

# Colorado Climate Update for WATF

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Along with: Zach Schwalbe, Becky Bolinger, Peter Goble, Dani Talmadge, Nolan Doesken



Water Availability Task Force meeting  
March 2019



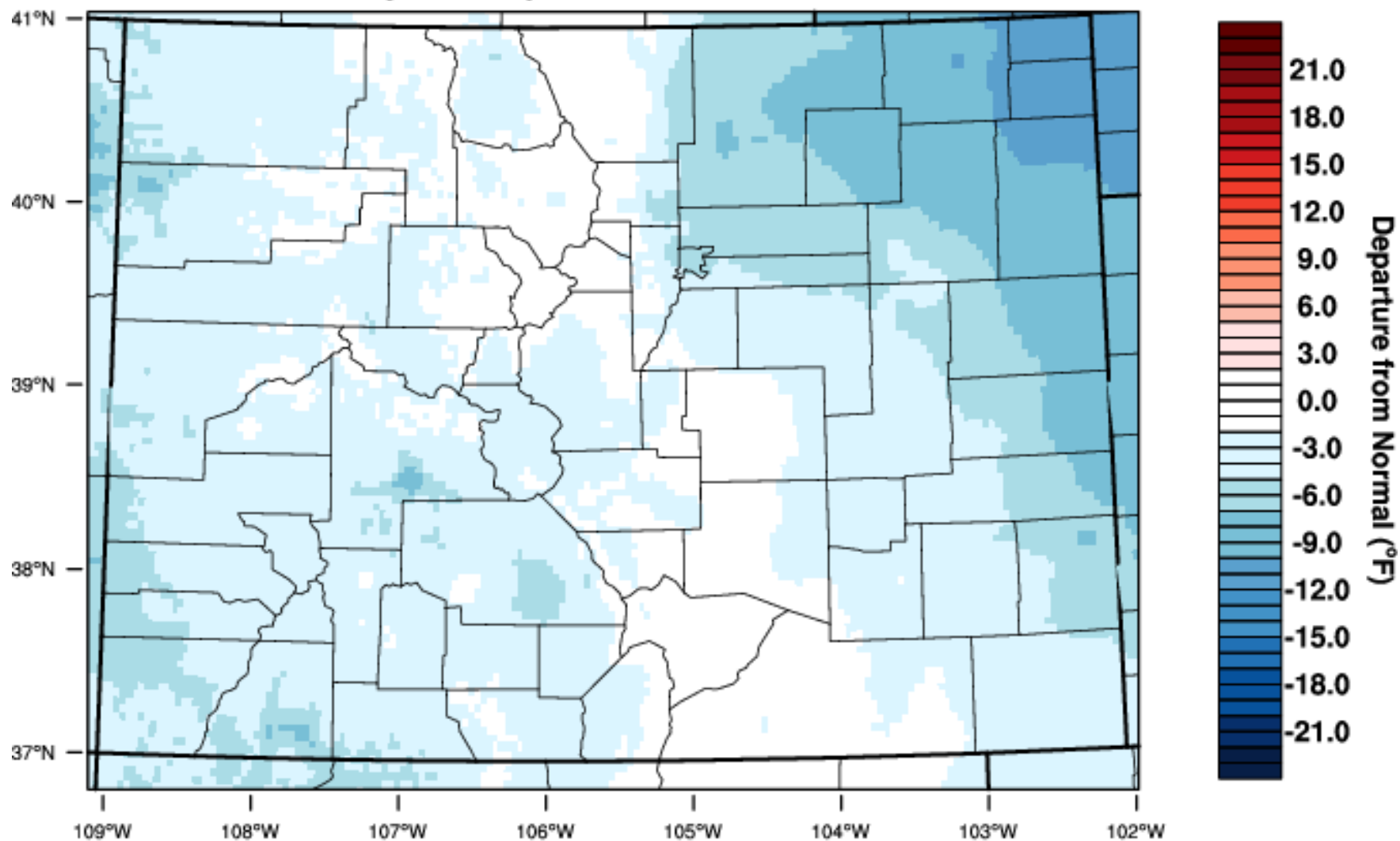
ATMOSPHERIC SCIENCE  
COLORADO STATE UNIVERSITY

# Water Year 2019 – Temperature



# Colorado - Mean Temperature

## February 2019 Departure from 1981-2010 Normal

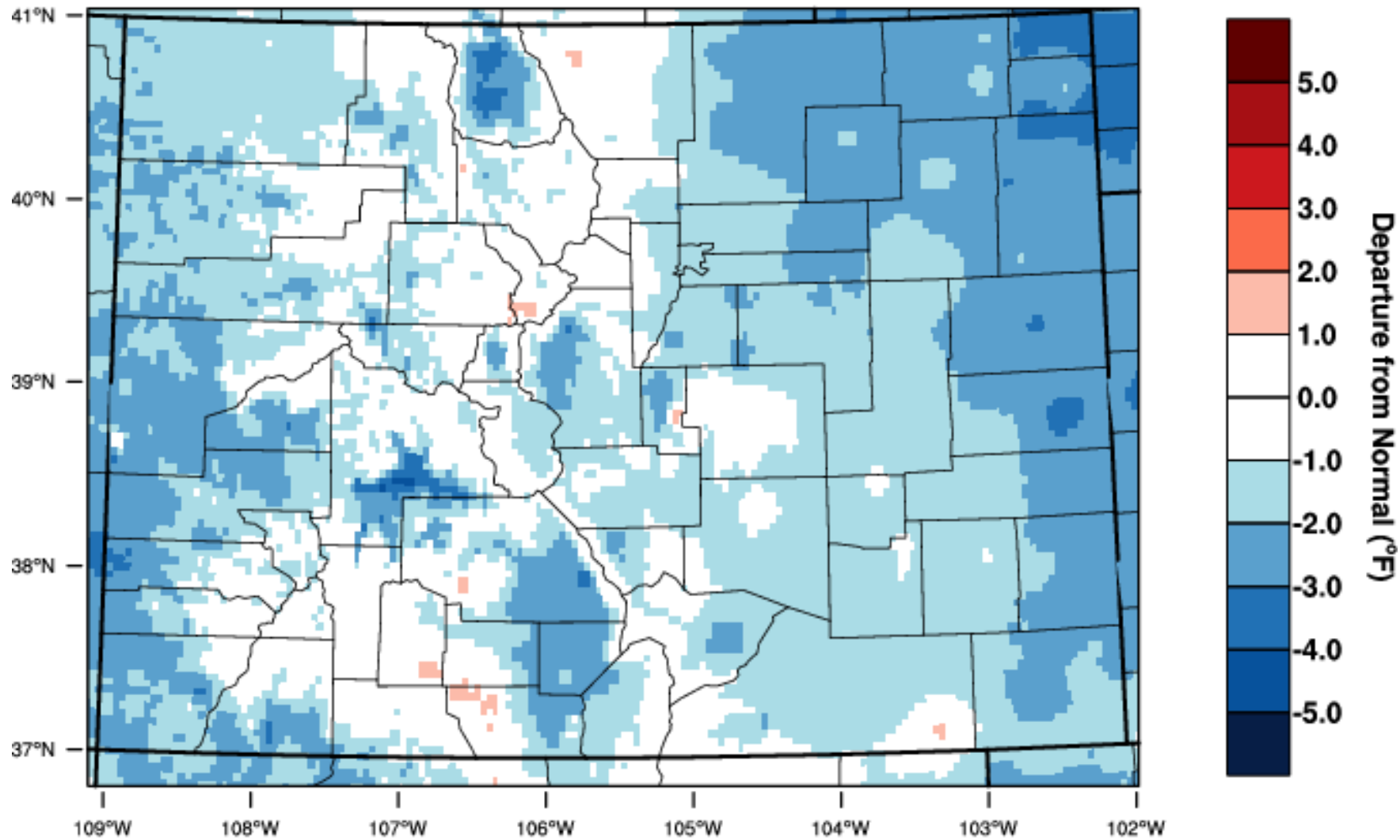


WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 MAR 2019



# Colorado - Mean Temperature

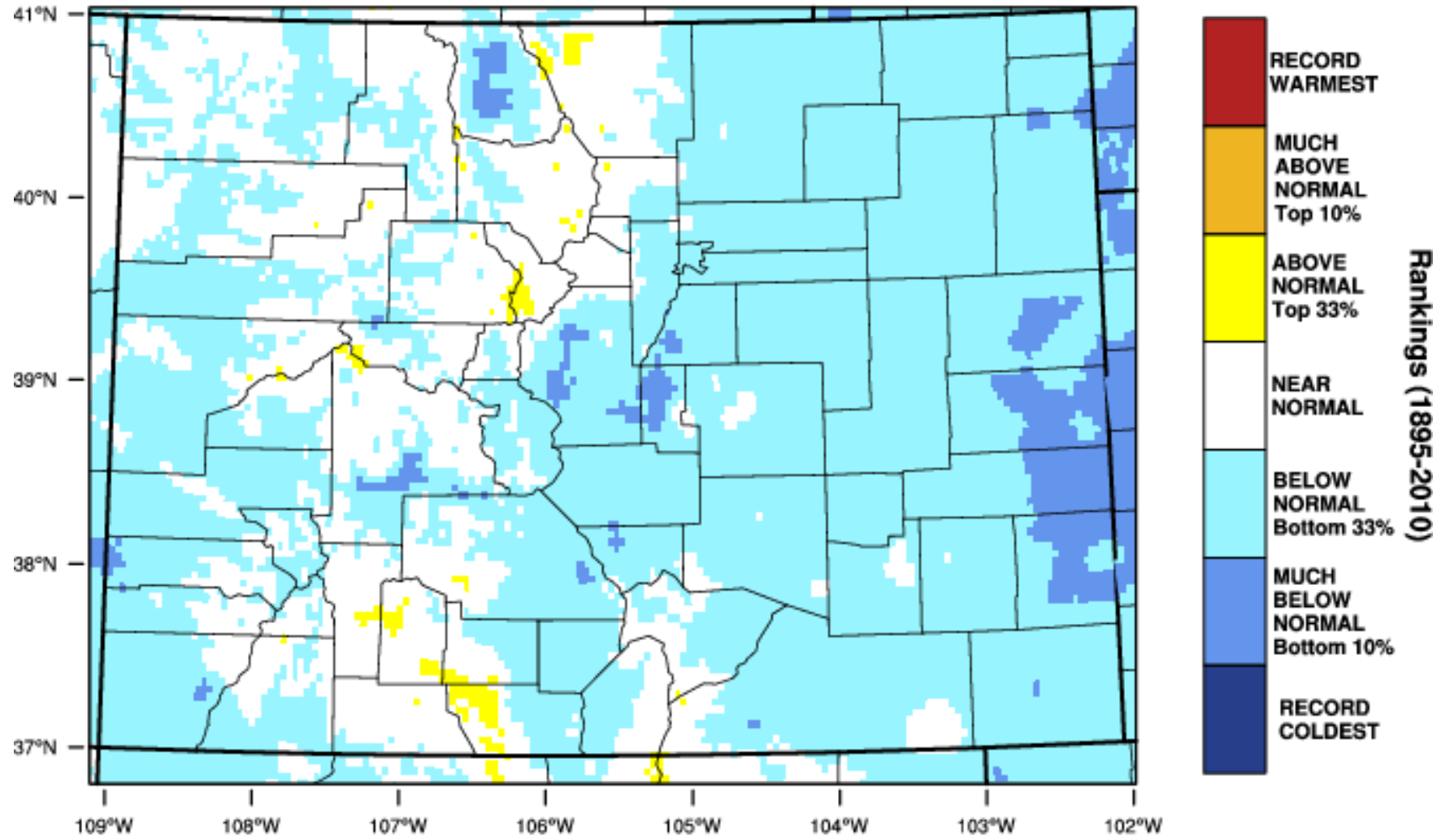
October-February 2019 Departure from 1981-2010 Normal



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 MAR 2019



# Colorado - Mean Temperature October-February 2019 Percentile

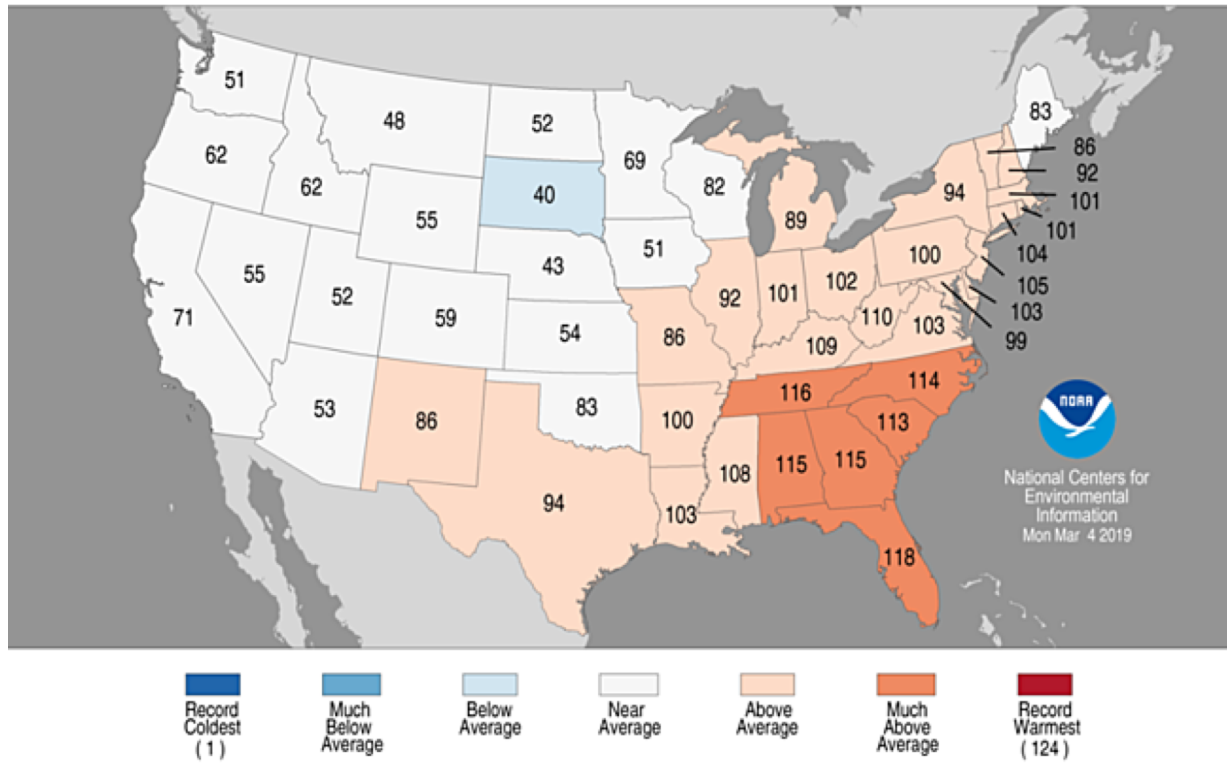


WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 MAR 2019

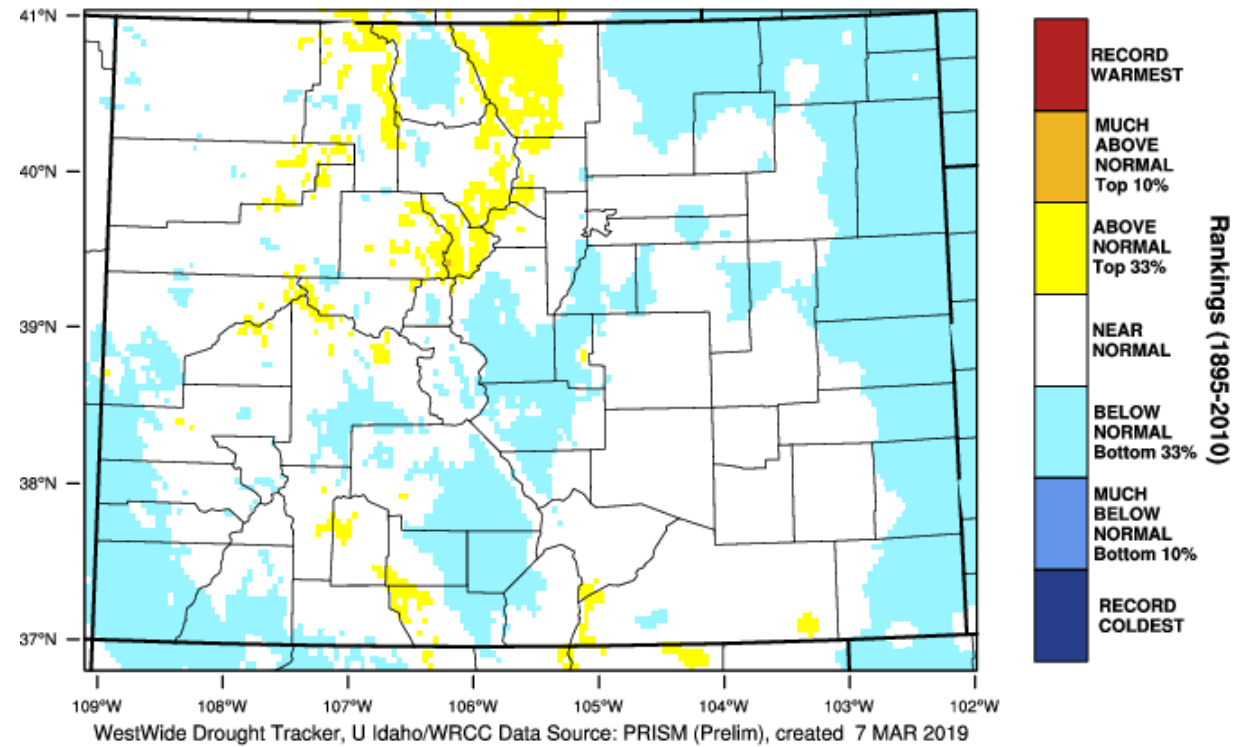


# Winter summary

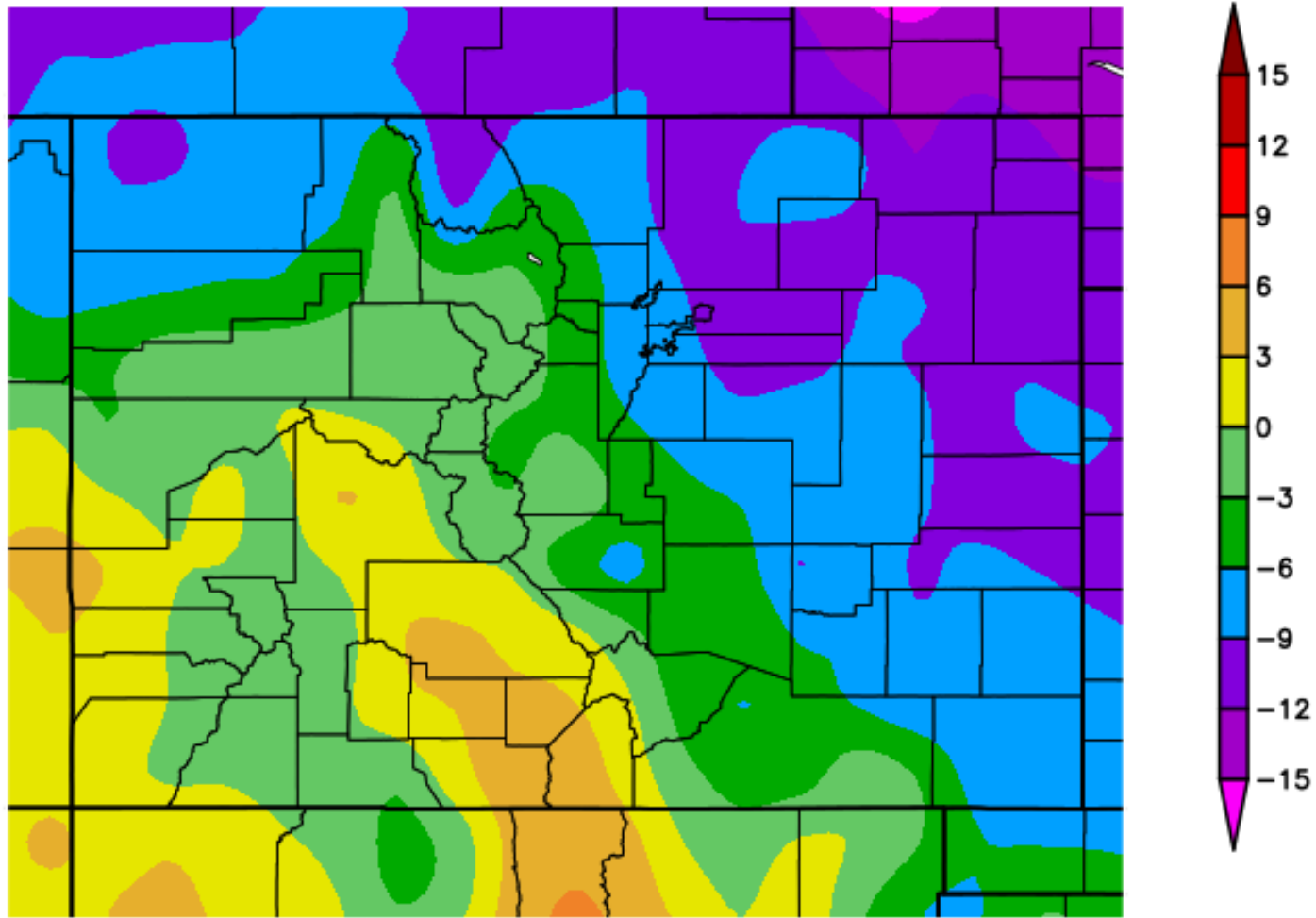
Statewide Average Temperature Ranks  
December 2018–February 2019  
Period: 1895–2019



Colorado - Mean Temperature  
December-February 2019 Percentile



# Departure from Normal Temperature (F) 3/1/2019 – 3/17/2019



Generated 3/18/2019 at HPRCC using provisional data.

NOAA Regional Climate Centers





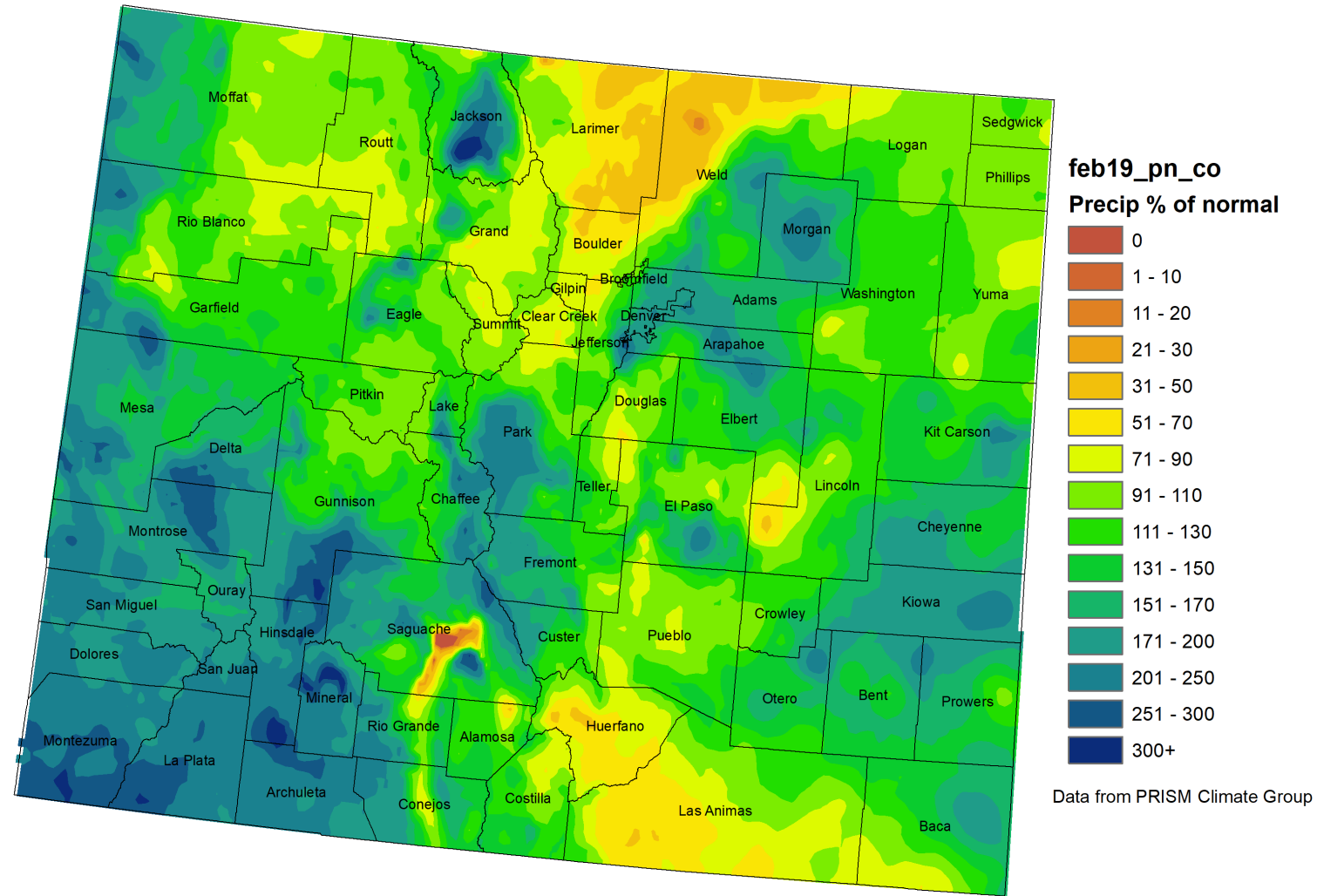
## Water Year 2019 – Precipitation

<https://bloximages.newyork1.vip.townnews.com/gazette.com/content/tncms/assets/v3/editorial/9/f2/9f22e48a-45d0-11e9-827f-034e3efb093d/5c896b61a8f4f.image.jpg?resize=1200%2C786>

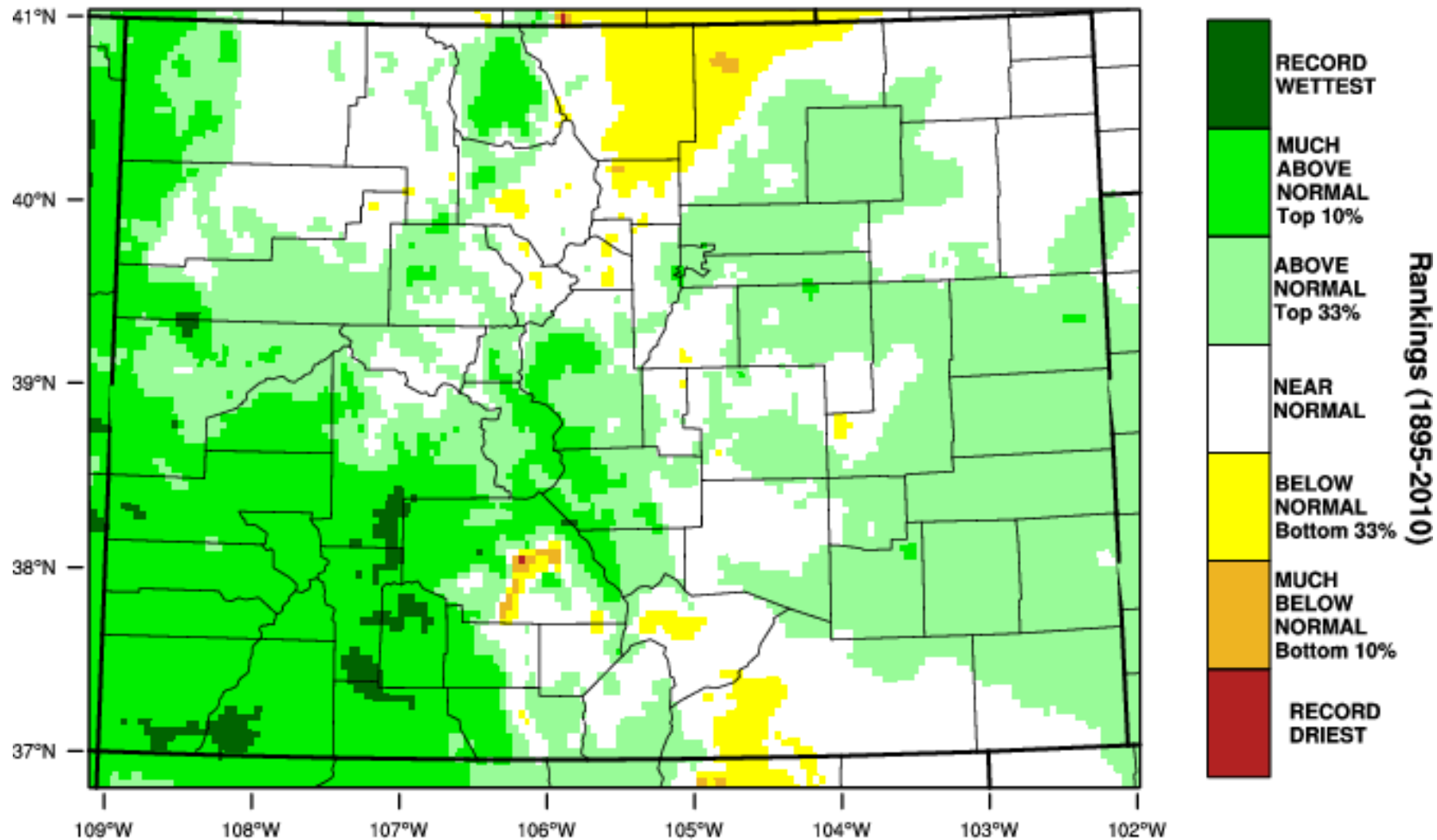




# Colorado February 2019 Precipitation as a Percentage of Normal



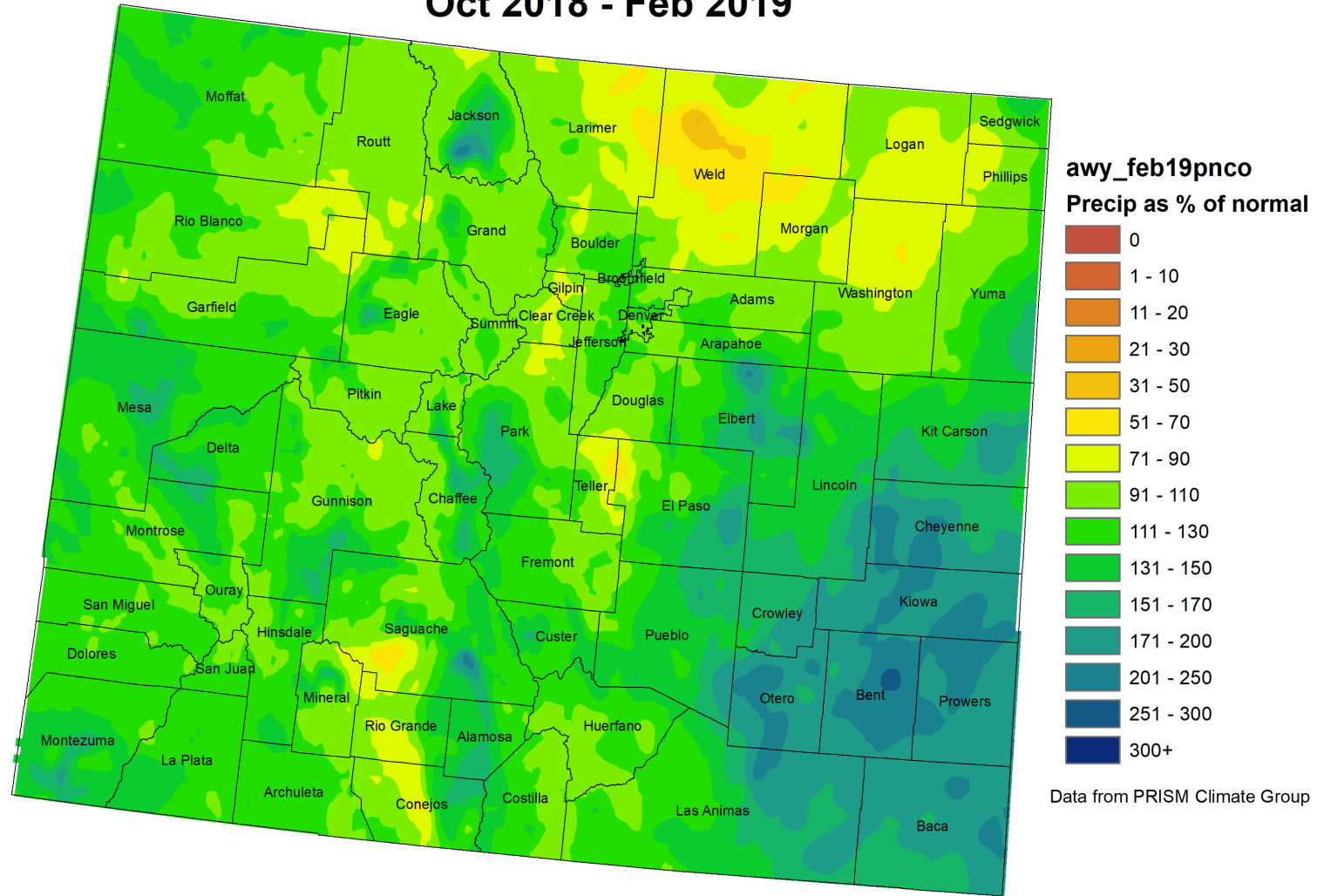
# Colorado - Precipitation February 2019 Percentile



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 MAR 2019

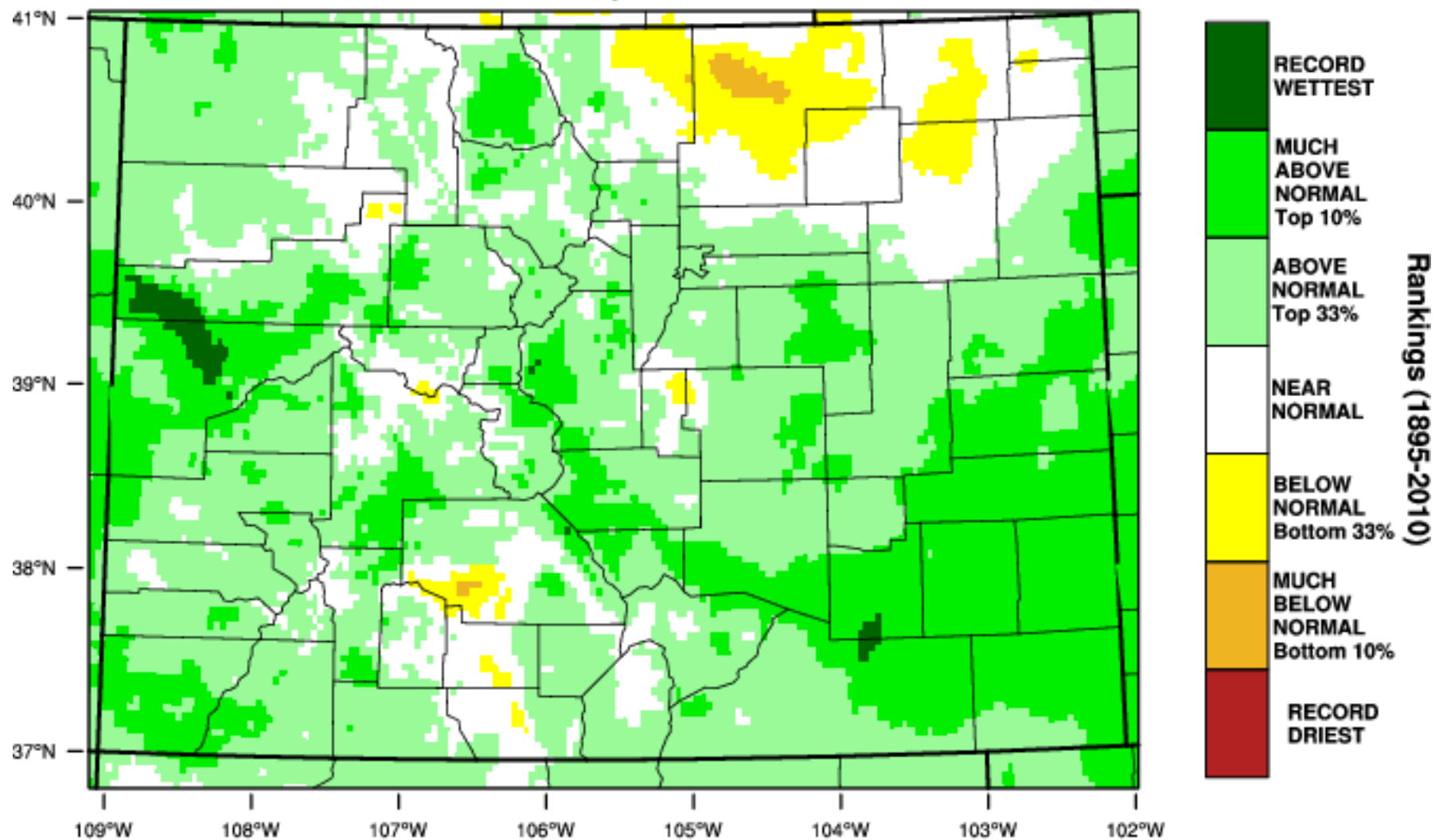


# Colorado Water Year 2019 Precipitation as a Percentage of Normal Oct 2018 - Feb 2019



# Colorado - Precipitation

## October-February 2019 Percentile

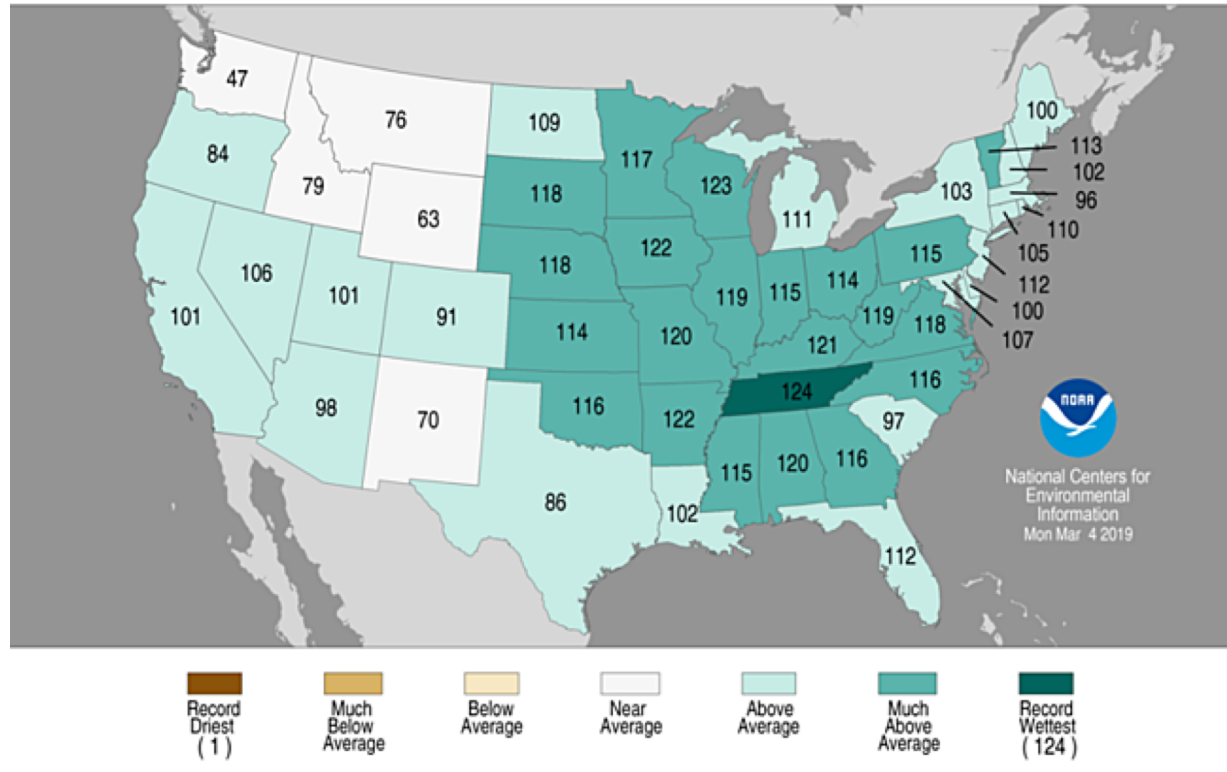


WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 MAR 2019

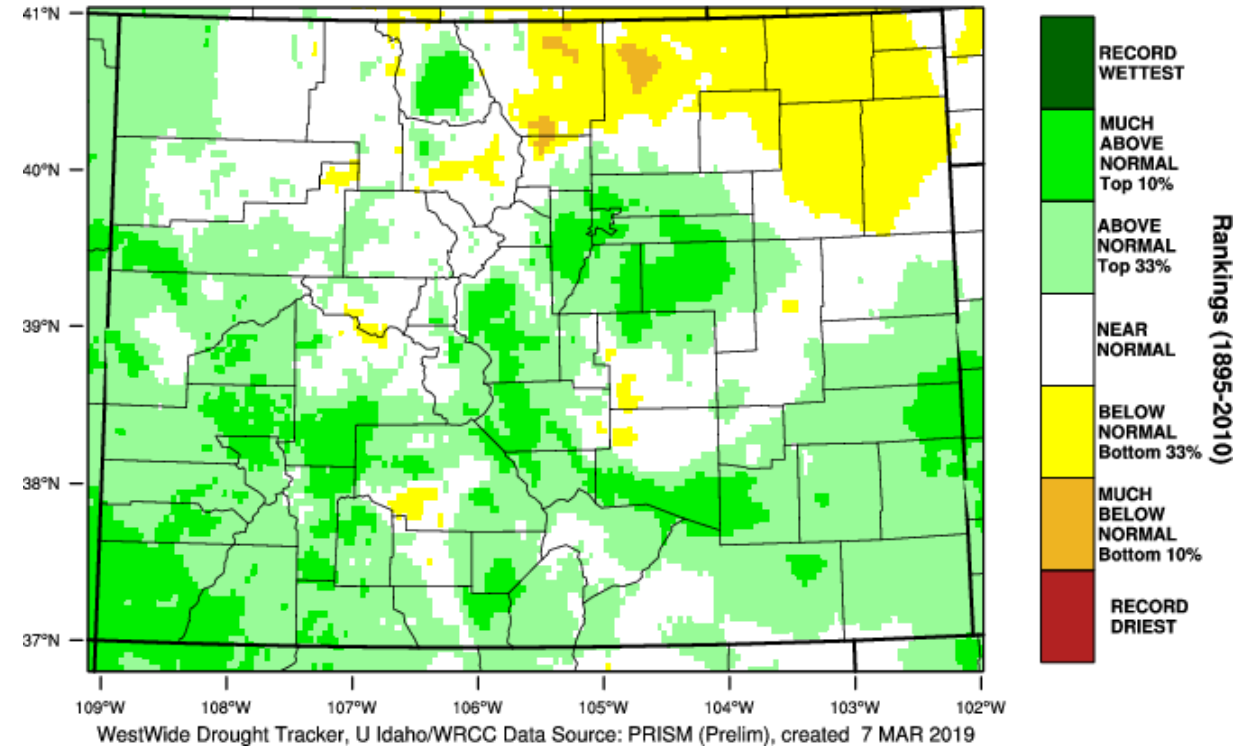


# Winter summary

Statewide Precipitation Ranks  
December 2018–February 2019  
Period: 1895–2019



Colorado - Precipitation  
December-February 2019 Percentile

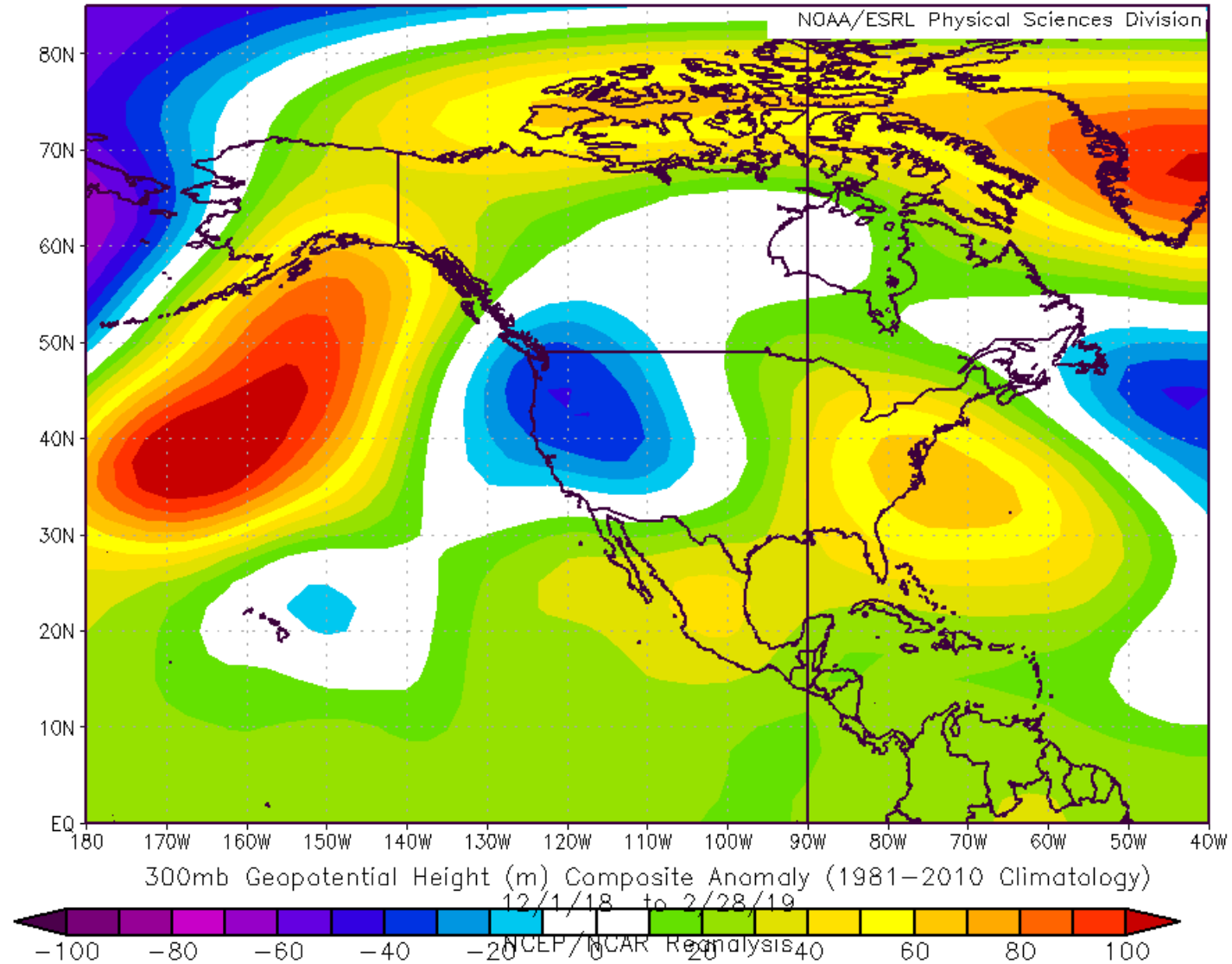


For continental US as a whole, wettest winter on record

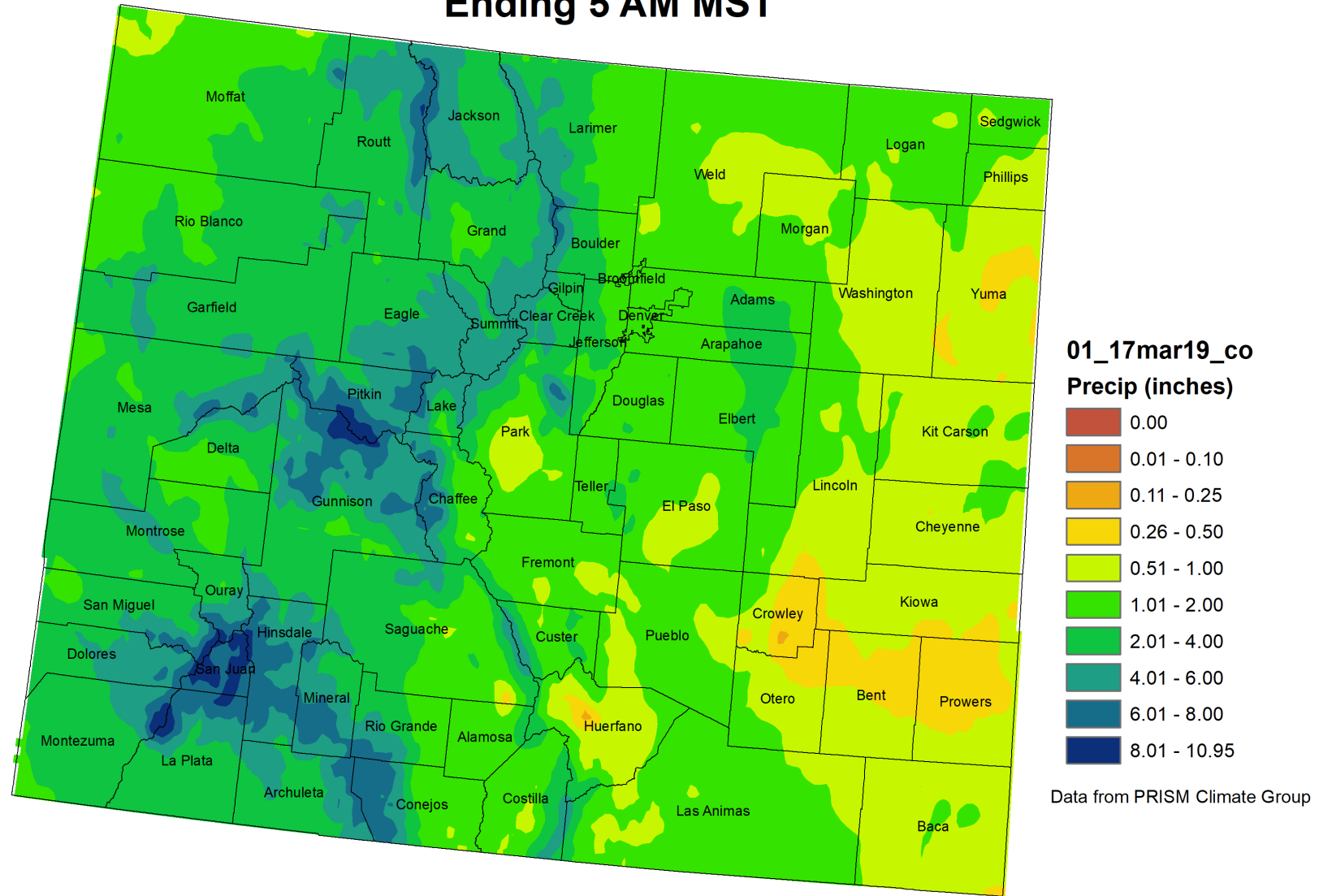


# Upper-level meteorology: how did the jet stream compare to typical winter?

Position of upper-level waves supported a very active storm track through Colorado

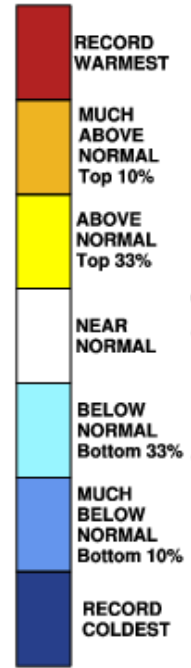
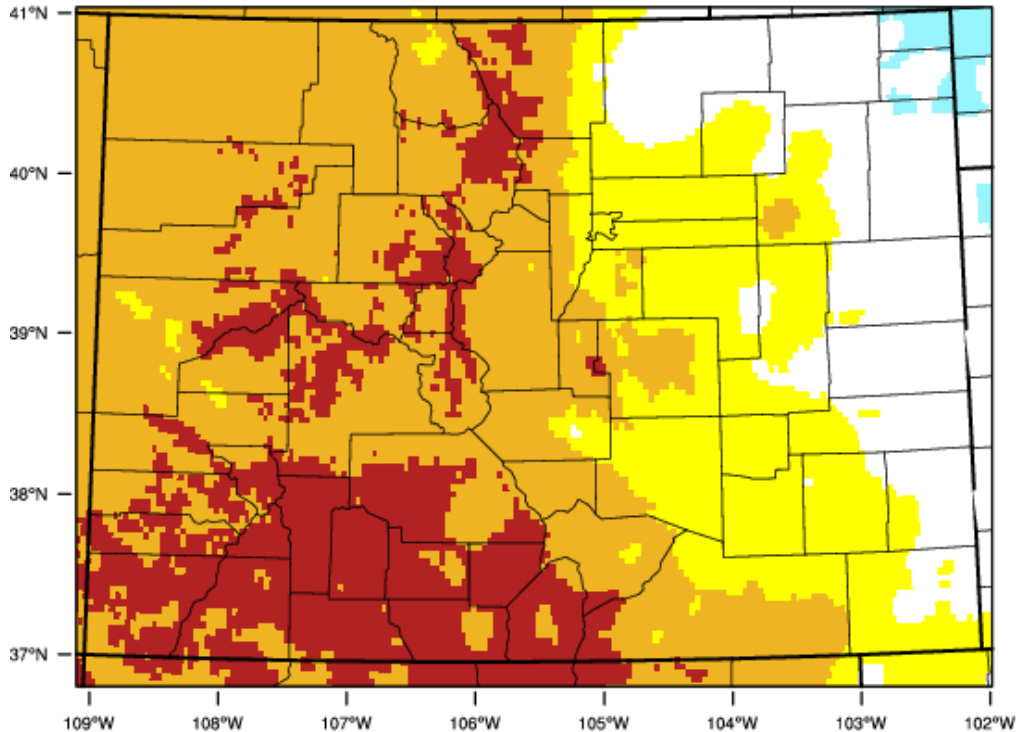


# Colorado Month to Date Precipitation 1 - 17 March 2019 Ending 5 AM MST



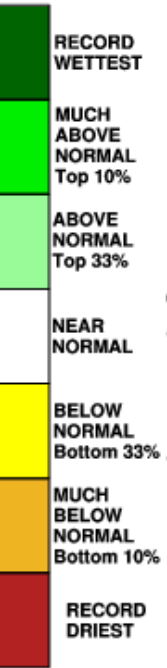
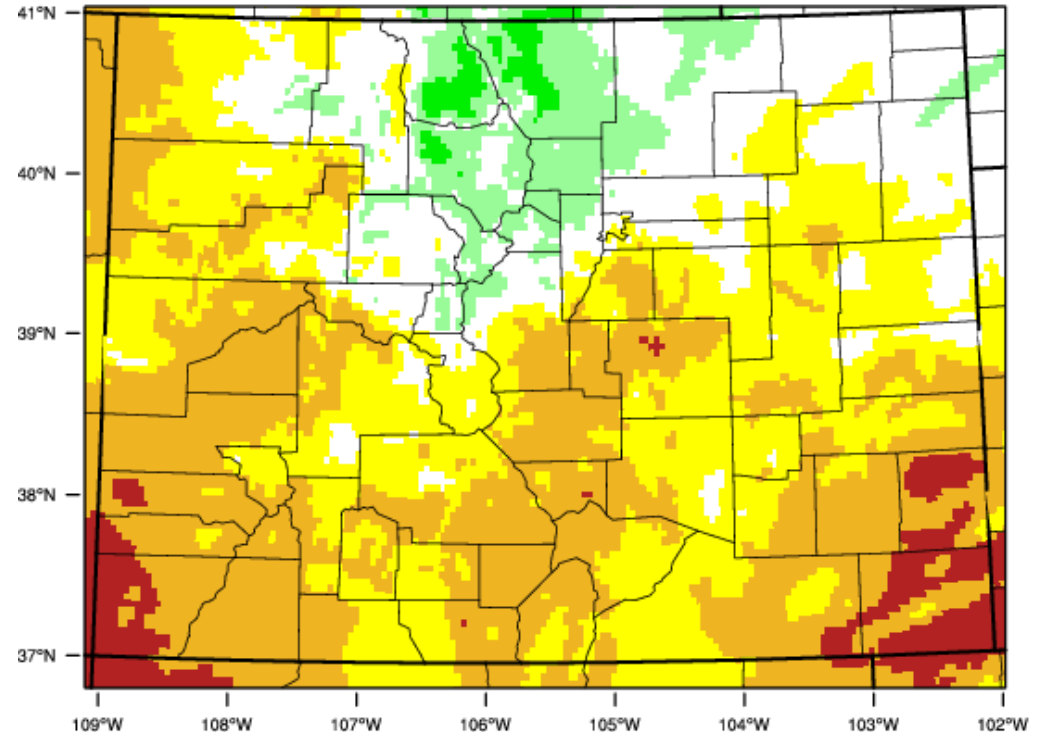
# Last year this time...

Colorado - Mean Temperature  
October-February 2018 Percentile



Rankings (1895-2010)

Colorado - Precipitation  
October-February 2018 Percentile



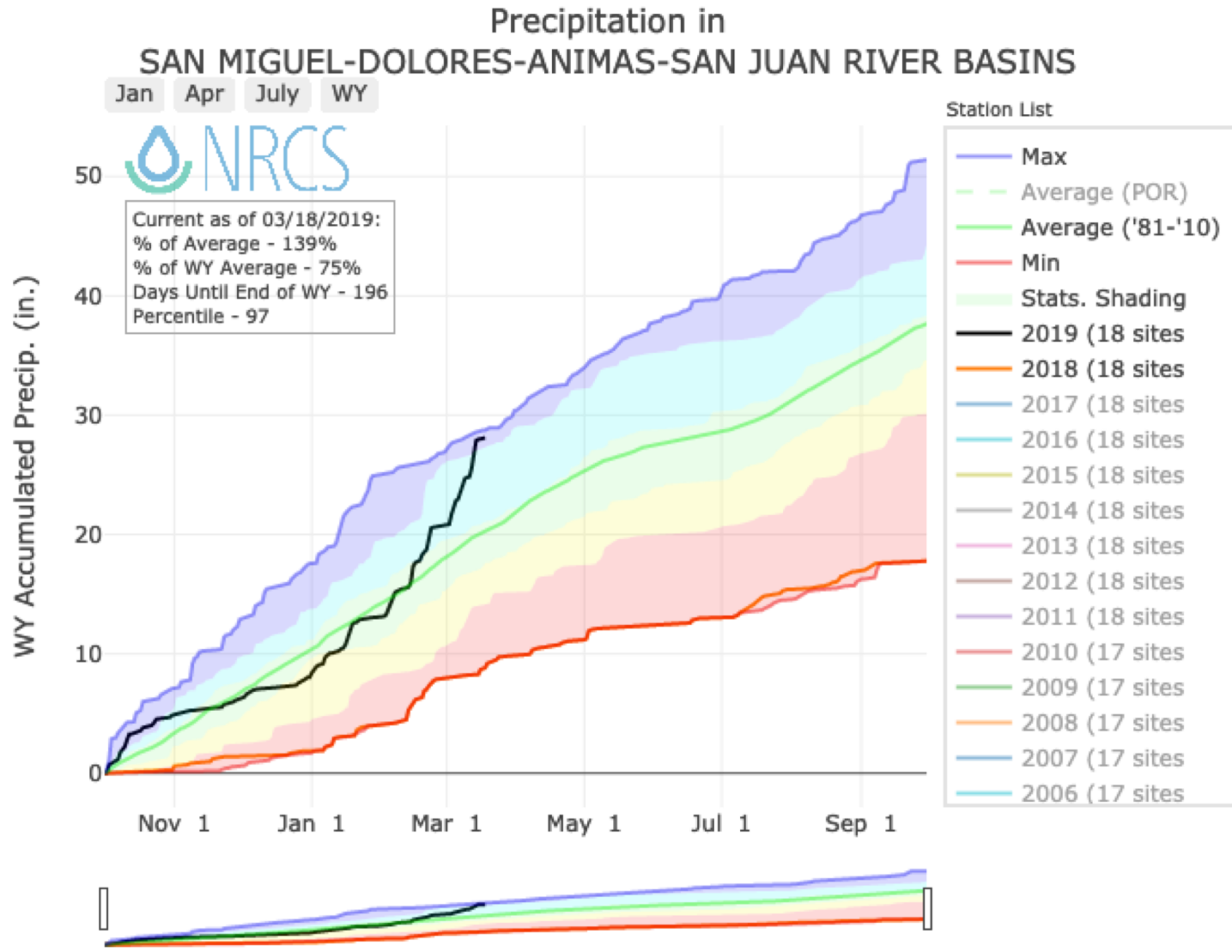
Rankings (1895-2010)

WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 11 MAR 2018

WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 11 MAR 2018







Basin average of 15" since February 1

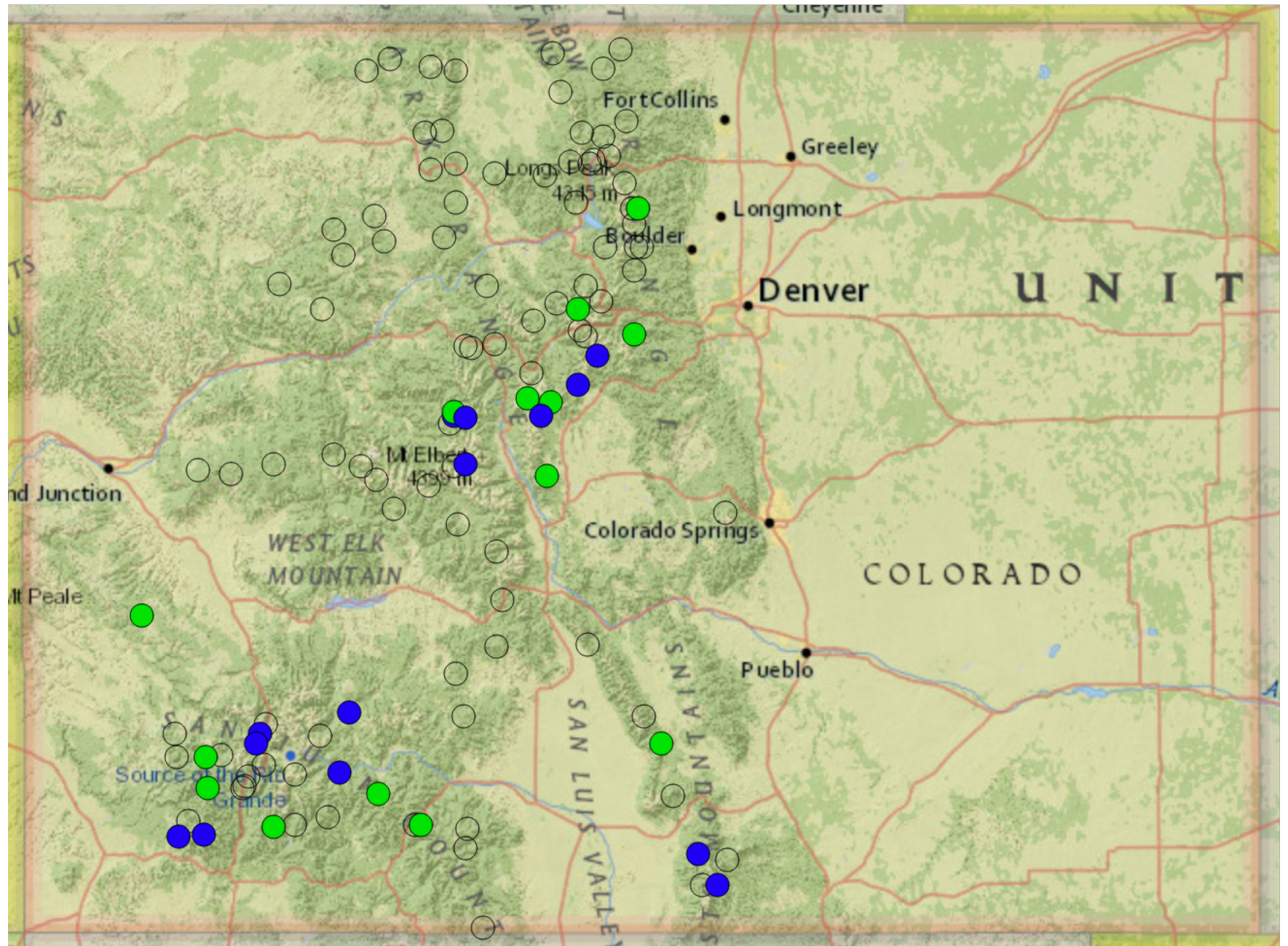
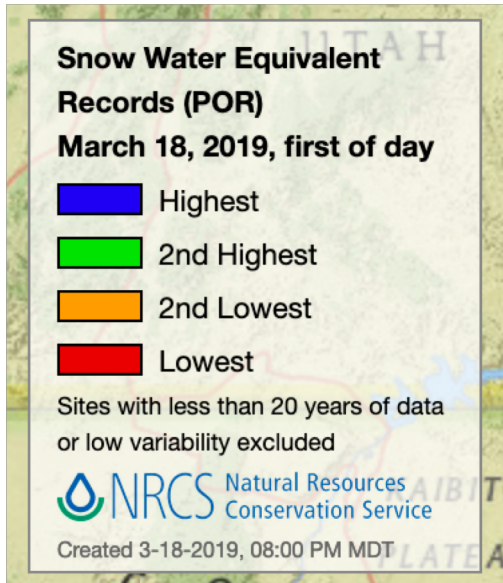
28.1" since October 1

Last year: 17.6" for the entire water year

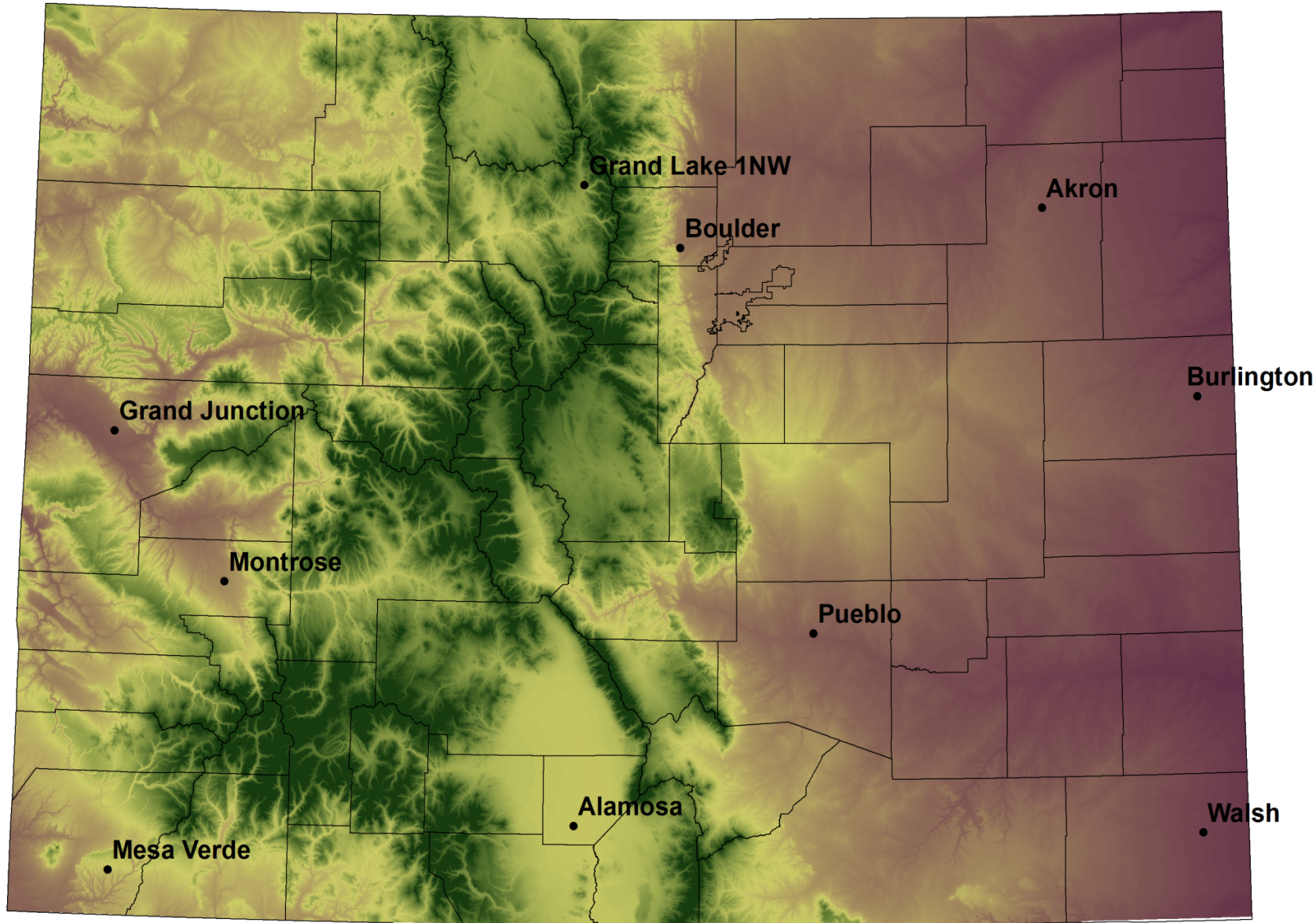
Statistical shading breaks at 10th, 30th, 50th, 70th, and 90th Percentiles.

For more information visit: [30 year normals calculation description.](#)





# NWS Cooperative Stations for WATF

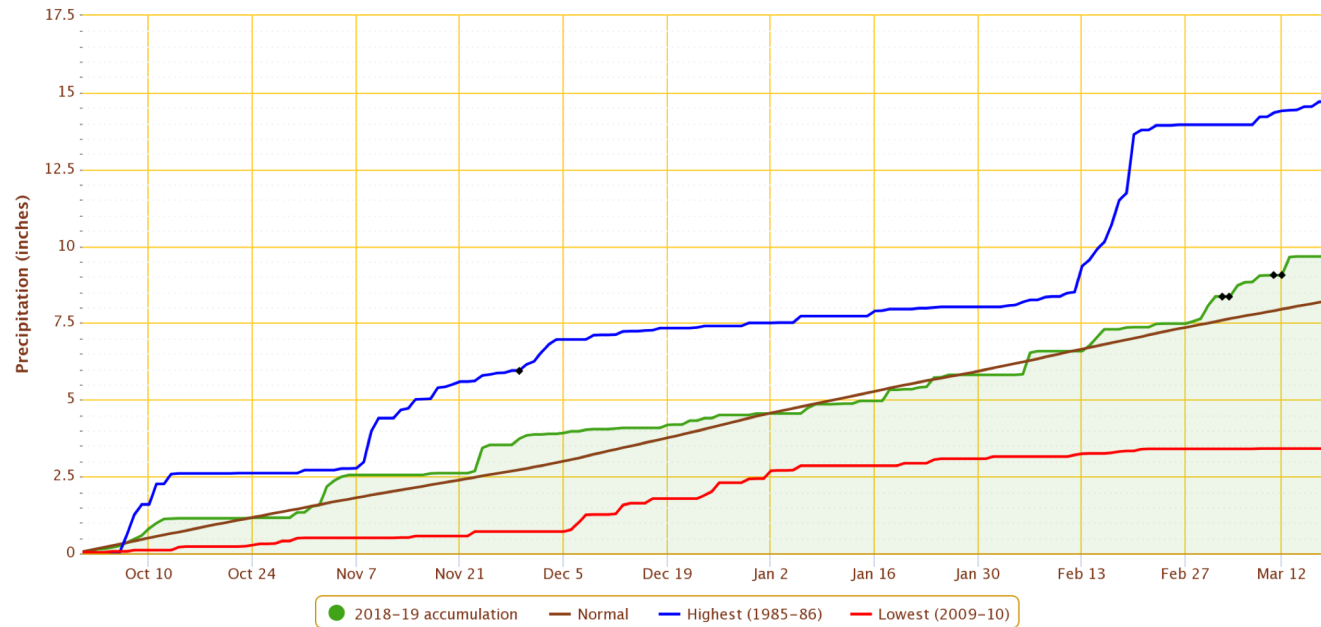


## Water Year 2019 – Station Updates



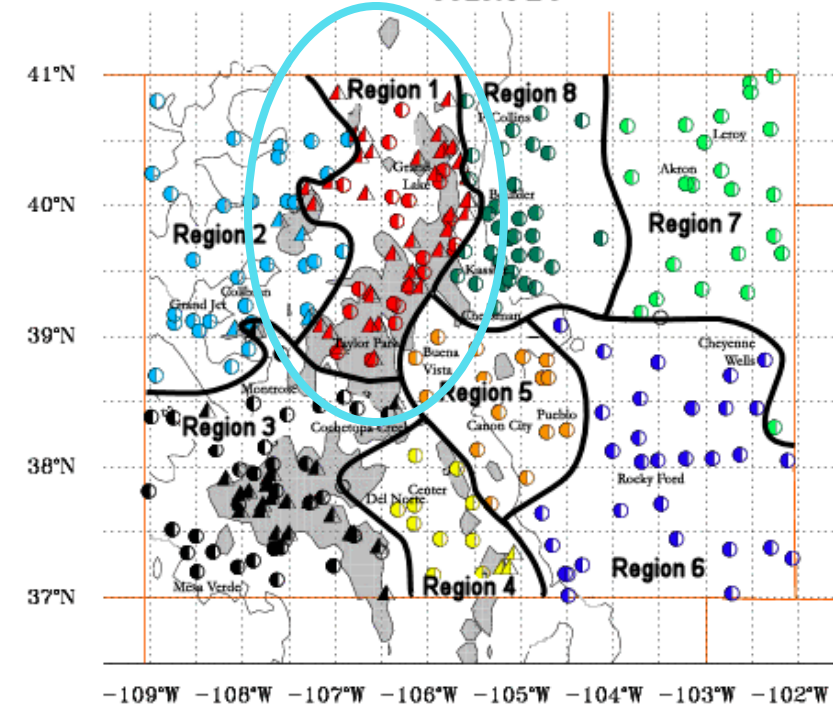
### Accumulated Precipitation – GRAND LAKE 1 NW, CO

Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



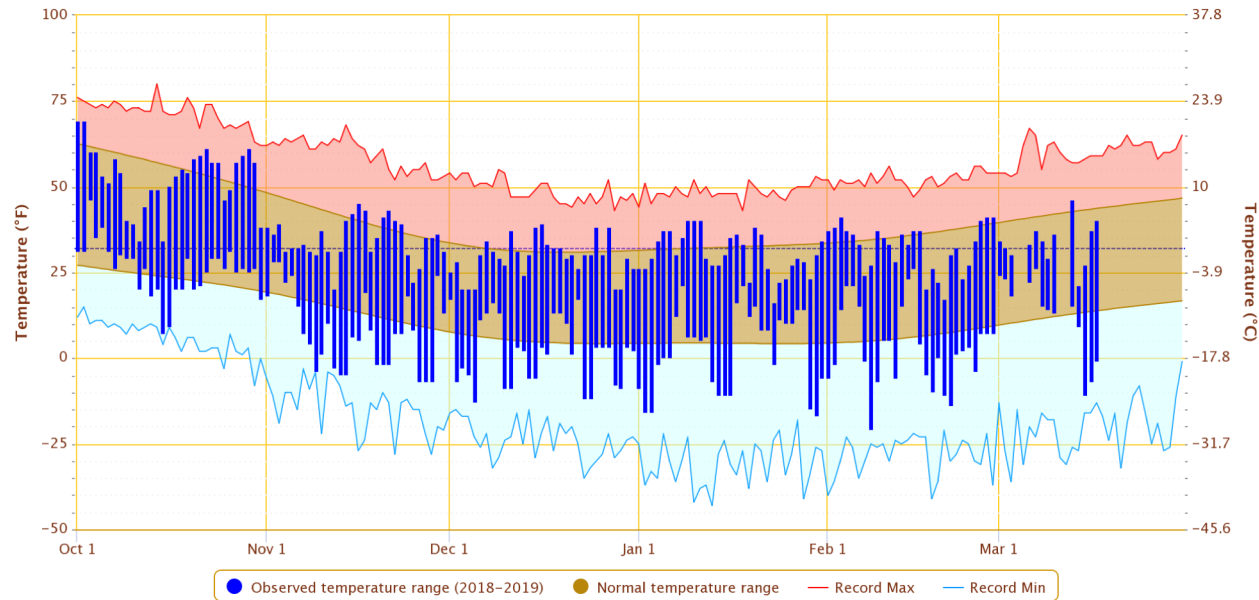
Powered by ACIS

### COLORADO



### Daily Temperature Data – GRAND LAKE 1 NW, CO

Period of Record – 1939-10-01 to 2019-03-17. Normals period: 1981-2010. Click and drag to zoom chart.

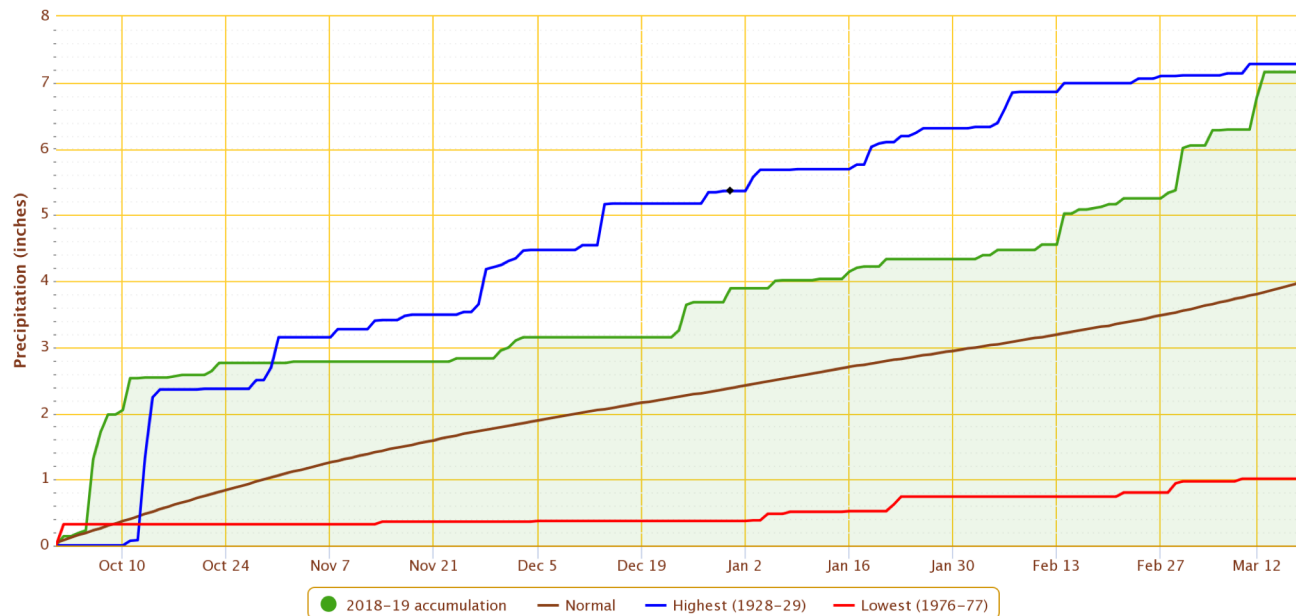


Powered by ACIS



### Accumulated Precipitation – GRAND JUNCTION WALKER FIELD, CO

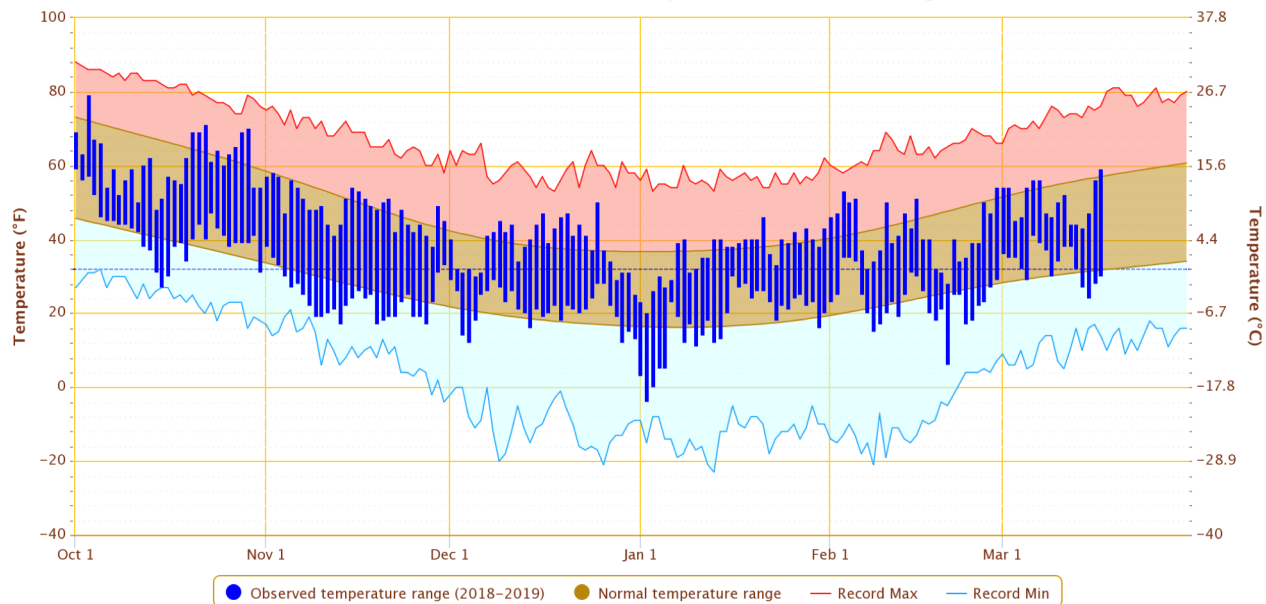
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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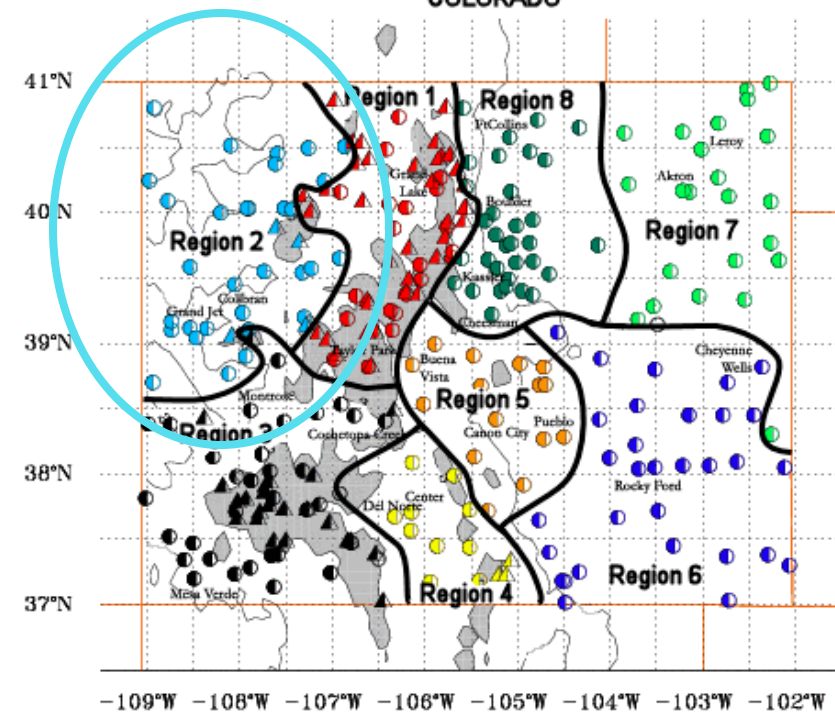
### Daily Temperature Data – GRAND JUNCTION WALKER FIELD, CO

Period of Record – 1900-01-01 to 2019-03-17. Normals period: 1981-2010. Click and drag to zoom chart.



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### COLORADO

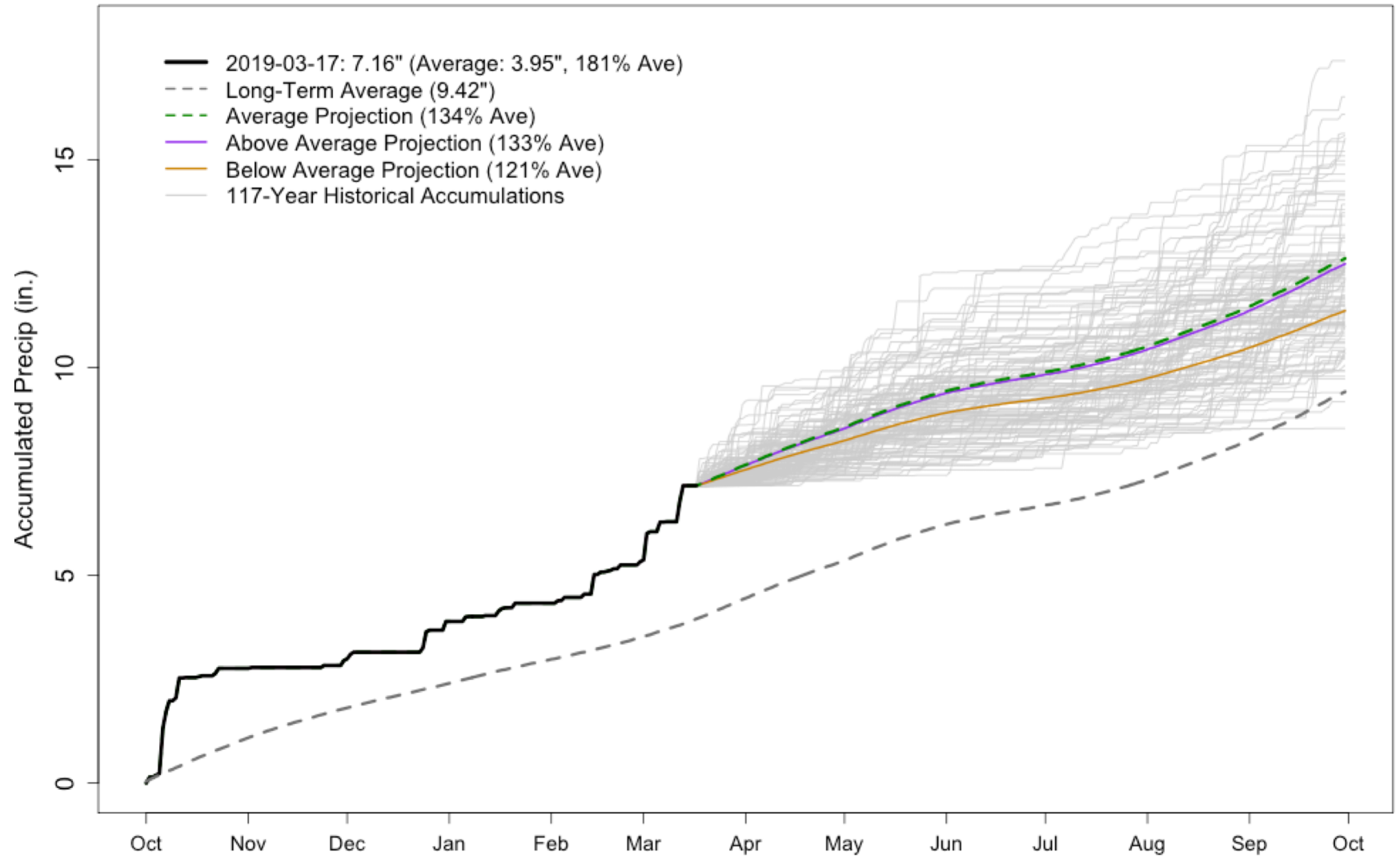


## GRAND JUNCTION WALKER FIELD WY2019 Precipitation Projections

“Projections” of water year precipitation based on historical data

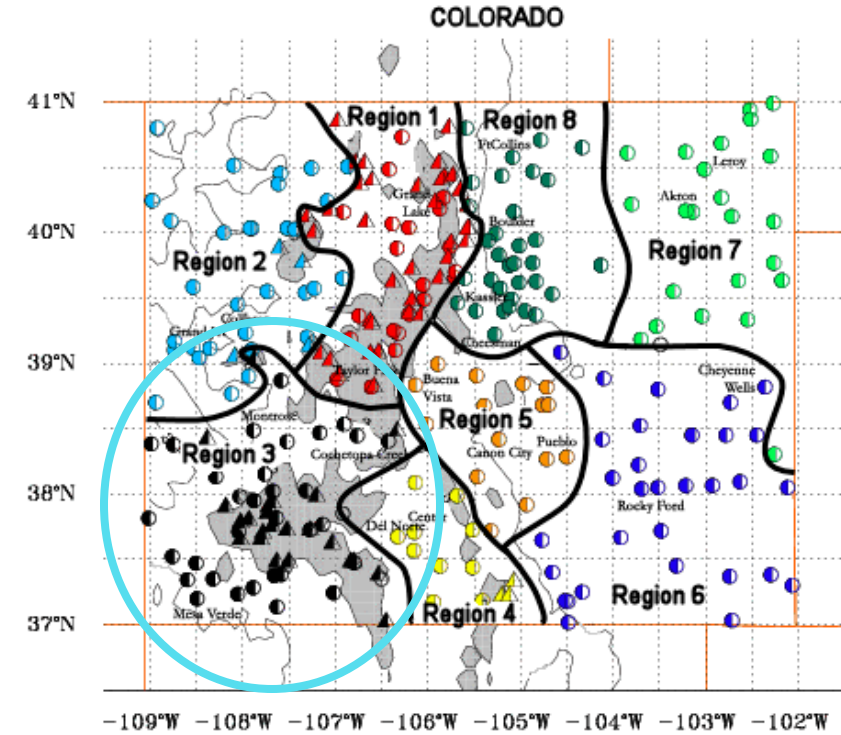
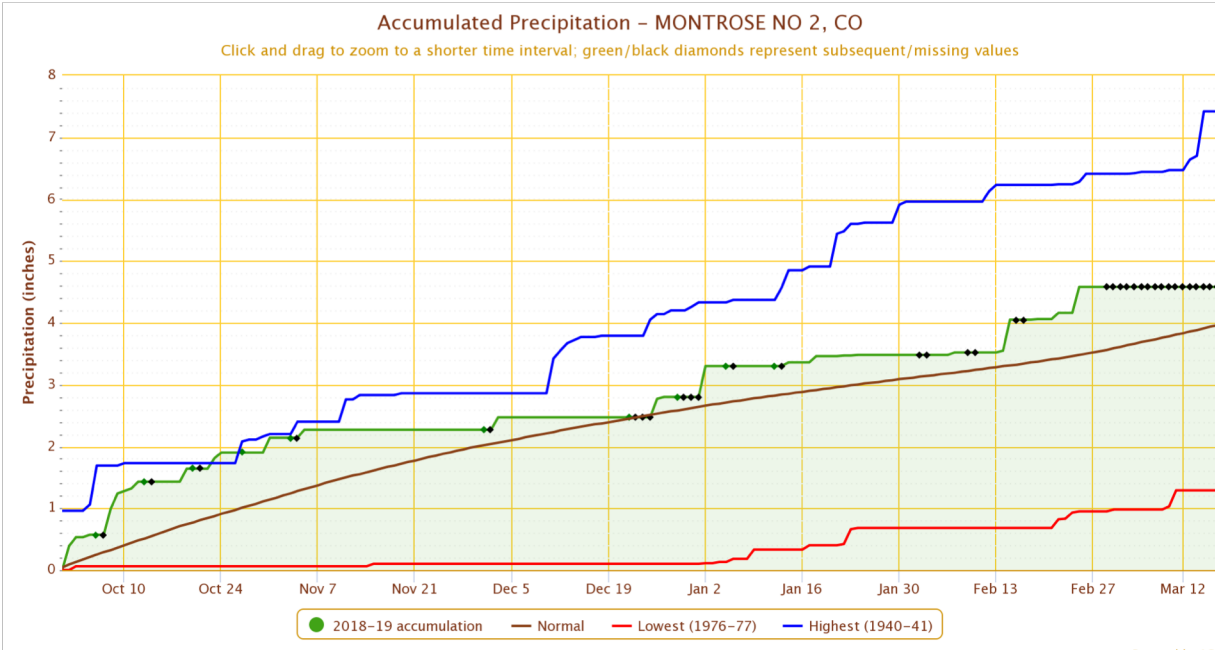
Even if Grand Junction was record dry from this point forward (which looks quite unlikely), they would be just barely below average for the water year

Last water year, only 4.65”



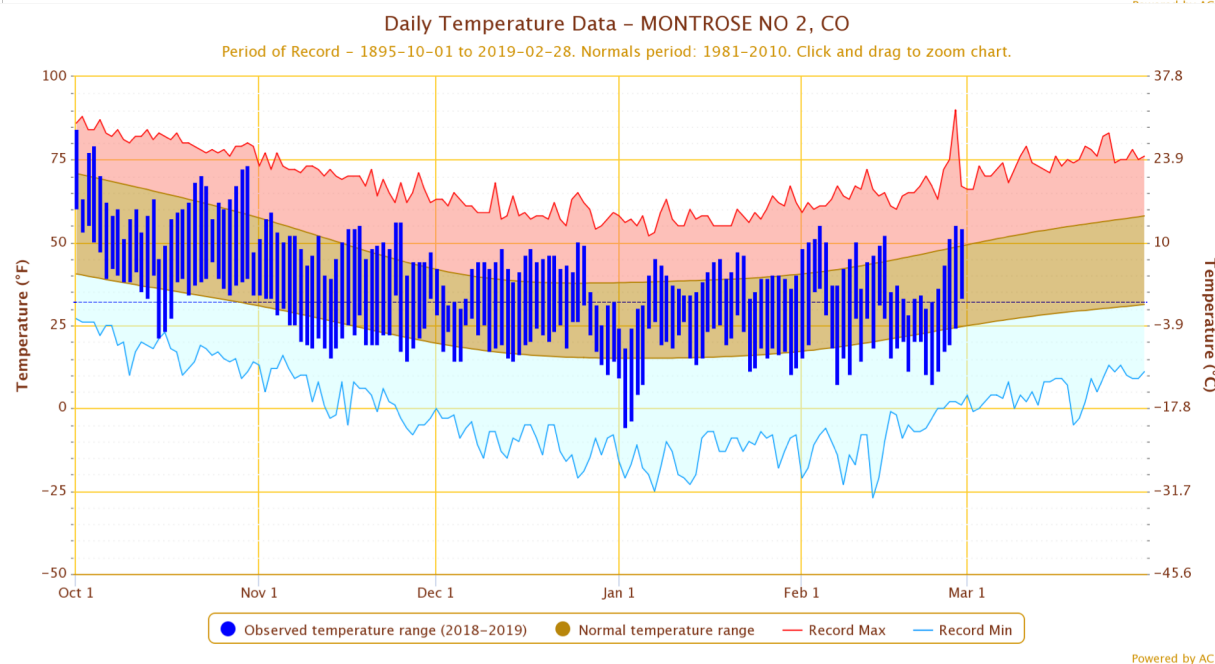
[http://climate.colostate.edu/precip\\_proj.html](http://climate.colostate.edu/precip_proj.html)





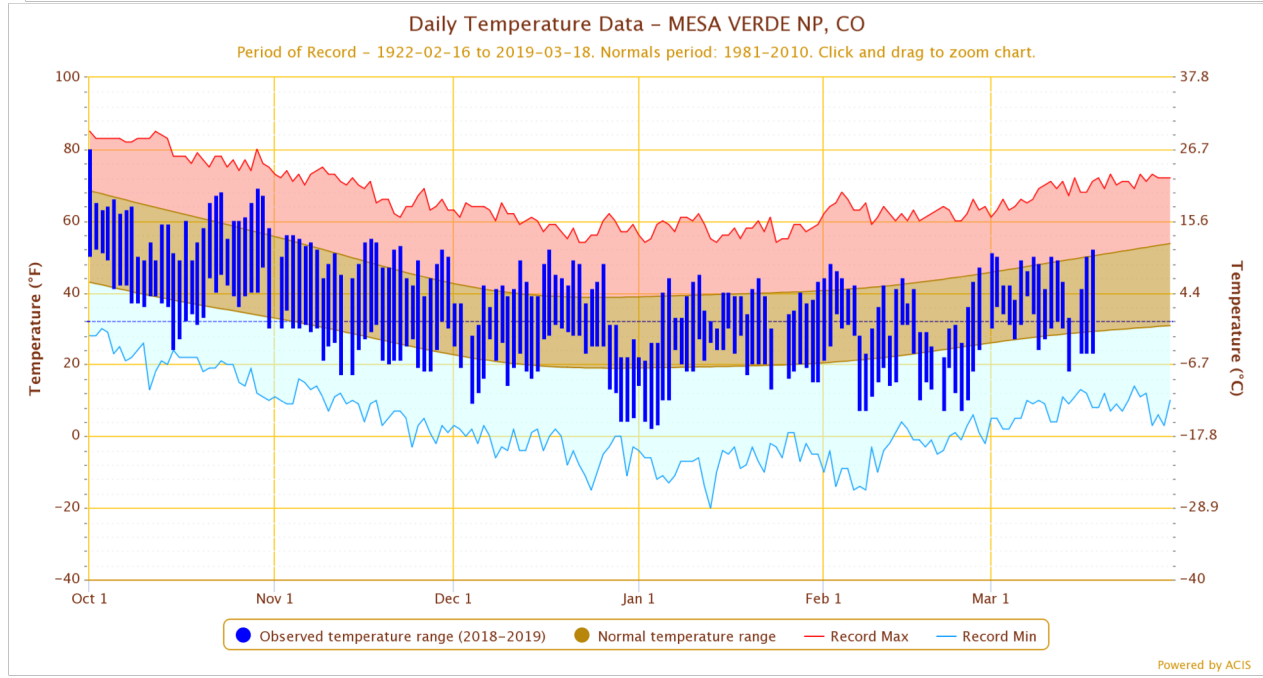
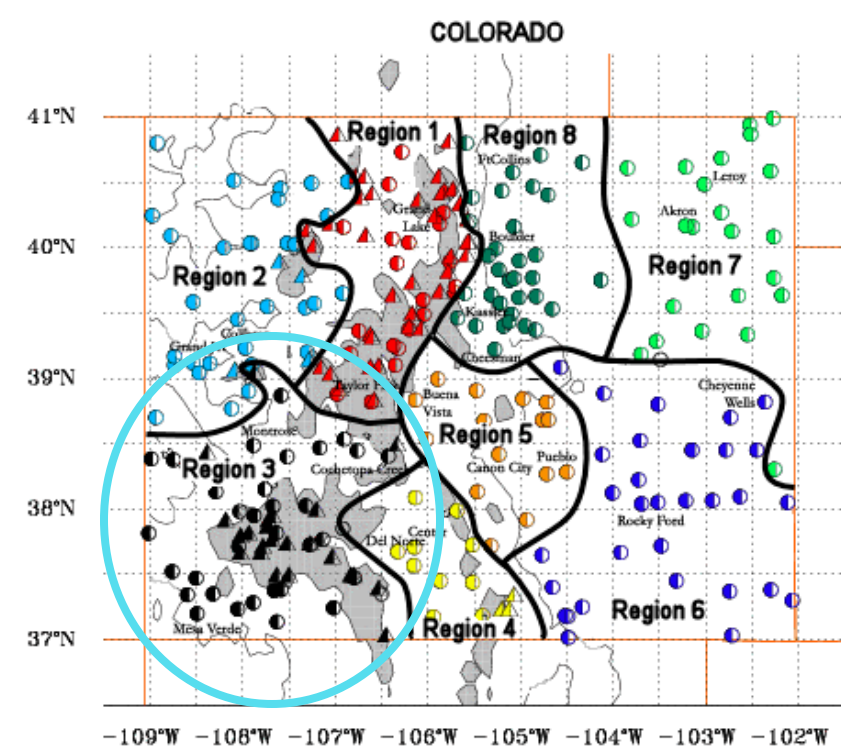
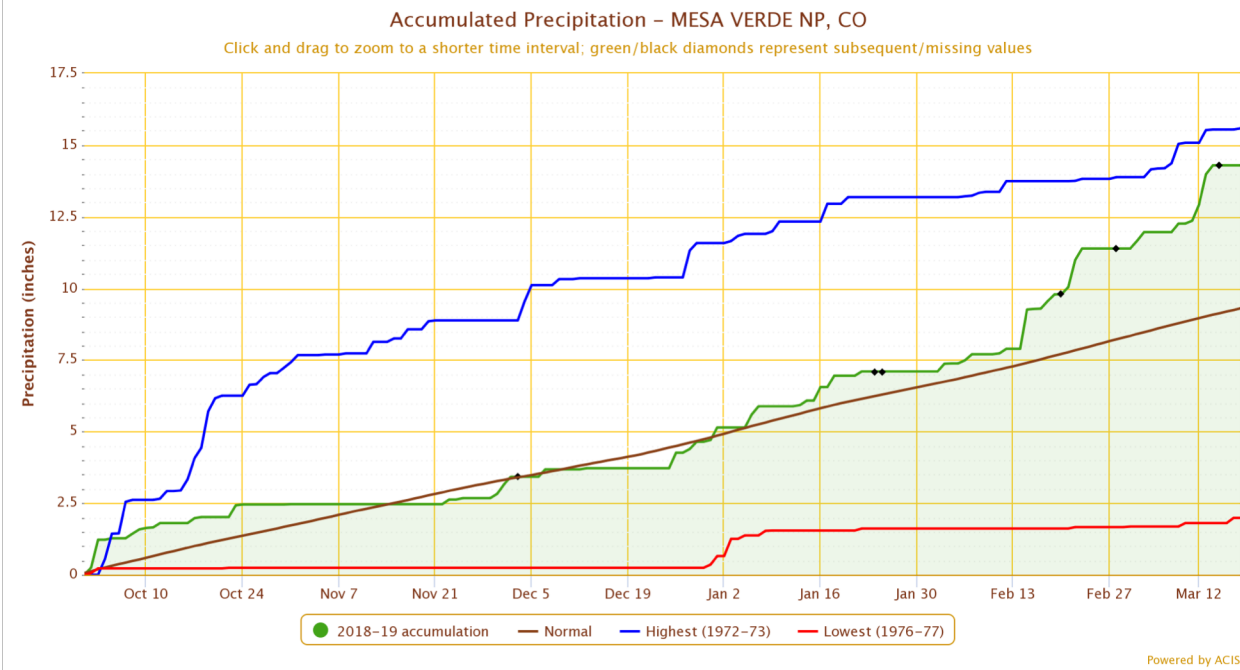
Montrose airport has received over 1.5” in March so far

Likely already exceeded their full WY2018 precip



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Mesa Verde has far surpassed their precip from all of last water year (14.29" through March 17; 8.06" all of WY2018)



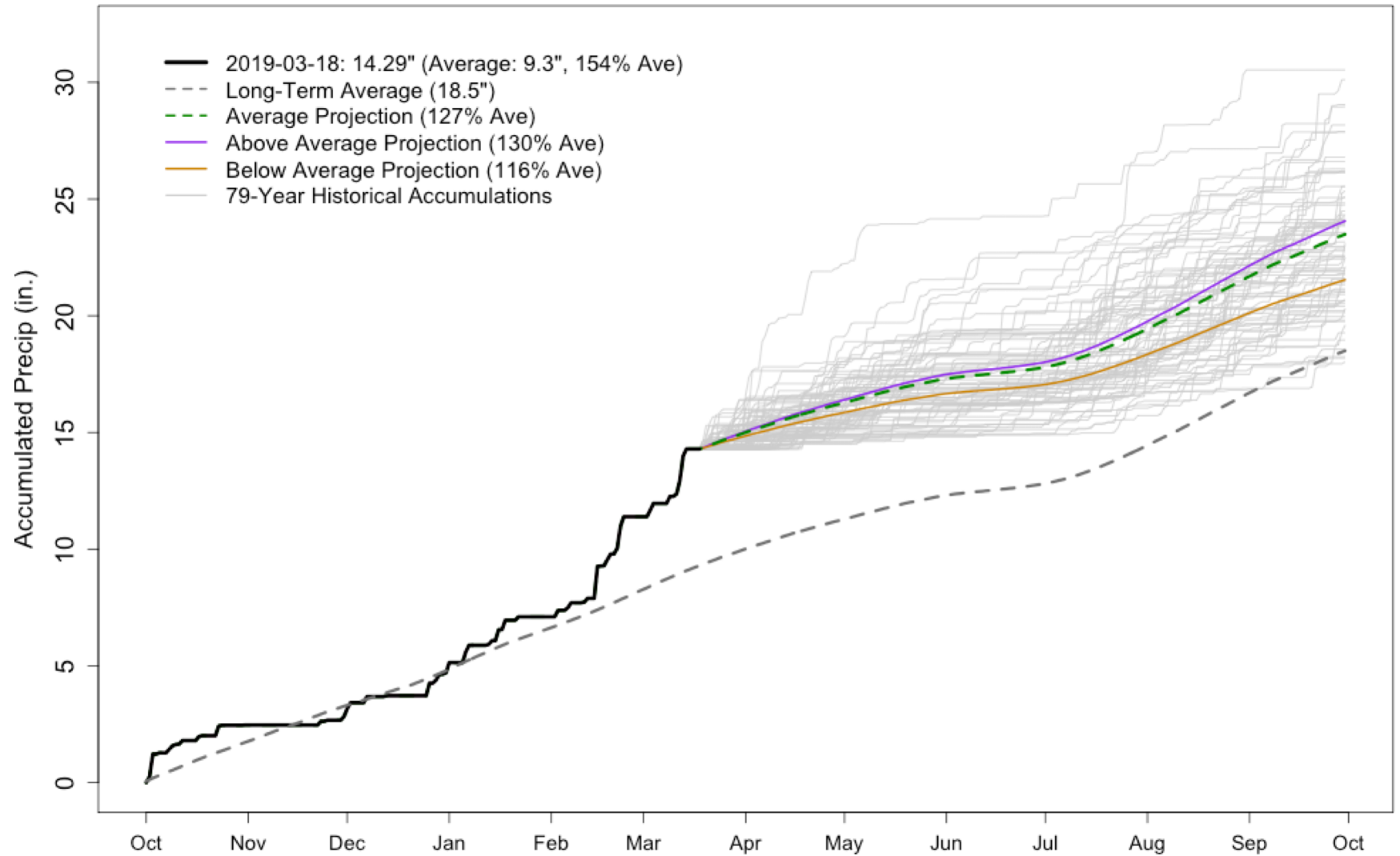


## MESA VERDE NP WY2019 Precipitation Projections

“Projections” of water year precipitation based on historical data

Mesa Verde is nearly past the “no chance of below-normal water-year precip” mark

Last water year, only 8.06”

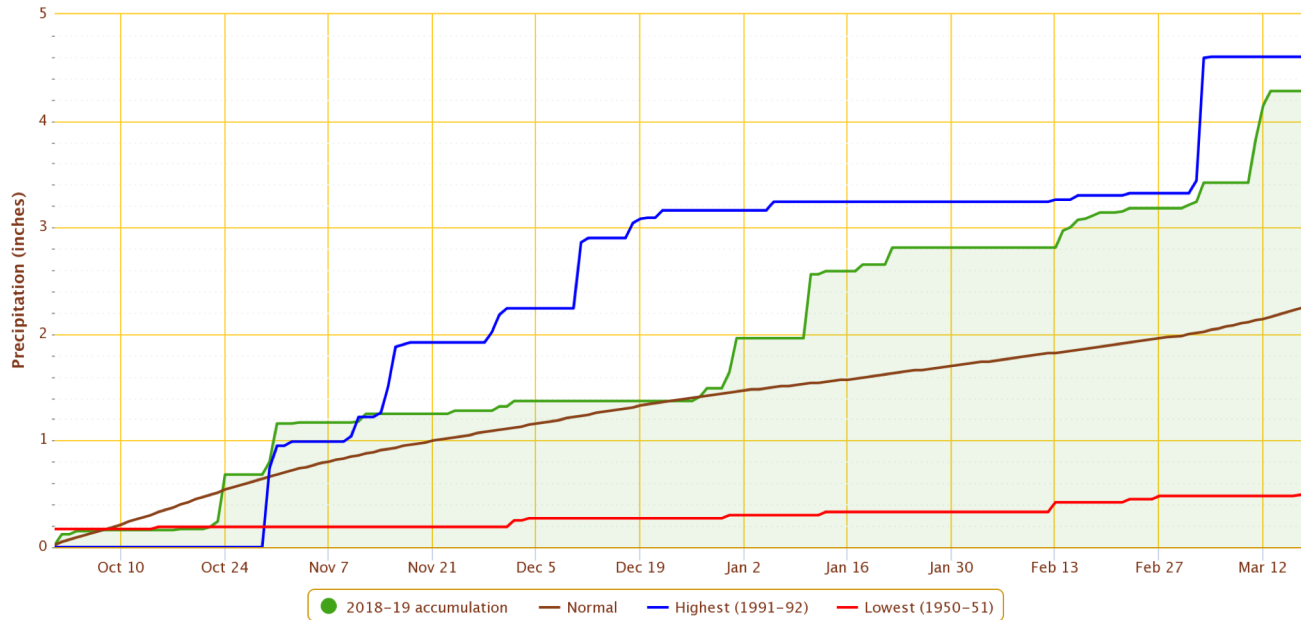


[http://climate.colostate.edu/precip\\_proj.html](http://climate.colostate.edu/precip_proj.html)



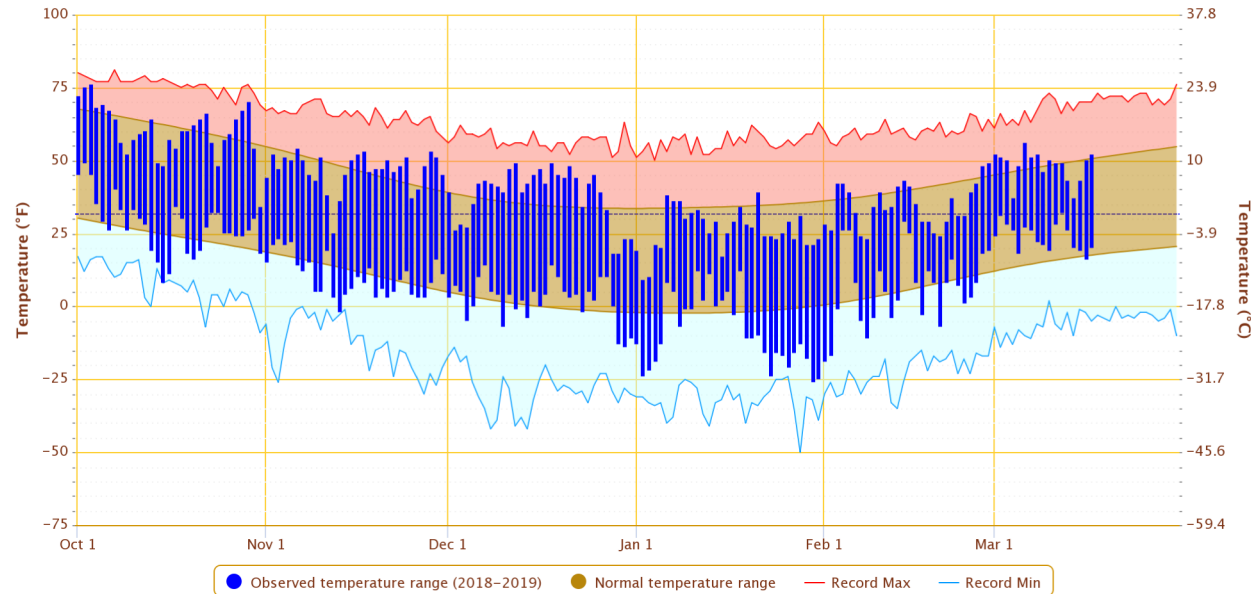
### Accumulated Precipitation – ALAMOSA SAN LUIS VALLEY REGIONAL AP, CO

Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



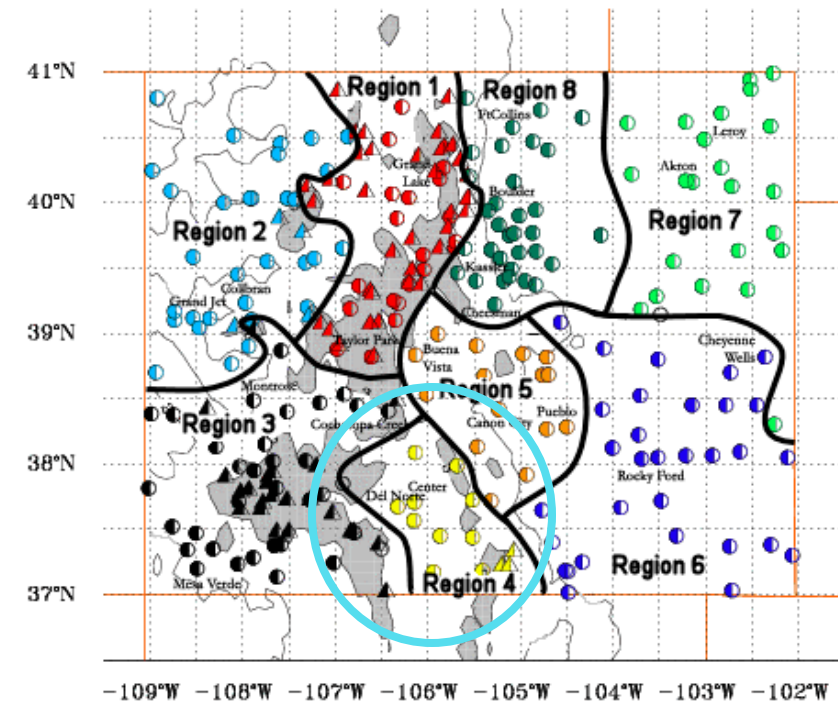
### Daily Temperature Data – ALAMOSA SAN LUIS VALLEY REGIONAL AP, CO

Period of Record – 1948-01-01 to 2019-03-17. Normals period: 1981-2010. Click and drag to zoom chart.



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### COLORADO



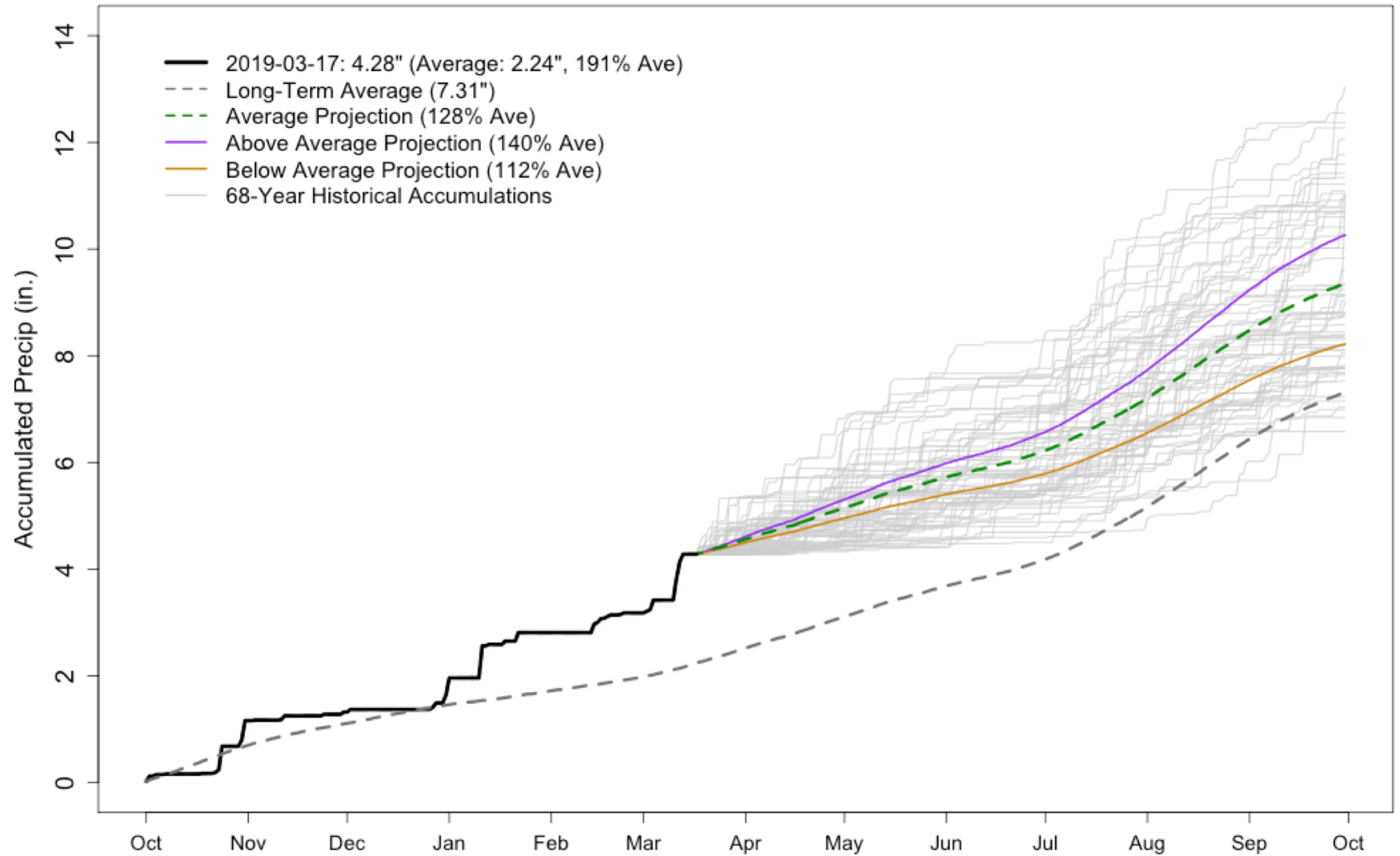
Alamosa has nearly surpassed their full WY2018 precip: 4.28” so far, 4.38” all of WY2018



# ALAMOSA SAN LUIS VALLEY REGIONAL AP WY2019 Precipitation Projections

“Projections” of water year precipitation based on historical data

With summer being the ‘wet season’ for the San Luis Valley, and highly variable, still a wide range of possible outcomes (but most still finish the water year above average)

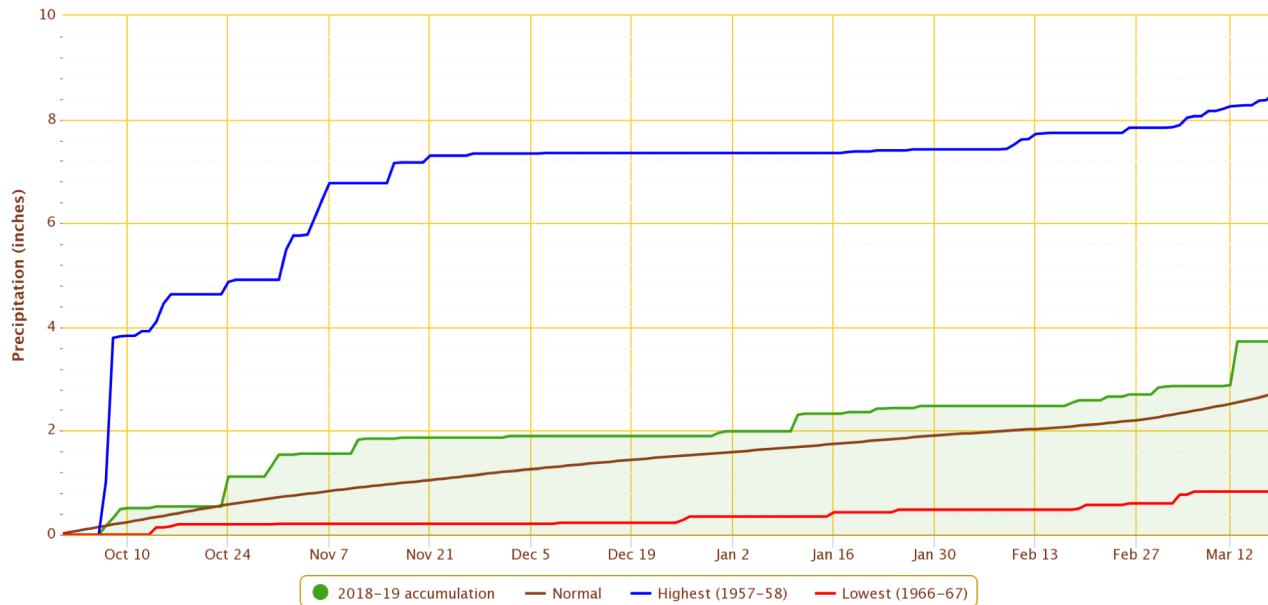


[http://climate.colostate.edu/precip\\_proj.html](http://climate.colostate.edu/precip_proj.html)



### Accumulated Precipitation – PUEBLO MEMORIAL AP, CO

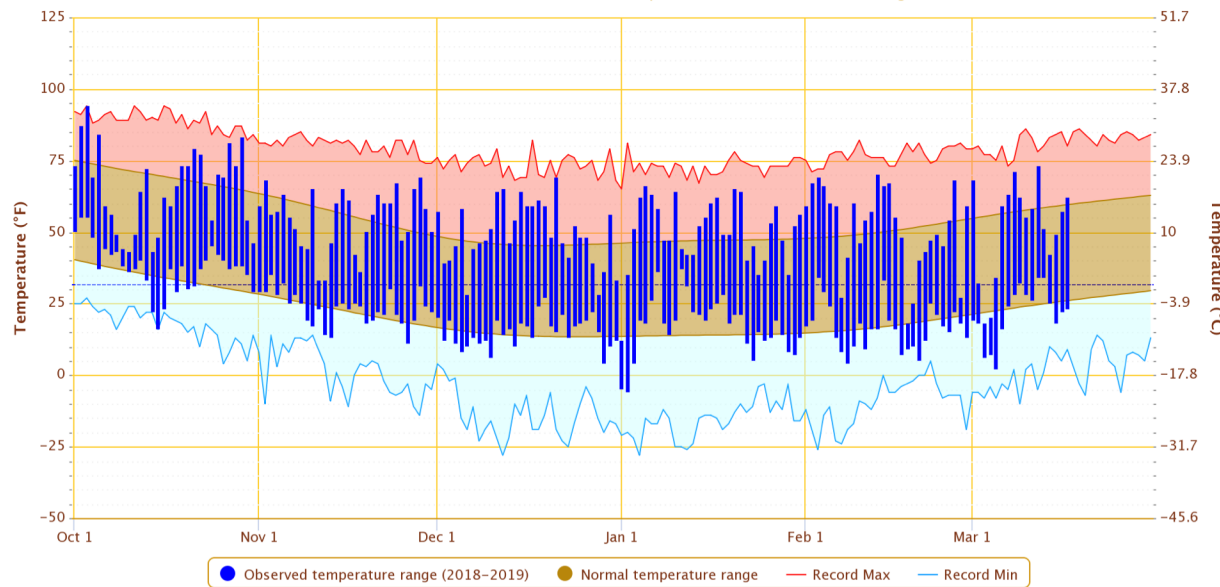
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

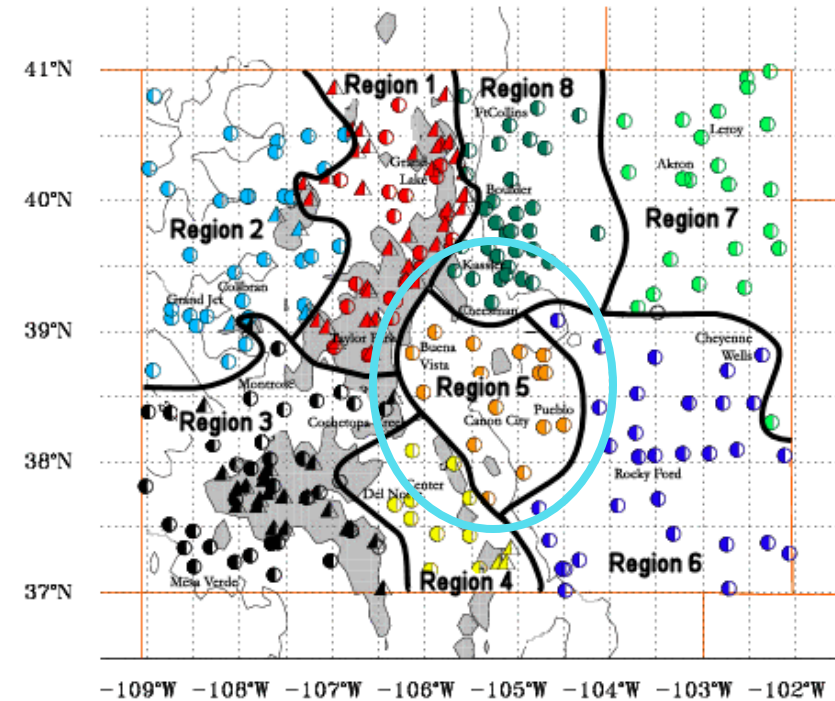
### Daily Temperature Data – PUEBLO MEMORIAL AP, CO

Period of Record – 1954-06-16 to 2019-03-17. Normals period: 1981-2010. Click and drag to zoom chart.



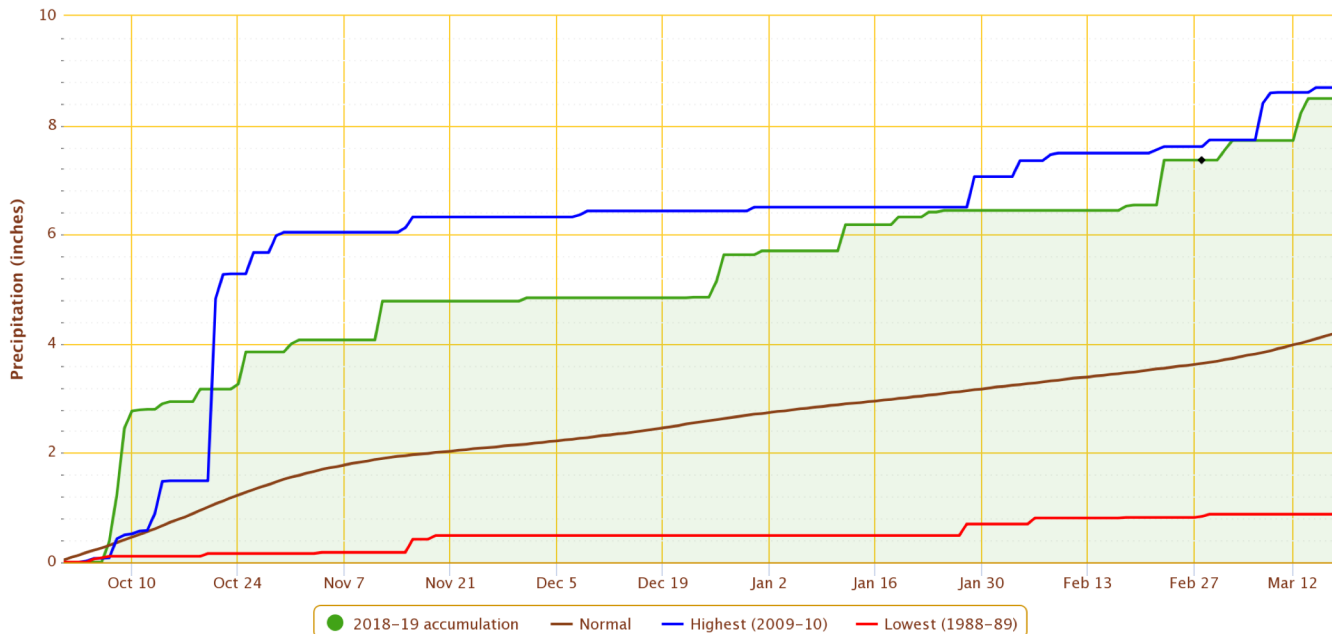
Powered by ACIS

### COLORADO



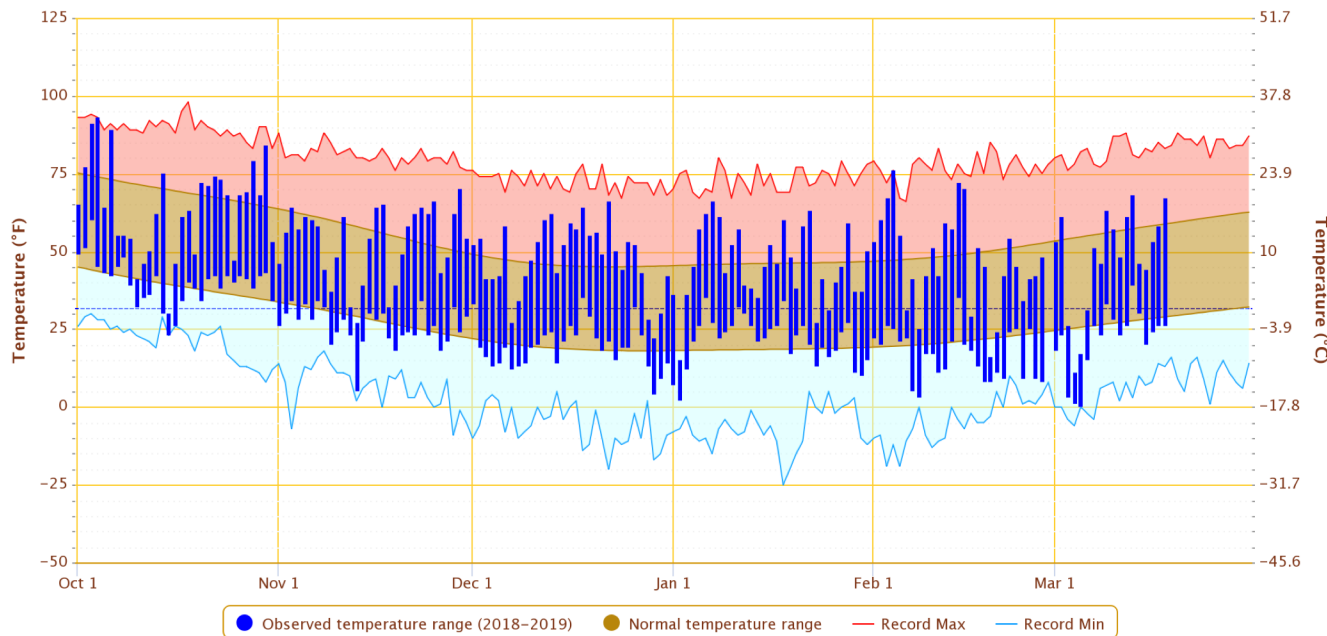
### Accumulated Precipitation – WALSH 1 W, CO

Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values

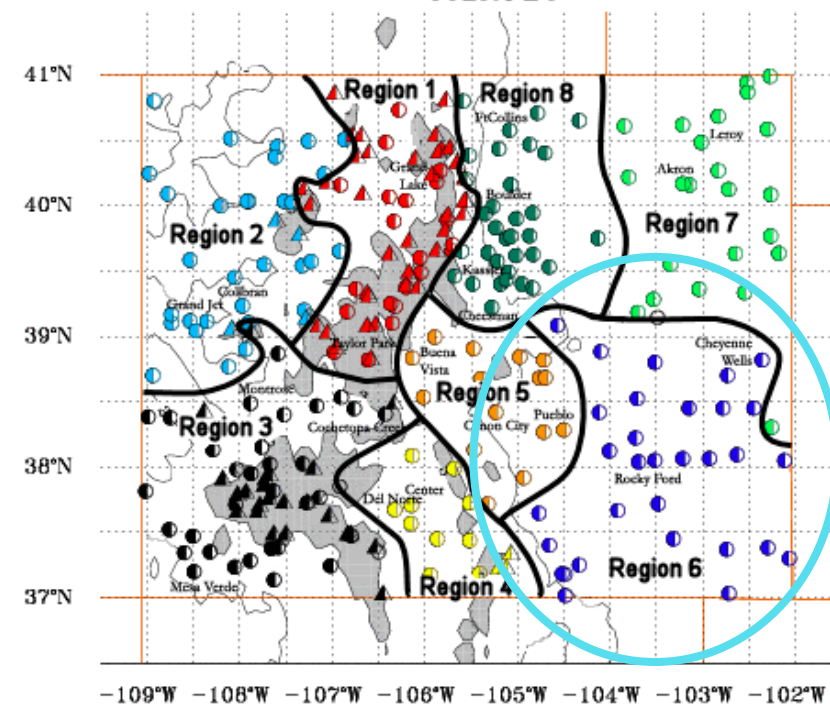


### Daily Temperature Data – WALSH 1 W, CO

Period of Record – 1967-09-01 to 2019-03-18. Normals period: 1981-2010. Click and drag to zoom chart.



### COLORADO



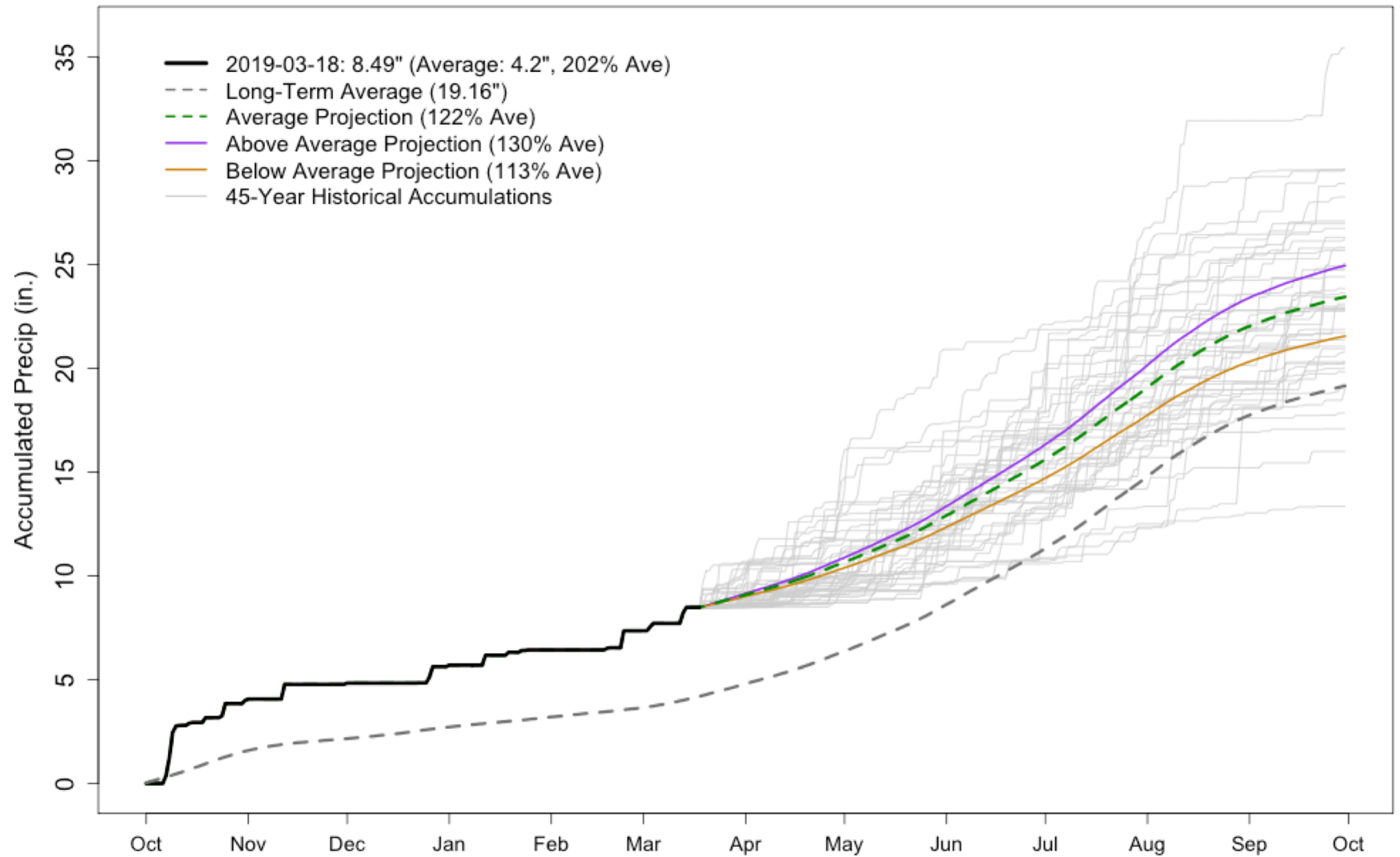
Walsh over double the normal precip for this point in the water year!



## WALSH 1 W WY2019 Precipitation Projections

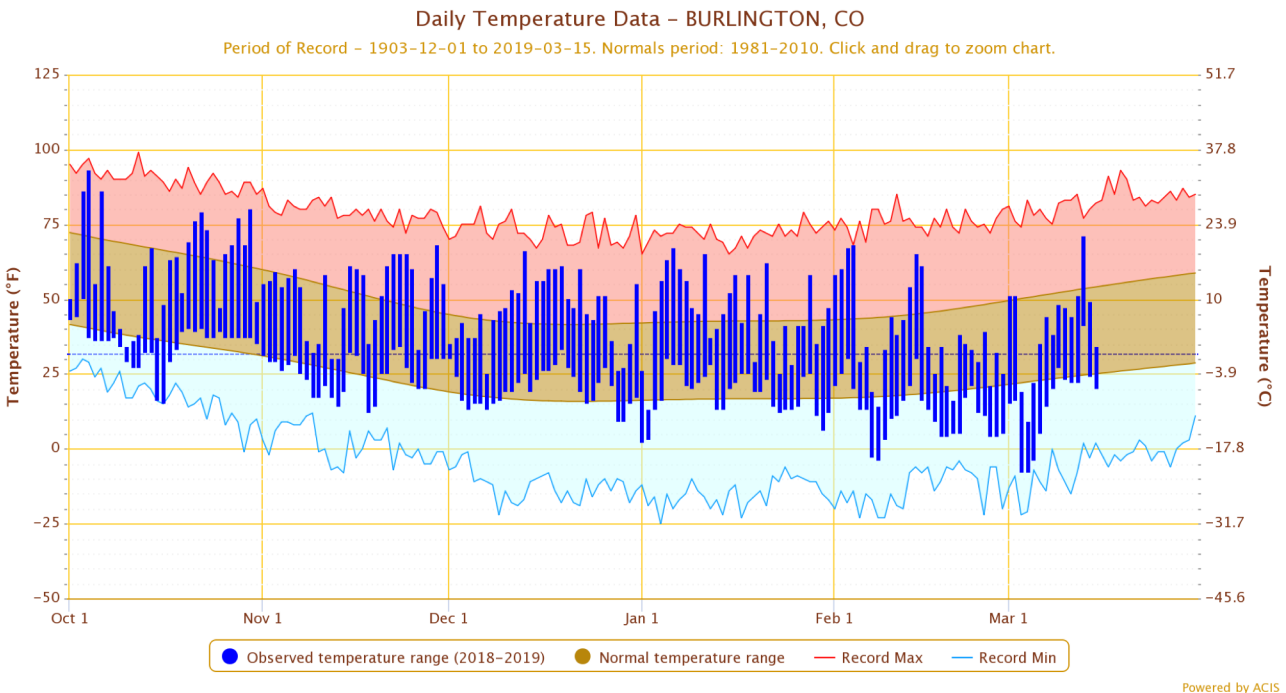
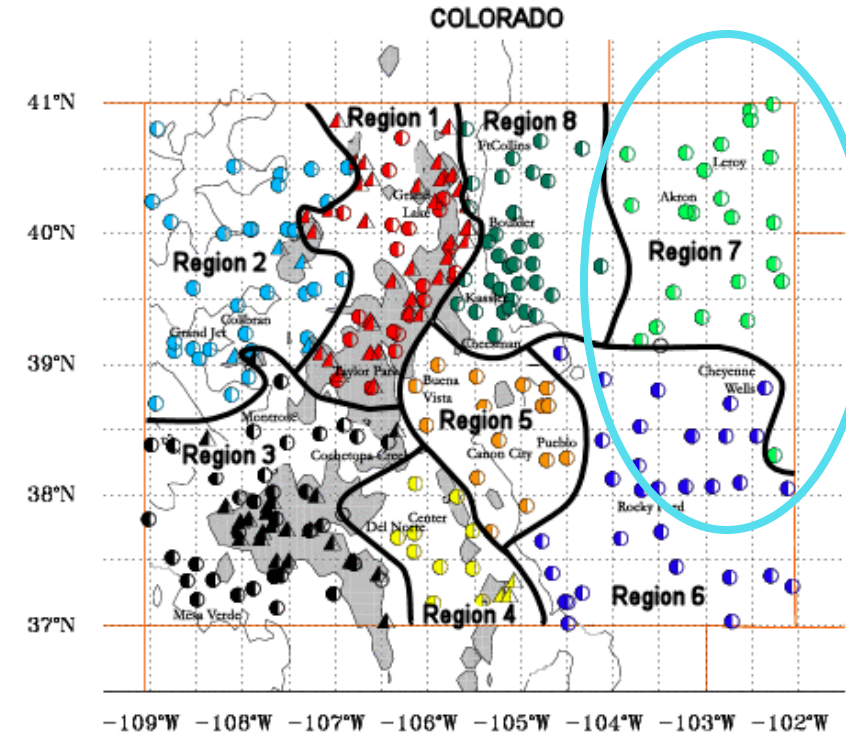
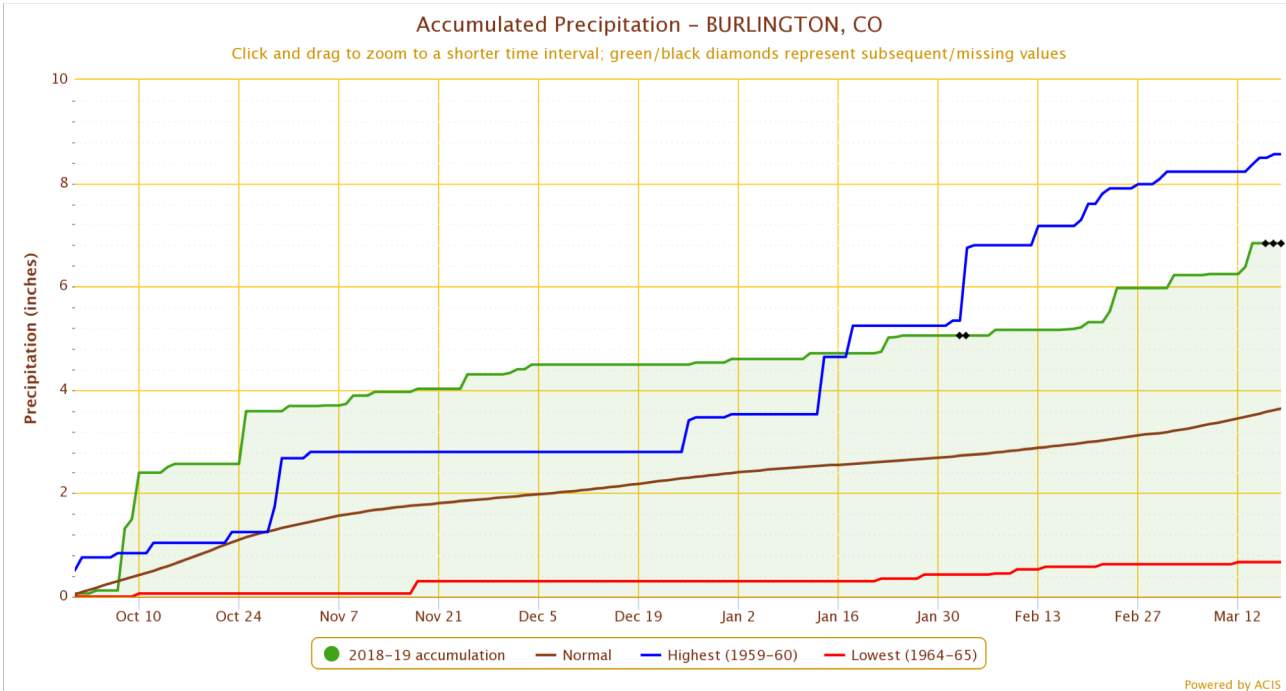
“Projections” of water year precipitation based on historical data

Wide range of possible outcomes with the wet months still to come



[http://climate.colostate.edu/precip\\_proj.html](http://climate.colostate.edu/precip_proj.html)



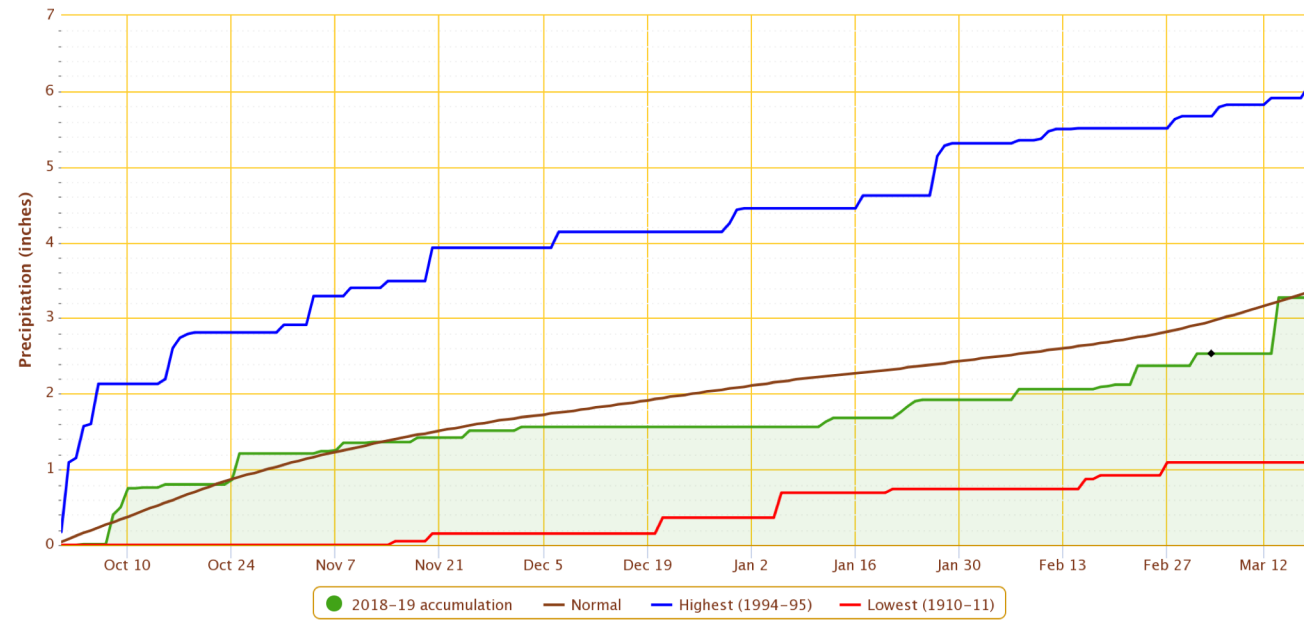


2<sup>nd</sup> half of Feb and first half of March have been much cooler than average on the eastern Plains



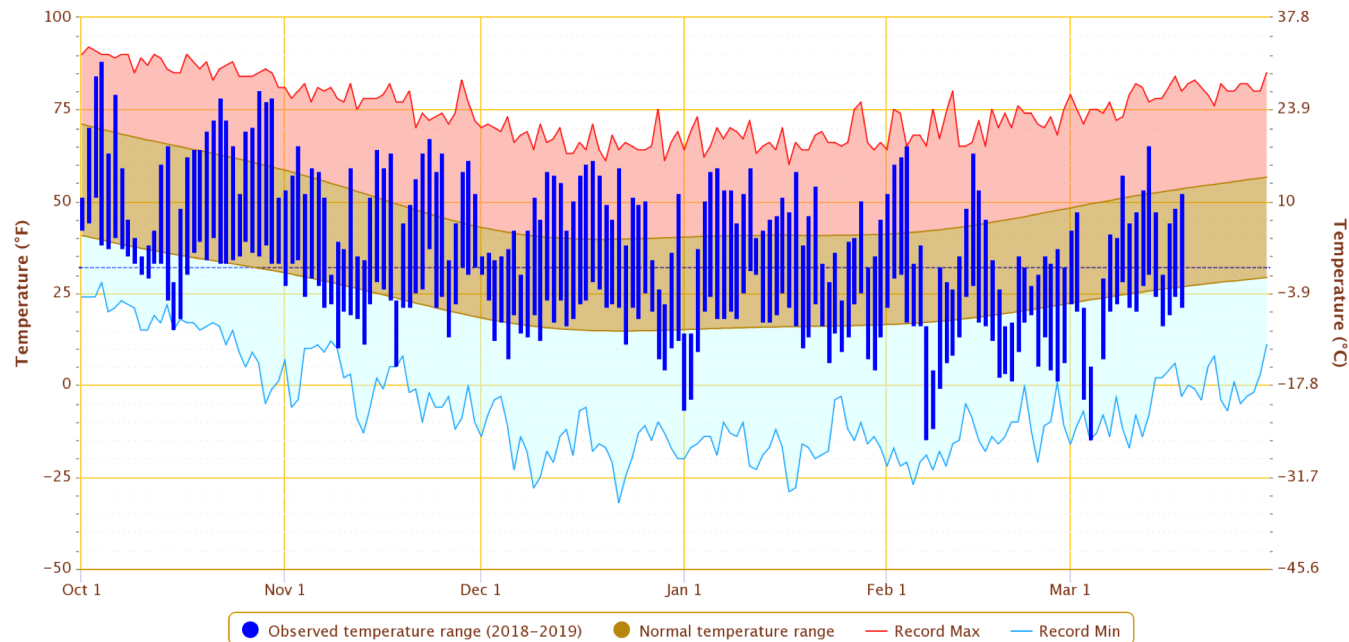
### Accumulated Precipitation – AKRON 4 E, CO

Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



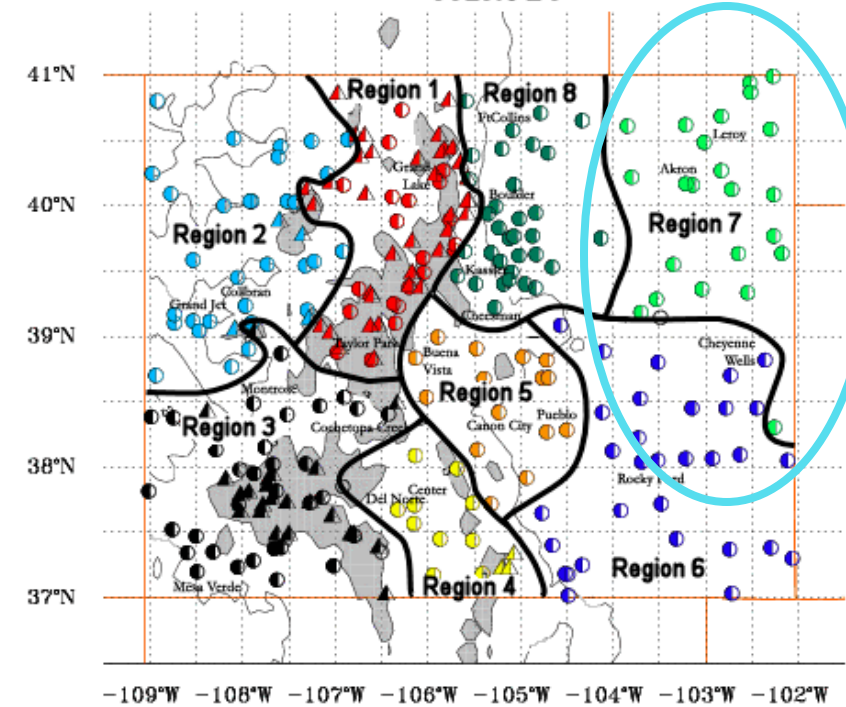
### Daily Temperature Data – AKRON 4 E, CO

Period of Record – 1893-06-01 to 2019-03-18. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

### COLORADO



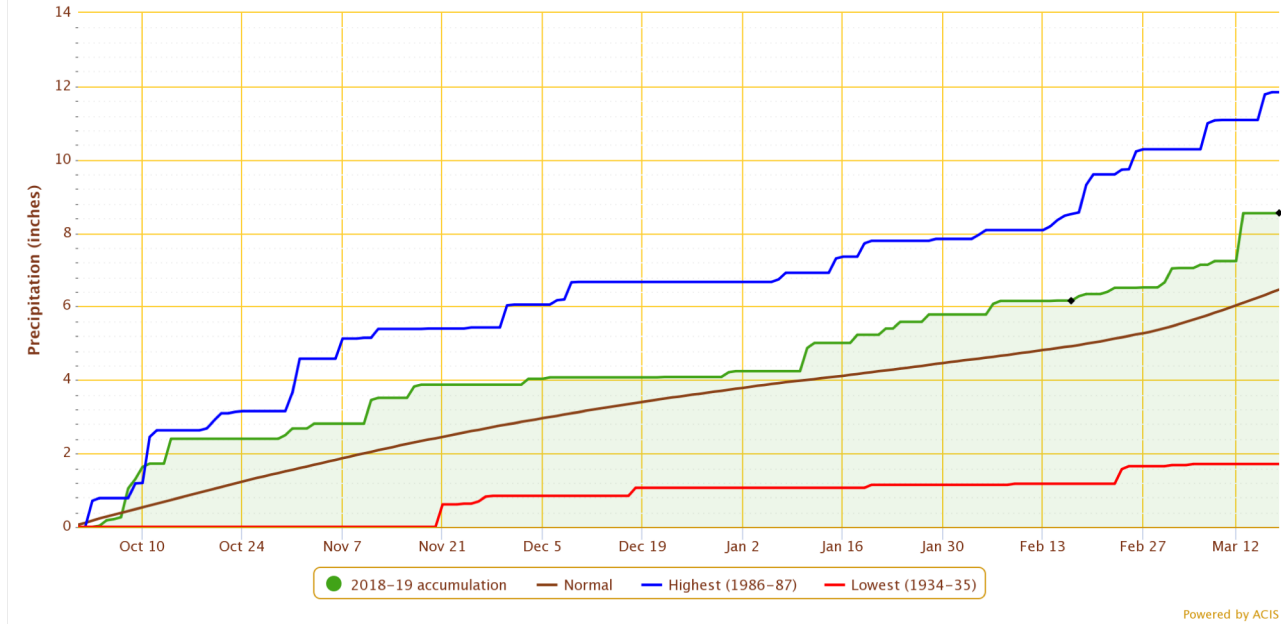
Akron now back to near-normal precip after last week's storm





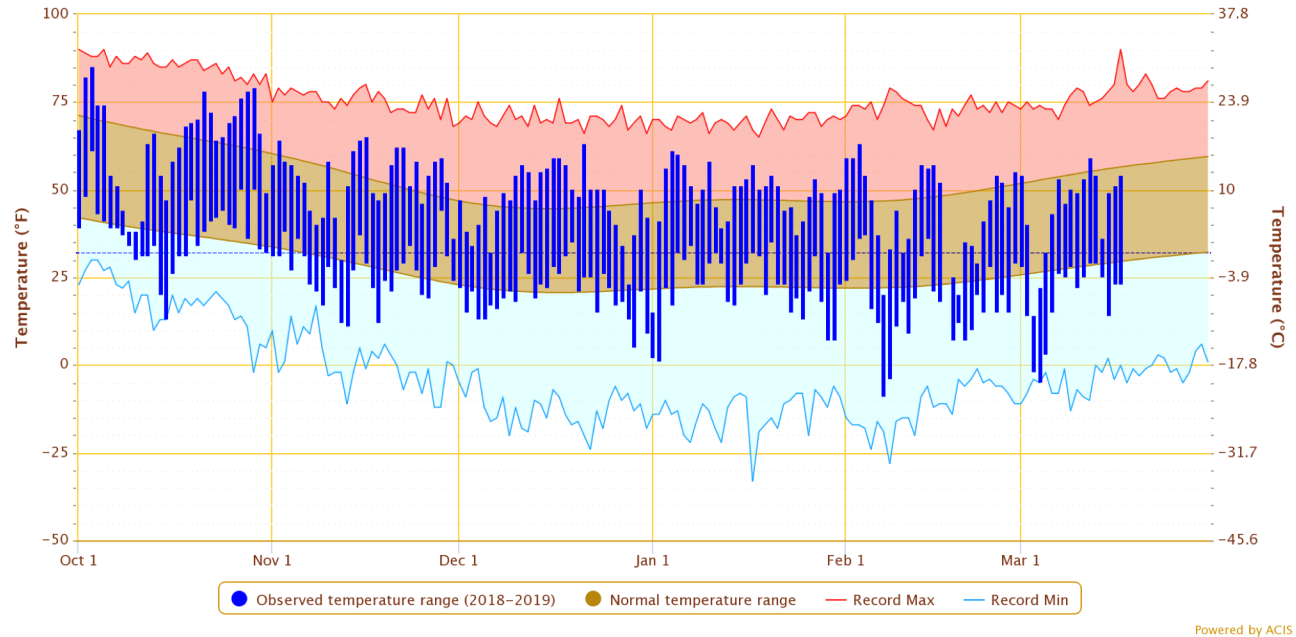
### Accumulated Precipitation – BOULDER, CO

Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values

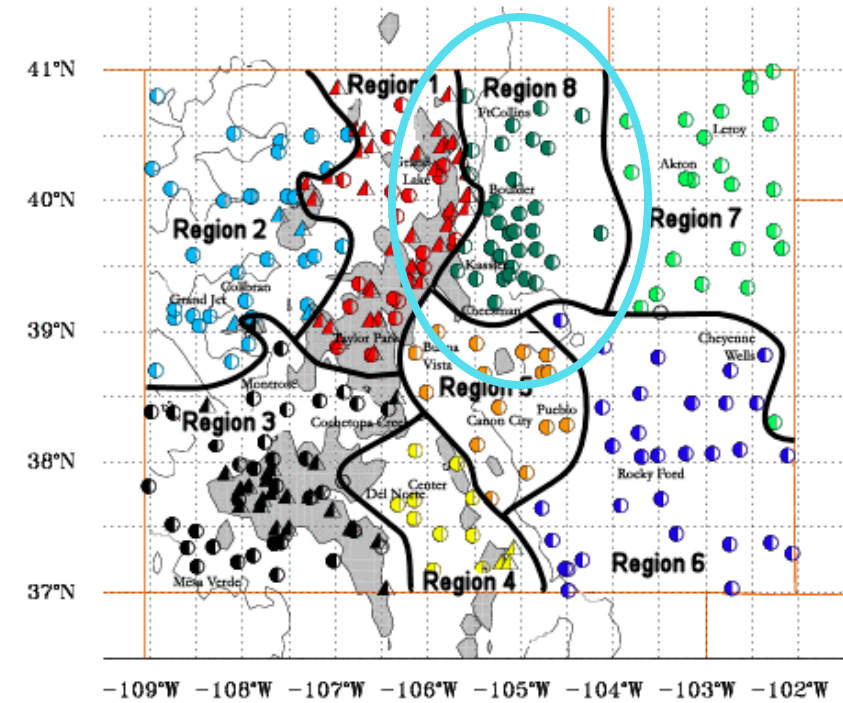


### Daily Temperature Data – BOULDER, CO

Period of Record – 1893-10-01 to 2019-03-17. Normals period: 1981-2010. Click and drag to zoom chart.



### COLORADO



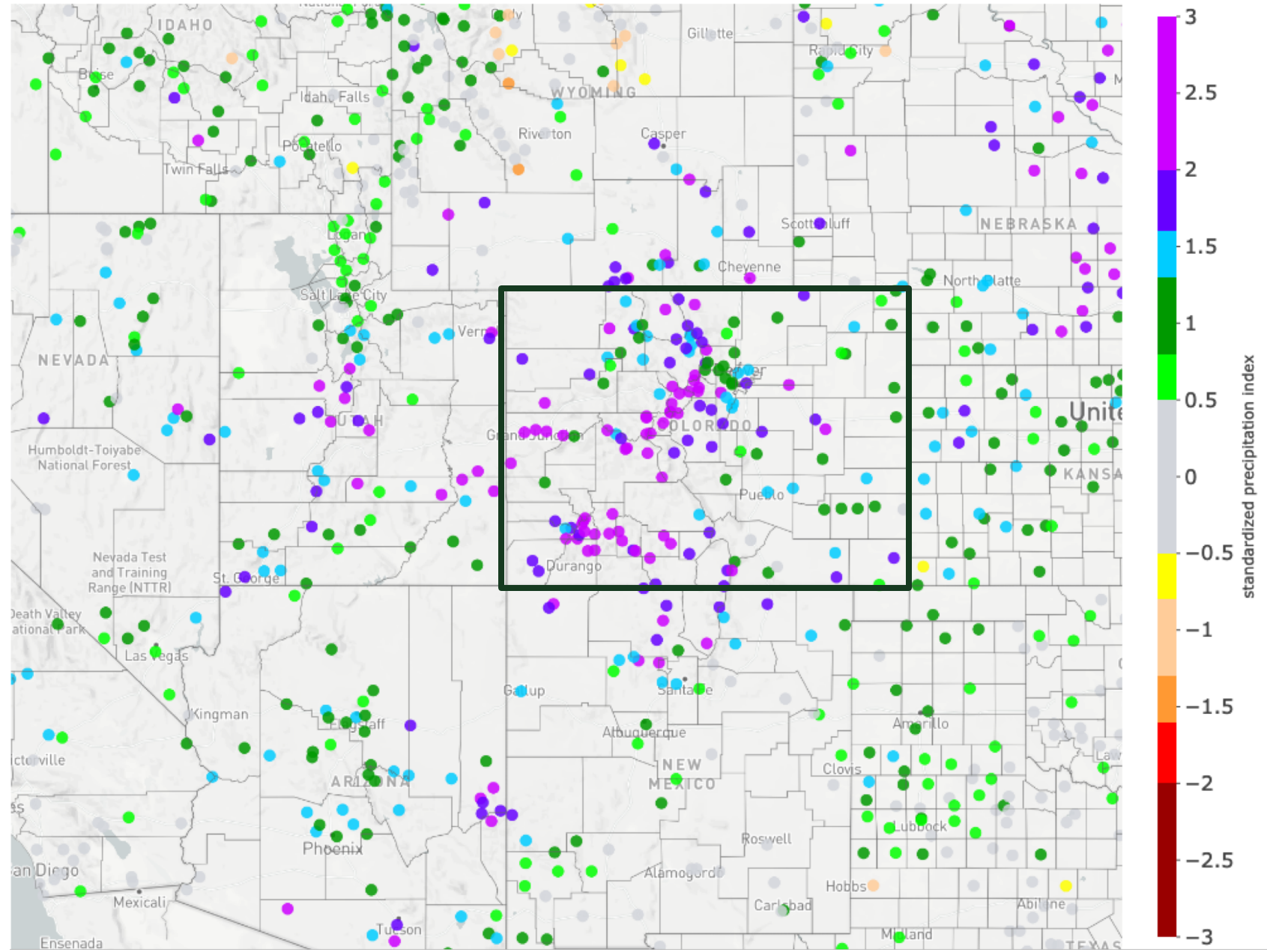


# Colorado Drought

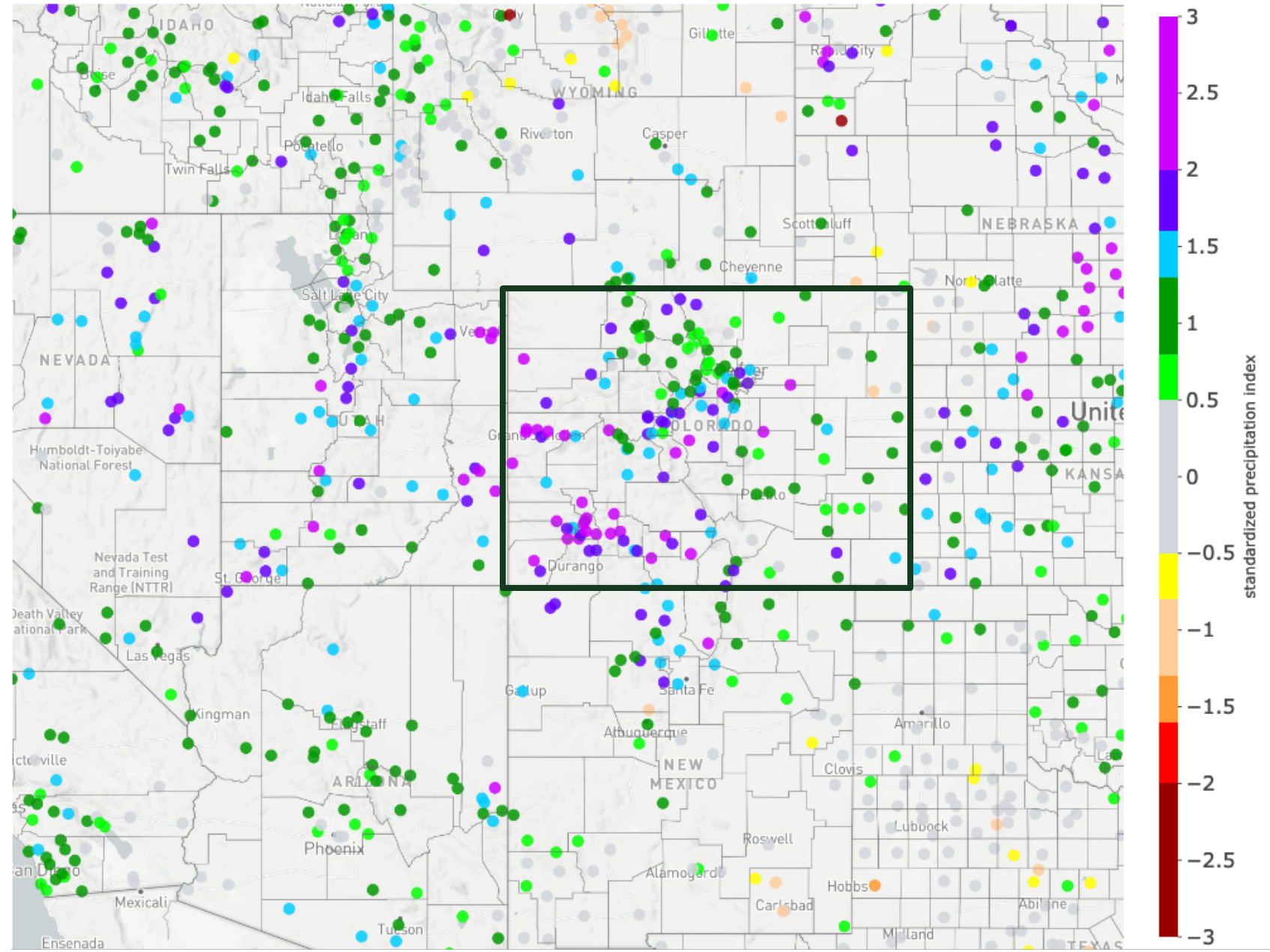
(photo: CAIC)



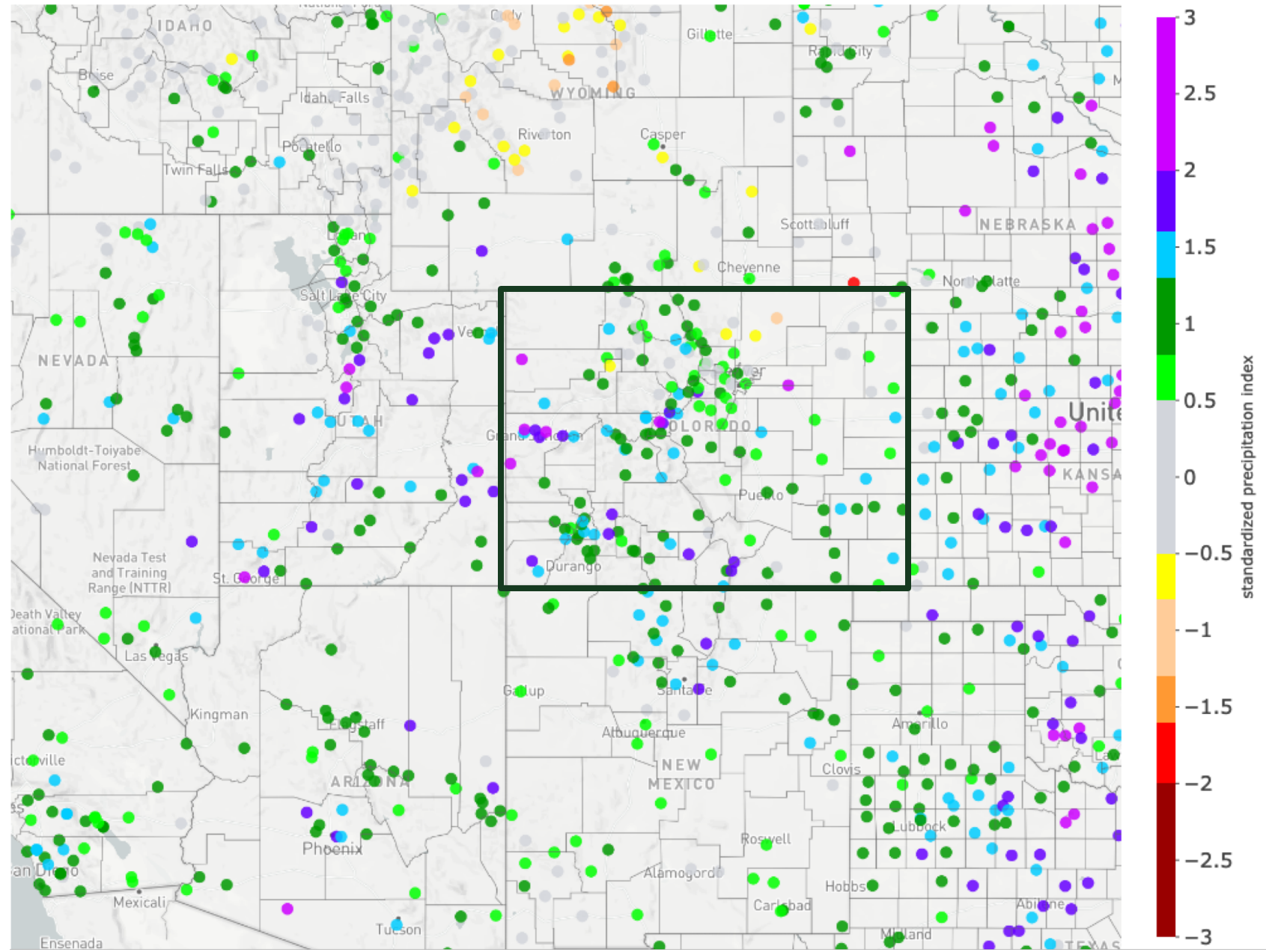
# 30-day Standardized Precipitation Index: 2/16/2019 - 3/17/2019



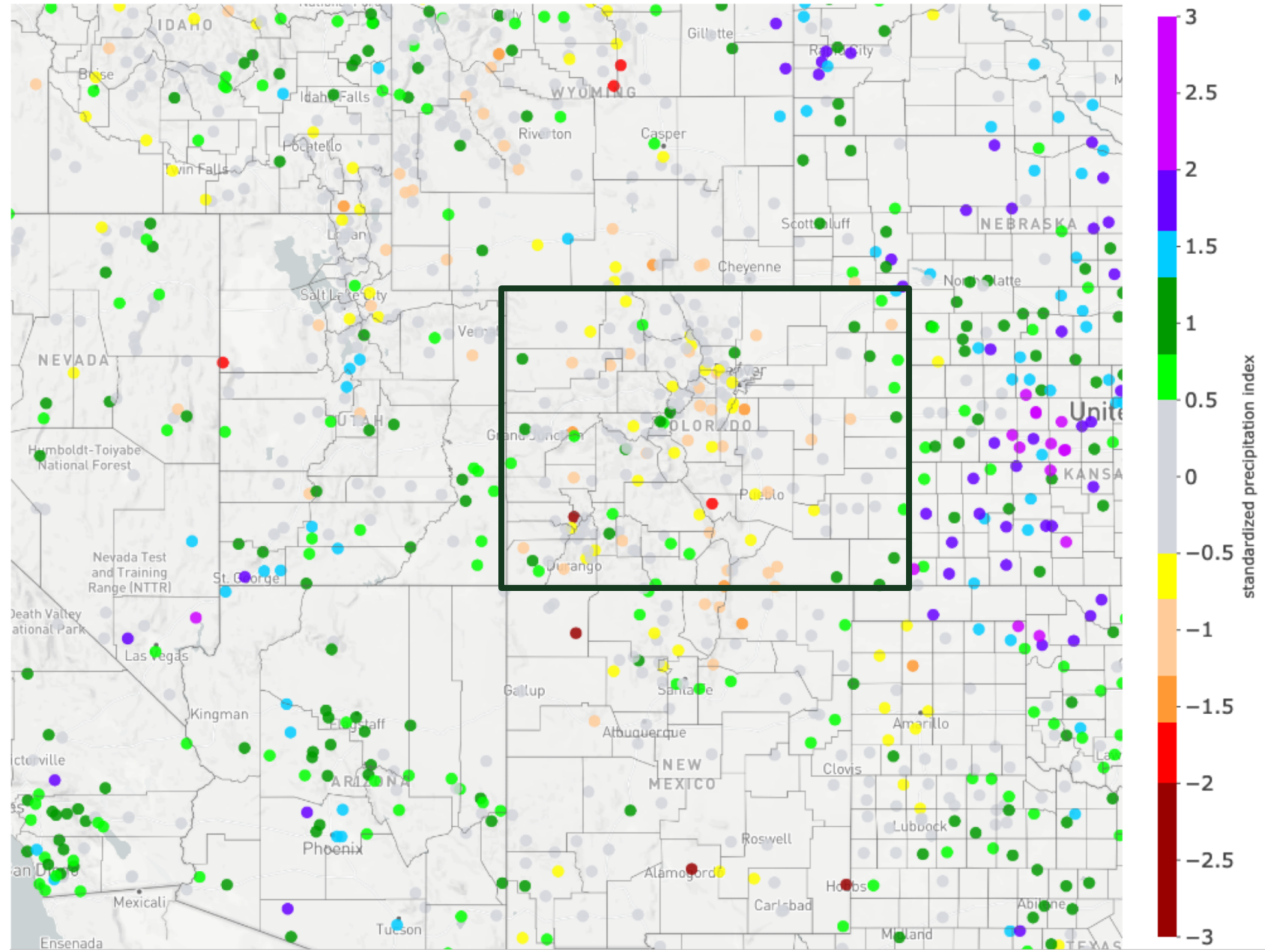
# 90-day Standardized Precipitation Index: 12/18/2018 - 3/17/2019



# 6-month Standardized Precipitation Index: 9/18/2018 - 3/17/2019

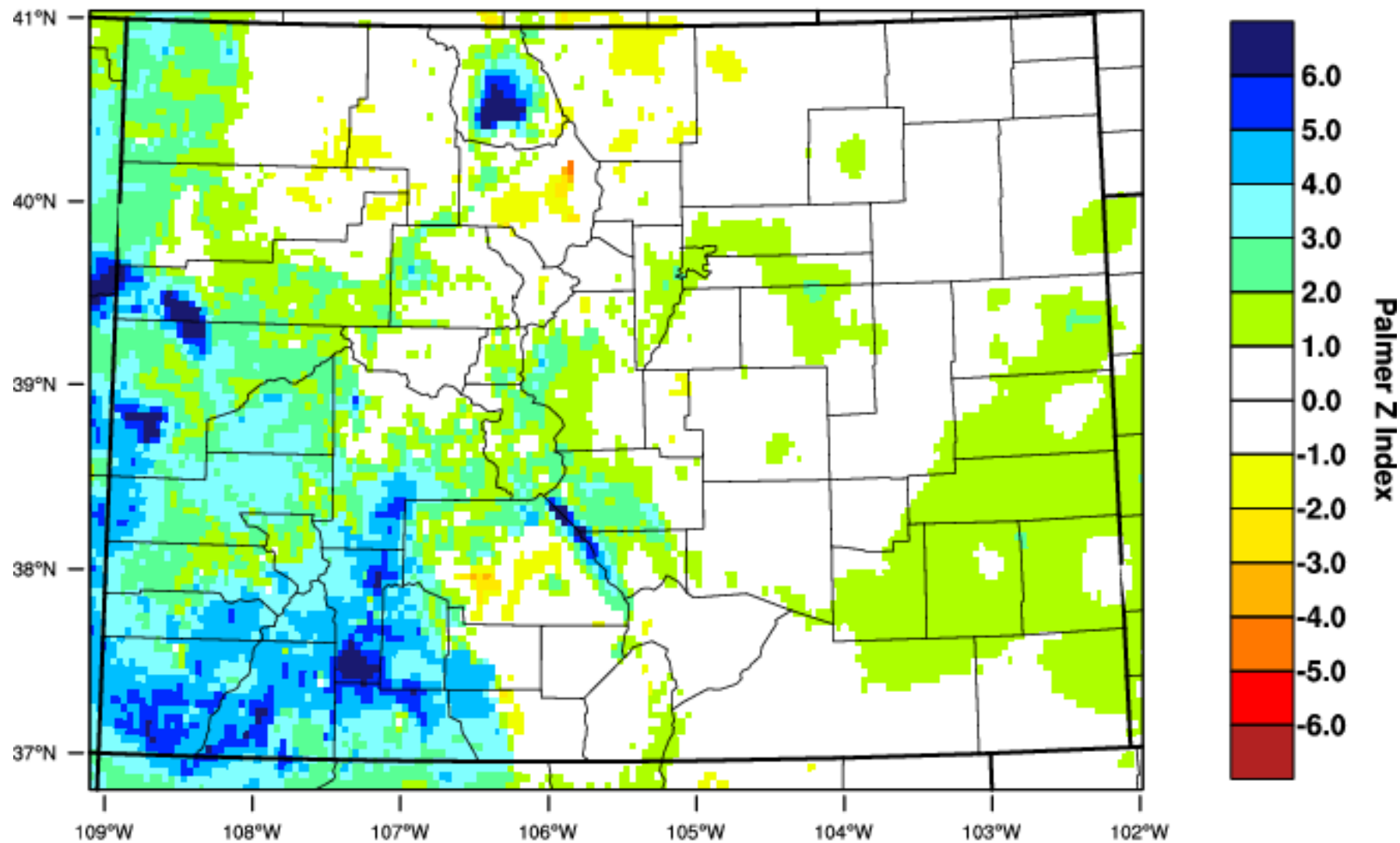


# 12-month Standardized Precipitation Index: 3/18/2018 - 3/17/2019



# Colorado - Palmer Z-Index

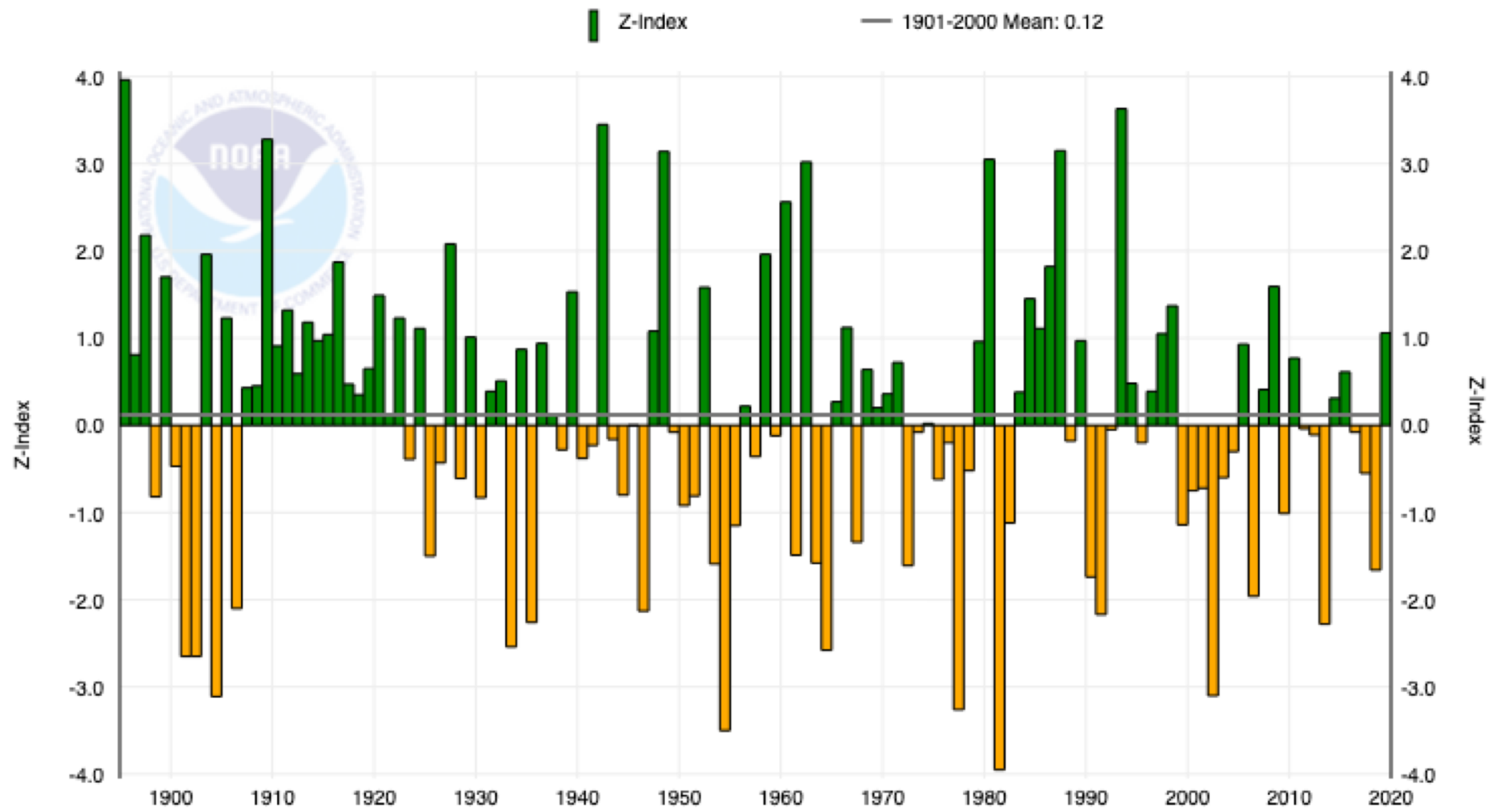
## February 2019



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 MAR 2019



# Colorado, Palmer Z-Index, February



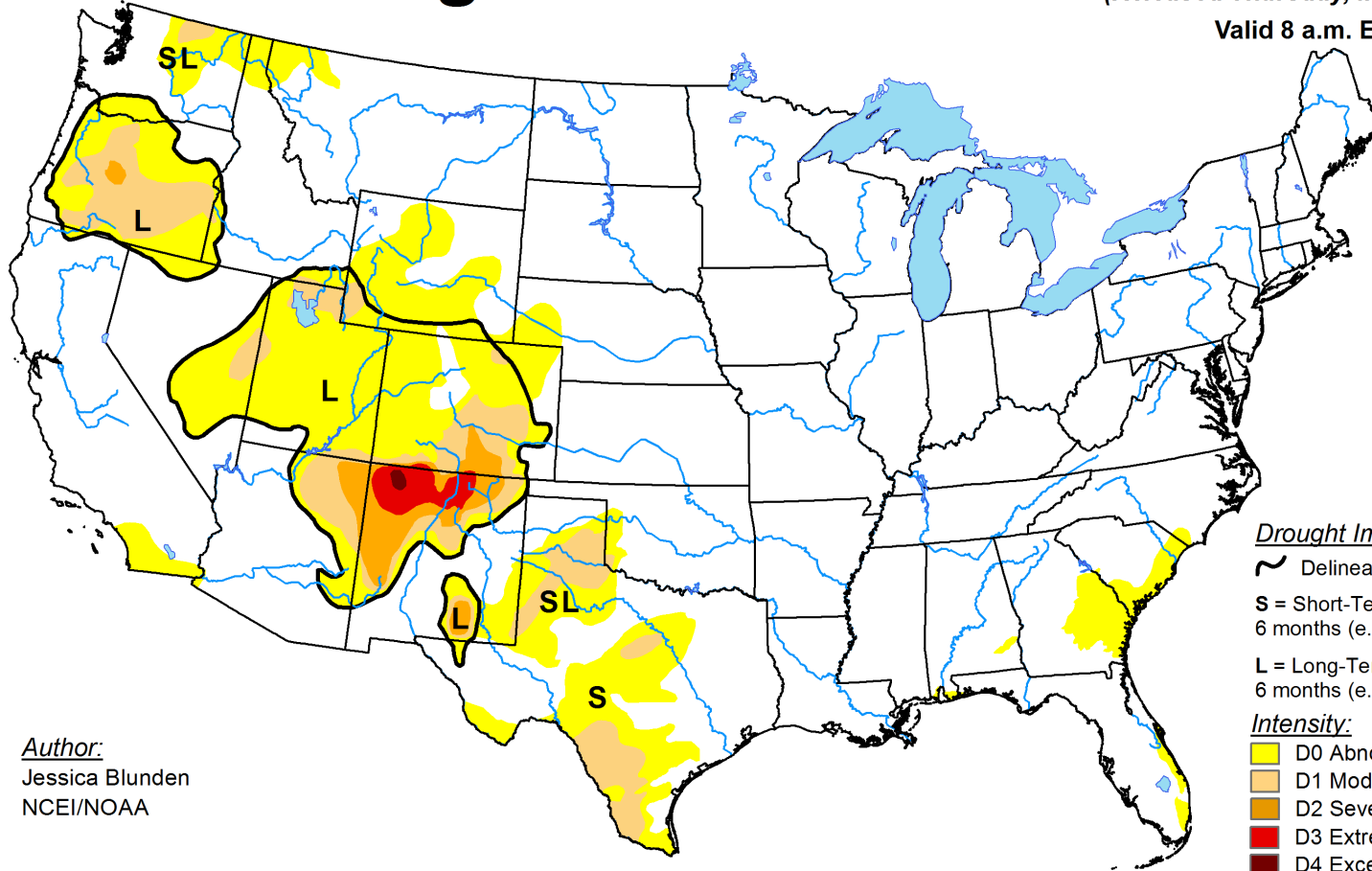


# U.S. Drought Monitor

March 12, 2019

(Released Thursday, Mar. 14, 2019)

Valid 8 a.m. EDT



*Author:*  
Jessica Blunden  
NCEI/NOAA

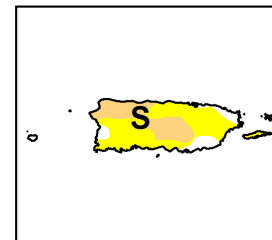
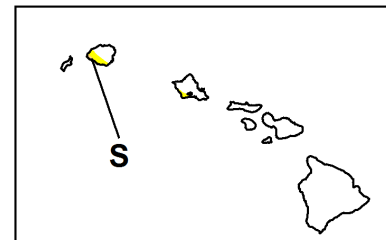
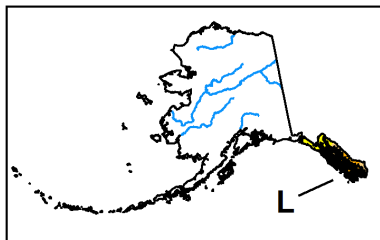
Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- 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. See accompanying text summary for forecast statements.



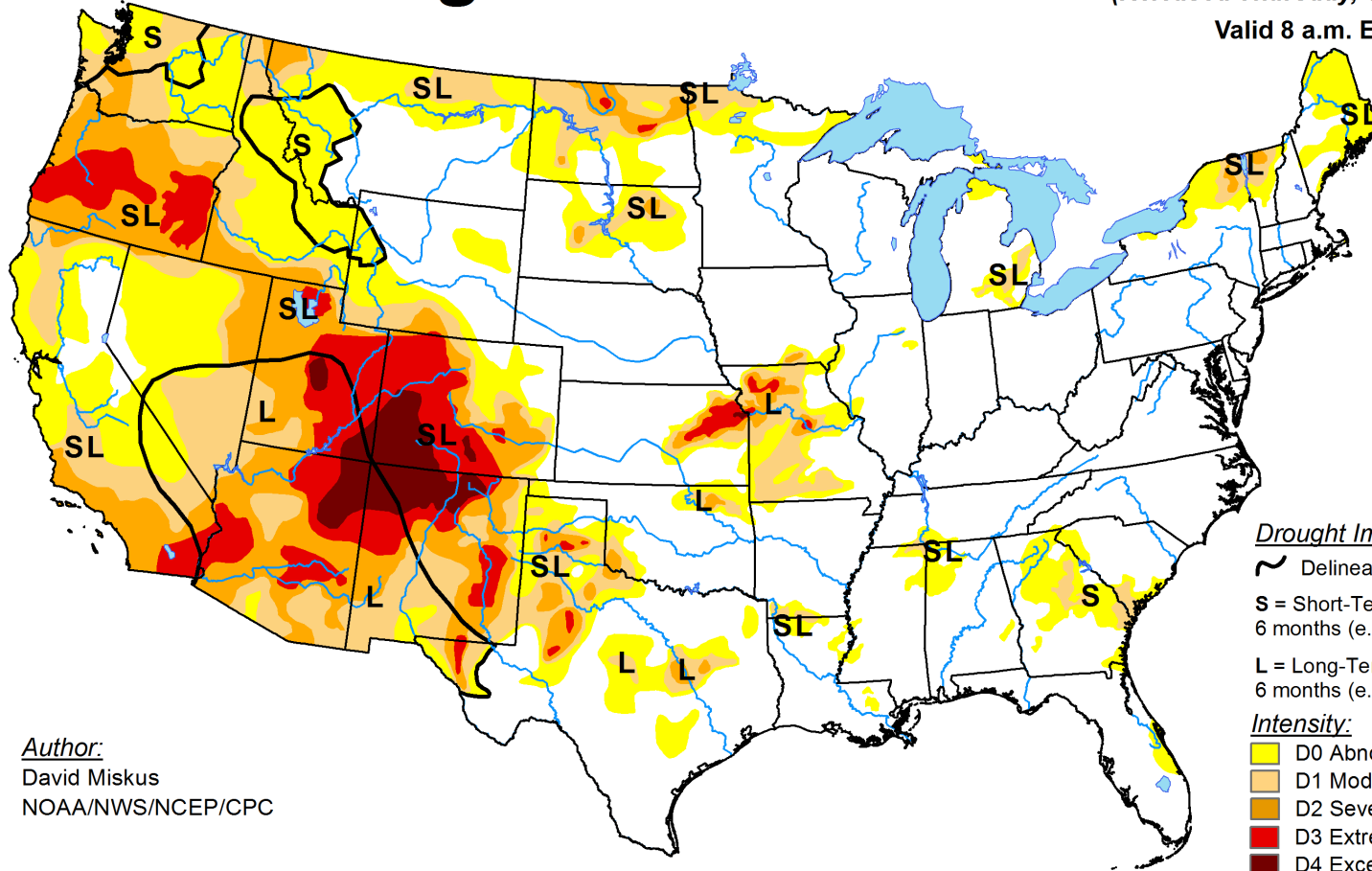
<http://droughtmonitor.unl.edu/>



# U.S. Drought Monitor

October 2, 2018  
(Released Thursday, Oct. 4, 2018)

Valid 8 a.m. EDT



*Author:*  
David Miskus  
NOAA/NWS/NCEP/CPC

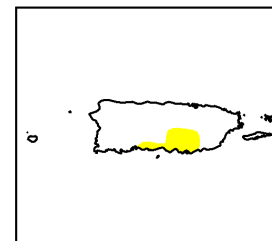
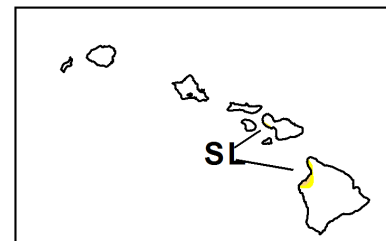
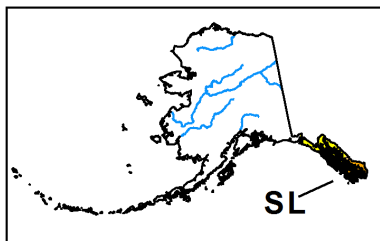
Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- 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. See accompanying text summary for forecast statements.

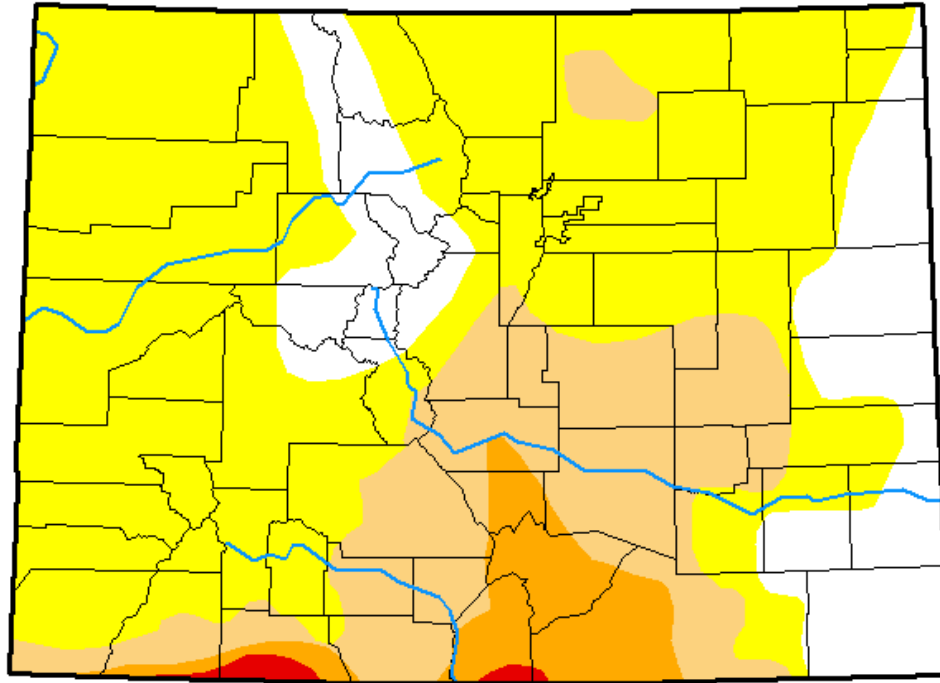


<http://droughtmonitor.unl.edu/>



# U.S. Drought Monitor Colorado

**March 12, 2019**  
(Released Thursday, Mar. 14, 2019)  
Valid 8 a.m. EDT



*Drought Conditions (Percent Area)*

|  | None  | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4    |
|--|-------|-------|-------|-------|-------|-------|
| <b>Current</b>                                     | 17.00 | 83.00 | 25.44 | 6.26  | 0.58  | 0.00  |
| <b>Last Week</b><br><i>03-05-2019</i>              | 10.64 | 89.36 | 58.05 | 12.08 | 0.58  | 0.00  |
| <b>3 Months Ago</b><br><i>12-11-2018</i>           | 17.10 | 82.90 | 66.26 | 54.82 | 27.11 | 11.22 |
| <b>Start of Calendar Year</b><br><i>01-01-2019</i> | 17.94 | 82.06 | 66.26 | 54.91 | 27.11 | 11.22 |
| <b>Start of Water Year</b><br><i>09-25-2018</i>    | 14.19 | 85.81 | 72.30 | 64.41 | 48.47 | 16.21 |
| <b>One Year Ago</b><br><i>03-13-2018</i>           | 10.16 | 89.84 | 70.75 | 47.44 | 13.44 | 0.00  |

Intensity:

- 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. See accompanying text summary for forecast statements.*

Author:

Jessica Blunden  
NCEI/NOAA

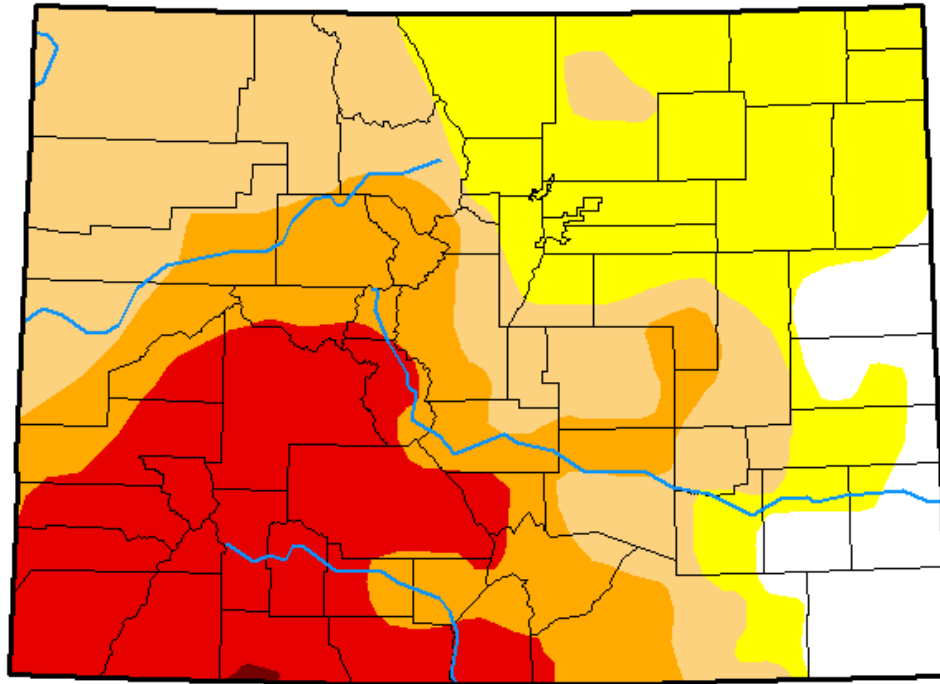


<http://droughtmonitor.unl.edu/>



# U.S. Drought Monitor Colorado

**February 12, 2019**  
(Released Thursday, Feb. 14, 2019)  
Valid 7 a.m. EST



Drought Conditions (Percent Area)

|  | None  | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4    |
|--|-------|-------|-------|-------|-------|-------|
| <b>Current</b>                                     | 8.15  | 91.85 | 67.16 | 39.69 | 21.84 | 0.11  |
| <b>Last Week</b><br><i>02-05-2019</i>              | 8.14  | 91.86 | 67.16 | 40.83 | 22.05 | 2.96  |
| <b>3 Months Ago</b><br><i>11-13-2018</i>           | 16.64 | 83.36 | 66.26 | 54.82 | 34.13 | 13.35 |
| <b>Start of Calendar Year</b><br><i>01-01-2019</i> | 17.94 | 82.06 | 66.26 | 54.91 | 27.11 | 11.22 |
| <b>Start of Water Year</b><br><i>09-25-2018</i>    | 14.19 | 85.81 | 72.30 | 64.41 | 48.47 | 16.21 |
| <b>One Year Ago</b><br><i>02-13-2018</i>           | 8.59  | 91.41 | 71.18 | 33.51 | 0.00  | 0.00  |

Intensity:

- 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. See accompanying text summary for forecast statements.*

Author:

Richard Tinker  
CPC/NOAA/NWS/NCEP

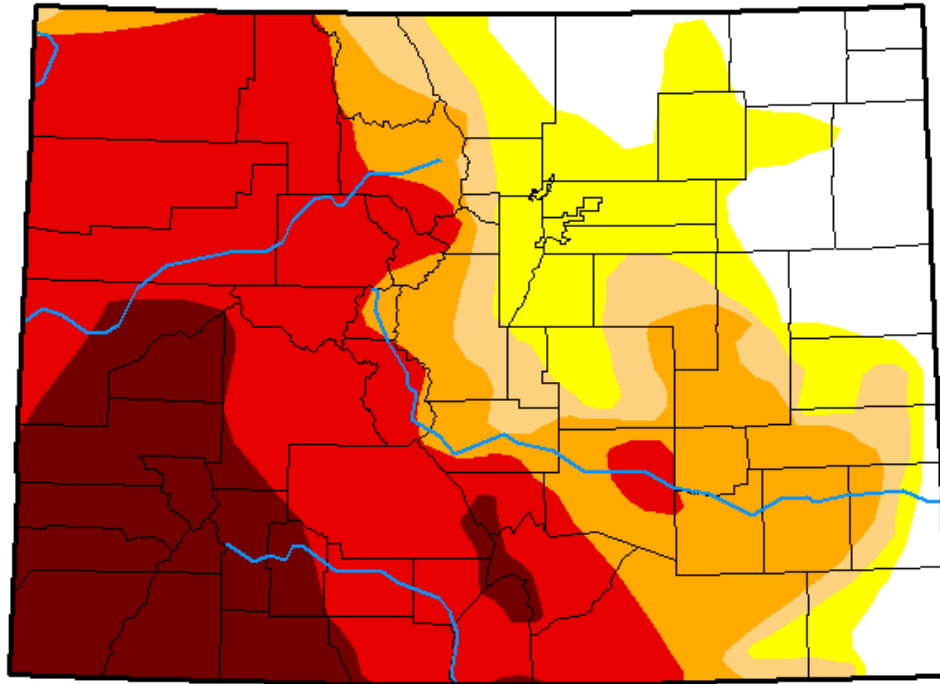


<http://droughtmonitor.unl.edu/>



# U.S. Drought Monitor Colorado

**October 2, 2018**  
(Released Thursday, Oct. 4, 2018)  
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

|  | None  | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4    |
|--|-------|-------|-------|-------|-------|-------|
| <b>Current</b>                                     | 14.19 | 85.81 | 72.30 | 64.41 | 48.47 | 16.21 |
| <b>Last Week</b><br><i>09-25-2018</i>              | 14.19 | 85.81 | 72.30 | 64.41 | 48.47 | 16.21 |
| <b>3 Months Ago</b><br><i>07-03-2018</i>           | 20.46 | 79.54 | 67.30 | 52.31 | 36.46 | 8.81  |
| <b>Start of Calendar Year</b><br><i>01-02-2018</i> | 6.57  | 93.43 | 33.53 | 7.27  | 0.00  | 0.00  |
| <b>Start of Water Year</b><br><i>09-25-2018</i>    | 14.19 | 85.81 | 72.30 | 64.41 | 48.47 | 16.21 |
| <b>One Year Ago</b><br><i>10-03-2017</i>           | 70.54 | 29.46 | 3.70  | 0.00  | 0.00  | 0.00  |

Intensity:

- 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. See accompanying text summary for forecast statements.*

Author:

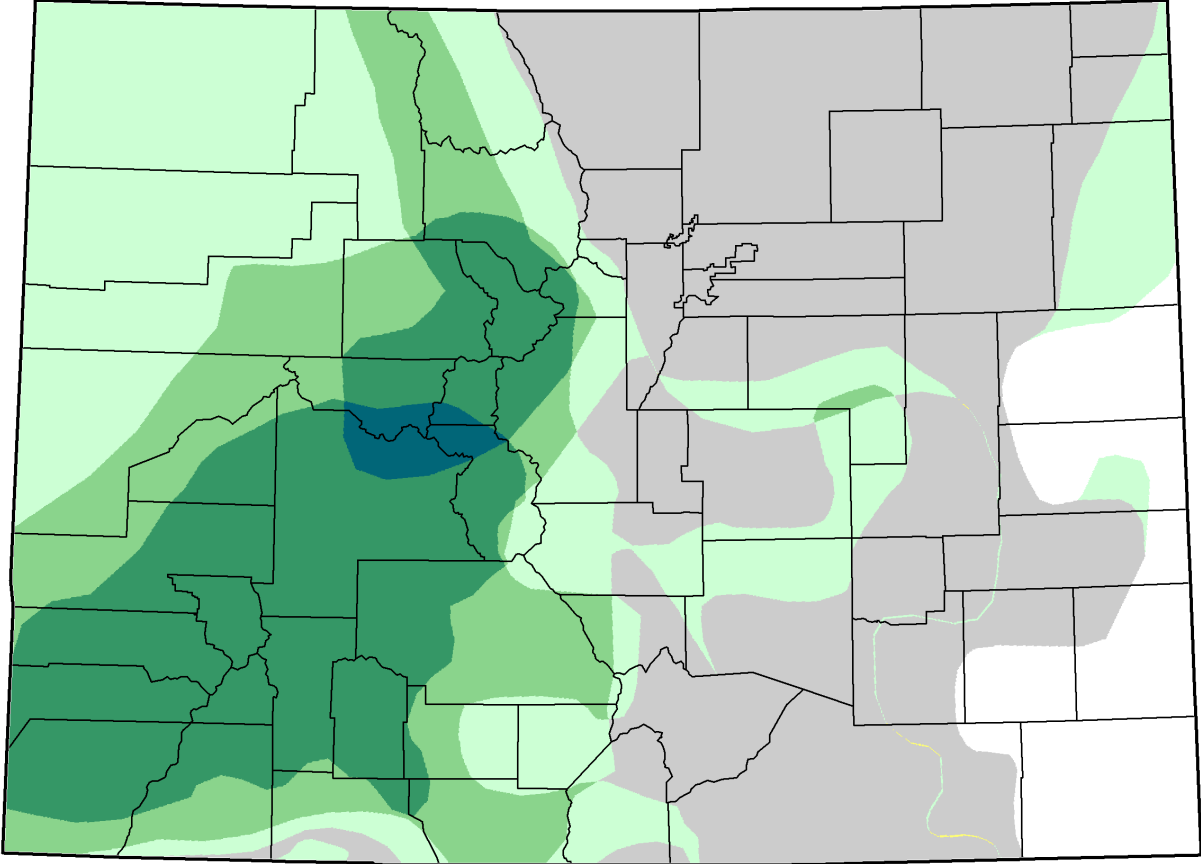
David Miskus  
NOAA/NWS/NCEP/CPC



<http://droughtmonitor.unl.edu/>



# U.S. Drought Monitor Class Change - Colorado 1 Month



March 12, 2019  
compared to  
February 12, 2019

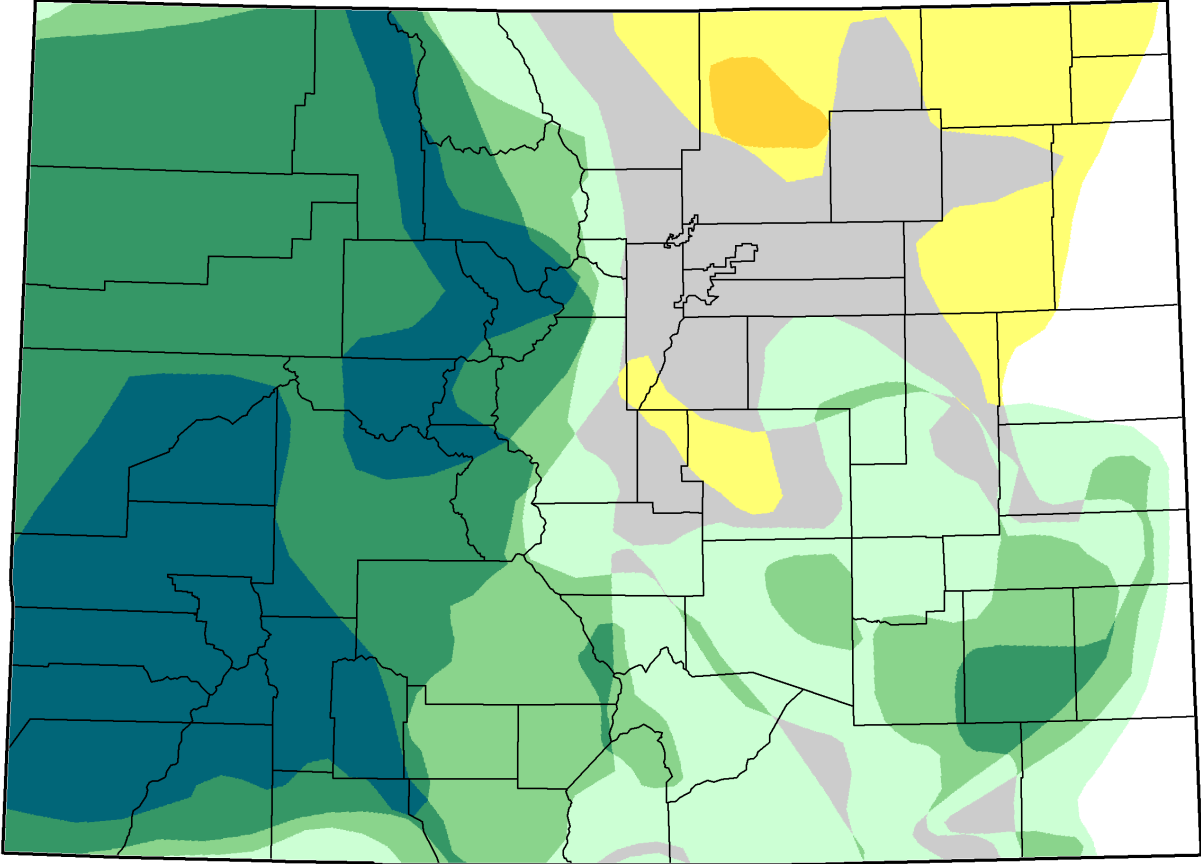
<http://droughtmonitor.unl.edu>



- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement



# U.S. Drought Monitor Class Change - Colorado Start of Water Year



March 12, 2019  
compared to  
September 25, 2018

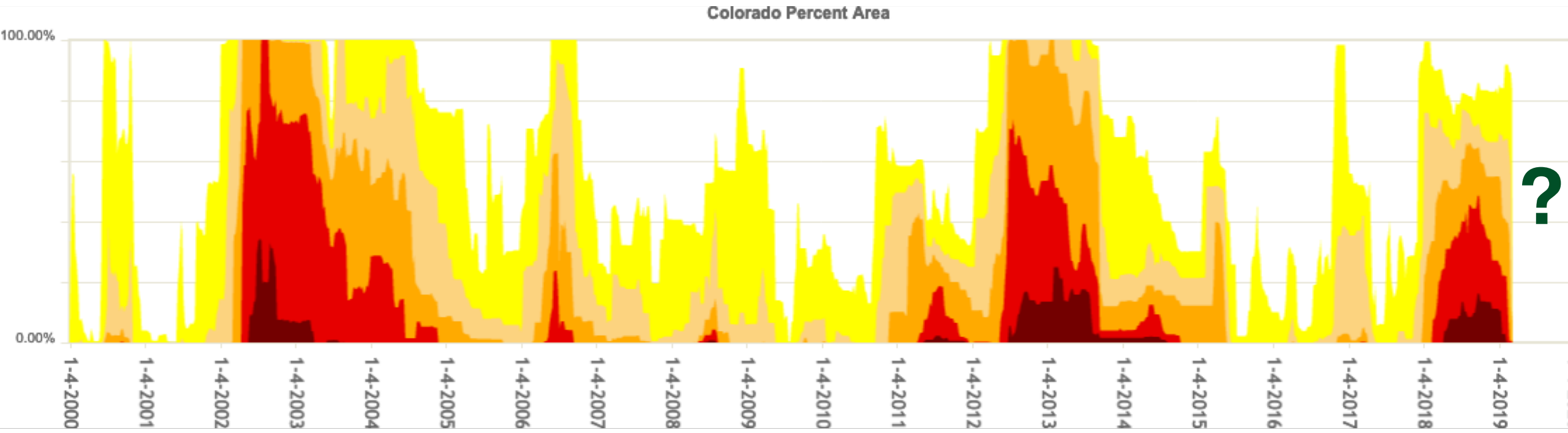
<http://droughtmonitor.unl.edu>







- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement



# US Drought Monitor: Colorado

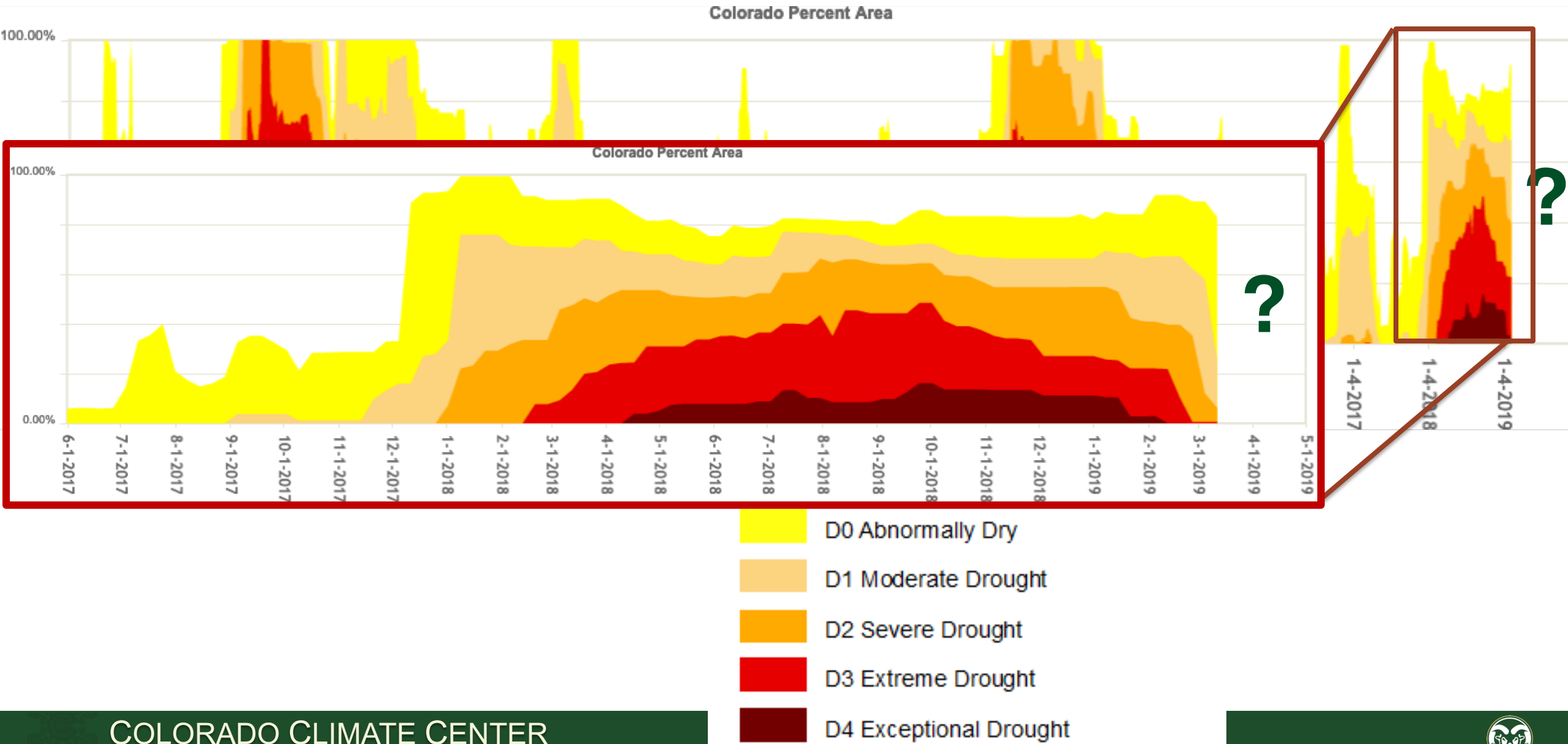


## Intensity:

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



# US Drought Monitor: Colorado

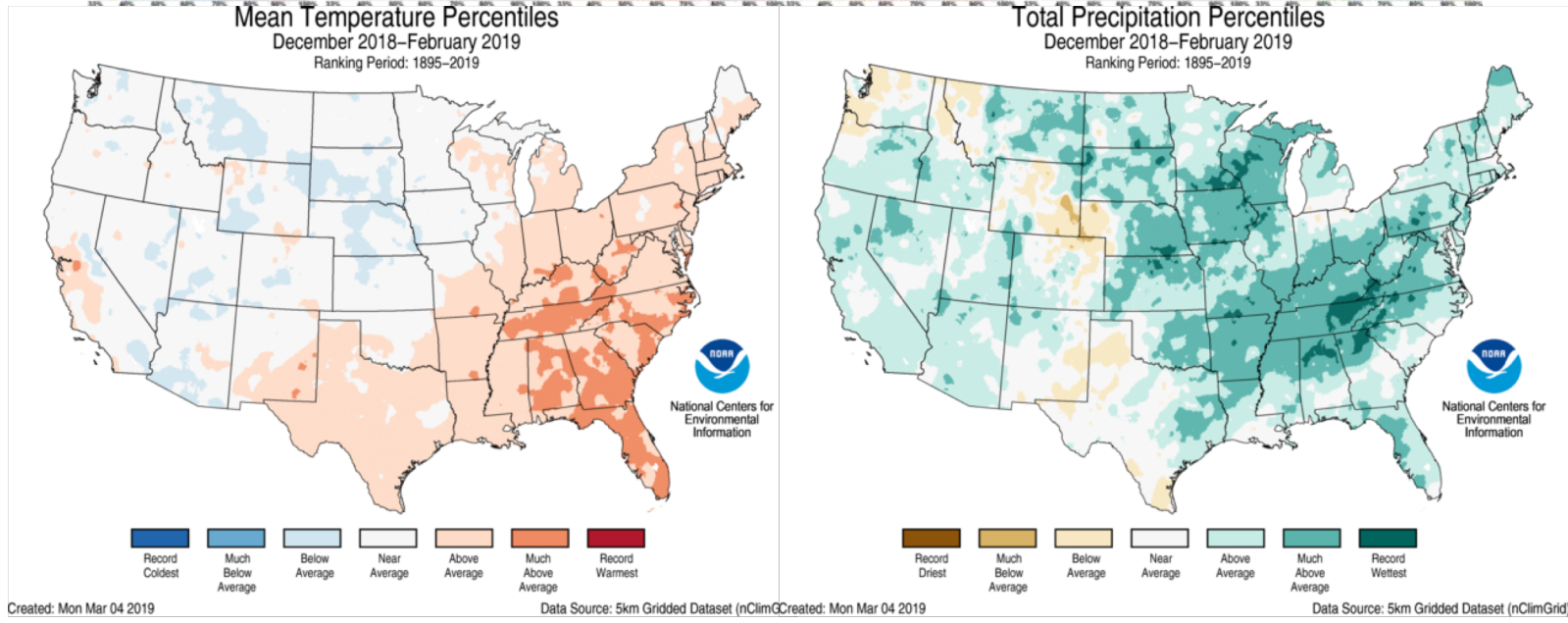
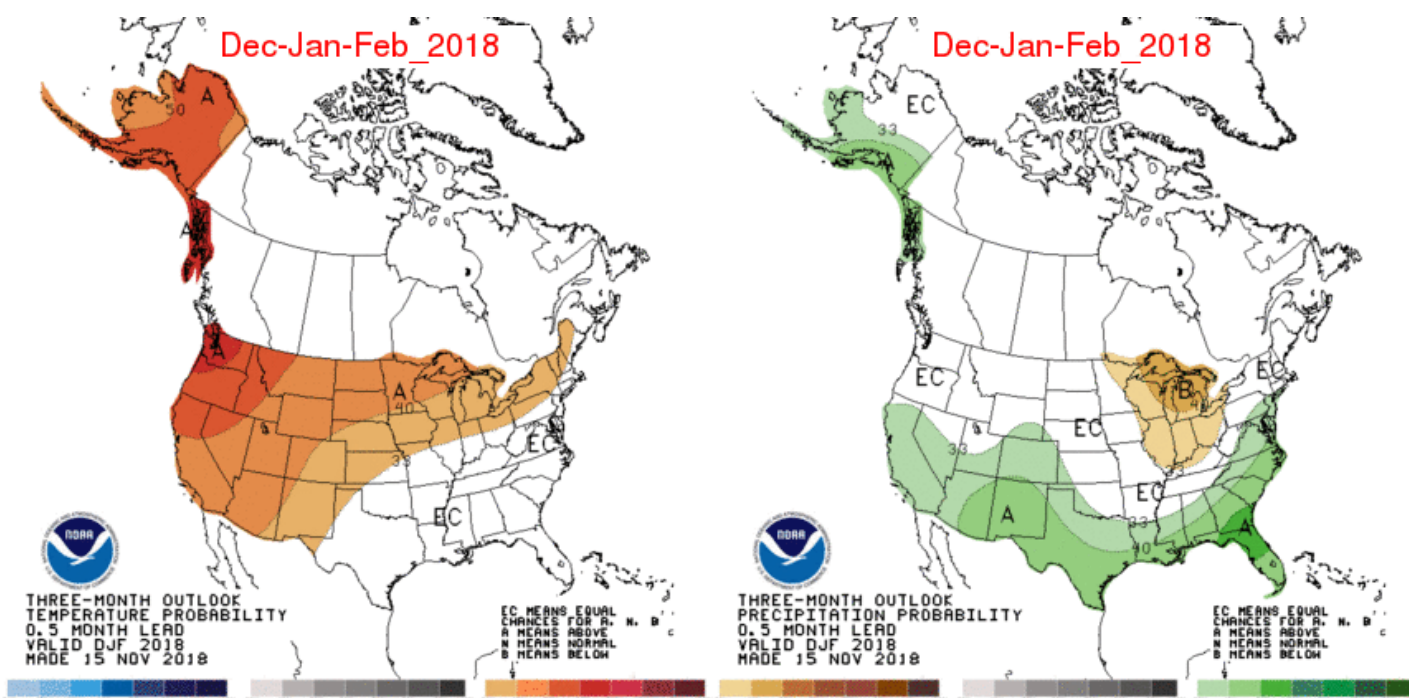




# Outlook

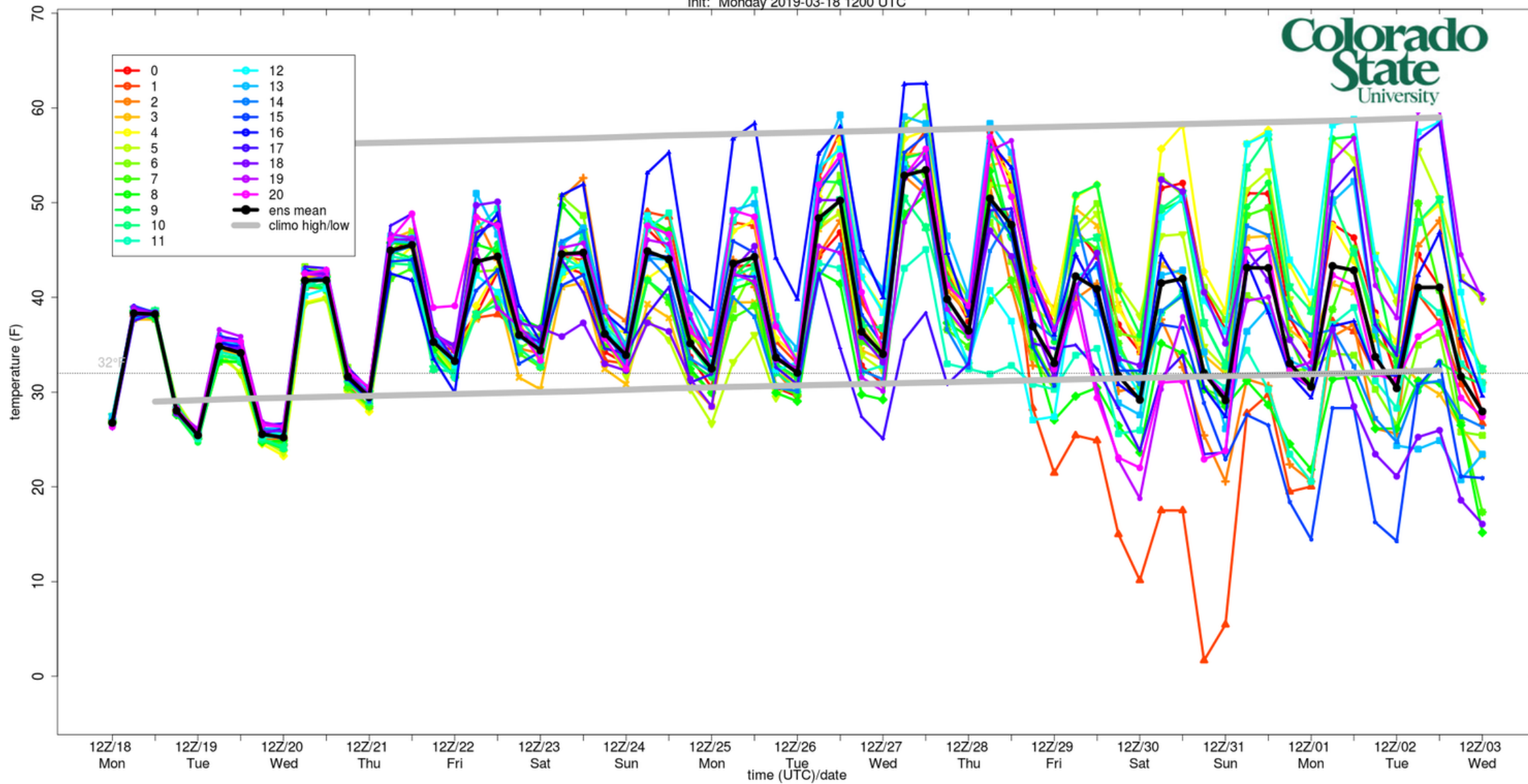


# Looking back...



# NCEP GEFS 2-m temperature at Fort Collins

init: Monday 2019-03-18 1200 UTC



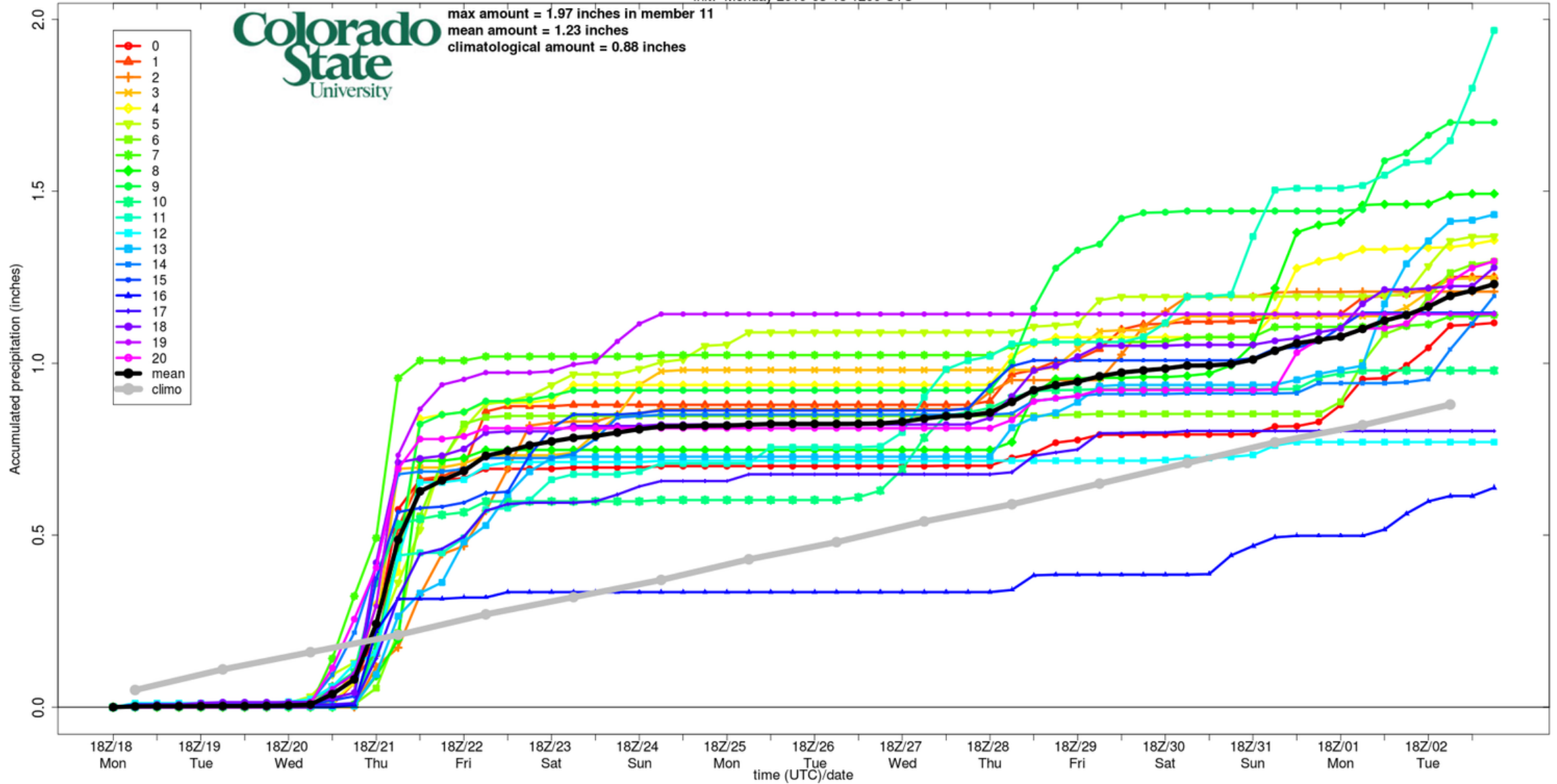
(April 3)

<http://schumacher.atmos.colostate.edu/weather/ens.php>



# NCEP GEFS accumulated precipitation at Durango

init: Monday 2019-03-18 1200 UTC



(April 3)

<http://schumacher.atmos.colostate.edu/weather/ens.php>

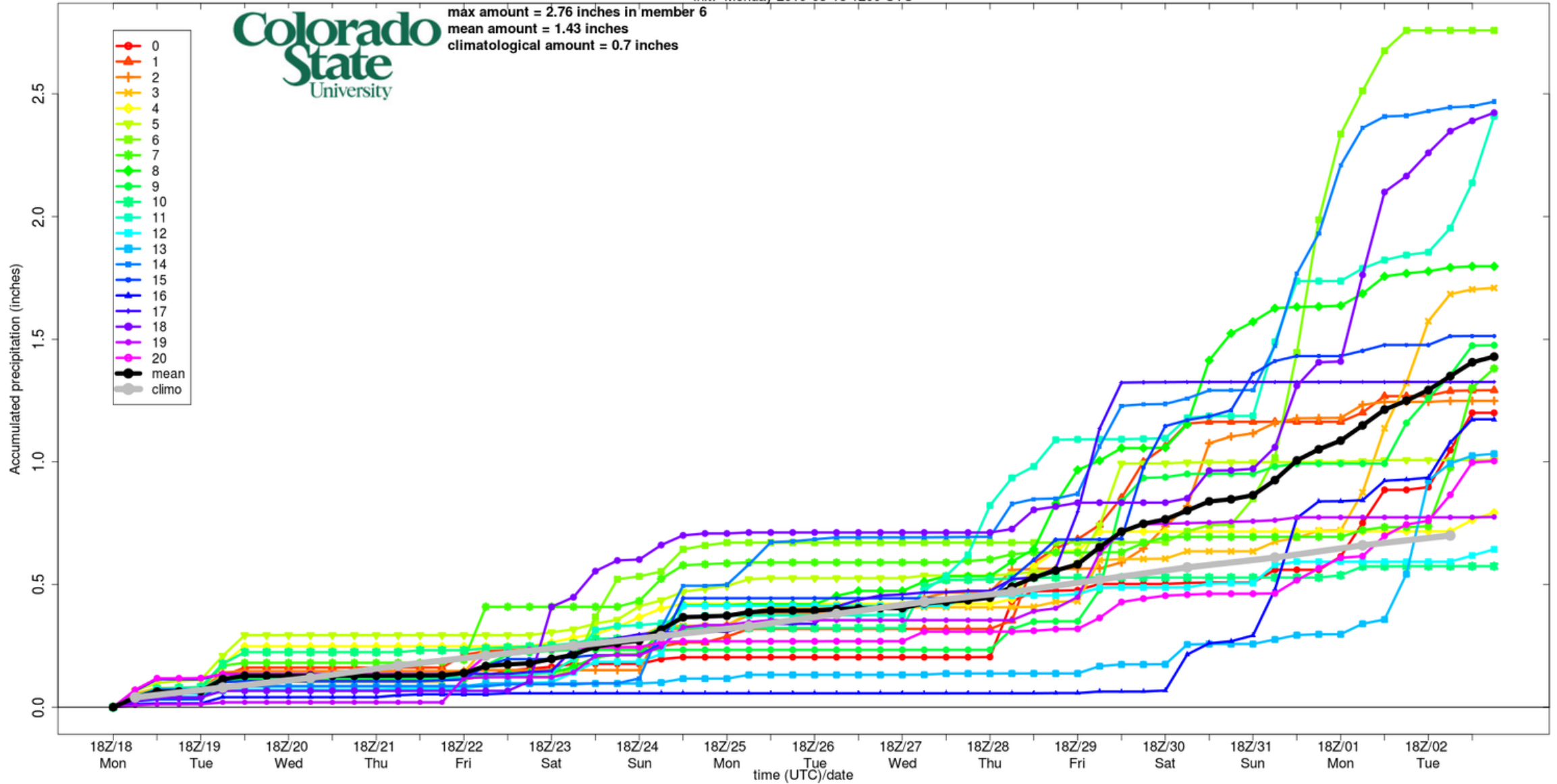


# NCEP GEFS accumulated precipitation at Denver

init: Monday 2019-03-18 1200 UTC



max amount = 2.76 inches in member 6  
mean amount = 1.43 inches  
climatological amount = 0.7 inches

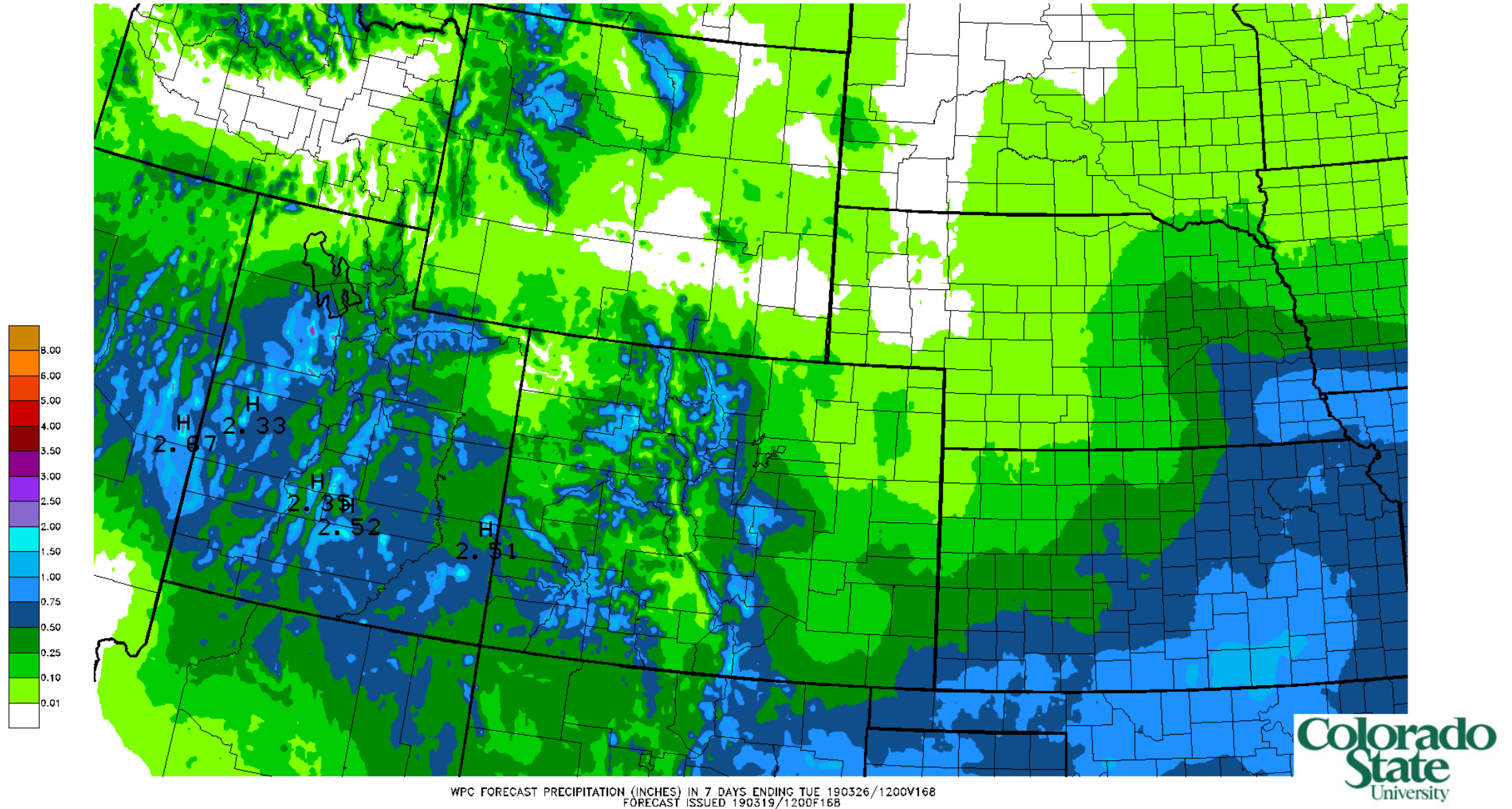


(April 3)

<http://schumacher.atmos.colostate.edu/weather/ens.php>



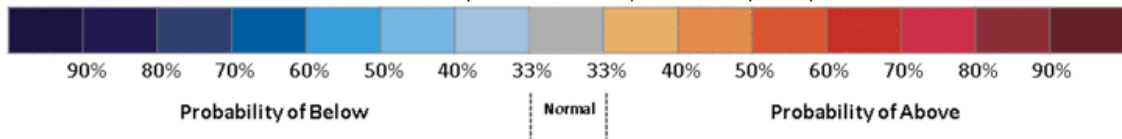
# 7-day precipitation outlook from NOAA Weather Prediction Center





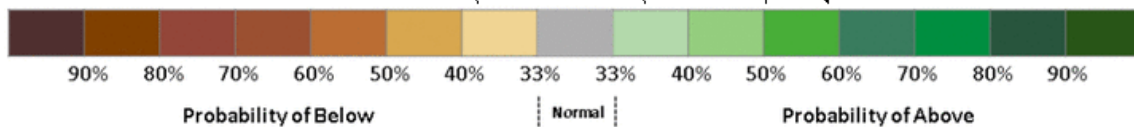
8-14 DAY OUTLOOK  
 TEMPERATURE PROBABILITY  
 MADE 18 MAR 2019  
 VALID MAR 26 - APR 01, 2019

DASHED BLACK LINES ARE CLIMATOLOGY  
 (DEG F) SHADED AREAS ARE FCS  
 VALUES ABOVE (A) OR BELOW (B) NORMAL  
 GRAY AREAS ARE NEAR-NORMAL



8-14 DAY OUTLOOK  
 PRECIPITATION PROBABILITY  
 MADE 18 MAR 2019  
 VALID MAR 26 - APR 01, 2019

DASHED BLACK LINES ARE CLIMATOLOGY  
 (10THS OF INCHES) SHADED AREAS ARE FCS  
 VALUES ABOVE (A) OR BELOW (B) NORMAL  
 GRAY AREAS ARE NEAR-NORMAL





# El Niño-Southern Oscillation (ENSO)

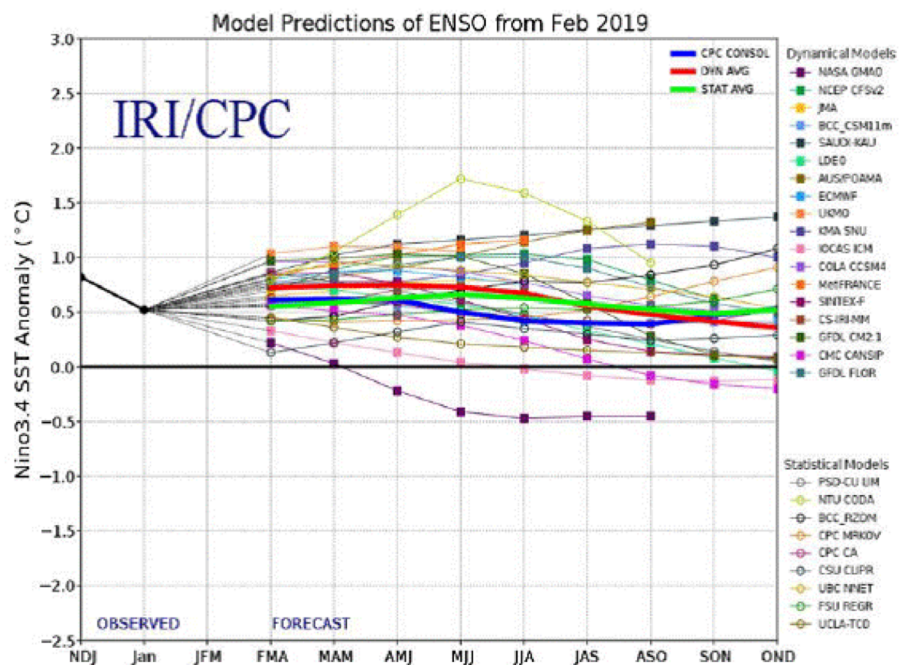
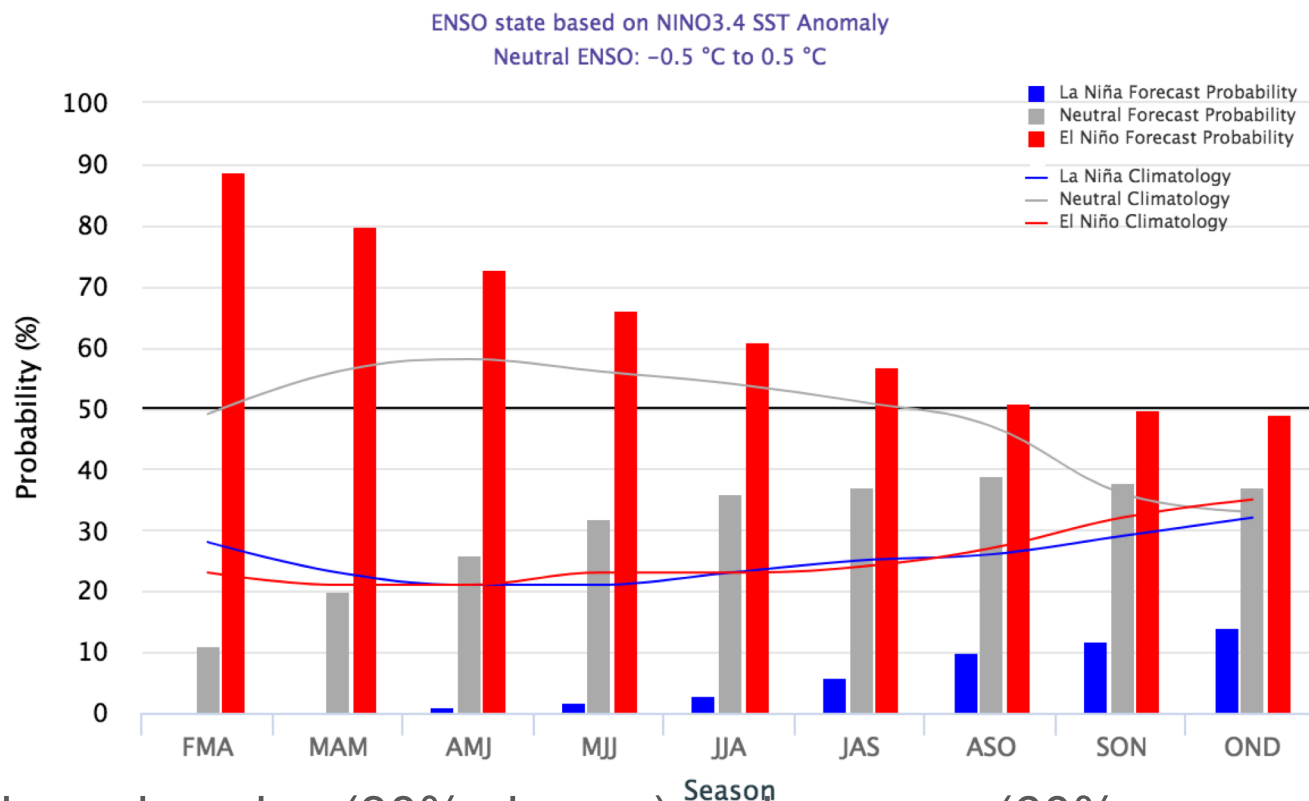


Figure 6. Forecasts of sea surface temperature (SST) anomalies for the Niño 3.4 region (5°N-5°S, 120°W-170°W). Figure updated 19 February 2019.

## Early-March 2019 CPC/IRI Official Probabilistic ENSO Forecasts



Weak El Niño in place, likely to continue through spring (80% chance) and summer (60% chance)

Through the winter, the Madden-Julian Oscillation (MJO) was a bigger player than ENSO, though current pattern is more aligned with El Niño

Wet springs in eastern CO are somewhat common during El Niño; summer influences not that strong

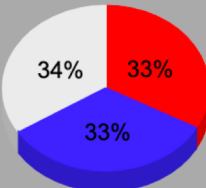


# Spring (March-April-May) outlook

Find address or place

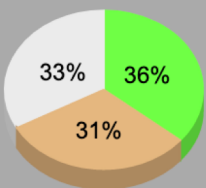
[7 Day Forecast for Greeley, CO](#)

Three Category Temperature Outlook  
 Normal Maximum Temperature: **64**  
 Normal Minimum Temperature: **34**



- Above Normal
- Below Normal
- Near Normal

Three Category Precipitation Outlook  
 Normal Precipitation: **5.09**



- Above Normal
- Below Normal
- Near Normal

Select Lead ▾

## Seasonal Outlook

March 2019-May 2019 (Lead 1)

**Temperature**

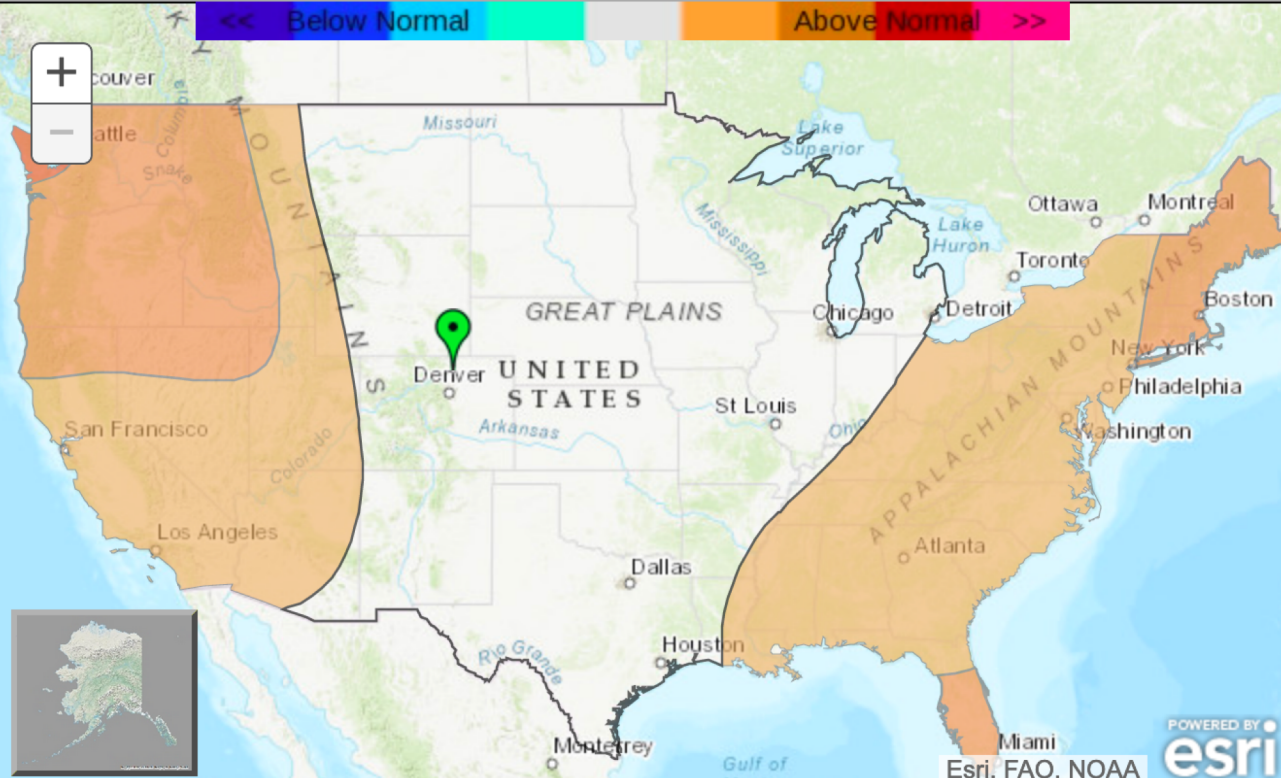
● Outlook

Opacity: 60%

**Precipitation**

● Outlook

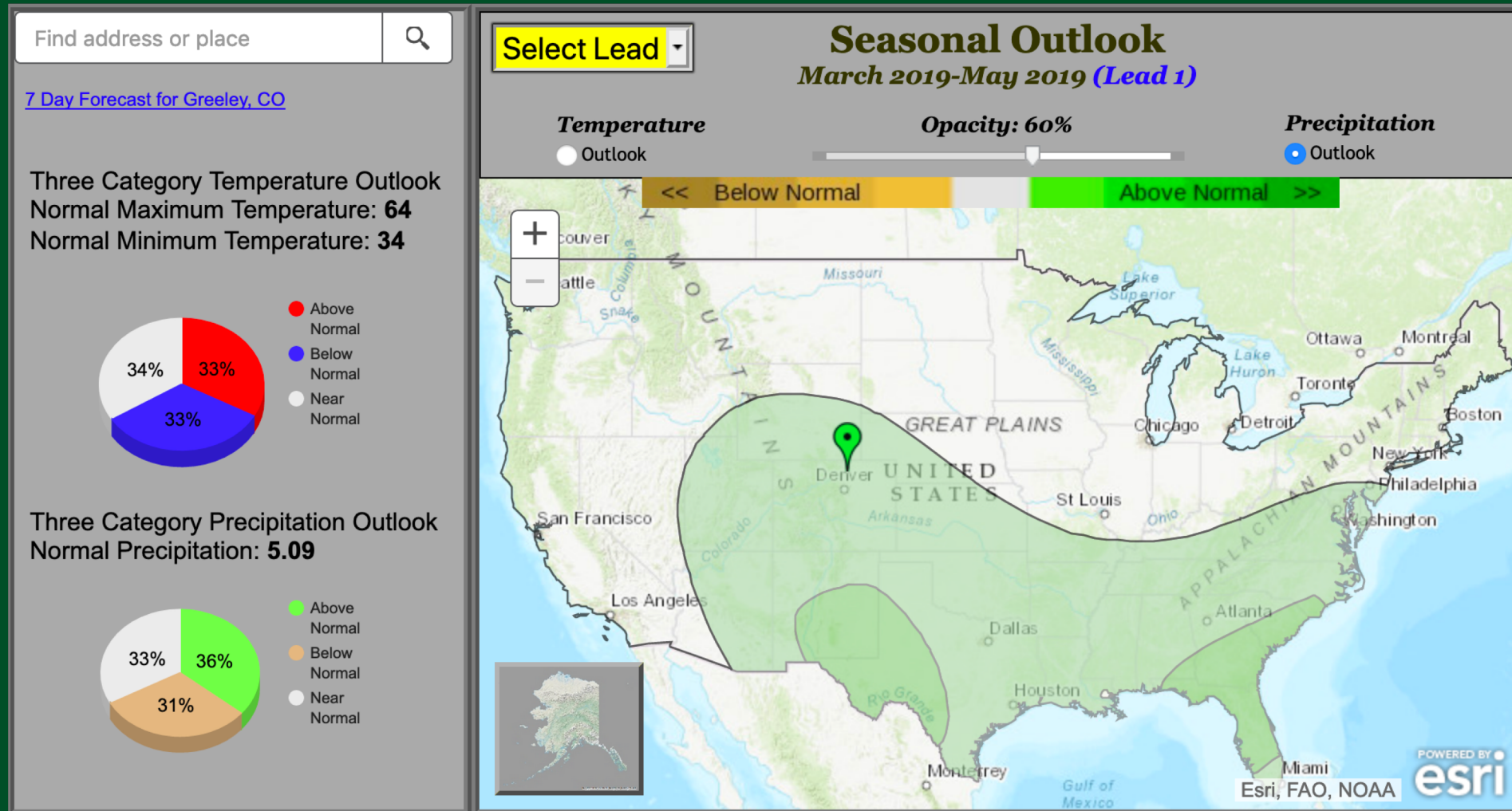
<< Below Normal    Above Normal >>



POWERED BY  
**esri**  
 Esri, FAO, NOAA

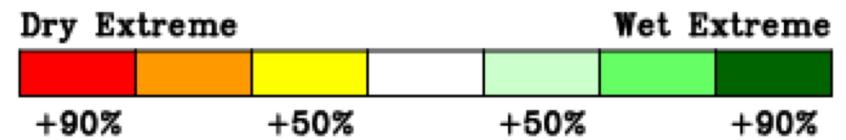
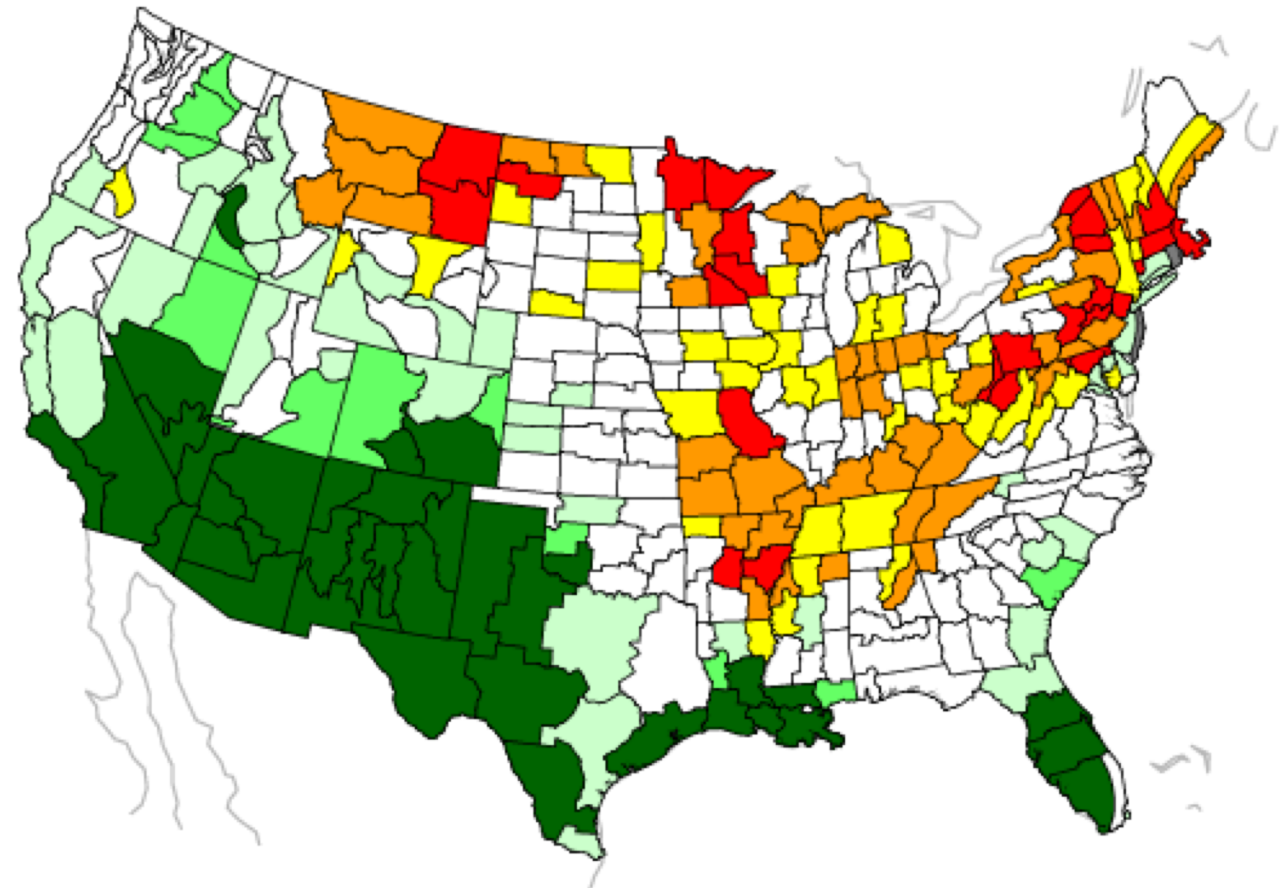
COLORADO CLIMATE CENTER

# Spring (March-April-May) outlook



# Chances of increased wet or dry extremes in spring during El Niño

MAM Precipitation During El Niño  
Increased Risk of Wet or Dry Extremes



Percent (%) Increase in Risk

NOAA/ESRL/PSD

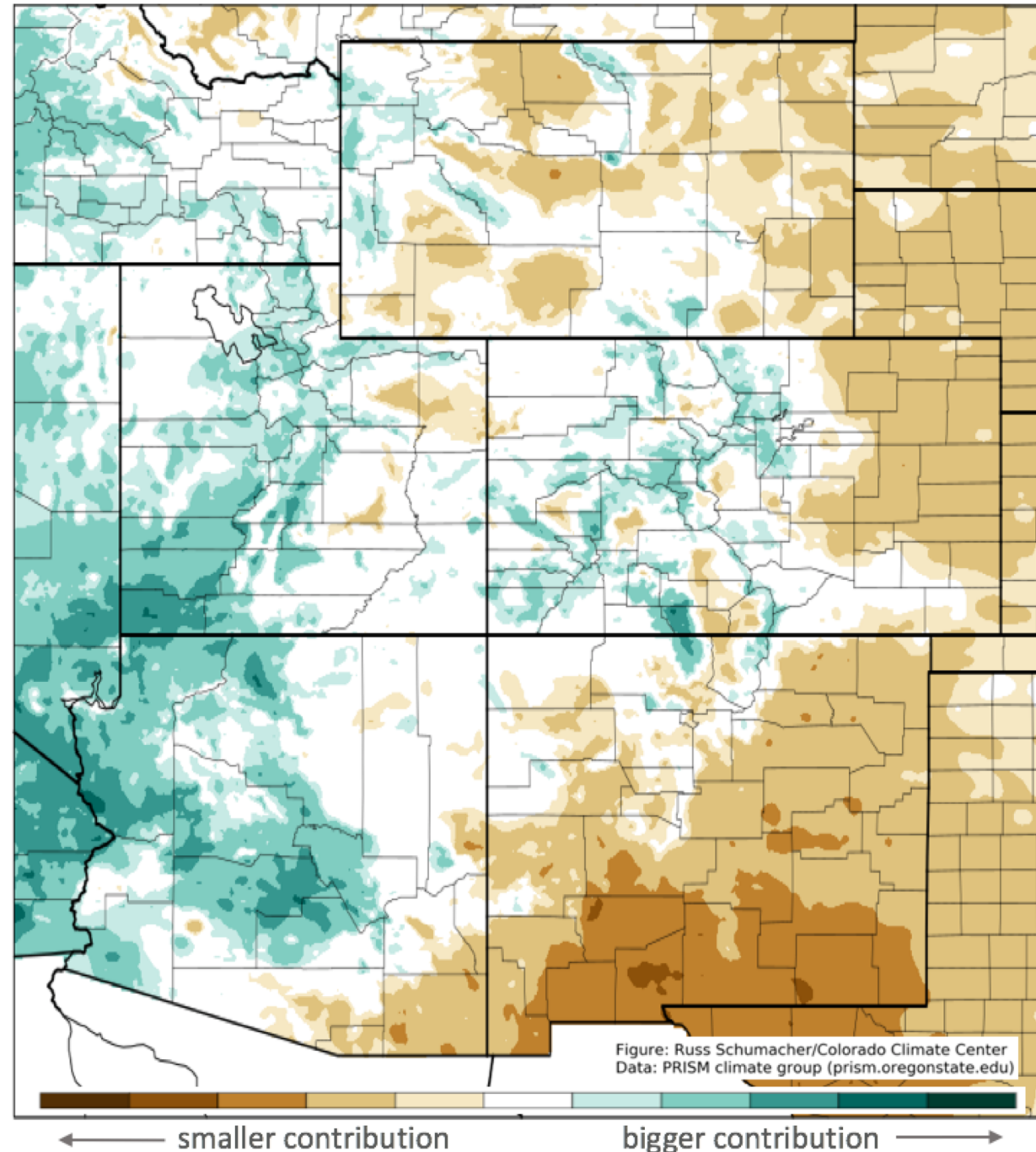
How important are the  
spring months to the total  
annual average  
precipitation?

March

Brown: much less than 1/12<sup>th</sup> of the annual precip  
Green: much more than 1/12<sup>th</sup> of the annual precip

COLORADO CLIMATE CENTER

March climatological contribution to annual average precipitation



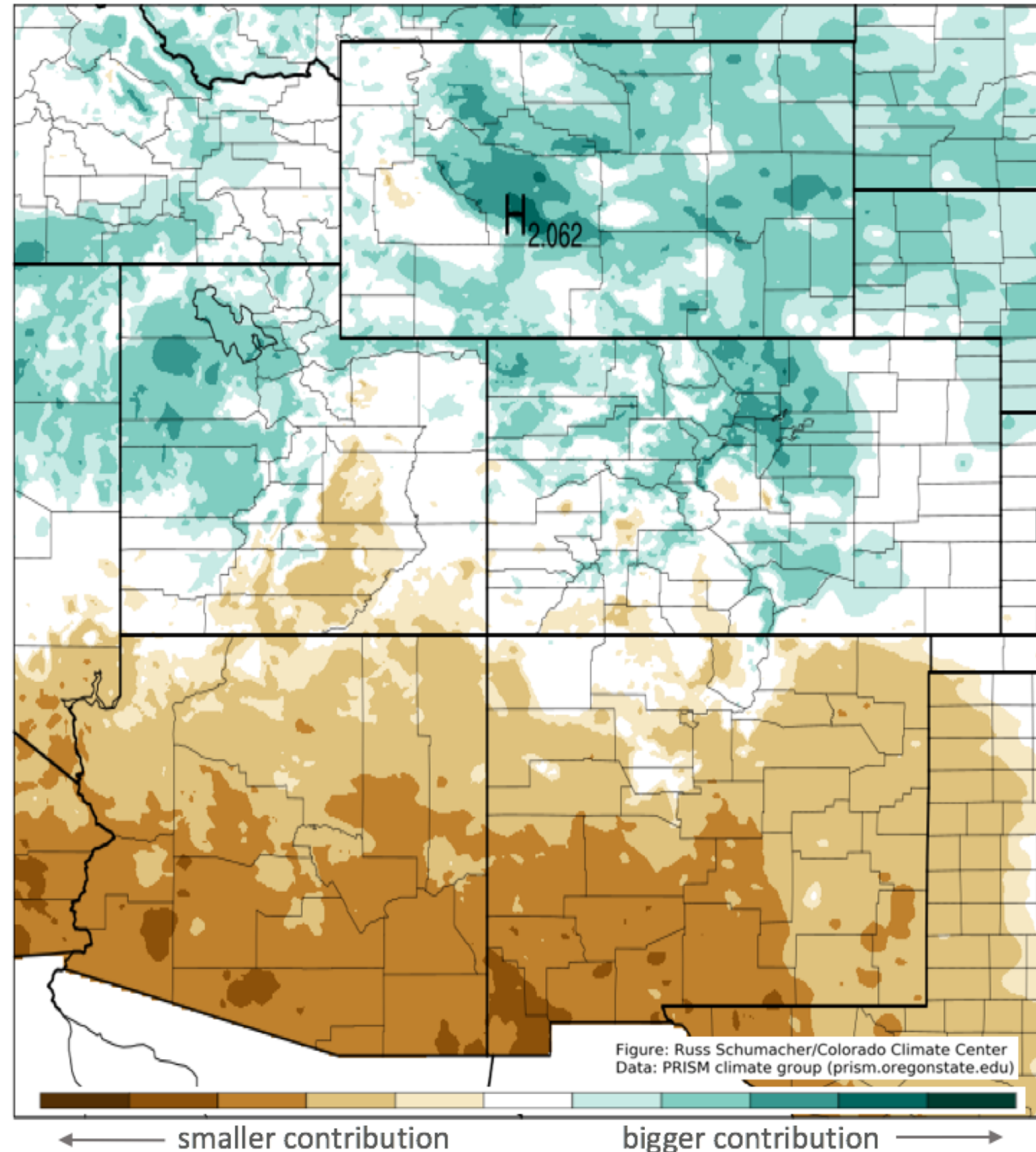
How important are the spring months to the total annual average precipitation?

April

Brown: much less than 1/12<sup>th</sup> of the annual precip  
Green: much more than 1/12<sup>th</sup> of the annual precip

COLORADO CLIMATE CENTER

April climatological contribution to annual average precipitation



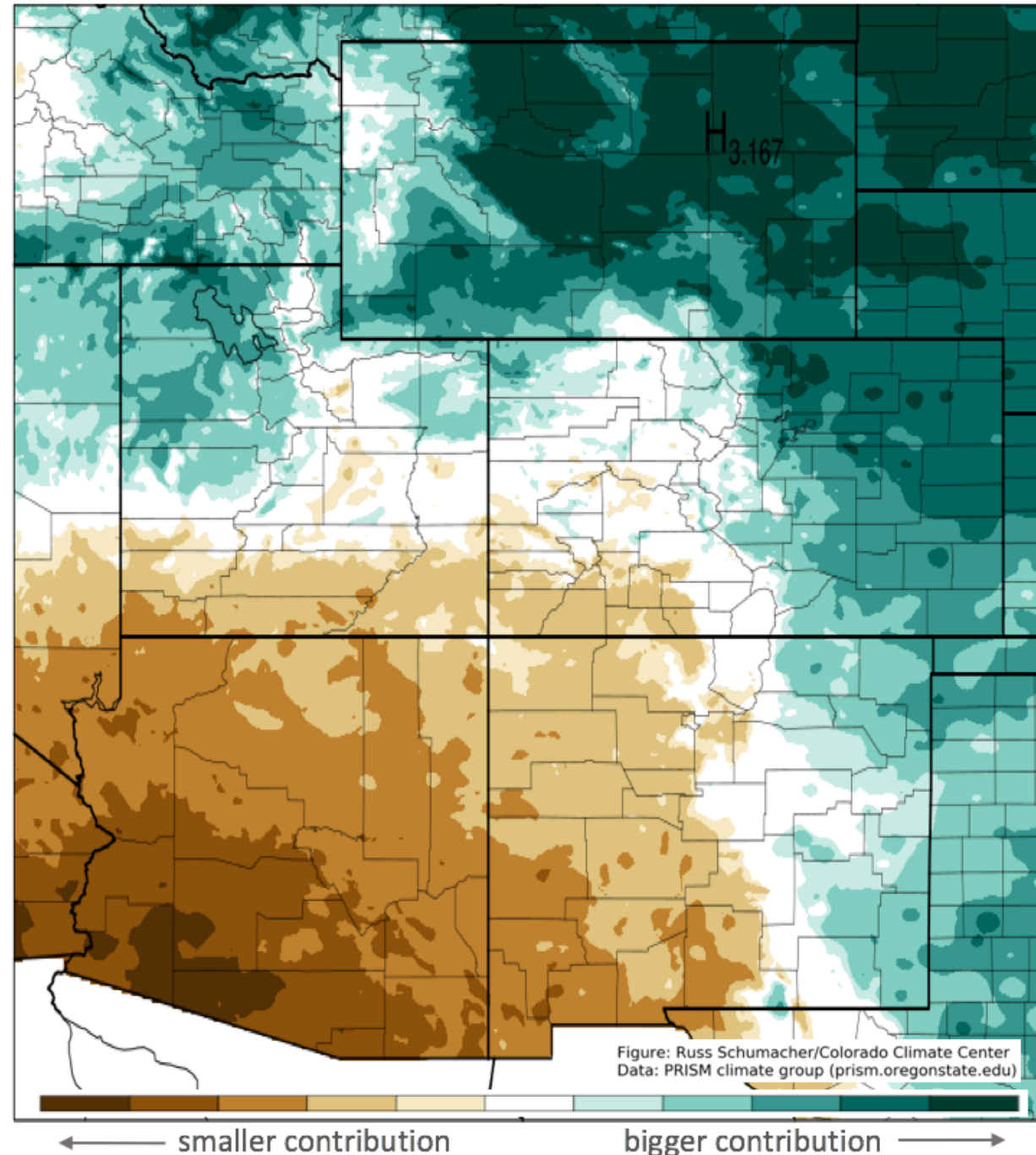
How important are the  
spring months to the total  
annual average  
precipitation?

May

Brown: much less than 1/12<sup>th</sup> of the annual precip  
Green: much more than 1/12<sup>th</sup> of the annual precip

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May climatological contribution to annual average precipitation



# Summary

- February was a huge month for snow in the mountains, and March has also been huge thus far
- Drought conditions have been drastically reduced across Colorado – now only 6% of the state in D2 (severe) drought or worse, with more improvements likely
- Furthermore, temperatures since the beginning of the water year have been near normal to a bit cooler than normal
- Still awaiting reservoir and soil recharge in the spring/summer snowmelt and runoff season
- Flood concerns are likely in spring, but will depend in large part on the weather over the next month or two





[russ.schumacher@colostate.edu](mailto:russ.schumacher@colostate.edu)

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*Providing information and expertise on Colorado's complex climate*