).

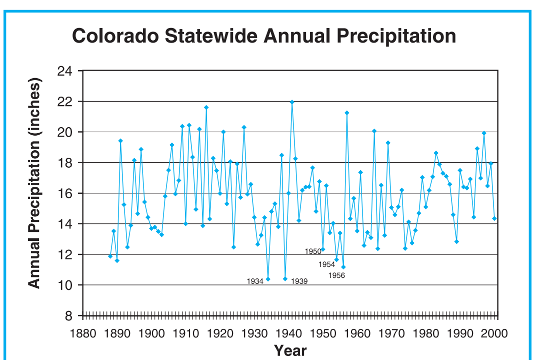


Figure 2. Colorado average annual precipitation values from 1888-2000.

For the state as a whole (not necessarily at each and every weather station) the driest years were found to be 1934, 1939, 1950, 1954 and 1956 (Figure 2). Precipitation totals for these five years were accumulated for many long-term weather stations across Colorado, expressed as a percent of the 1931-1990 average, and plotted on a Colorado map. The resulting pattern of precipitation as a percent of average is shown in Figure 3. For most of the state this would amount to just 70% of the long-term average. While this may not sound that extreme, under this scenario, the vast majority of Colorado would be facing extreme water shortages. Often, the analysis of droughts at a point gives a good idea of the drought severity around a particular location. For example, Figure 4a (top) shows the annual precipitation record for Boulder, Colorado and Figure 4b (bottom) shows the corresponding sequence of drought durations (relative to the sample median). The return period of droughts of 6-years duration (the longest drought in the record of 91 years) is 126 years (Fernandez and Salas, 1999). Also Frick et al. (1990) analyzing annual streamflows shows that Fort Collins could have a deficit of water over 350,000 acres feet as a result of a serious 5 year drought with even more serious consequences for longer duration events. Furthermore, the analysis of the annual streamflows of the South Platte River measured at Denver station indicates that the return periods of droughts (relative to the long term sample mean) of 5 and 10 years durations are of the order of 15 and 115 years, respectively (Chung and Salas, 2000; Salas et al, 2001). Figure

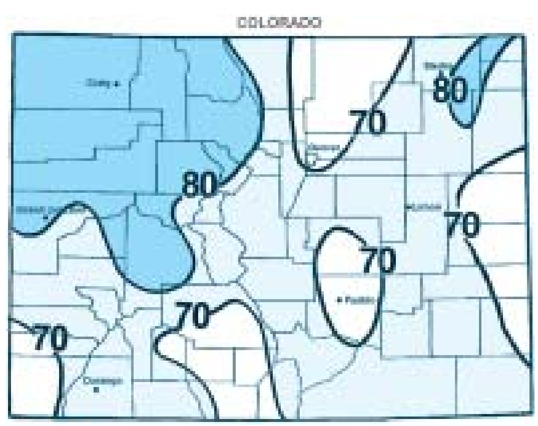


Figure 3. Colorado's five driest years of precipitation (1934, 1939, 1950, 1954 and 1956) summed and averaged and shown here as a percent of the 1931-1990 average.

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Drought Threat to Colorado Water *(continued from page 13)*

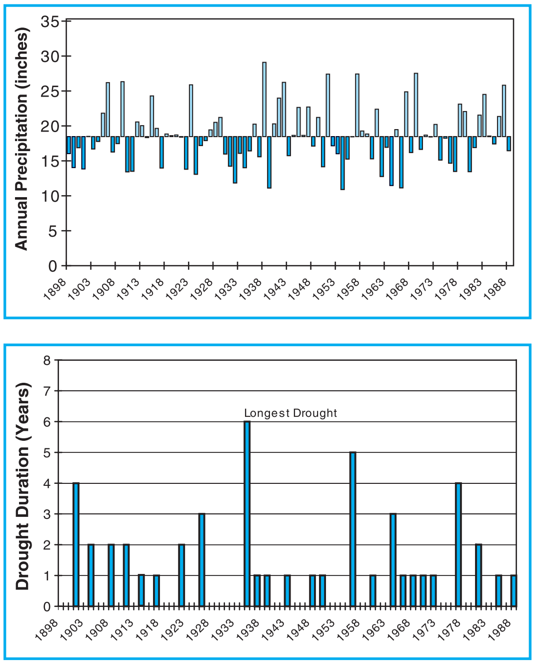

Figure 4. (top) Deficit and excess (relative to the median Y_0) of annual precipitation at Boulder; (bottom) corresponding drought durations (from Fernandez and Salas, 1999).

5 shows the relation of estimated return periods for various drought lengths.

These are quite sobering results. The consequences of such a prolonged drought would not only impact agriculture, but other water resource issues such as municipal water supplies. These risks need to be assessed so as a society we can prepare for such extreme events. We do not need to make predictions of the future climate, with all the uncertainties that they have (Pielke, 2001) in order to be concerned.

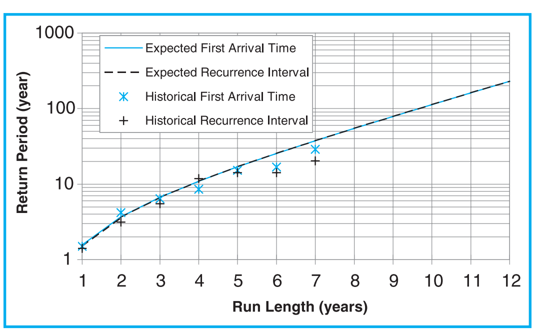

Figure 5. Return period of drought lengths (relative to the long-term mean) for the South Platte River annual flows at Denver (from Chung and Salas, 2000).

The years that were used to create the map actually occurred!

Prior to the historical record, even more serious drought conditions occurred. As seen in Figure 1, the 1930s were the time period of most serious long-term drought in Colorado since weather records were collected beginning in the later 1800s. However, as we discussed in the Fall 2000 issue of the Colorado Climate, is this as bad as it can get? The 16th Century megadrought that occurred over large parts of North America including Colorado lasted for decades, and far exceeded any drought over North America for at least the last 500 years! This drought was part of the Earth's natural climate system and cannot be explained by any human causes.

Natural drought by itself is frightening. If it happened today, are we prepared to adapt to such extreme, long-term dry conditions? The answer is no. We are only resistant in our municipal water supplies, for example, for about a couple of years. Plans should be made today for such an occurrence. The challenge is to develop an environmentally sensitive, yet effective long-term water use efficiency and storage capability. Is it absurd to consider pipelines to transport water from elsewhere in North America to Colorado? Perhaps, but water is an even more fundamental requirement for society than oil, so we should consider similar technologies to assure we don't run out!

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Record Extremes

Roger A. Pielke, Sr., Lisa Schell[1], Tom Stohlgren[1], and Nolan Doesken
[1](Natural Resource Ecology Lab, Colorado State University)

The occurrence of extreme temperatures is of considerable importance and interest. Extremely hot or cold weather, for example, place stresses on electric power generation. Crop damage can occur when late spring or early fall weather results in freezes.

Daily record temperatures are set for weather stations in Colorado during most years. A "normal" year includes a few extremely hot and extremely cold days. If the climate were unchanging, we would expect the likelihood of records to decrease as the period of observations history becomes longer.

We can investigate the history of daily record temperatures in Colorado for several locations. Four measures of records are the record high maximum and record low minimum temperatures, and the record low maximum and record high minimum temperatures. A record low maximum is a cold day, while a record high minimum is a warm night!

To analyze this data, we have binned the record temperatures in two half years (October-March; April-September) for selected Colorado weather stations. There are interesting trends in the data. Fort Collins, for example, has a clear trend towards more record high temperatures and record high minimum temperatures. Record low temperatures and record low maximum temperatures decreased through the 1900s.

Is this a local trend, or representative of all Colorado? Even a glance at the other figures, however, clearly shows that most of the other climate observing sites in the state do not show the same trends. Fort Collins climate is changing, presumably, because it is a rapidly urbanizing area (Urb = Urban; Agr =

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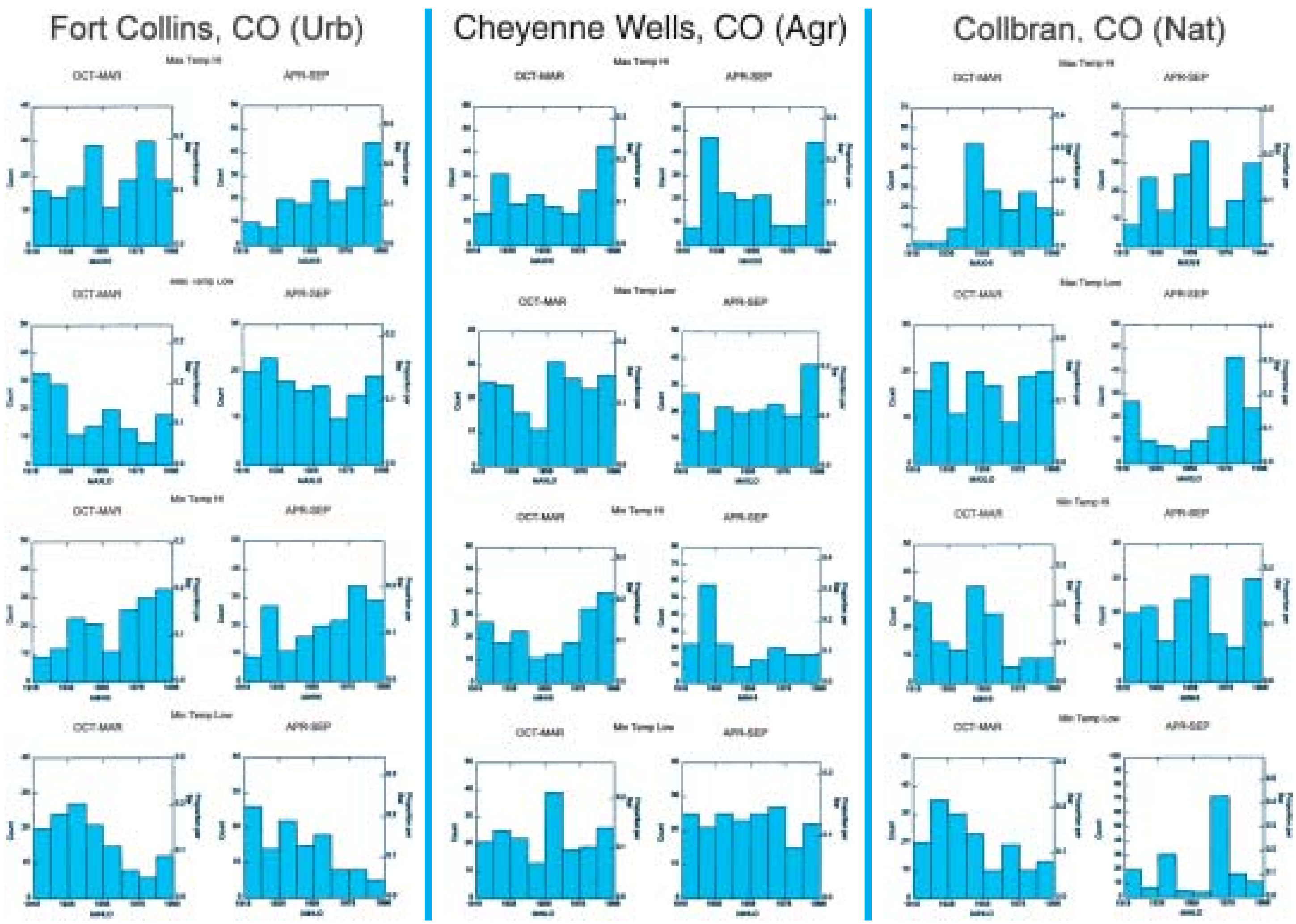

Record Extremes *(continued from page 15)*

Agriculture; Nat = Natural). The collection of roads, parking lots, and buildings in the vicinity of the Fort Collins weather station at Colorado State University has apparently produced a clear urban warming signal. From this data, we do not see a trend in temperature records in Colorado, except for urban sites.

We can also investigate monthly mean, maximum and minimum temperatures. Tom McKee, State Climatologist Emeritus, had the temperatures evaluated as part of his 1998 class on Colorado Climate. Figures on page 17 show results for Grand Junction and Montrose, separated into three-month seasons – winter (Dec-Feb); summer (Jun-Aug); spring (Mar-May); and autumn (Sep-Nov).

At Grand Junction, 1981 had the warmest winter in the average maximums, but 1983 has the warmest average minimum temperatures. The coldest average maximum was in 1973, while the coldest average minimum was in 1934. In the spring, Grand Junction warmest maximum and minimum temperatures were both also in 1934! The coolest maximum and minimum were both in 1917. In the summer, 1994 had the warmest maximum, while the warmest minimums were nearly tied between 1994 and 1933, 1936 and 1940. The coolest summer maximum was in 1914 with the coolest minimums in 1906 and 1950. In the fall, the warmest mean maximum and minimum were both in 1963. The coolest fall minimum was in 1961 while the coolest fall minimum was in 1912.

These values show that extreme average warm daytime or cold daytime temperatures do no always occur in the same year. Also, the variability of these means in greater in the winter and least in the summer.

For Montrose, the warmest winter average maximum was in 1981, while the warmest minimum was in 1934. The coldest month maximum was in 1979, closely followed by 1929, 1933 and 1937, while the coldest monthly minimum was in 1933. In the spring the warmest mean maximum and minimum were both in 1934. The coldest maximum and minimum mean temperature were 1917. In the summer means, the

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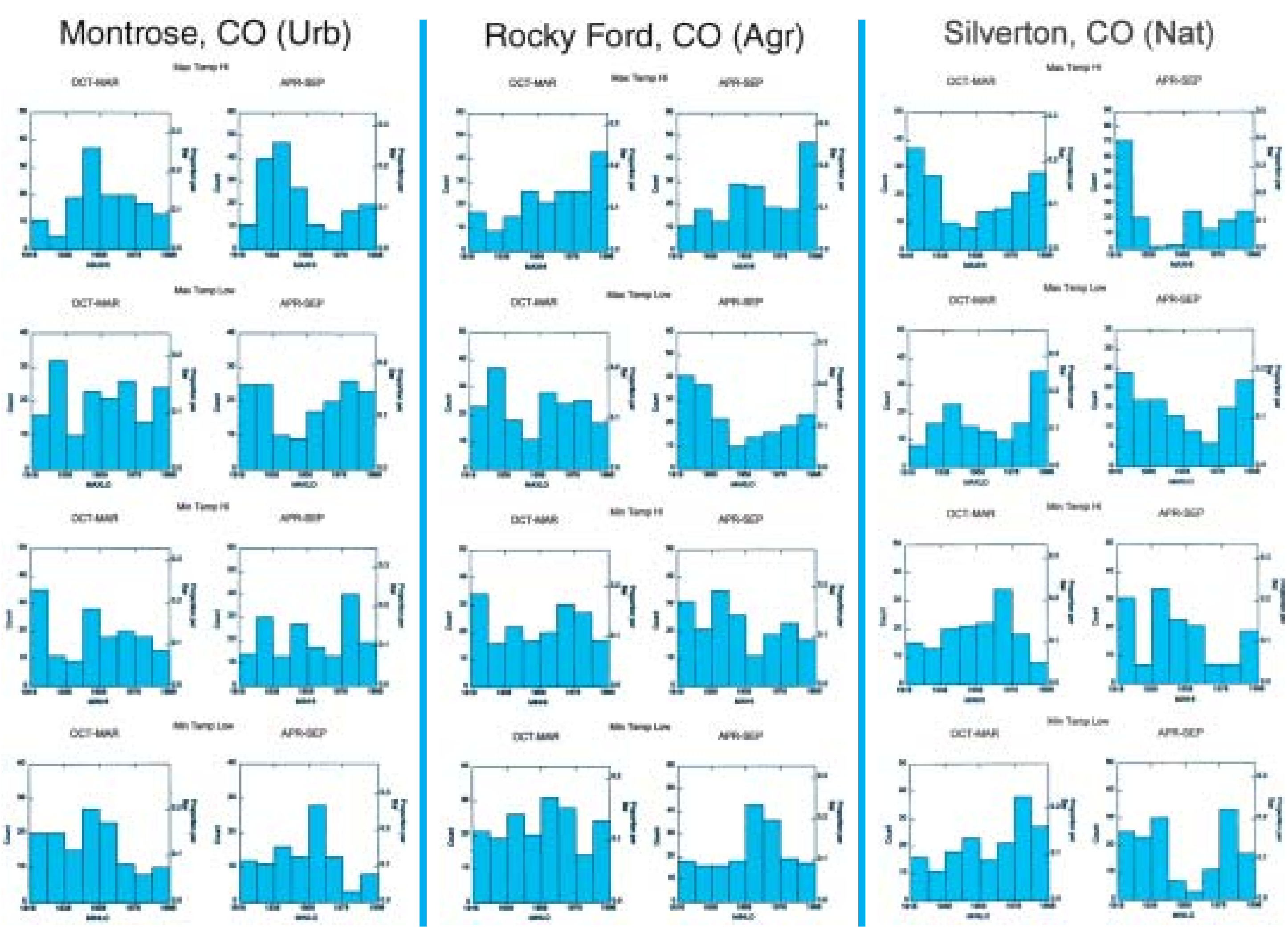
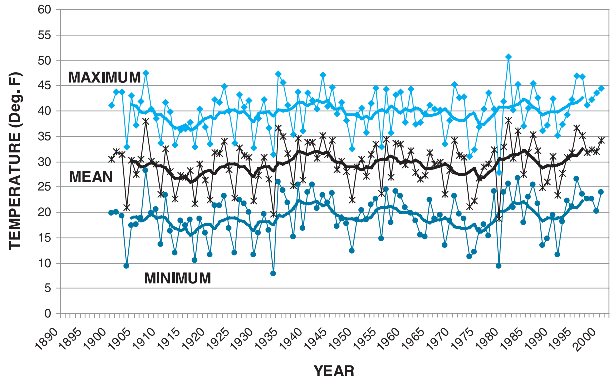
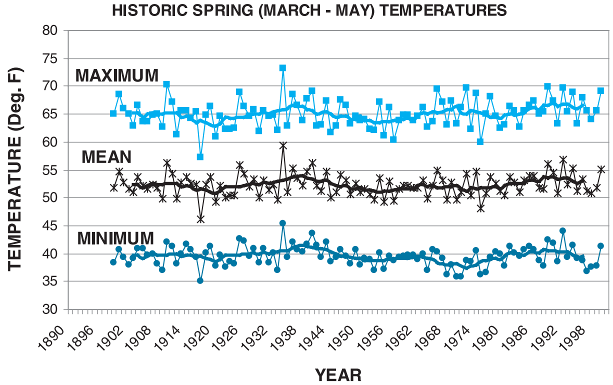


GRAND JUNCTION, COLORADO

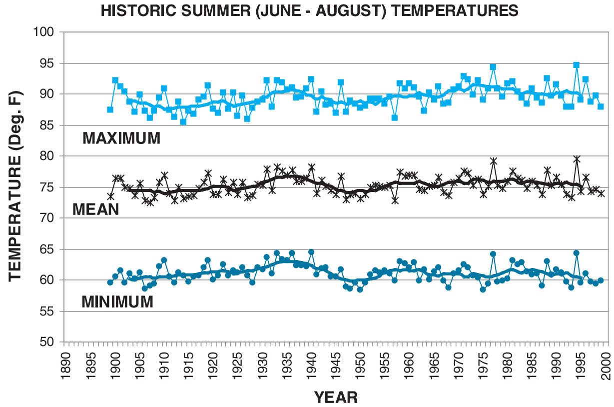
HISTORIC WINTER (DECEMBER - FEBRUARY) TEMPERATURES



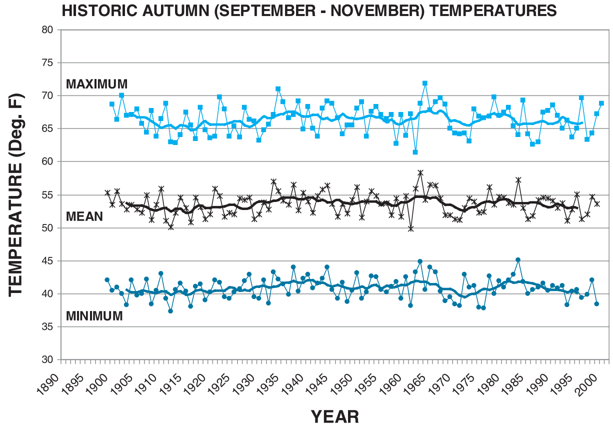
HISTORIC SPRING (MARCH - MAY) TEMPERATURES



HISTORIC SUMMER (JUNE - AUGUST) TEMPERATURES

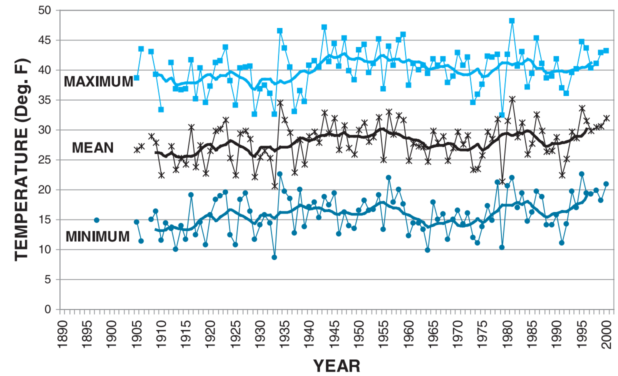


HISTORIC AUTUMN (SEPTEMBER - NOVEMBER) TEMPERATURES

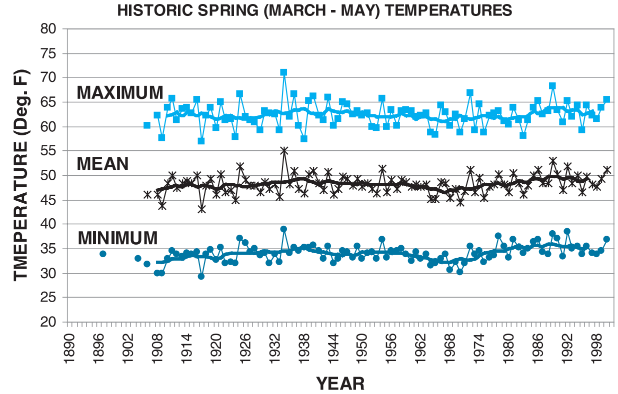


MONTROSE, COLORADO

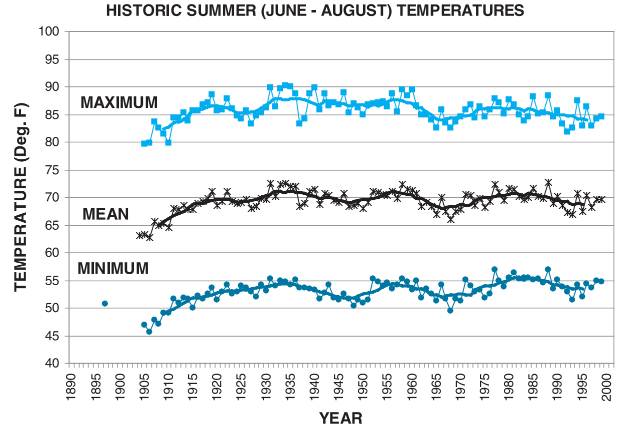
HISTORIC WINTER (DECEMBER - FEBRUARY) TEMPERATURES



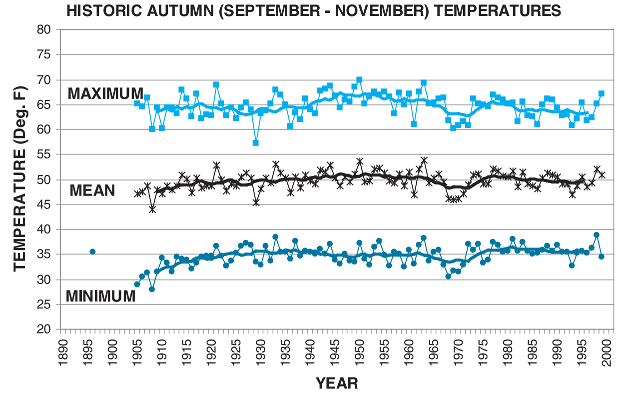
HISTORIC SPRING (MARCH - MAY) TEMPERATURES



HISTORIC SUMMER (JUNE - AUGUST) TEMPERATURES



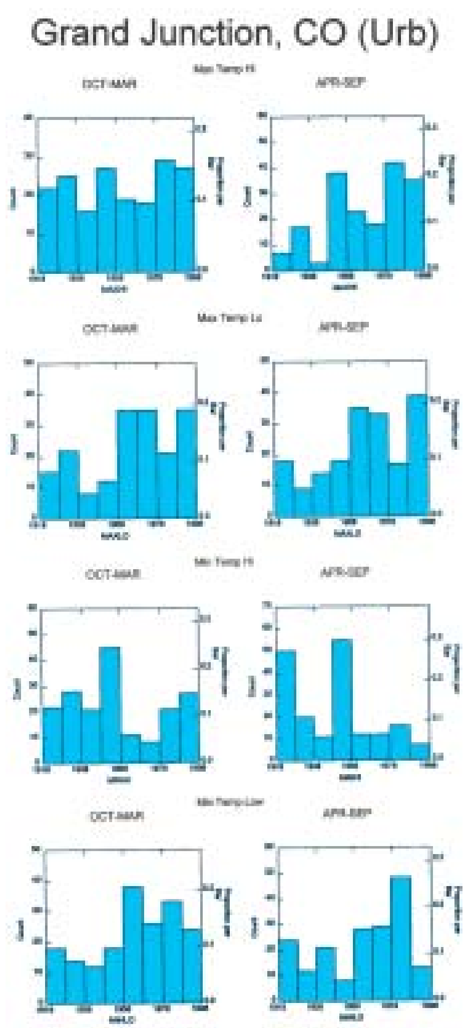
HISTORIC AUTUMN (SEPTEMBER - NOVEMBER) TEMPERATURES

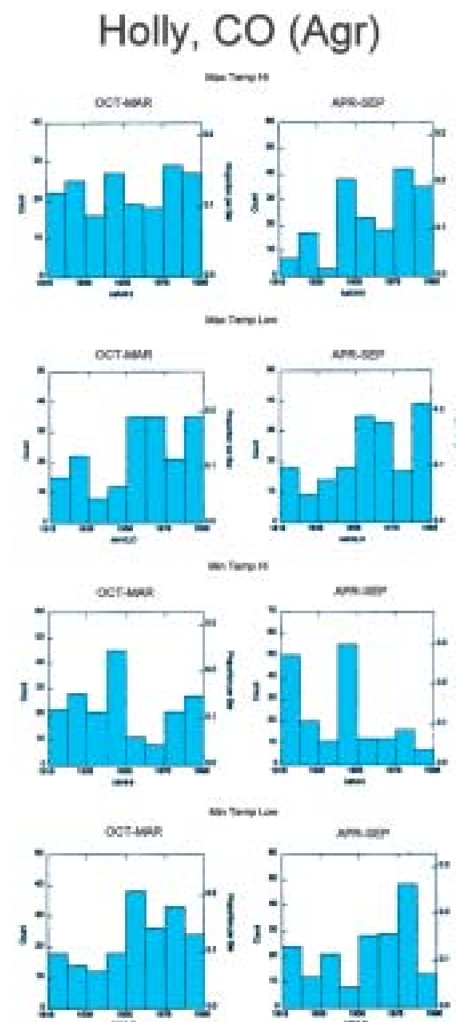


Record Extremes *(continued from page 16)*

warmest maximum was 1934 with the warmest minimum was 1977. In the fall the warmest maximum mean was 1950, while the warmest minimum was 1936 and 1933. The coldest fall maximum was 1929 and the coldest fall minimum in 1908.

These stations illustrate several conclusions that seem to apply statewide. First, there is no consistent trend for extreme warm or cold seasons in the state. Despite the warm weather of the last two years, the 1990s were not a period of record temperatures.





Policy Statement on Climate Variability and Change

*American Association of State Climatologists (AASC)**

This statement provides the perspective of the AASC on issues of climate variability and change. Since the AASC members work directly with users of climate information at the local, state and regional levels, it is uniquely able to put global climate issues into the local perspective needed by the users of climate information. Our conclusions are as follows:

1. Past climate is a useful guide to the future – Assessing past climate conditions provides a very effective analysis tool to assess societal and environmental vulnerability to future climate, regardless of the extent the future climate is altered by human activity. Our current and future vulnerability, however, will be different than in the past, even if climate were not to change, because society and the environment change as well. Decision makers need assessments of how climate vulnerability has changed.

2. Climate prediction is complex with many uncertainties – The AASC recognizes climate prediction is an extremely difficult undertaking. For time scales of a decade or more, understanding the empirical accuracy of such predictions – called "verification" – is simply impossible, since we have to wait a decade or longer to assess the accuracy of the forecasts.

Climate prediction is difficult because it involves complex, nonlinear interactions among all components of the earth's environmental system. These components include the oceans, land, lakes, and continental ice sheets, and involve physical, biological, and chemical processes. The complicated feedbacks and forcings within the climate system are the reasons for the difficulty in accurately predicting the future climate. The AASC recognizes that human activities have an influence on the climate system. Such activities, however, are not limited to greenhouse gas forcing and include changing land use and sulfate emissions, which further complicates the issue of climate prediction. Furthermore, climate predictions have not demonstrated skill in projecting future variability and changes in such important climate conditions as growing season, drought, flood-producing rainfall, heat waves, tropical cyclones and winter storms. These are the type of events that have a more significant impact on society than annual average global temperature trends.

3. Policy responses to climate variability and change should be flexible and sensible – The difficulty of prediction and the impossibility of verification of predictions decades into the future are important factors that allow for competing views of the long-term climate future. Therefore, the AASC recommends that policies related to long-term climate not be based on particular predictions, but instead should focus on policy alternatives that make sense for a wide range of plausible climatic conditions regardless of future climate. Climate is always changing on a variety of time scales and being prepared for the consequences of this variability is a wise policy.

4. In their interactions with users of climate information, AASC members recognize that the nation's climate policies must involve much more than discussions of alternative energy policies – Climate has a profound effect on sectors such as energy supply and demand, agriculture, insurance, water supply and quality, ecosystem management and the impacts of natural disasters. Whatever policies are promulgated with respect to energy, it is imperative that policy makers recognize that climate – its variability and change - has a broad impact on society. The policy responses should also be broad.

Thus, to address the issues of climate variability and change, modernizing and maintaining high quality long-term climate data must be a high priority in order to permit careful monitoring. With the rapid dissemination of these data, State Climate Offices, as well as the Regional Climate Centers, and the National Climatic Data Center can better monitor emerging climate threats to critical national resources, such as our water supply, agriculture, and energy needs. The climate data must include all-important components of the climate system (e.g., temperature, precipitation, humidity, vegetation health and soil moisture). We also recommend that the nation strengthen its local, state, and regional climate services infrastructure in order to develop greater support capabilities for those decision makers who have to respond to climate variability and change.

Finally, ongoing political debate about global energy policy should not stand in the way of common sense action to reduce societal and environmental vulnerabilities to climate variability and change. Considerable potential exists to improve policies related to climate; the AASC is working to turn that potential into reality.

(Approved by AASC in November, 2001.)

* *The American Association of State Climatologists (AASC) is the professional organization of State Climatologists of the United States. Each State Climatologist is appointed in his/her respective state to provide expertise on issues associated with climate. The State Climatologists collaborate with the six Regional Climate Centers and the Department of Commerce's National Climatic Data Center (NCDC) located in Asheville, North Carolina.*

Cooperative Observer at Cochetopa Creek Earns Holm Award

National Weather Service Office, Grand Junction

On a sunny and warm fall afternoon in Gunnison, Colorado, Mr. Harold Kreuger was presented with the John Campanius Holm Award. Mr. Doug Crowley, Meteorologist In Charge at Grand Junction, presented the award before 60 of Mr. Kreuger's family and friends on October 27, 2001. Mr. Kreuger was also presented with several congratulatory letters, including letters from United States Senators Wayne Allard and Ben Nighthorse Campbell. As a special memento, Congressman Scott McInnis of Colorado's 3rd Congressional District sent a "tribute" to Mr. Kreuger that was recorded as part of the official congressional record. The presentation coincided with his 87th birthday celebration and 56th wedding anniversary, making for quite a festive atmosphere. To compliment the birthday cake and punch, the National Weather Service provided a congratulatory cake, embossed with the NWS emblem.

The Holm Award is given to 25 observers annually, out of approximately 11,000 observers nationwide, and is one of the highest awards an observer can achieve. This award honors observers for outstanding accomplishments in the field of cooperative observations. The award was named for a Lutheran minister who was the first person known to have taken systematic weather observations in the American Colonies in 1644 and 1645.

Mr. Kreuger has provided weather information to the NWS on a voluntary basis for more than 54 years. He established the Cochetopa Creek station on October 16, 1947, at the Weather Service's request after another area rancher wanted to be relieved of the recording duties. The U.S. Army veteran and World War II anti-aircraft gunner moved the equipment to his ranch 16 miles southeast of Gunnison that afternoon. A letter written about Mr. Kreuger back in 1991 stated the worst weather he could remember was in 1969, "It started snowing about Oct. 1, and by Christmas we had 36 inches of snow on the ground. It didn't cause any real problems here until spring, when it melted and the water washed out several small bridges here."

The office and staff of the National Weather Service in Grand Junction would like to thank Mr. Kreuger for his years of dedication in the cooperative observing program. Without the devotion and commitment displayed by Mr. Kreuger, the climate, warning and hydrology programs in Gunnison county would be severely degraded. Thank you Mr. Kreuger!

Harold Kreuger receives the John Campanius Holm Award from Doug Crowley, National Weather Service Office, Grand Junction. Photo taken by John Kyle.

National Weather Service Cooperative Weather Observer Length of Service Awards

40

- Mr. and Mrs. Joseph L. Hannigan of Norwood, Colorado received a 40 Year Length of Service Award from the Grand Junction National Weather Service (NWS) for their contributions as cooperative observers.

  Photo courtesy The National Cooperative Observer.

30

- Mr. Wilson (second from left) and his wife Ester (second from right) received a 30 Year Length of Service Award at their home in Yellow Jacket. Meteorologist in Charge, Doug Crowley (left) and Cooperative Program Manager, Becky Klenk (right) from Grand Junction NWS Office presented the award.

  Photo by John Kyle.

30

- Mr. James T. Musgrave (left) of Hoyt, Colorado received the 30 Year Length of Service Award from Carl Burroughs (right) Hydrometeorological Technician (HMT) at the Boulder NWS Office

  Photo courtesy The National Cooperative Observer.

20

- Mr. James Newberry (left) of Cimarron, Colorado was presented with the 20 Year Length of Service Award January 2000 by Becky Klenk (center), HMT Grand Junction NWS Office. His father, Bill Newberry (right) was presented with a 35 Year LOS Award in October 1999. The NWS is honored to have the Newberry family in the Cooperative Observer Program.

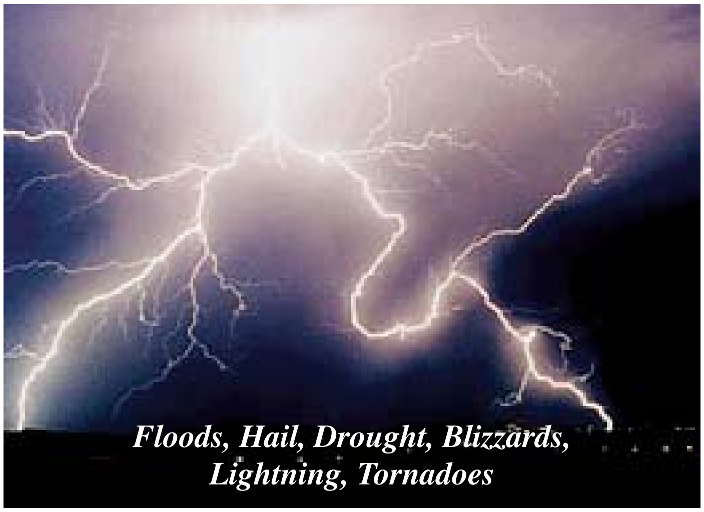
  Photo by John Kyle.

10

- Mr. Duane Davis of Drake, Colorado received the 10 Year Length of Service Award.

  No photo available.

Congratulations to you all on this very important service to the state and our country!



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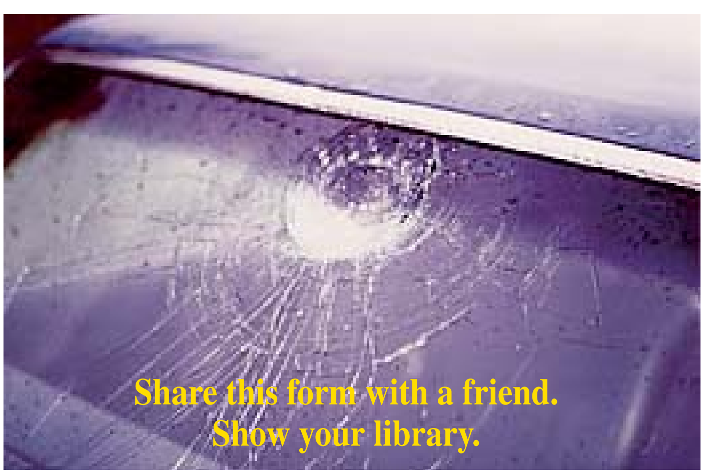

Photo by C. David Whiteman, July hailstorm.

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