Water Year 2020: A fast-developing drought and a historic wildfire year

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Director, Colorado Climate Center
Department of Atmospheric Science, Colorado State University

Along with: Becky Bolinger, Peter Goble, Zach Schwalbe

Poudre River Runs Through It
November 2020
Brief history of the CCC

• Until 1973, the federal government operated a “state climatologist” program – but in 1973 this was abolished.

• Later that same year, Colorado established the Colorado Climate Center at CSU with support through the Colorado Agricultural Experiment Station.
Our mission

The Colorado Climate Center at CSU provides valuable climate expertise to the residents of the state through its threefold program of:

1) **Climate Monitoring** (data acquisition, analysis, and archiving)

2) **Climate Research**

3) **Climate Services** (providing data, analysis, climate expertise, education and outreach)
Fort Collins, September 7

Fort Collins, September 8

Photo credit: Scott Denning

COLORADO CLIMATE CENTER
Statewide: 12th warmest water year (out of 125)
3rd warmest summer

Northeastern Colorado (South Platte drainage): tied for 14th warmest water year, tied for 2nd warmest summer

<table>
<thead>
<tr>
<th>Month</th>
<th>T Rank (of 126 years)</th>
<th>Above, below, or near avg?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct</td>
<td>3rd coolest</td>
<td>much below</td>
</tr>
<tr>
<td>Nov</td>
<td>39th warmest</td>
<td>above</td>
</tr>
<tr>
<td>Dec</td>
<td>25th warmest</td>
<td>above</td>
</tr>
<tr>
<td>Jan</td>
<td>25th warmest</td>
<td>above</td>
</tr>
<tr>
<td>Feb</td>
<td>51st coolest</td>
<td>near avg</td>
</tr>
<tr>
<td>Mar</td>
<td>14th warmest</td>
<td>above</td>
</tr>
<tr>
<td>Apr</td>
<td>58th warmest</td>
<td>near avg</td>
</tr>
<tr>
<td>May</td>
<td>4th warmest</td>
<td>much above</td>
</tr>
<tr>
<td>June</td>
<td>15th warmest</td>
<td>above</td>
</tr>
<tr>
<td>July</td>
<td>20th warmest</td>
<td>above</td>
</tr>
<tr>
<td>August</td>
<td>1st warmest</td>
<td>record</td>
</tr>
<tr>
<td>September</td>
<td>40th warmest</td>
<td>above</td>
</tr>
</tbody>
</table>
Globally, 2\textsuperscript{nd} warmest year-to-date through October, trailing only 2016

“the year 2020 is very likely to rank among the three warmest years on record”
Statewide Precipitation Ranks
October 2019 – September 2020
Period: 1895–2020

<table>
<thead>
<tr>
<th>Month</th>
<th>P Rank (of 126 years)</th>
<th>Above, below, or near avg?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct</td>
<td>40th driest</td>
<td>below</td>
</tr>
<tr>
<td>Nov</td>
<td>52nd wettest</td>
<td>near avg</td>
</tr>
<tr>
<td>Dec</td>
<td>41st wettest</td>
<td>above</td>
</tr>
<tr>
<td>Jan</td>
<td>34th driest</td>
<td>below</td>
</tr>
<tr>
<td>Feb</td>
<td>58th wettest</td>
<td>near avg</td>
</tr>
<tr>
<td>Mar</td>
<td>55th driest</td>
<td>near avg</td>
</tr>
<tr>
<td>Apr</td>
<td>7th driest</td>
<td>much below</td>
</tr>
<tr>
<td>May</td>
<td>18th driest</td>
<td>below</td>
</tr>
<tr>
<td>June</td>
<td>43rd driest</td>
<td>near avg</td>
</tr>
<tr>
<td>July</td>
<td>41st driest</td>
<td>below</td>
</tr>
<tr>
<td>August</td>
<td>5th driest</td>
<td>much below</td>
</tr>
<tr>
<td>Sept</td>
<td>39th driest</td>
<td>below</td>
</tr>
</tbody>
</table>

Statewide: 3rd driest water year (out of 125), only 2002 and 2018 drier

Northeastern Colorado (South Platte drainage): 9th driest water year
Colorado Water Year 2020 Precipitation as a Percentage of Normal

Wy2020_pn
Precip % of normal

0
0 - 10
11 - 20
21 - 30
31 - 50
51 - 70
71 - 90
91 - 110
111 - 130
131 - 150
151 - 170
171 - 200
201 - 250
251 - 300
300+

Data from PRISM Climate Group
Water year 2020
Water year 2020
SNOTEL snowpack: April 1
SNOTEL snowpack: May 1
Fort Collins: Water Year total of 12.89”, compared to normal of 16.10”
Joe Wright SNOTEL site: deficit of about 5” of precip from June-September
28-day average streamflow
Colorado SNOTEL Snow Water Equivalent (SWE) Update Map with Site Data

Current as of Nov 18, 2020

Statewide: 99%

Yampa & White: 92%

Colorado: 90%

Gunnison: 80%

San Miguel, Dolores, Animas & San Juan: 107%

Upper Rio Grande: 145%

North Platte: 89%

South Platte: 91%

Arkansas: 93%

SWE
Percent of Median
- Missing or Invalid
- < 50
- 50 - 69
- 70 - 89
- 90 - 109
- 110 - 129
- 130 - 149
- >= 150

SNOTEL

Current as of Nov 18, 2020

United States Department of Agriculture
Natural Resources Conservation Service
### U.S. Drought Monitor

**Colorado**

**November 17, 2020**  
(Released Thursday, Nov. 19, 2020)  
Valid 7 a.m. EST

#### Drought Conditions (Percent Area)

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>D0-D4</th>
<th>D1-D4</th>
<th>D2-D4</th>
<th>D3-D4</th>
<th>D4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current</strong></td>
<td>0.00</td>
<td>100.00</td>
<td>100.00</td>
<td>98.71</td>
<td>74.08</td>
<td>27.22</td>
</tr>
<tr>
<td><strong>Last Week</strong></td>
<td>0.00</td>
<td>100.00</td>
<td>100.00</td>
<td>98.71</td>
<td>74.08</td>
<td>24.64</td>
</tr>
<tr>
<td><strong>3 Months Ago</strong></td>
<td>0.00</td>
<td>100.00</td>
<td>98.76</td>
<td>72.69</td>
<td>27.31</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Start of Calendar Year</strong></td>
<td>31.72</td>
<td>68.28</td>
<td>51.19</td>
<td>20.11</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Start of Water Year</strong></td>
<td>0.00</td>
<td>100.00</td>
<td>99.29</td>
<td>89.35</td>
<td>52.88</td>
<td>2.64</td>
</tr>
<tr>
<td><strong>One Year Ago</strong></td>
<td>25.19</td>
<td>74.81</td>
<td>58.85</td>
<td>32.23</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

#### Intensity:
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

**Author:** Richard Tinker  
CP/NOAA/NWSINCEP

[View the Drought Monitor website](droughtmonitor.unl.edu)
Four months ago
Six months ago

U.S. Drought Monitor
Colorado

May 19, 2020
(Released Thursday, May 21, 2020)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

<table>
<thead>
<tr>
<th></th>
<th>D0-D4</th>
<th>D1-D4</th>
<th>D2-D4</th>
<th>D3-D4</th>
<th>D4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>23.22</td>
<td>76.78</td>
<td>65.20</td>
<td>86.31</td>
<td>17.52</td>
</tr>
<tr>
<td>Last Week</td>
<td>20.79</td>
<td>79.24</td>
<td>62.66</td>
<td>86.09</td>
<td>14.65</td>
</tr>
<tr>
<td>3 Months Ago</td>
<td>28.74</td>
<td>71.26</td>
<td>43.82</td>
<td>3.30</td>
<td>0.00</td>
</tr>
<tr>
<td>Start of</td>
<td>31.72</td>
<td>68.28</td>
<td>51.19</td>
<td>20.11</td>
<td>0.00</td>
</tr>
<tr>
<td>Calendar Year</td>
<td>30.14</td>
<td>69.86</td>
<td>27.53</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Start of</td>
<td>99.99</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Water Year</td>
<td>19-20</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
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Intensity:
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Author:
Brian Fuches
National Drought Mitigation Center

droughtmonitor.unl.edu
September’s Memorable Extremes

- La Junta municipal airport reported the hottest September temperature on record for the state with 108° on September 6.
- Earliest snow on record for Fort Collins with 2.3” on September 8. Previous earliest snow was September 12.
- Denver, Colorado Springs, and Pueblo have all had the most 90° days on record in 2020.
- Monte Vista reported 14 inches of snow in 2 days, toppling all September records and even counting as one of the top ranked snowiest events in all months.
- Two stations tied national record for shortest period between 100° and snowfall
  - La Junta: 101° September 7, 3.4” September 9
  - Ordway 1 ENE: 104° September 7, 3.9” September 9
Evaporative Demand Drought Index

Record levels of evaporative demand across the west in late summer

We expect more moisture, clouds, rain in August on the western slope, but not this year
Warming Temperatures Have Most Consistent Impact on Mid-to-Late Summer

- Warming trend is fairly seasonally independent
- Natural variability is much stronger in winter/spring
- What was a warm summer 75 years ago is now a cool summer

(from Peter Goble)

Data source: NOAA/NCEI
The 2020 fire season is unusually late

Large wildfires started later in 2020
Acres burned per year by the month in which the fire started

From https://coloradosun.com/2020/10/20/colorado-largest-wildfire-history
Some modest chances for precip in the next week, but no significant storms on the horizon
December-January-February outlook

Three Category Temperature Outlook
Normal Maximum Temperature: 43
Normal Minimum Temperature: 17

Three Category Precipitation Outlook
Normal Precipitation: 1.72

Seasonal Outlook
December 2020-February 2021 (Lead 1)
December-January-February outlook
La Niña this winter and likely spring

We’re in a La Niña advisory. Both sea surface temperatures and atmospheric variables are consistent with La Niña conditions. 95% chance that La Niña conditions will continue through the winter; 65% chance through spring.
What’s La Niña mean for fall/winter?

DJF Temperature During La Nina
Increased Risk of Warm or Cold Extremes

DJF Precipitation During La Nina
Increased Risk of Wet or Dry Extremes
What’s La Niña mean for snow?

CoAgMET Station Locations
About the stations

Anemometer and wind vane: Wind speed, direction and gusts

Pyranometer: Solar radiation

Temperature/Humidity sensor in radiation shield

Tipping bucket rain gage

Solar panel powers the station when the sun shines

Data logger

Soil temperatures

2 and 6 inches below ground

Above all else facing South
CoAgMET web access:
http://coagmet.colostate.edu/
Data are free and available to the public
And finally, the all-important question: “Do you have a rain gauge?”
If you are interested in weather and the variations in precipitation, please join the Community Collaborative Rain, Hail and Snow Network

http://www.cocorahs.org
New maps for CoCoRaHS!  https://maps.cocorahs.org/

Show the total precip over a period up to 45 days!
Thank you!

http://climate.colostate.edu/
russ.schumacher@colostate.edu

Follow us on Facebook and Twitter! @ColoradoClimate
Standardized Precipitation Index (SPI)

SPI developed by McKee, Doesken and Kleist; figure from Spade et al. (2020)
Also, the analogous Standardized Precipitation-Evapotranspiration Index (SPEI), which considers the effects of temperature on evaporative demand: a hotter atmosphere is more "thirsty"
Standardized precipitation index: water year in Larimer County
Standardized precipitation-evapotranspiration index: water year in Larimer County

(accounts for both precipitation and "thirst" of the atmosphere)
Standardized precipitation index: June through August in Larimer County
Standardized precipitation-evapotranspiration index: June through August in Larimer County

(accounts for both precipitation and “thirst” of the atmosphere)