

United States Department of Agriculture  
Midwest Climate Hub

# Central Region Climate & Drought Outlook

## January 21, 2021

---

**TRENT FORD**

ILLINOIS STATE CLIMATOLOGIST

ILLINOIS STATE WATER SURVEY | PRAIRIE RESEARCH INSTITUTE

UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN



**I ILLINOIS**

Illinois State Water Survey

PRAIRIE RESEARCH INSTITUTE

# General Information

## Providing Climate Services to the Central Region

- Collaboration Activity Between:
  - USDA Climate Hubs
  - American Association of State Climatologists
  - Midwest and High Plains Regional Climate Centers
  - NOAA NCEI/NWS/OAR/NIDIS
  - National Drought Mitigation Center
- Access to Future Climate Webinars & Past Recordings can be found:
  - <http://mrcc.isws.illinois.edu/multimedia/webinars.jsp>
  - <http://www.hprcc.unl.edu/webinars.php>

## Next Climate/Drought Outlook Webinar

- **Thursday, February 18<sup>th</sup>**
- **Dr. Becky Bollinger: Assistant State Climatologist, Colorado Climate Center, Colorado State University**

**Open Questions at the End**



# Outline

## Recent Climate Conditions

- December and 2020 review
- Last 60-, 90-days

## Current Hydrology Conditions

- Snow, Soils, & Streams (oh my!)
- Drought
- Great Lakes

## Impacts

- Earth, Wind, & Fire

## Outlooks

- ENSO & Short-term
- Winter & Spring



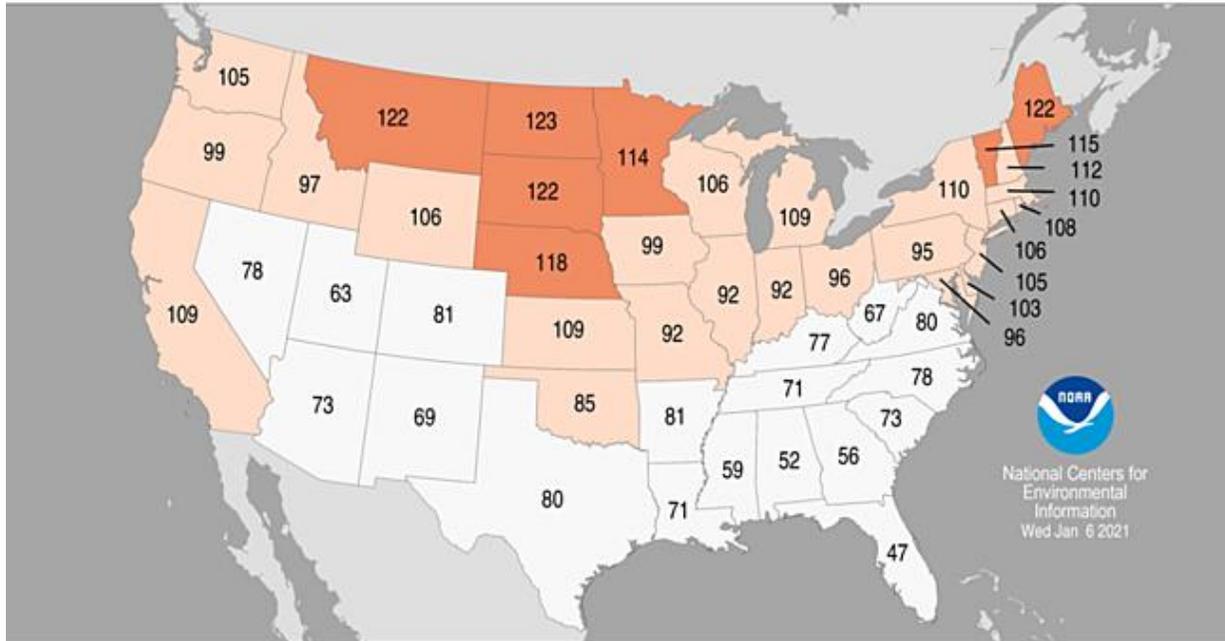
# Recent Climate Conditions



# December Climate Review

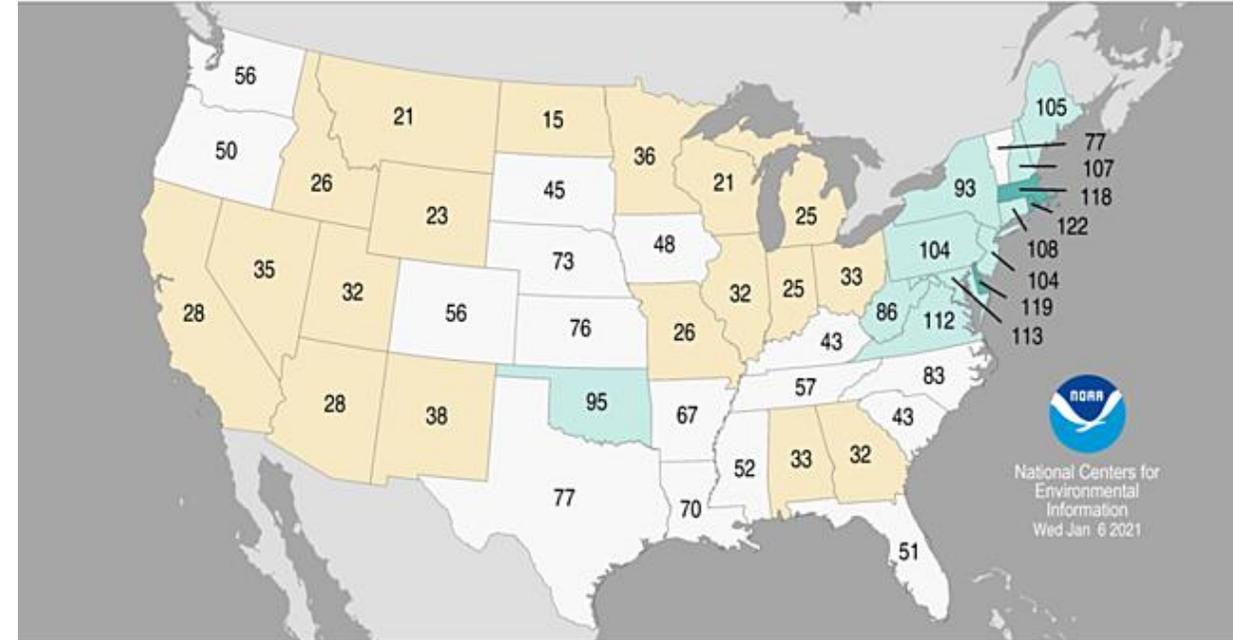
## Statewide Average Temperature Ranks

December 2020  
Period: 1895–2020



## Statewide Precipitation Ranks

December 2020  
Period: 1895–2020



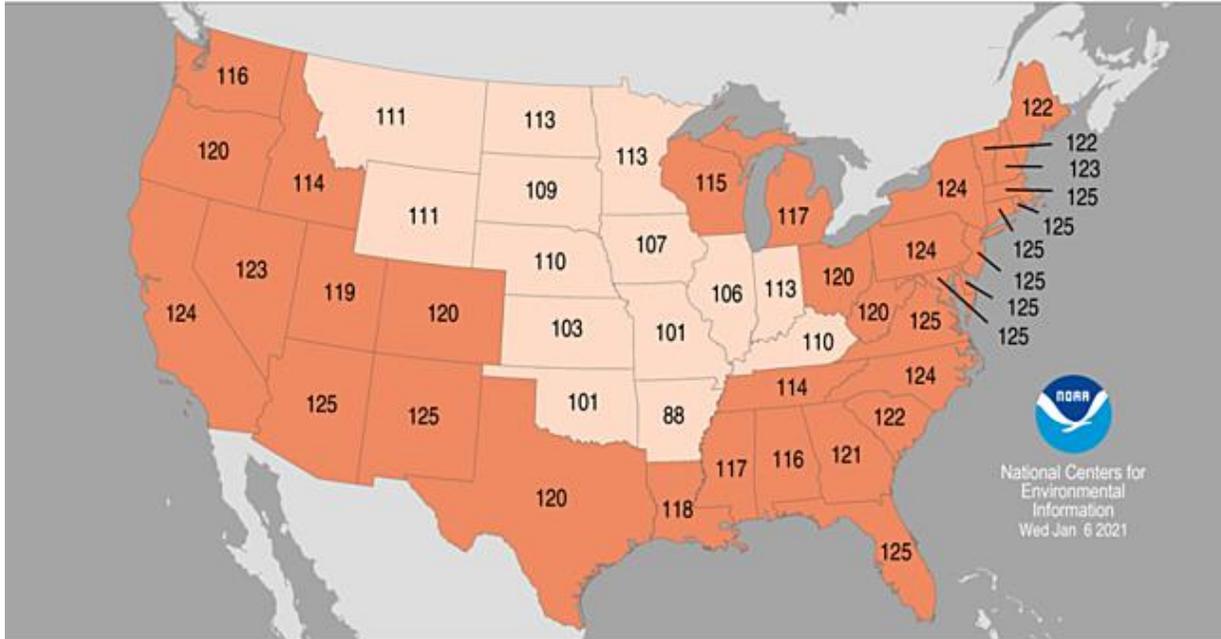
- Top 10 warmest December in MT, SD, ND, NE
- Drier than average in most states

Source: <https://www.ncdc.noaa.gov/temp-and-precip/us-maps/>

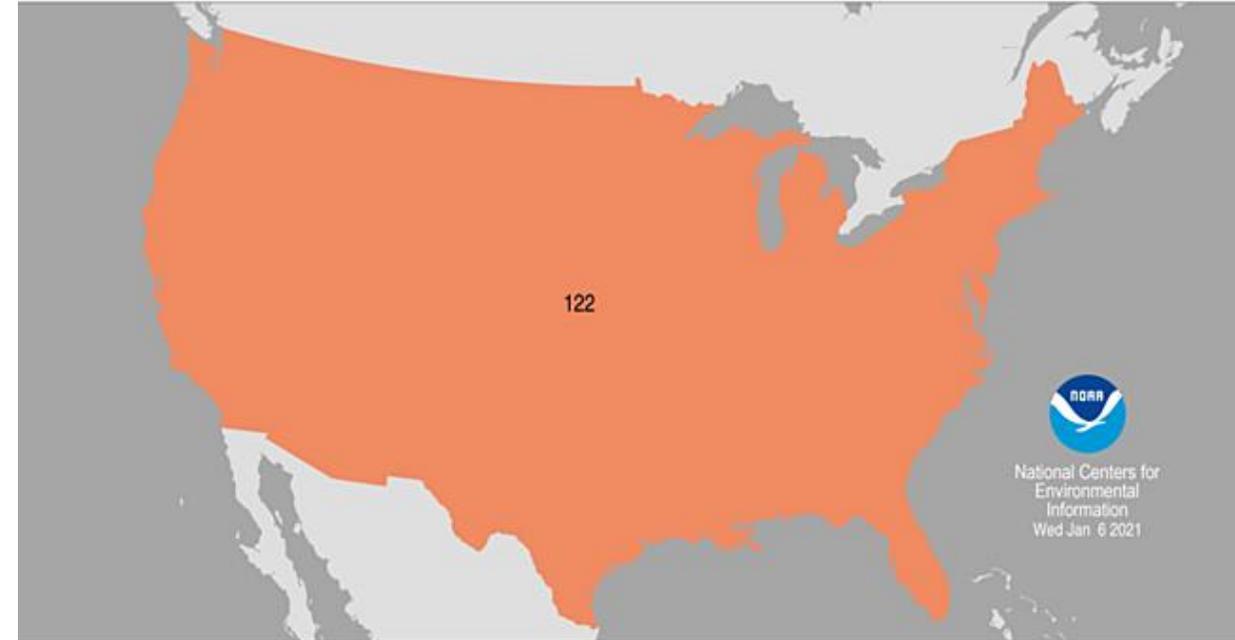


# 2020 Annual Review – Temperature

Statewide Average Temperature Ranks  
January – December 2020  
Period: 1895–2020



National Average Temperature Rank  
January–December 2020  
Period: 1895–2020



- 2020 was warmer than average for every state in the region, top 10 warmest in OH and MI
- 5<sup>th</sup> warmest year on record across lower 48 states

Source: <https://www.ncdc.noaa.gov/temp-and-precip/us-maps/>

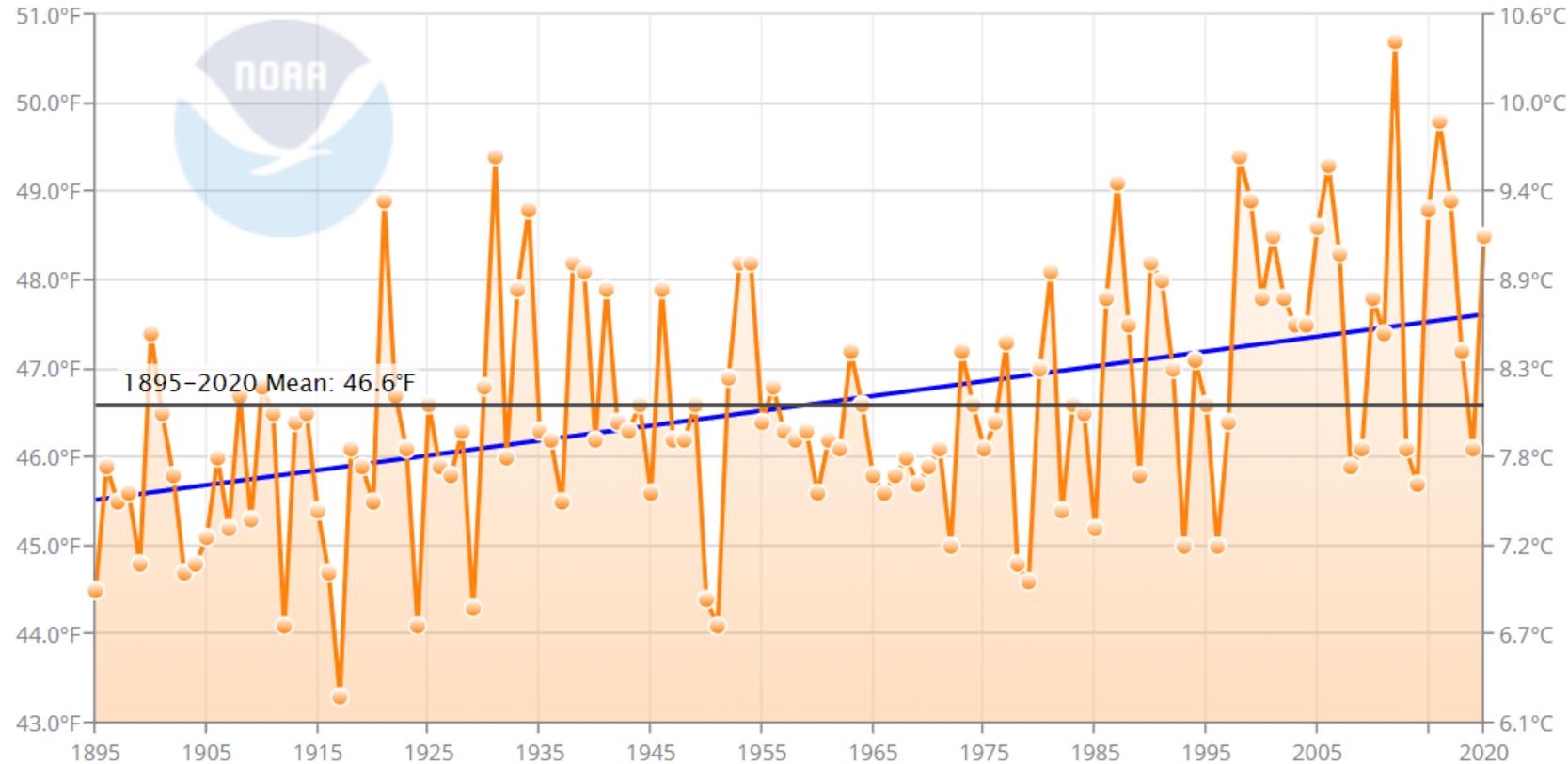


# Long-term Warming in North Central U.S.

Central NWS Region Average Temperature

January–December

1895–2020 Trend  
(+0.2°F/Decade)



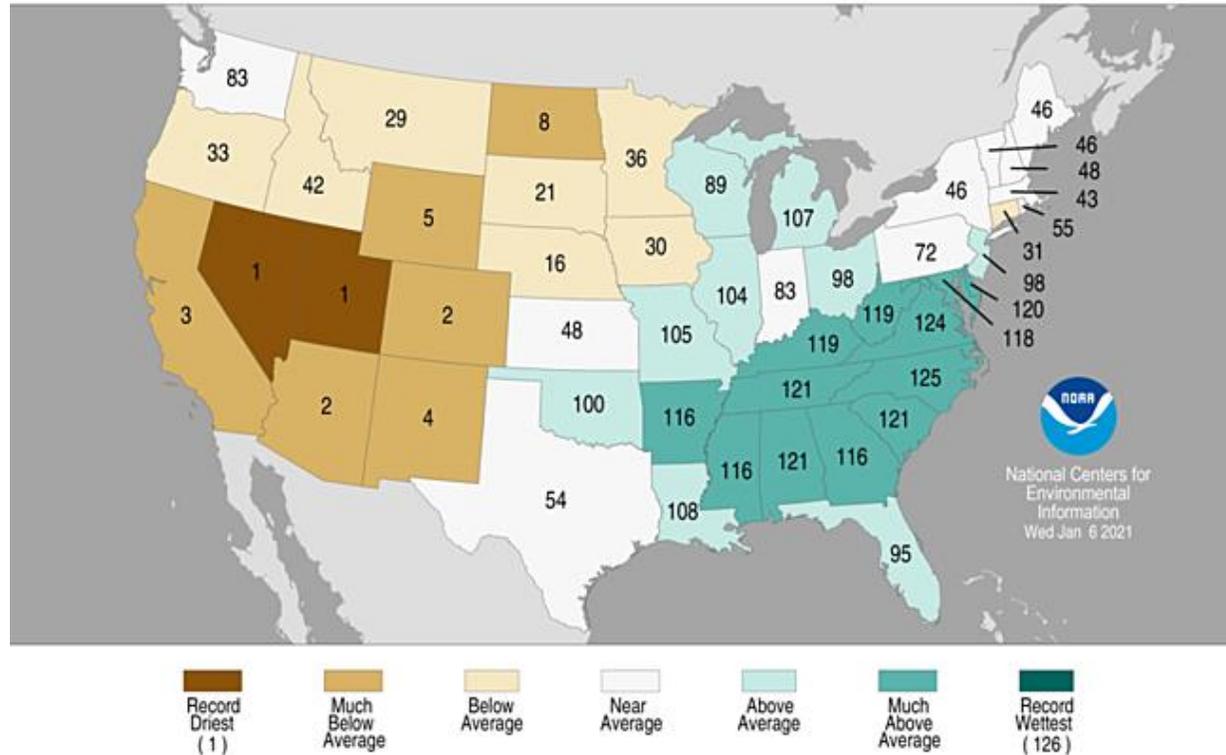
- 2020 is part of a long-term increasing trend in area from Rockies to Great Lakes
- Minimum temperature is the driver, as in this year

Source: <https://www.ncdc.noaa.gov/cag/regional/mapping>



# 2020 Annual Review - Precipitation

Statewide Precipitation Ranks  
January – December 2020  
Period: 1895–2020



- 2020 was very wet in southeast US, very dry in west/northwest US
- Top 10 driest year on record in ND, WY, and CO... 2<sup>nd</sup> driest on record in CO (after 2002)
- Top 3 driest years on record in CO have been in last 20 years (2002, 2012, 2020)
- Top 10 wettest on record in KY
- The Big Flip:
  - Sioux Falls, SD: 2018 was 2<sup>nd</sup> wettest, 2019 was wettest, 2020 was 6<sup>th</sup> driest (record back to 1893)
  - Bismarck, ND: 2019 was 2<sup>nd</sup> wettest, 2020 was 3<sup>rd</sup> driest (record back to 1874)

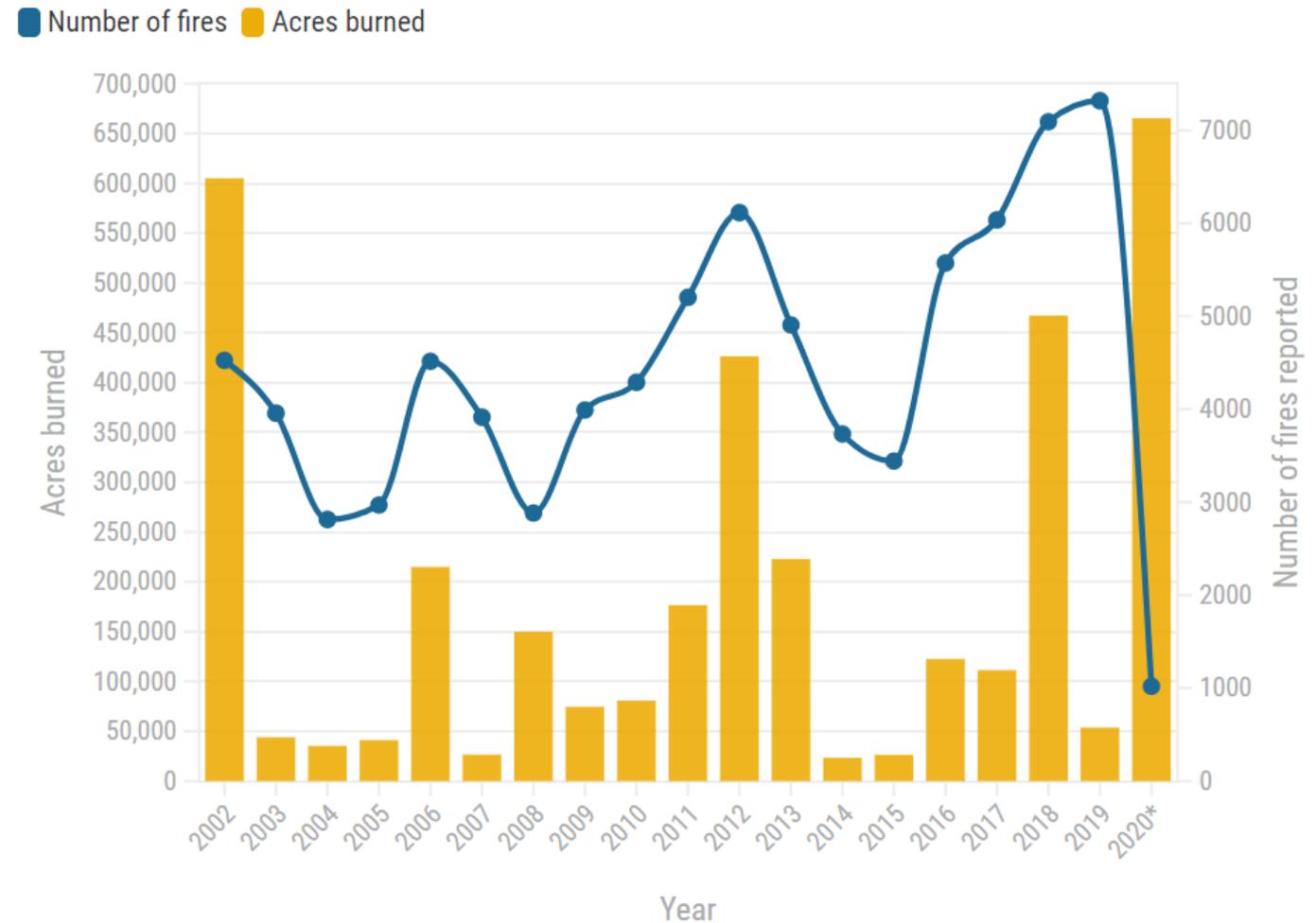
Source: <https://www.ncdc.noaa.gov/temp-and-precip/us-maps/>



# 2020 Weather Year

- Terrible wildfire year in Colorado
  - Most acres burned from fewest fires, since 2000
- Derecho on August 10<sup>th</sup>
  - \$11 billion in insurance claims so far in IA
  - 3.5 million corn acres, 2.5 million bean acres destroyed
  - Significant specialty crop damage in IA
- 22, \$1+ billion disasters nationwide, most on record
  - Severe storms across the region
  - Wildfires in CO

## Number of wildfires and acres burned in Colorado by year

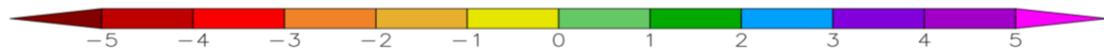
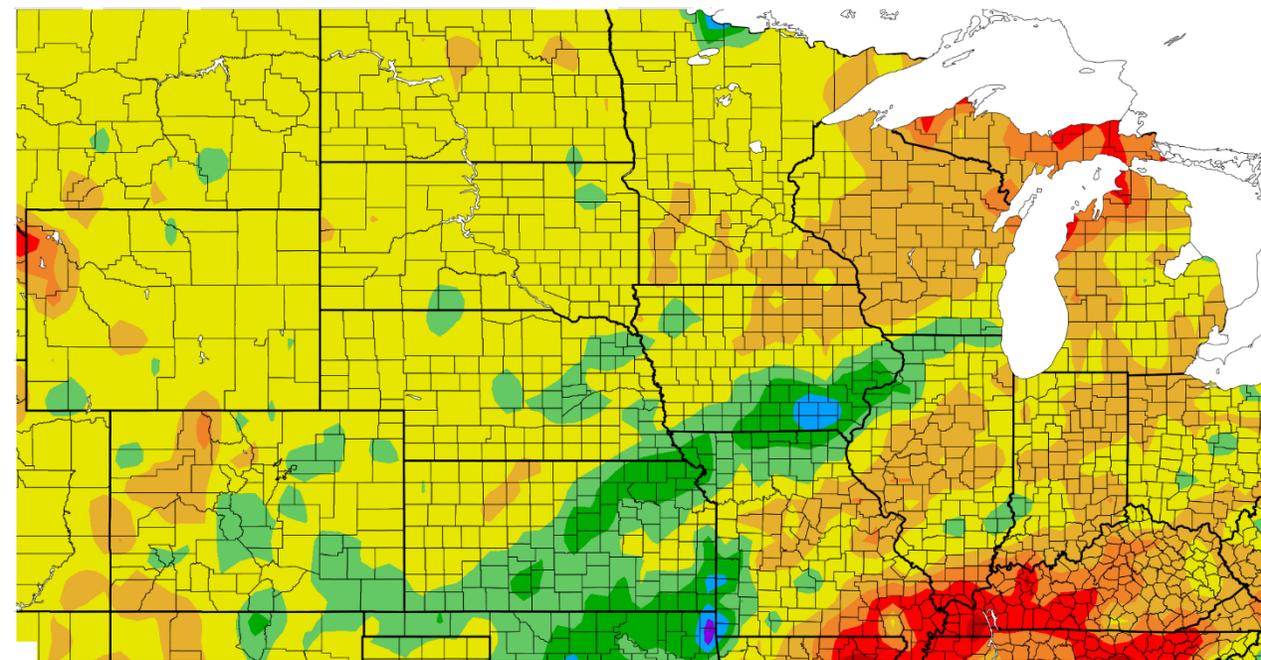


Source: The Colorado Sun

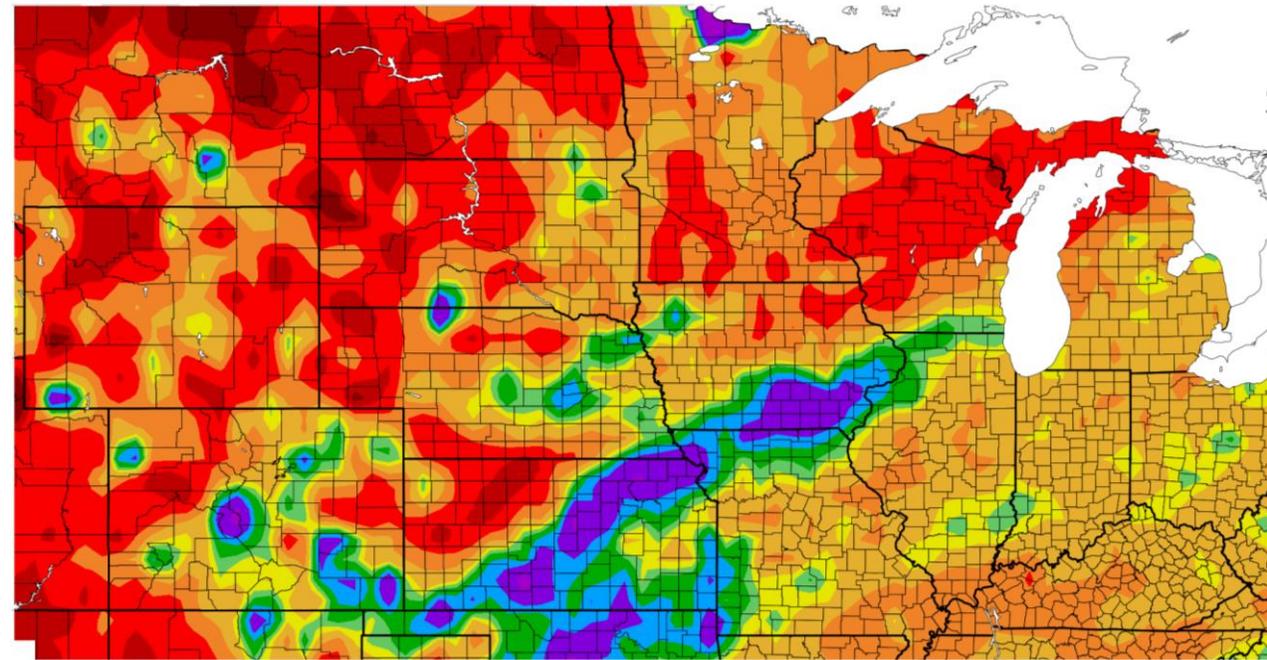


# Precipitation – Last 60 Days

## Departure from Normal (inches)



## Percent of Normal (%)

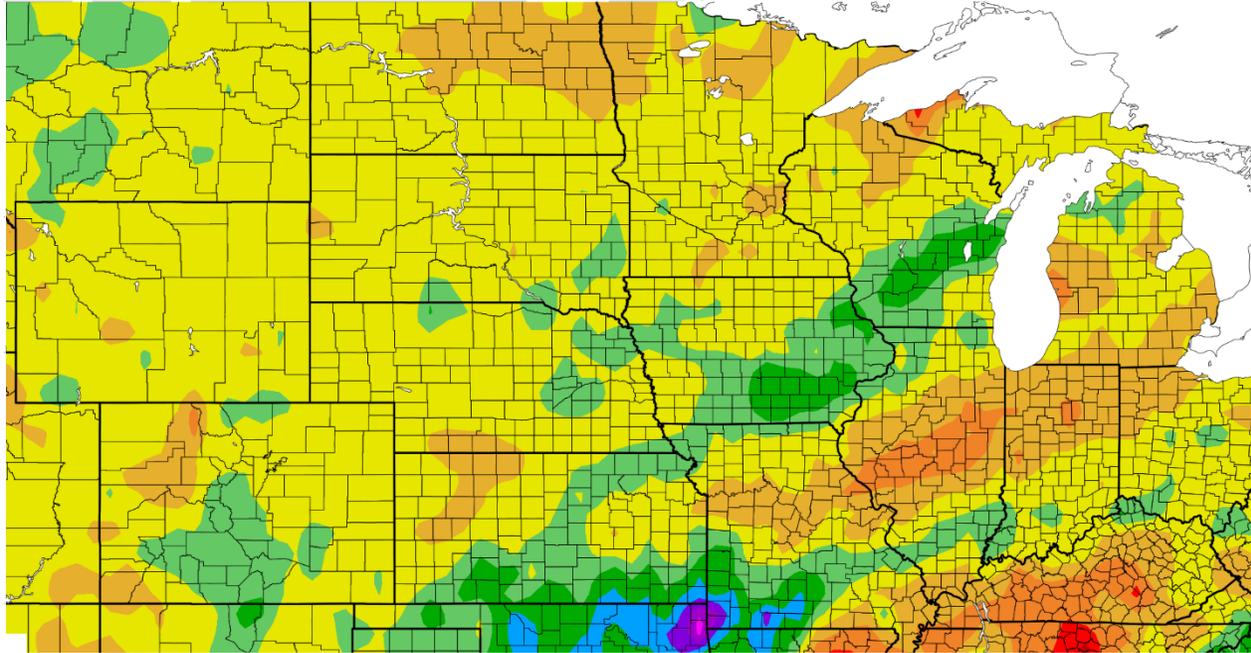


Source: HPRCC, [hprcc.unl.edu](http://hprcc.unl.edu)

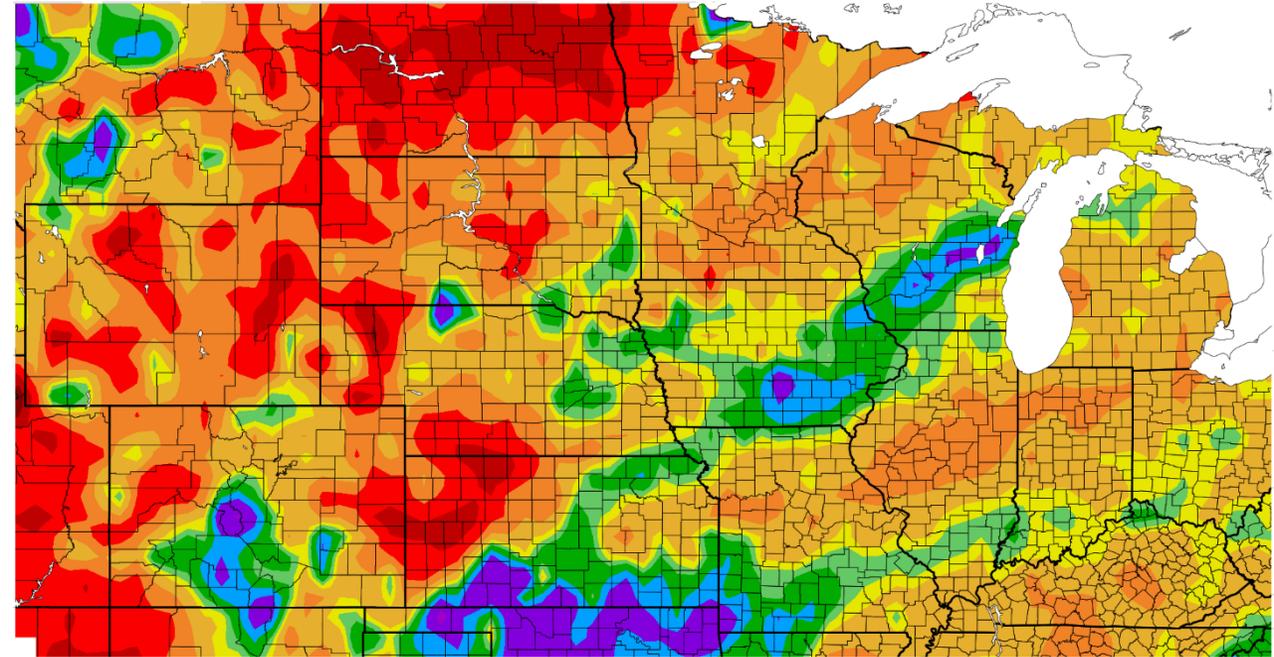
- Most of the region is 1 to 4" drier than normal since November
- Parts of the northern Plains have had < 10% of normal precipitation over last 60 days
- Normally driest time of the year for much of the region

# Precipitation – Last 90 Days

## Departure from Normal (inches)



## Percent of Normal (%)

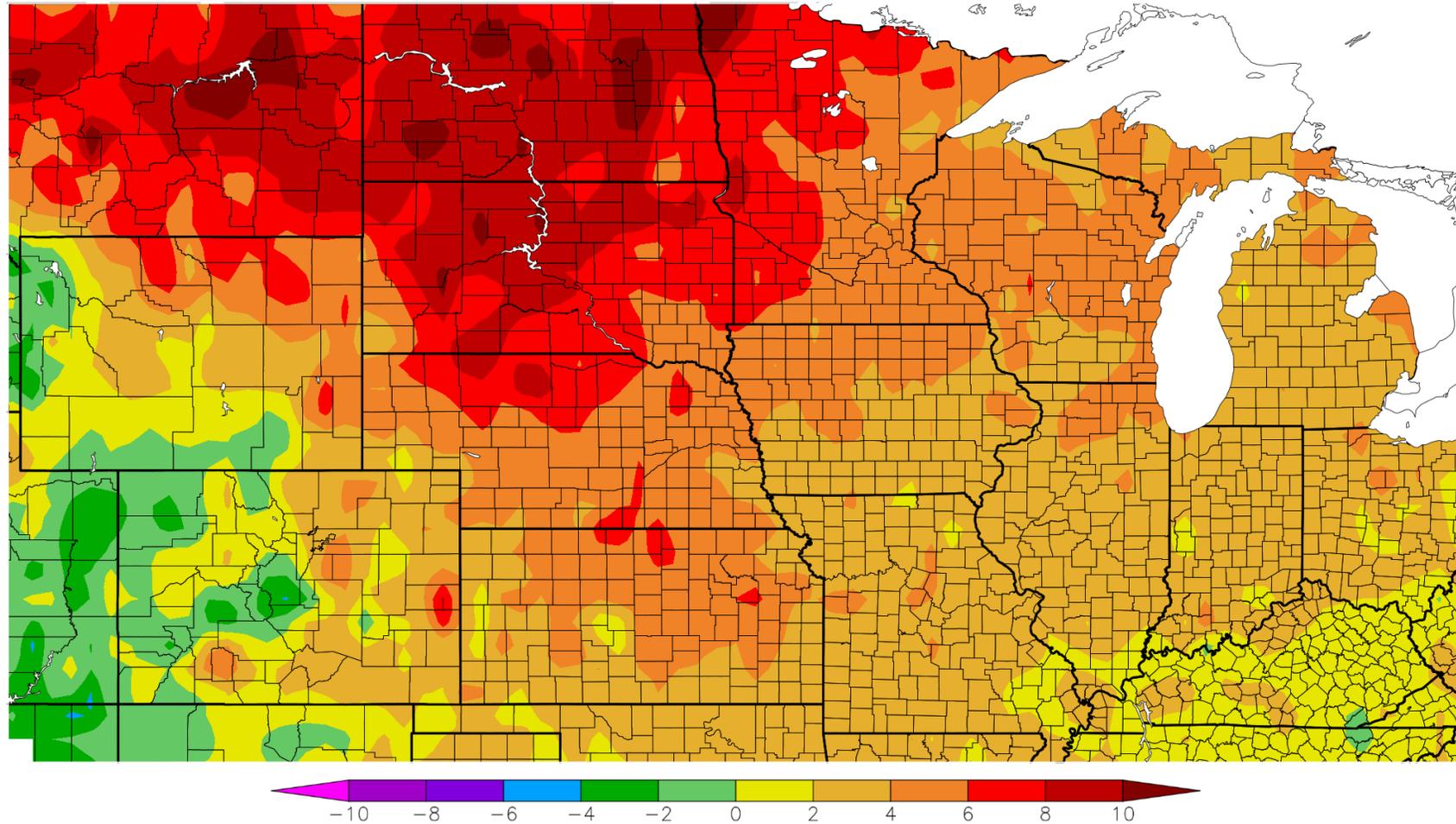


Source: HPRCC, [hprcc.unl.edu](http://hprcc.unl.edu)

- Most of the region drier than normal at 90-days, too
- 2 to 5" deficits equate to less than 70% of normal in most places, < 25% of normal in parts of ND, NE, KS



# Temperature Departure (°F) 60-day

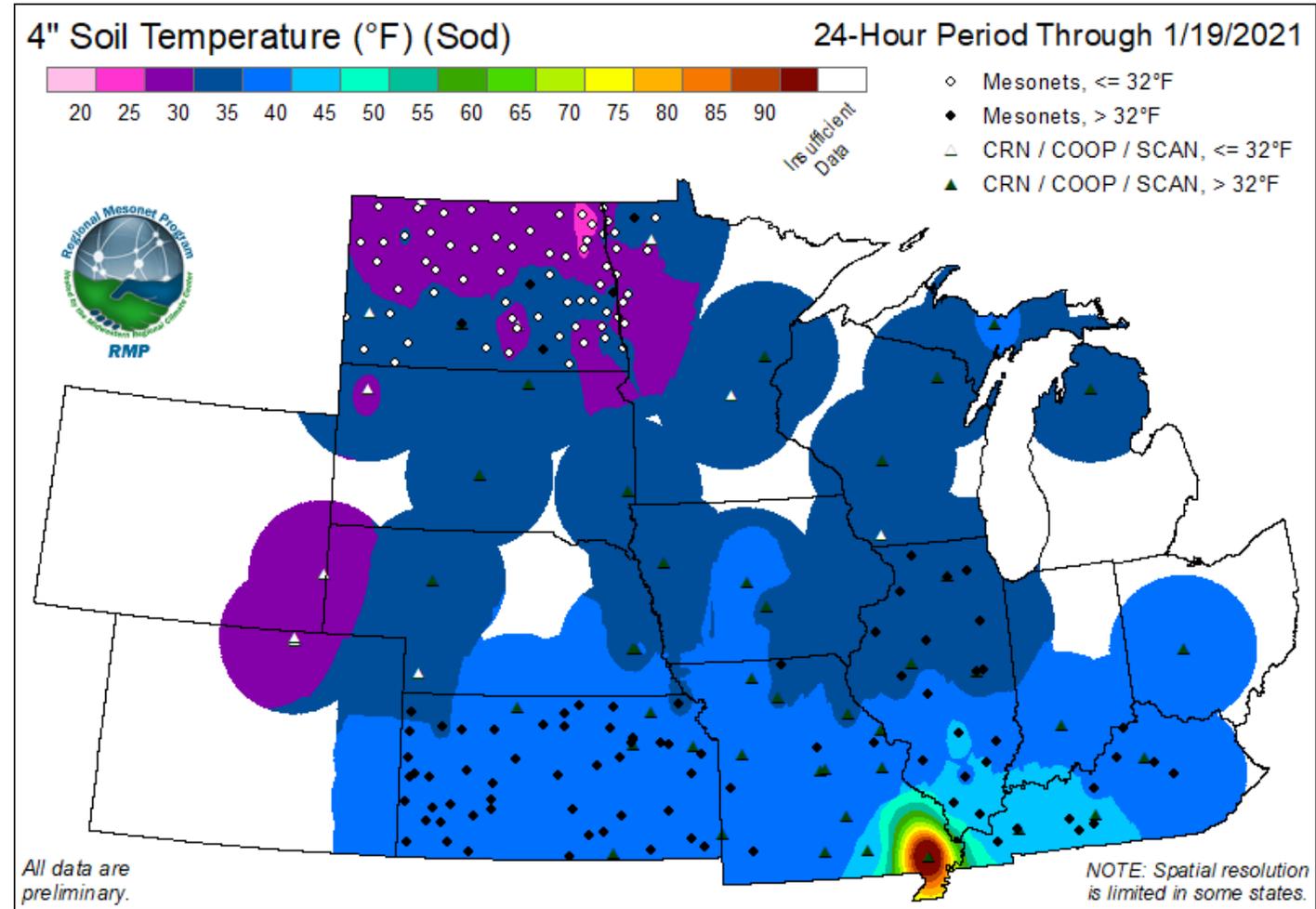


Source: HPRCC, [hprcc.unl.edu](http://hprcc.unl.edu)

- Virtually all areas warmer than normal since November; 8 to 10 degree departures in northern Plains

# Soil Temperatures – 4” Sod

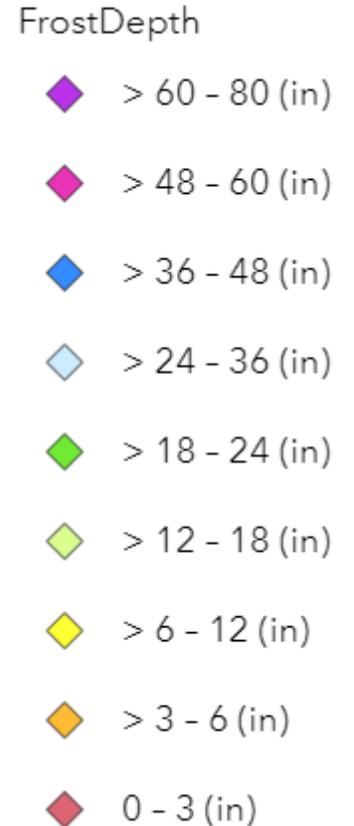
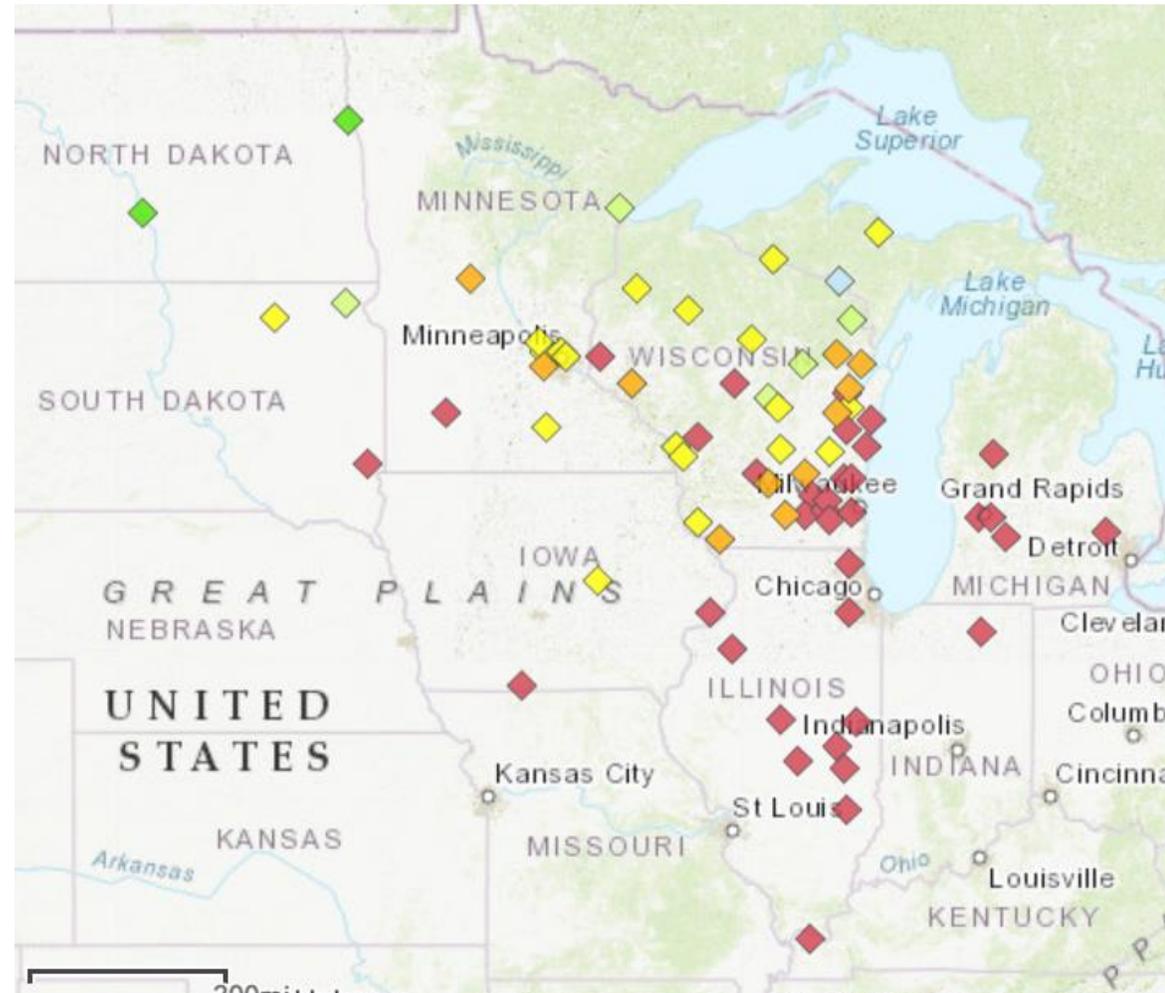
- Only stations in northern half of ND, eastern CO are below freezing
- Temperatures remain in high 30s/low 40s in southern third of the region



Source: MRCC, <https://mrcc.illinois.edu/RMP/currentMaps.html#banner>

# Soil Temperatures & Frost Depth

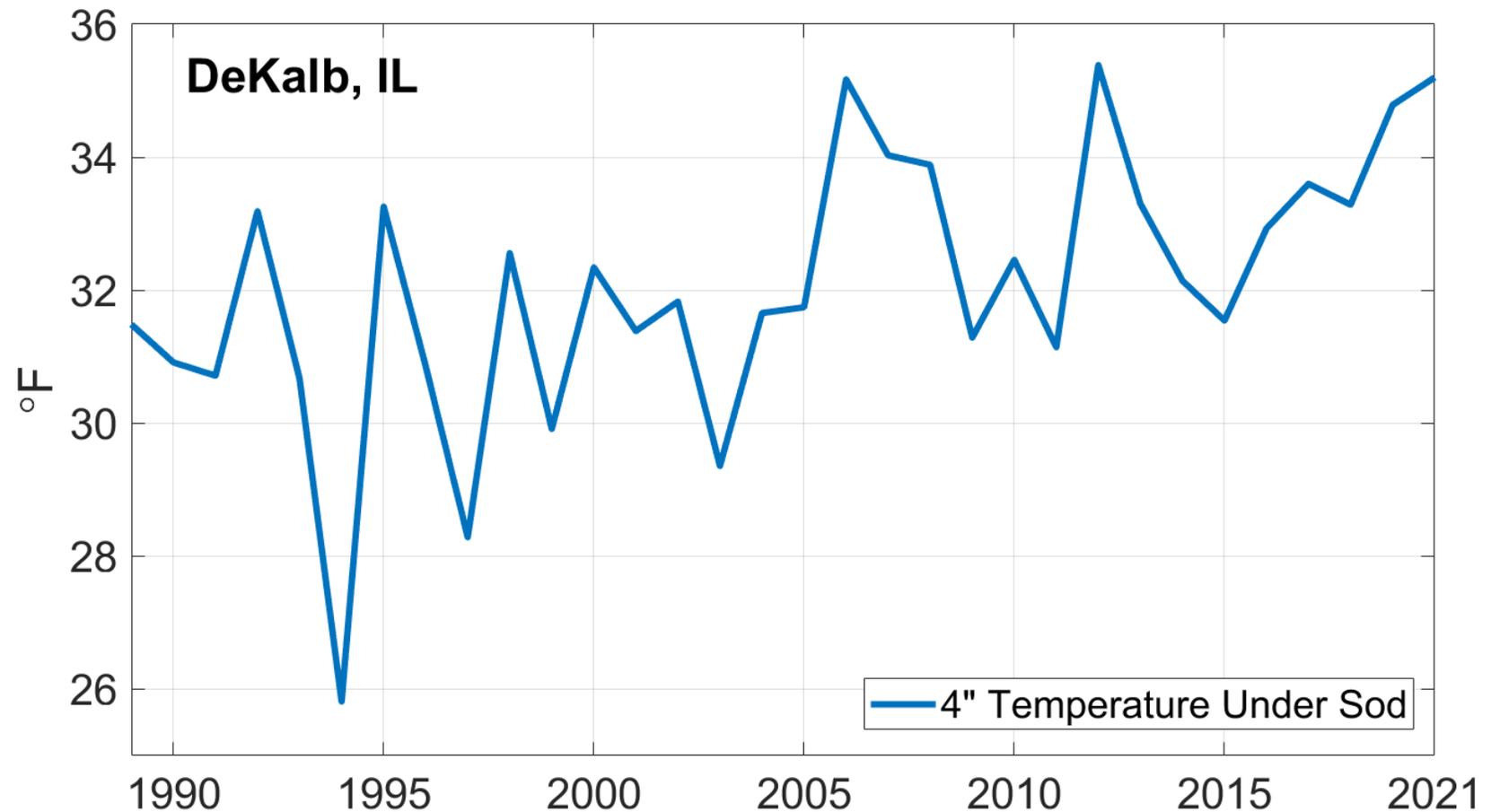
- Frost depths range from 18-24" in ND to less than 3" in IL and MI
- Potential for infiltration with precipitation
- Reduced snowpack increases risk of quick soil frost depth fluctuations



Source: NWS, [https://www.weather.gov/ncrfc/LMI\\_FrostDepthMap](https://www.weather.gov/ncrfc/LMI_FrostDepthMap)

# Very Warm Soils

- Plot shows January 4" soil temperature under sod in northern Illinois
- Second highest this time of the year, after 2012
- Both 2006 and 2012 were warm, dry winters in IL

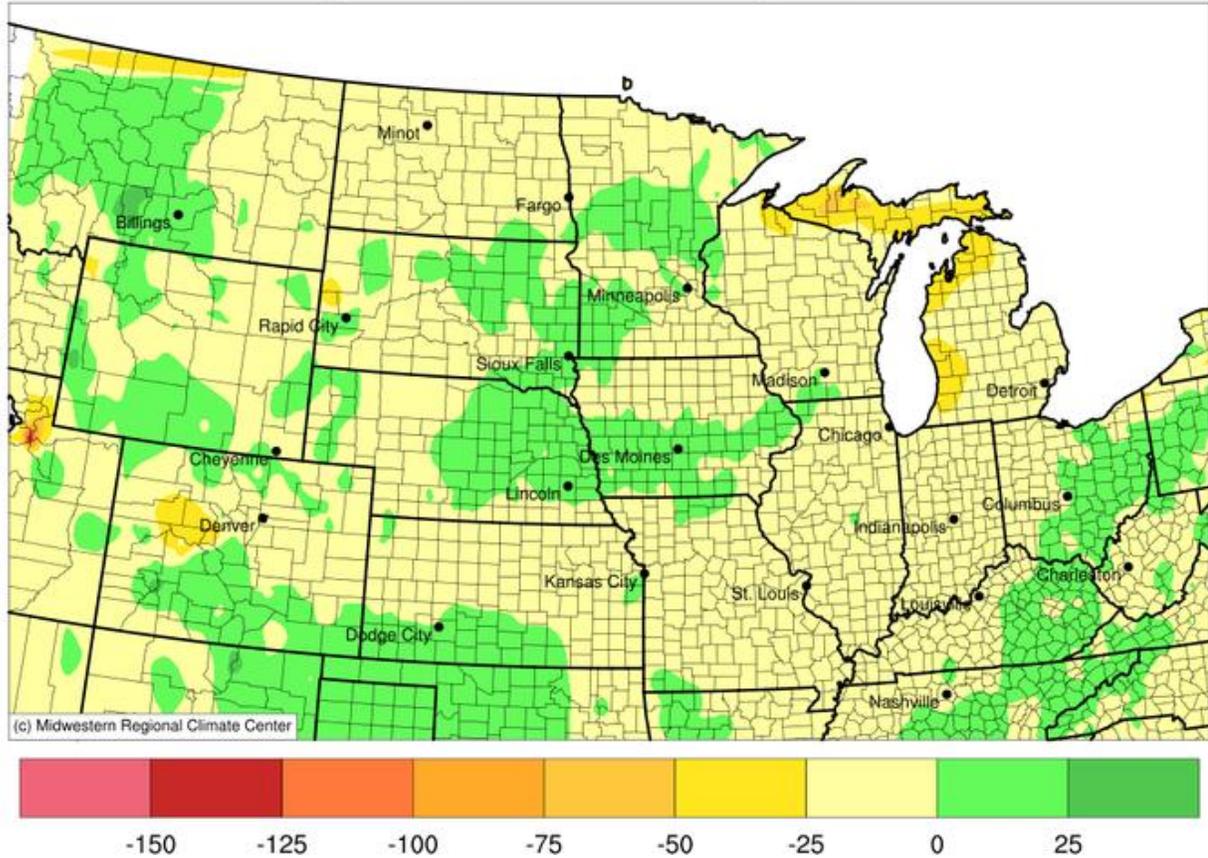


Source: Illinois Climate Network, <https://www.isws.illinois.edu/warm/weather/>

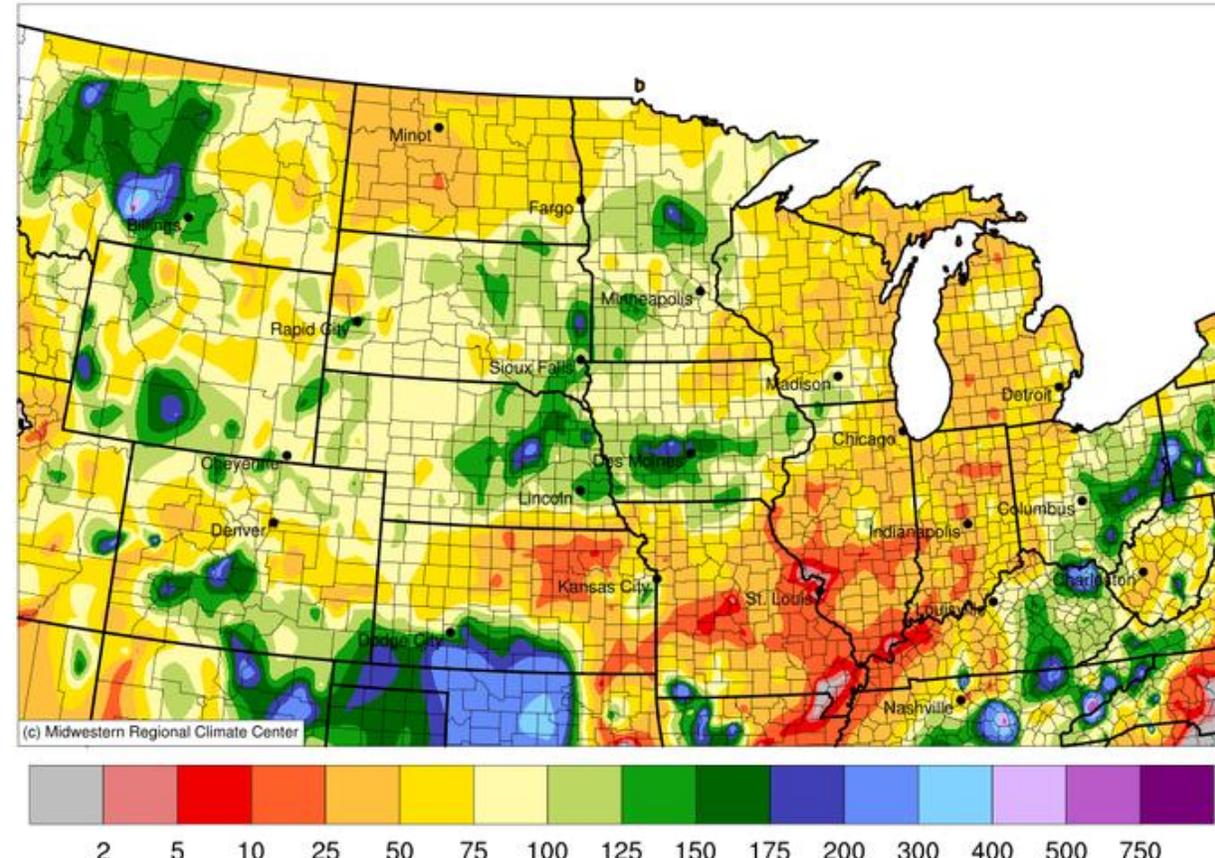


# Accumulated Snowfall (Since August 1<sup>st</sup>)

## Departure from Normal (inches)



## Percent of Normal (%)



Source: MRCC, <https://mrcc.illinois.edu/CLIMATE/Maps>

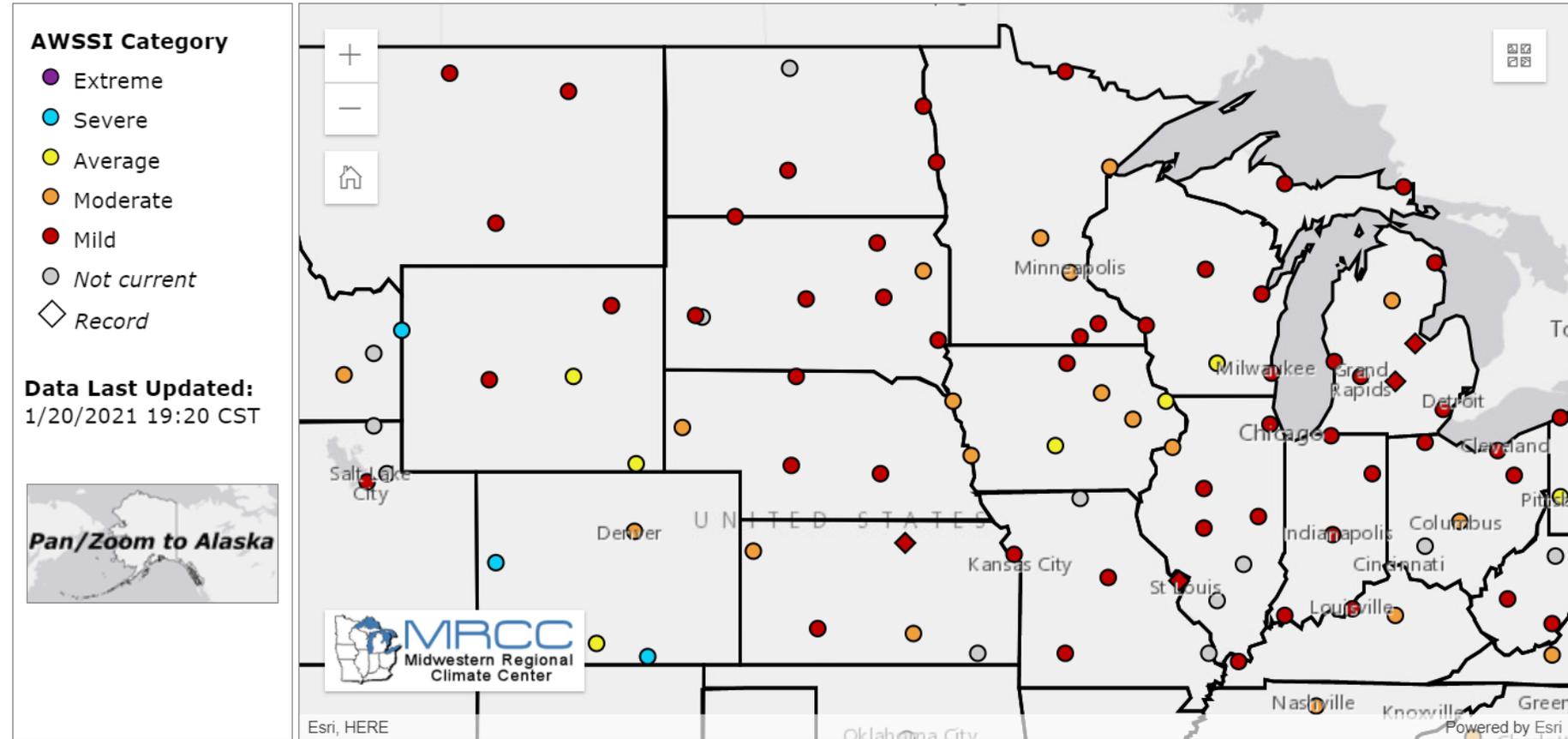
- Most of Upper Midwest and eastern corn belt have had < 75% normal snowfall



# “Winter” Severity So Far

## Accumulated Winter Season Severity Index (AWSSI)

- Daily accumulation based on snowfall, snow depth, minimum/maximum temperature
- Represents cumulative winter season “severity” with respect to historical record
- Severity at all stations in red is less than 20<sup>th</sup> percentile
- Record “mild” winter so far in St. Louis, Lansing, Saginaw, and Concordia KS



Source: MRCC, <https://mrcc.illinois.edu/research/awssi/indexAwssi.jsp>



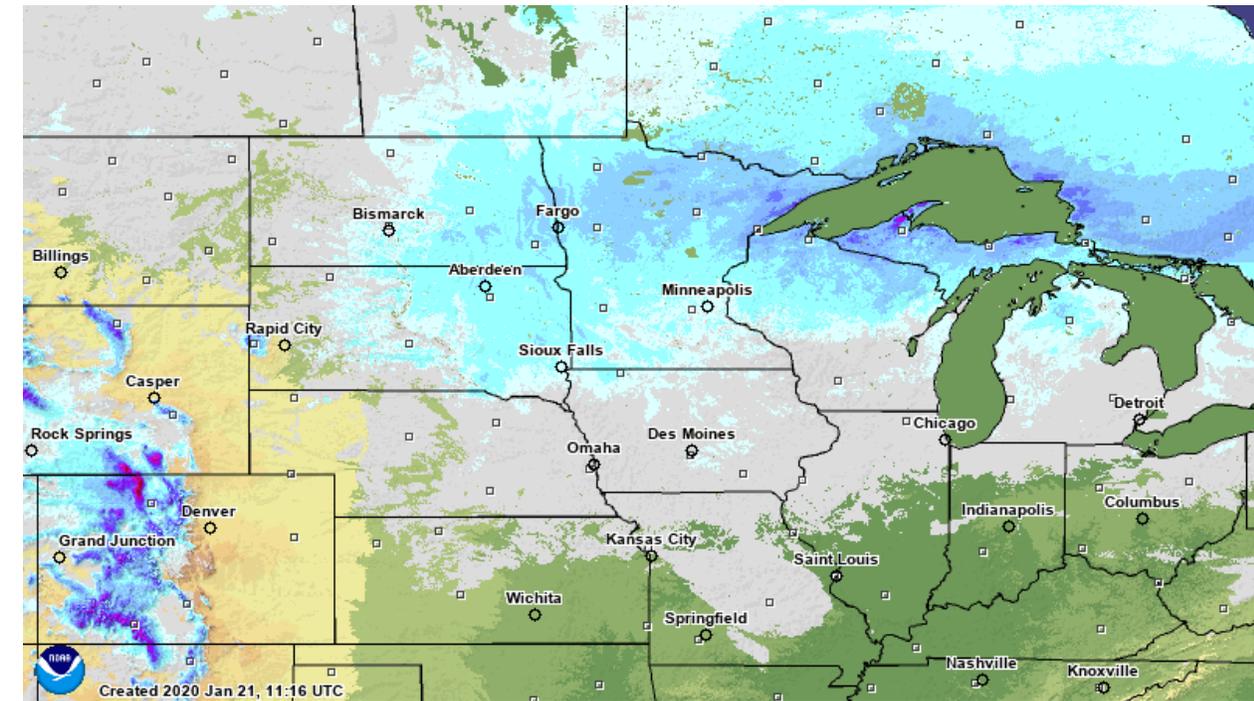
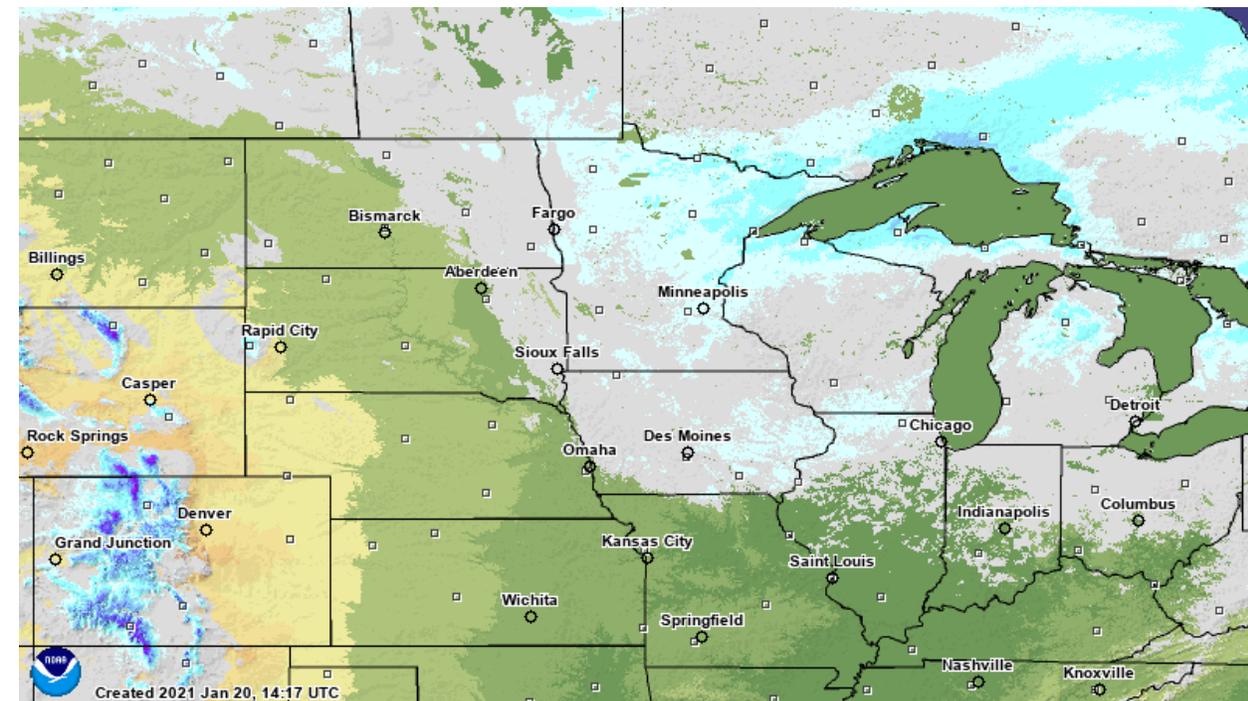
# Current Hydrology Conditions



# Snowpack (snow water equivalent)

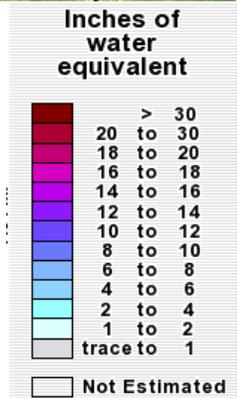
January 21, 2021

January 21, 2020



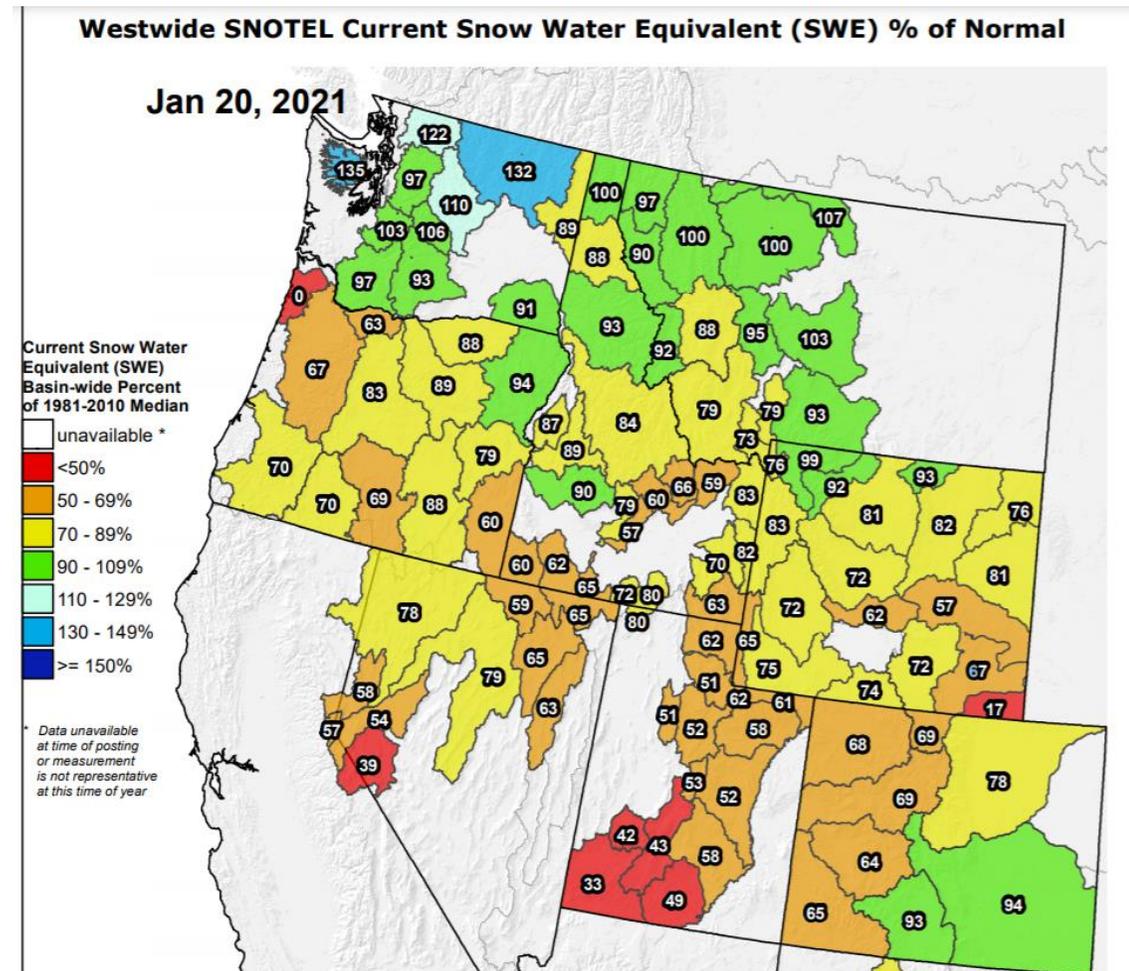
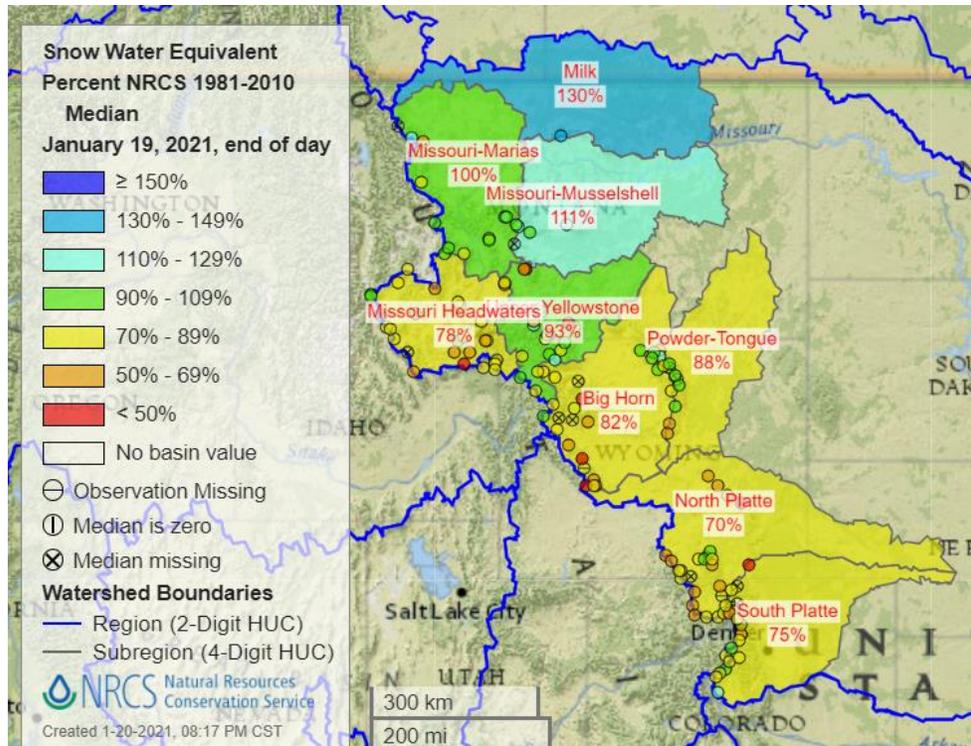
<https://www.nohrsc.noaa.gov/interactive/html/map.html>

- Reduced snowpack across the region, relative to last year
- Large differences from last year in Dakotas, upper Midwest



# Mountain Snowpack

- USDA/NRCS Snow Water Equivalent (% normal)
- Most MT basins are near to above average
- Missouri Headwaters at 78%, Plattes at 70% and 75%



<https://www.nrcs.usda.gov/wps/portal/wcc/home/quicklinks/imap>

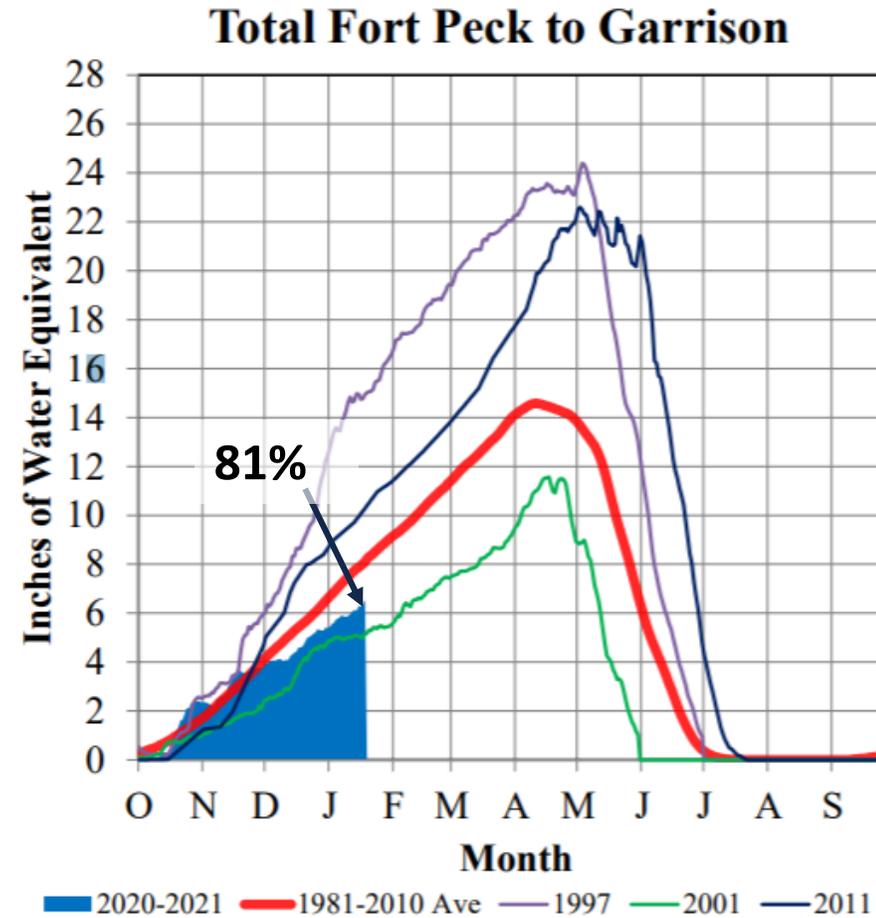
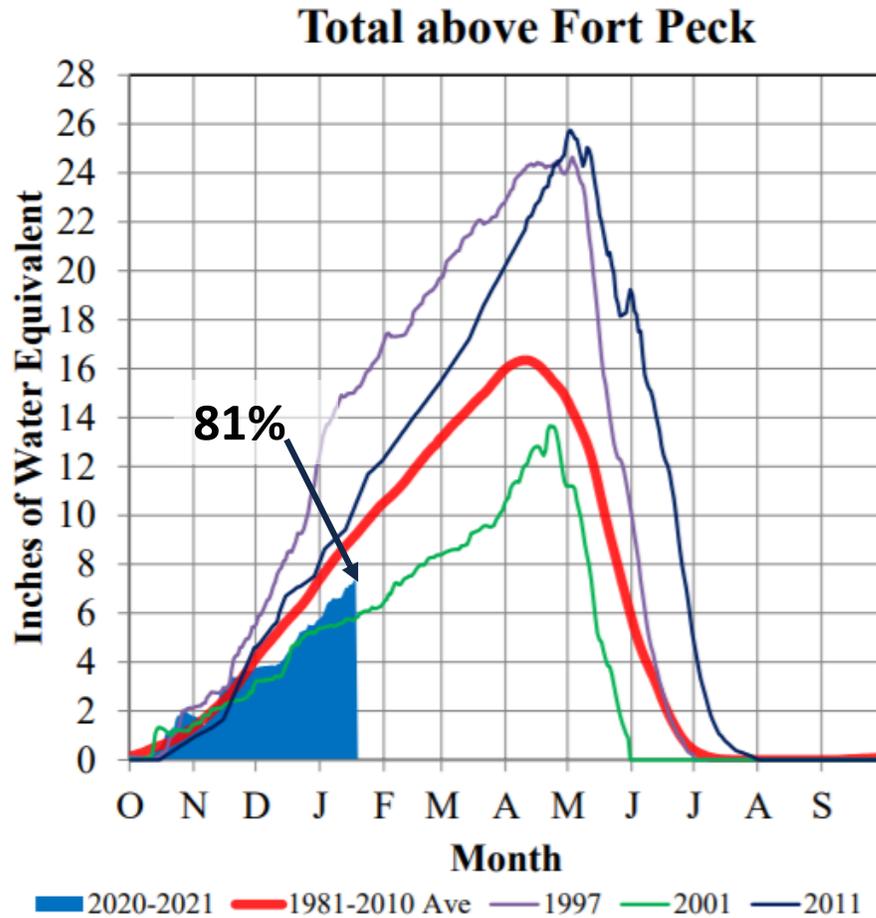
<https://www.wcc.nrcs.usda.gov/snow/snotel-wereports.html>



# Mountain Snowpack – Missouri River Basin

## Missouri River Basin – Mountain Snowpack Water Content 2020-2021 with comparison plots from 1997\*, 2001\*, and 2011

18-Jan-2021



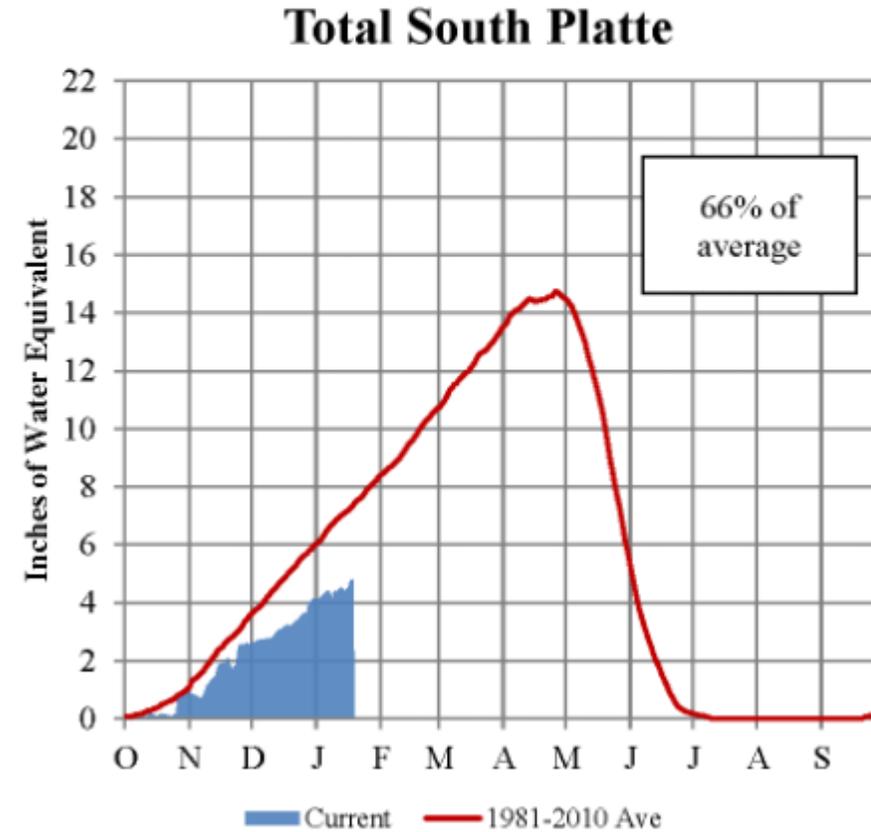
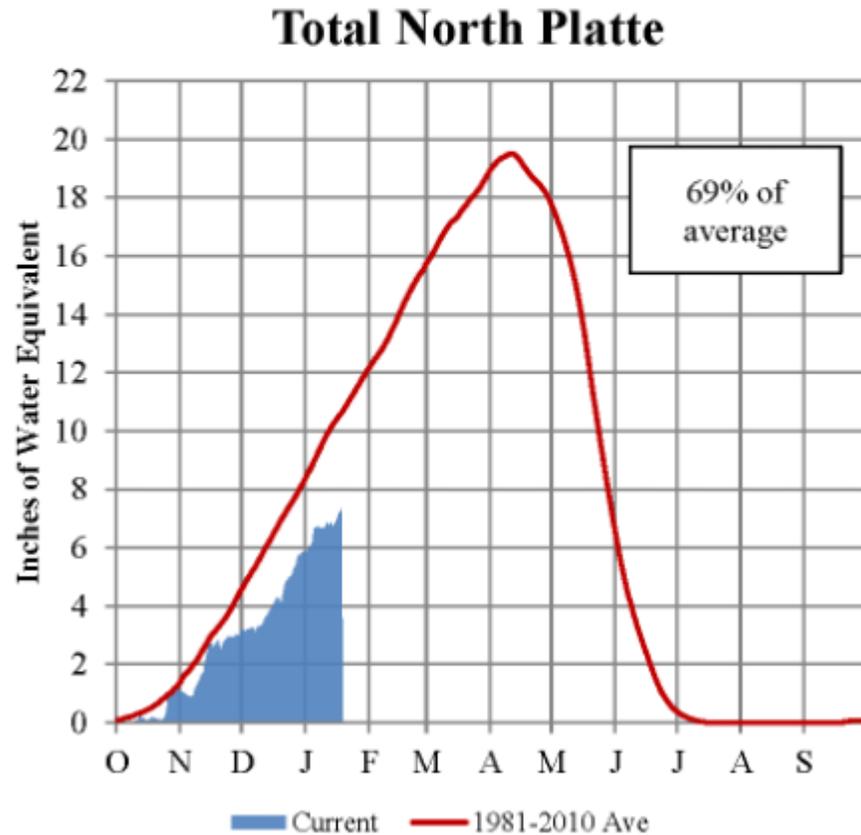
<http://www.nwd-mr.usace.army.mil/rcc/reports/snow.pdf>



# Mountain Snowpack – Missouri River Basin

## Platte River Basin - Mountain Snowpack Water Content Water Year 2020-2021

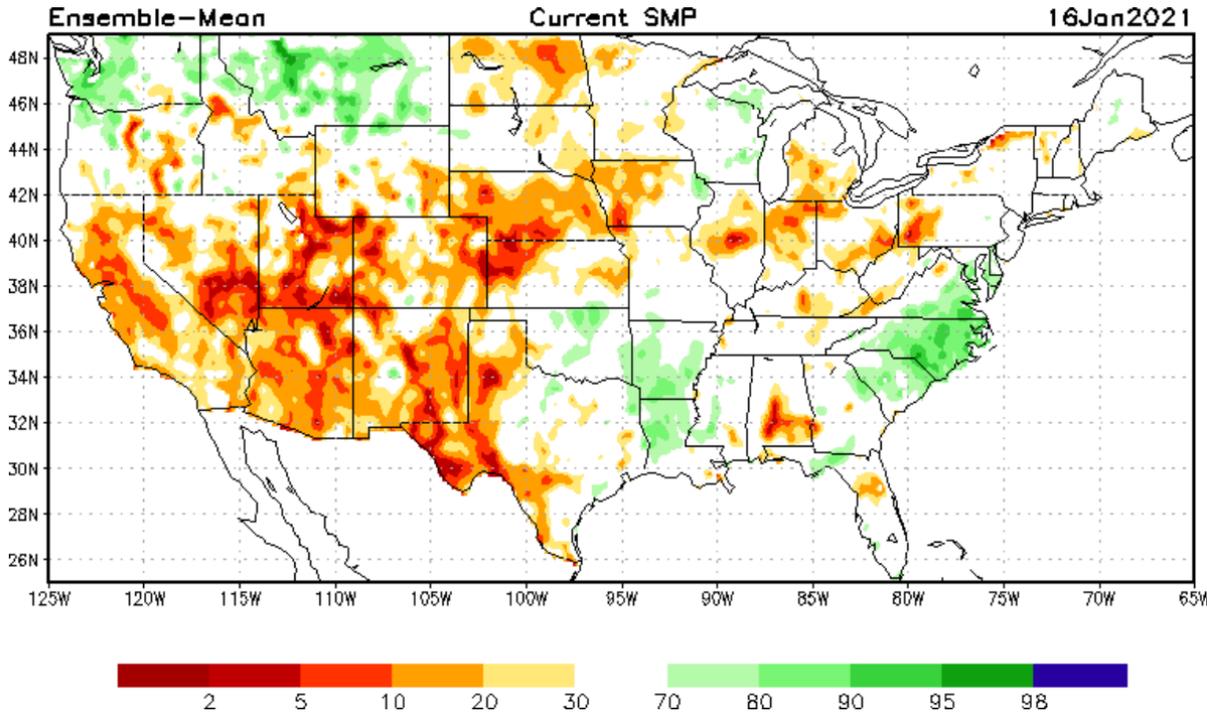
January 19, 2021



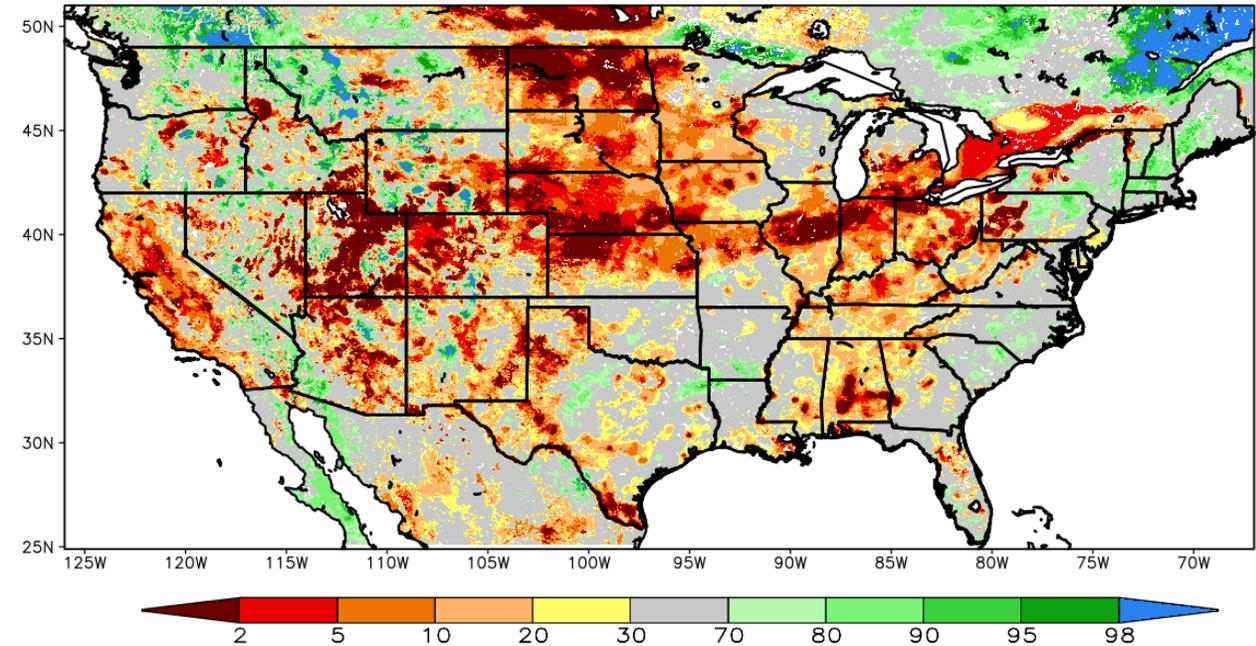
<http://www.nwd-mr.usace.army.mil/rcc/reports/snow.pdf>



# Soil Moisture: 0 – 40” Percentiles



Source: [https://www.cpc.ncep.noaa.gov/products/Drought/Monitoring/smp\\_new.shtml](https://www.cpc.ncep.noaa.gov/products/Drought/Monitoring/smp_new.shtml)

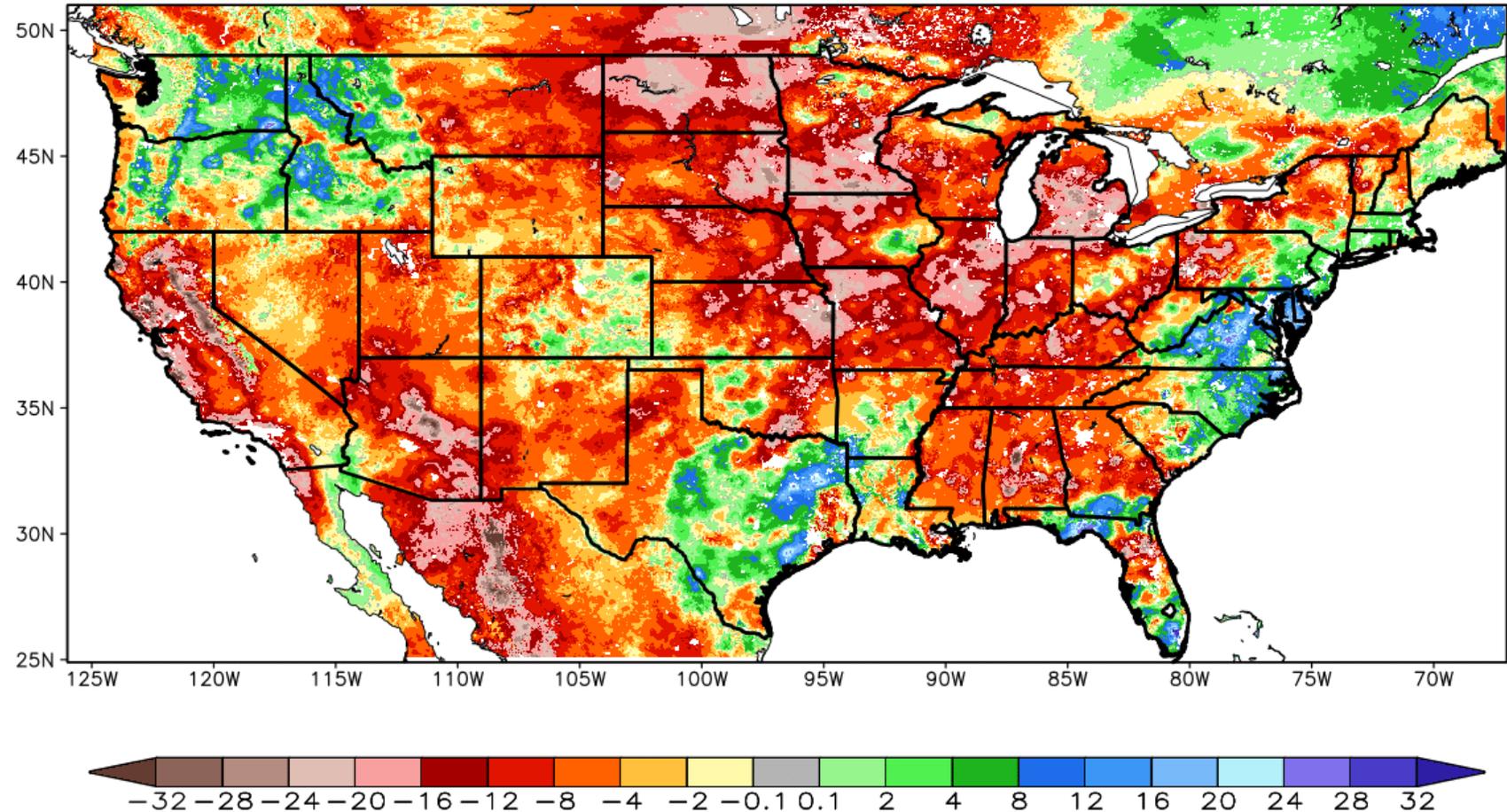


Source: [weather.msfc.nasa.gov/sport/case\\_studies/lis\\_CONUS.html](http://weather.msfc.nasa.gov/sport/case_studies/lis_CONUS.html)

- Very dry soils across central Plains and eastern corn belt
- Moisture in areas of KS, NE, ND, IL, and IN are less than 5<sup>th</sup> percentile level (1 in 20 years)

# Soil Moisture: 1-year change (% water content)

- Entire region is drier this year than last
- In driest areas, 0 – 40” column has 5 to 10” less water than last year



Source: [weather.msfc.nasa.gov/sport/case\\_studies/lis\\_CONUS.html](http://weather.msfc.nasa.gov/sport/case_studies/lis_CONUS.html)

# Streamflow

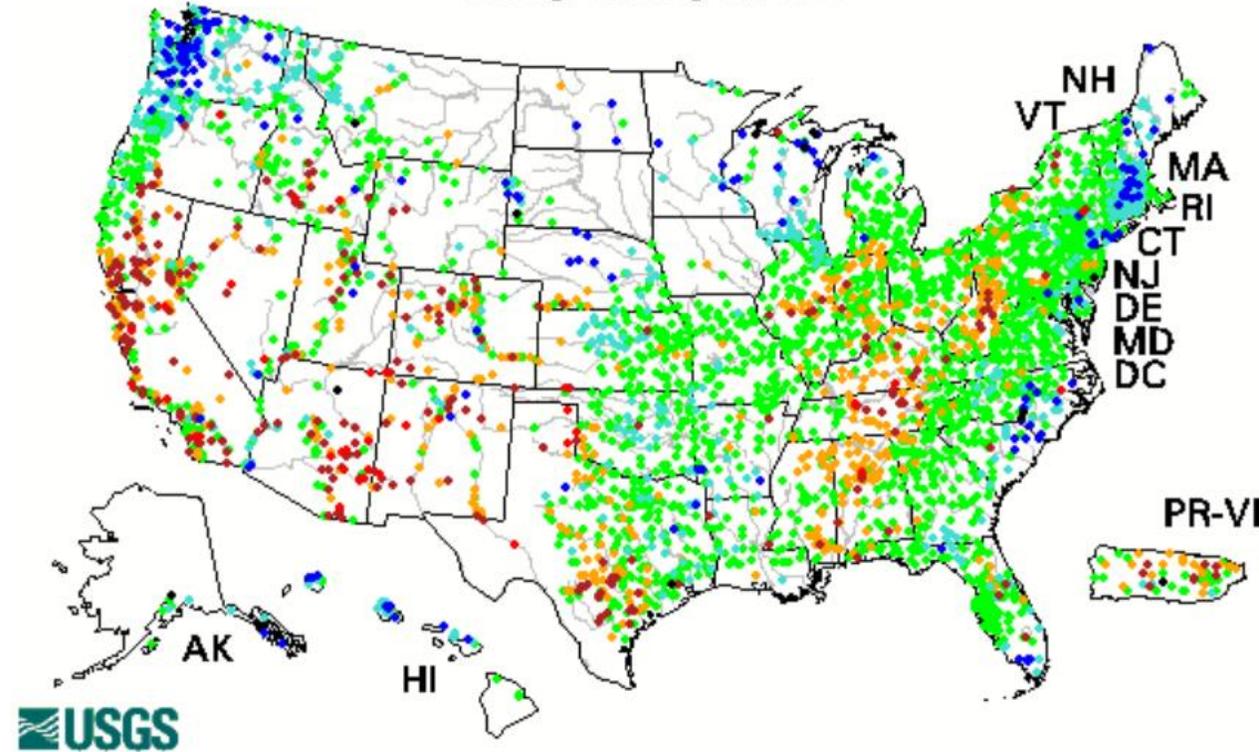
- Streamflow is below to much below normal in central IL and IN, throughout CO
- Only 1 gauge between Upper MS and MO River Basins at flood stage – Jefferson River near Three Forks, MT



Credit : Patrick Lonegran, Gallatin County (MT)

## 7-day Average Streamflow

Tuesday, January 19, 2021



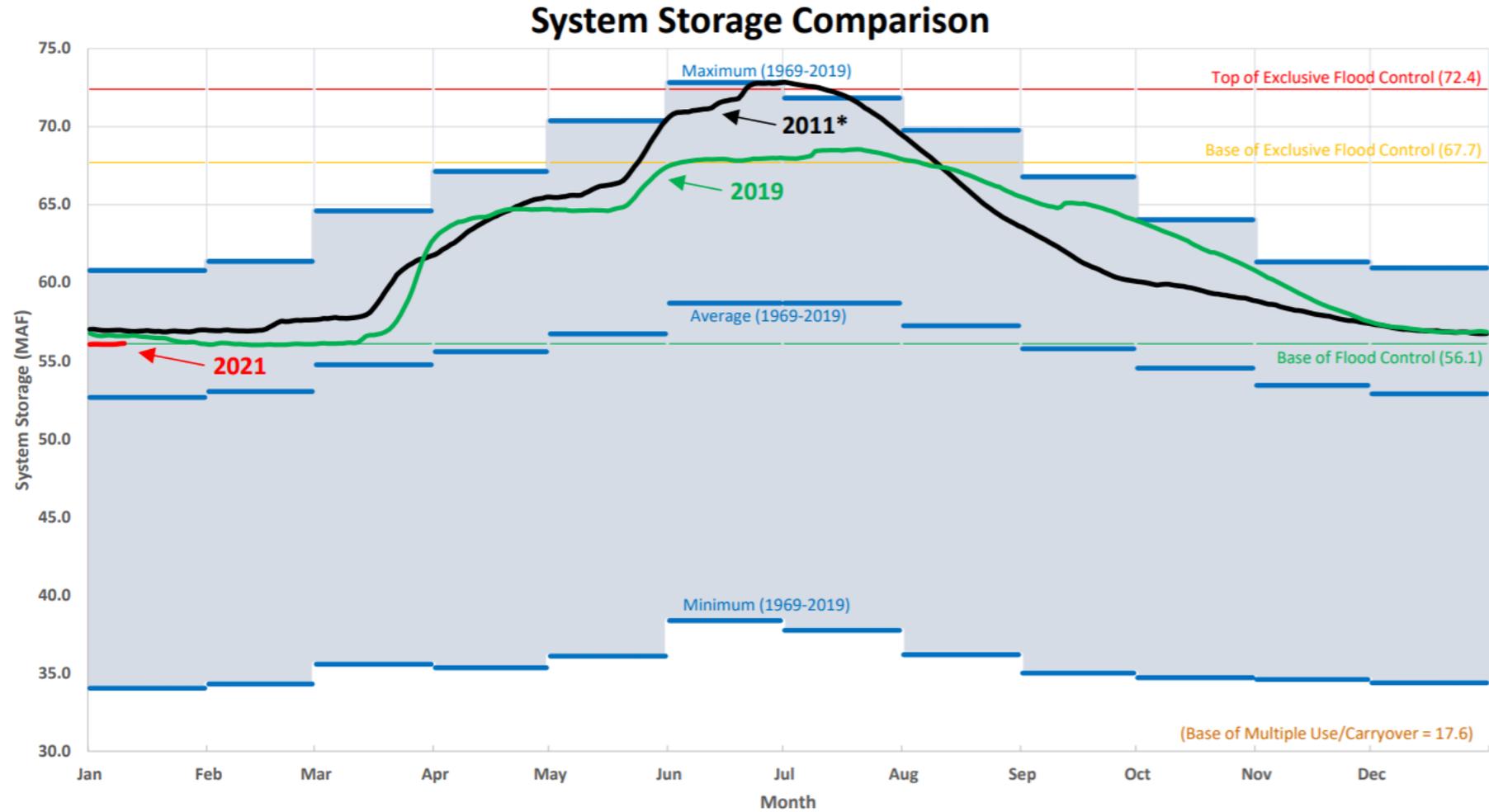
Explanation - Percentile classes						
<span style="color: red;">●</span>	<span style="color: red;">●</span>	<span style="color: orange;">●</span>	<span style="color: green;">●</span>	<span style="color: cyan;">●</span>	<span style="color: blue;">●</span>	<span style="color: black;">●</span>
Low	<10 Much below normal	10-24 Below normal	25-75 Normal	76-90 Above normal	>90 Much above normal	High

Source: [waterwatch.usgs.gov](http://waterwatch.usgs.gov)



# Missouri Mainstem River

- System storage is 56.2 million-acre feet



Source: [waterwatch.usgs.gov](http://waterwatch.usgs.gov)



# Drought

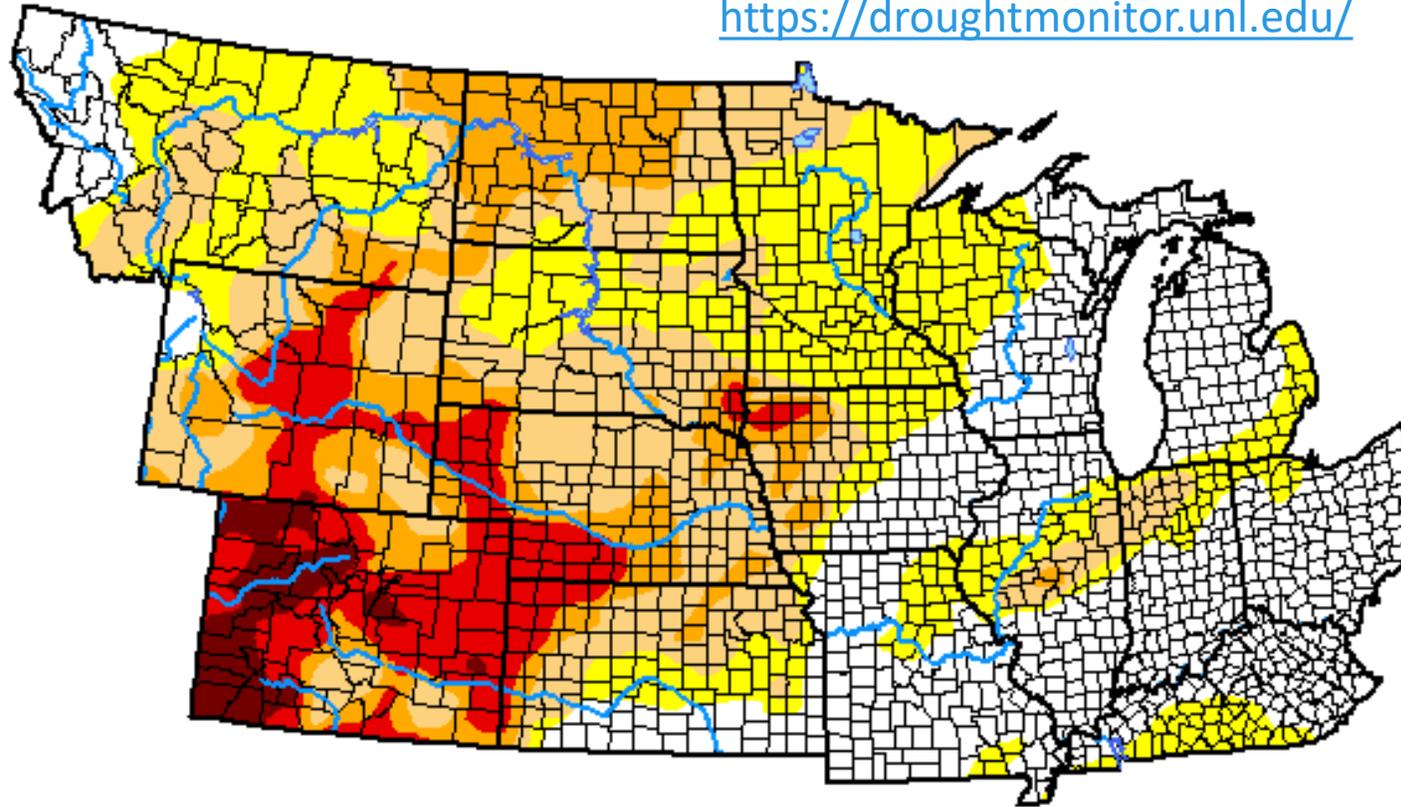
## U.S. Drought Monitor NWS Central Region

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

January 19, 2021  
(Released Thursday, Jan. 21, 2021)  
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	29.24	70.76	45.44	23.90	11.51	2.52
<b>Last Week</b> <i>01-12-2021</i>	30.27	69.73	45.16	24.13	11.54	2.52
<b>3 Months Ago</b> <i>10-20-2020</i>	24.26	75.74	45.08	23.25	10.87	1.97
<b>Start of Calendar Year</b> <i>12-29-2020</i>	30.52	69.48	46.07	24.23	12.18	2.52
<b>Start of Water Year</b> <i>09-29-2020</i>	29.60	70.40	37.34	17.96	7.13	0.24
<b>One Year Ago</b> <i>01-21-2020</i>	87.13	12.87	5.31	1.54	0.00	0.00



**Intensity:**



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  
CPC/NOAA/NWS/NCEP



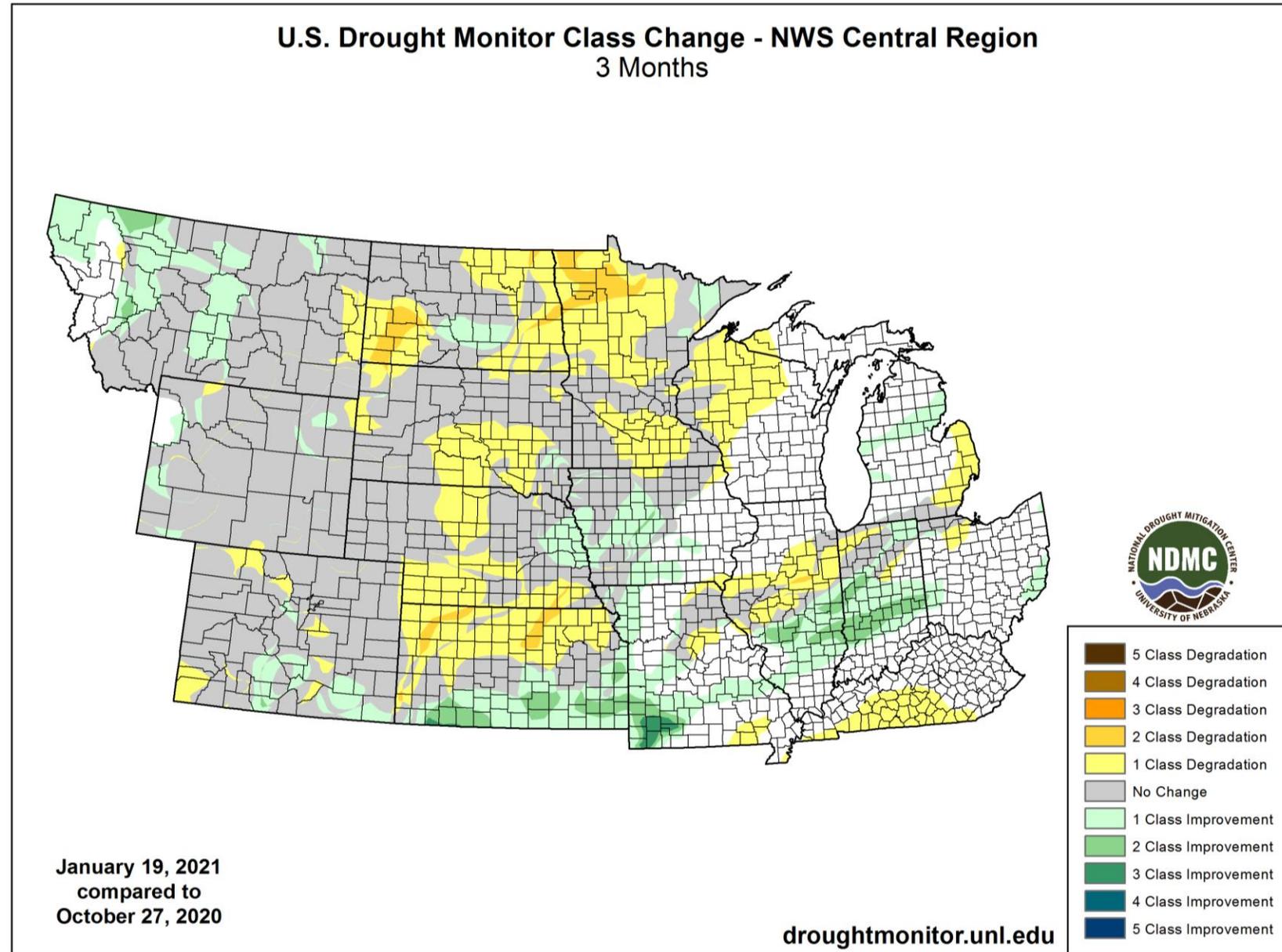
[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

- Western half of the region remains in moderate to exceptional drought
- 45% of the entire region is experiencing at least moderate drought



# Drought

- Drought has either persisted or intensified in the Plains since October
- Some improvement in southern KS and MO, IA, IL, and IN

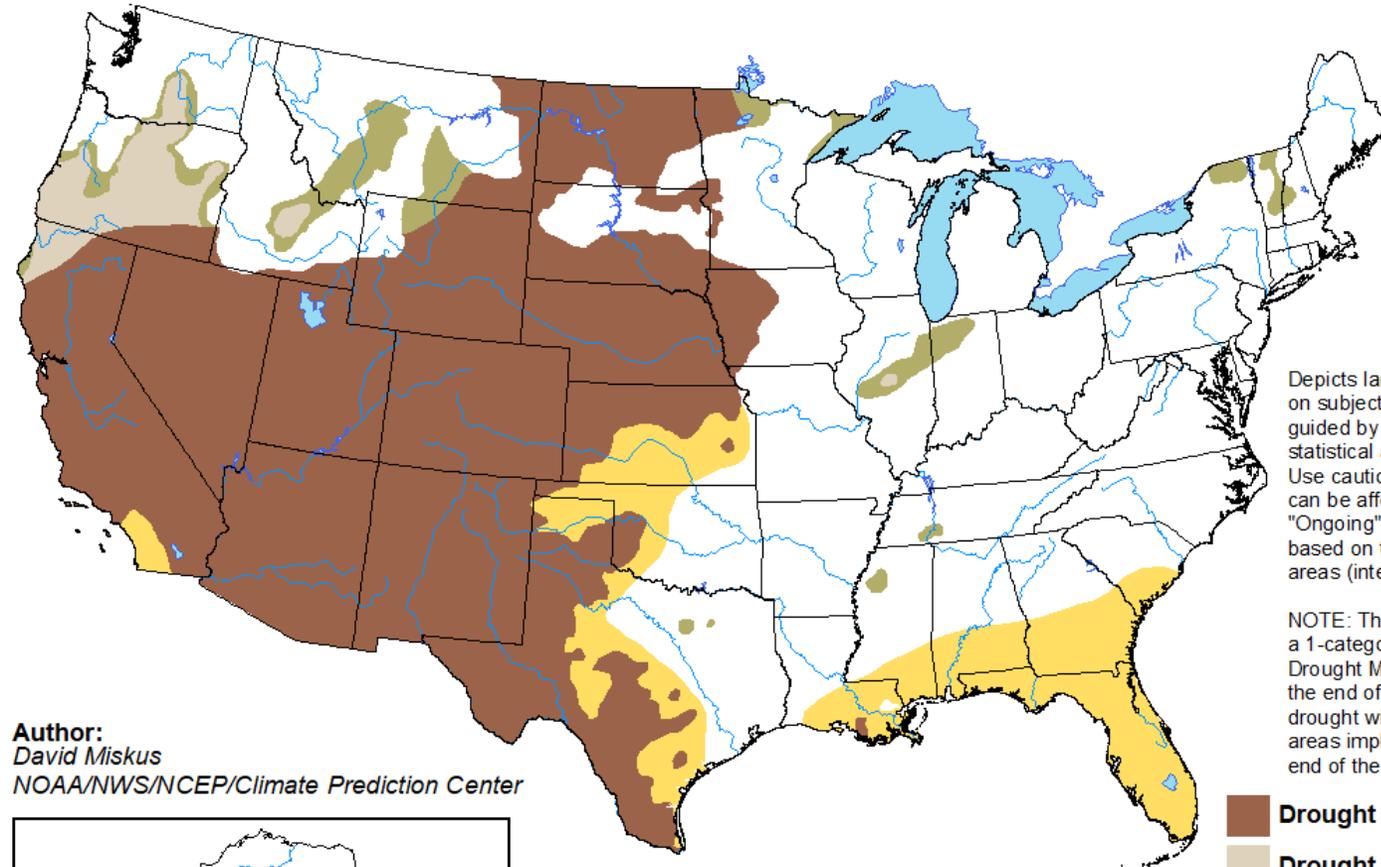


# Drought

- CPC Drought outlook – released today
- Highest odds of drought persistence and/or development throughout the Plains through April

## U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

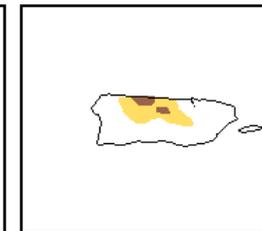
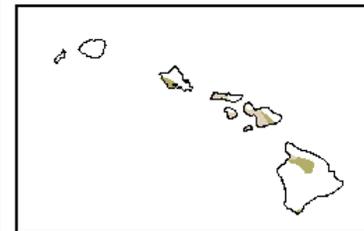
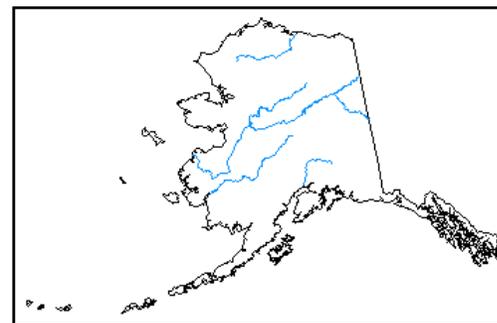
Valid for January 21 - April 30, 2021  
Released January 21



Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

Author:  
David Miskus  
NOAA/NWS/NCEP/Climate Prediction Center



-  Drought persists
-  Drought remains but improves
-  Drought removal likely
-  Drought development likely

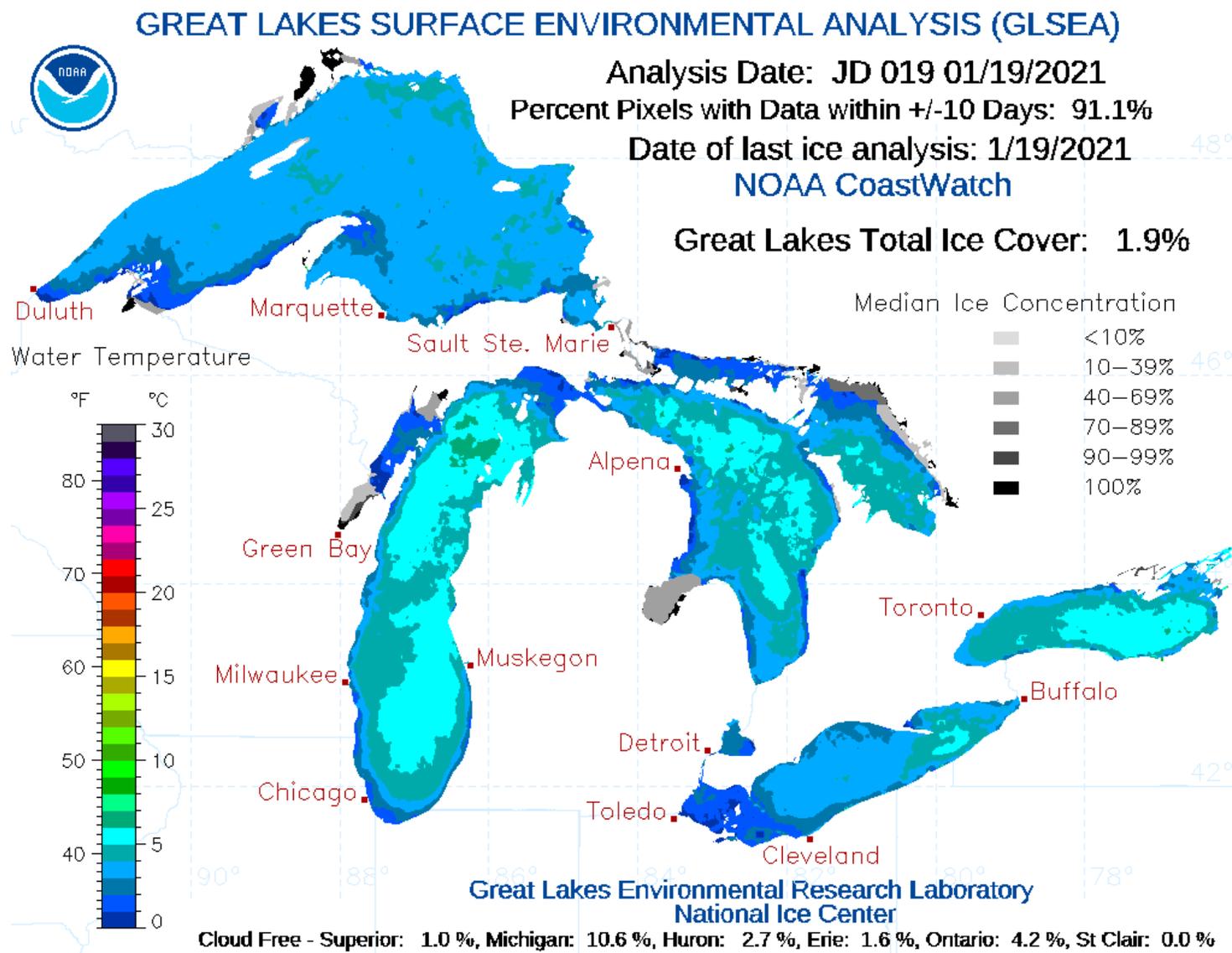


<http://go.usa.gov/3eZ73>



# Great Lakes Temperatures & Ice

- Great Lakes temperatures remain above normal in response to warm first half of winter
- Total 1.9% ice cover
  - 10% this time in 2020
  - 16% in 2019
- Less ice allows for more lake evaporation, removes buffer for lakeshore damage

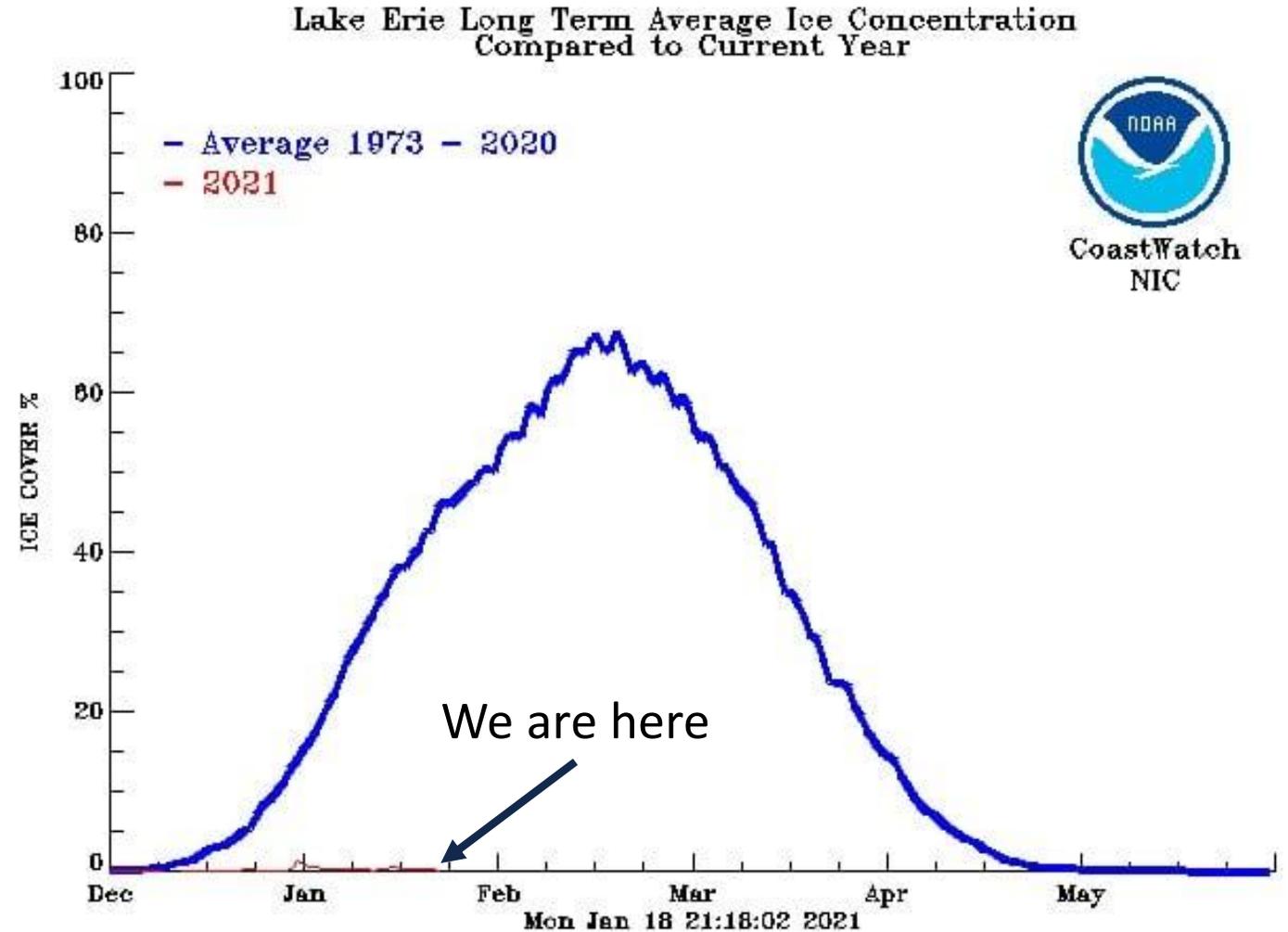


Source: <https://www.glerl.noaa.gov/data/ice/>



# Great Lakes Temperatures & Ice

- Great Lakes temperatures remain above normal in response to warm first half of winter
- Total 1.9% ice cover
  - 10% this time in 2020
  - 16% in 2019
- Less ice allows for more lake evaporation, removes buffer for lakeshore damage

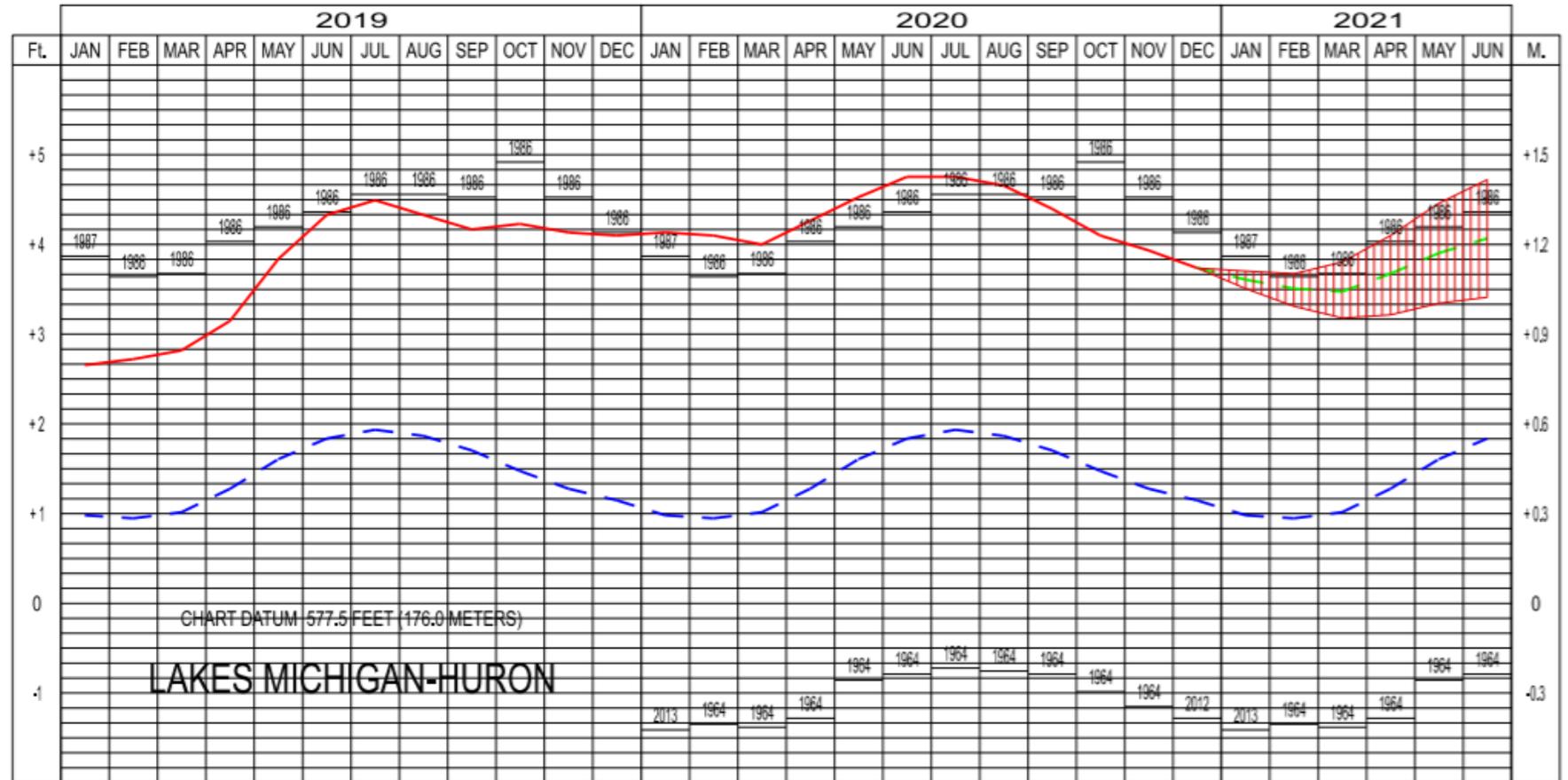


Source: <https://coastwatch.glerl.noaa.gov/statistic/statistic.html>



# Great Lakes Levels

## LAKES MICHIGAN-HURON WATER LEVELS - JANUARY 2021



### LEGEND

LAKE LEVELS

RECORDED

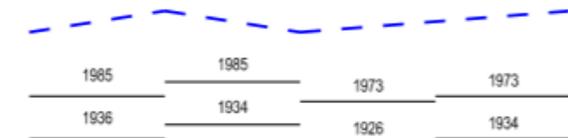
PROJECTED



AVERAGE \*\*

MAXIMUM \*\*

MINIMUM \*\*



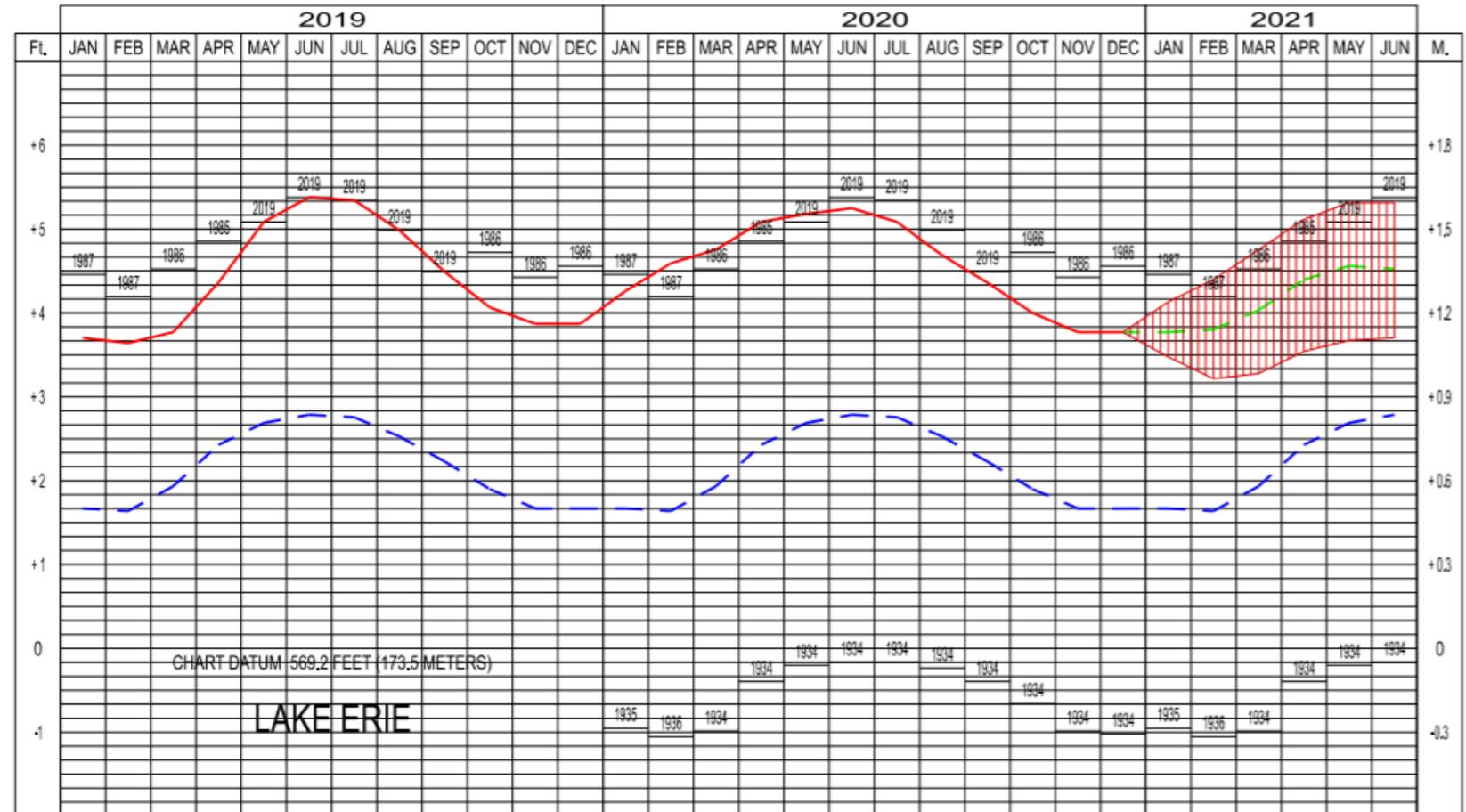
\*\* Average, Maximum and Minimum for period 1918-2019

<https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/Monthly-Bulletin-of-Great-Lakes-Water-Levels/>



# Great Lakes Levels

## LAKE ERIE WATER LEVELS - JANUARY 2021

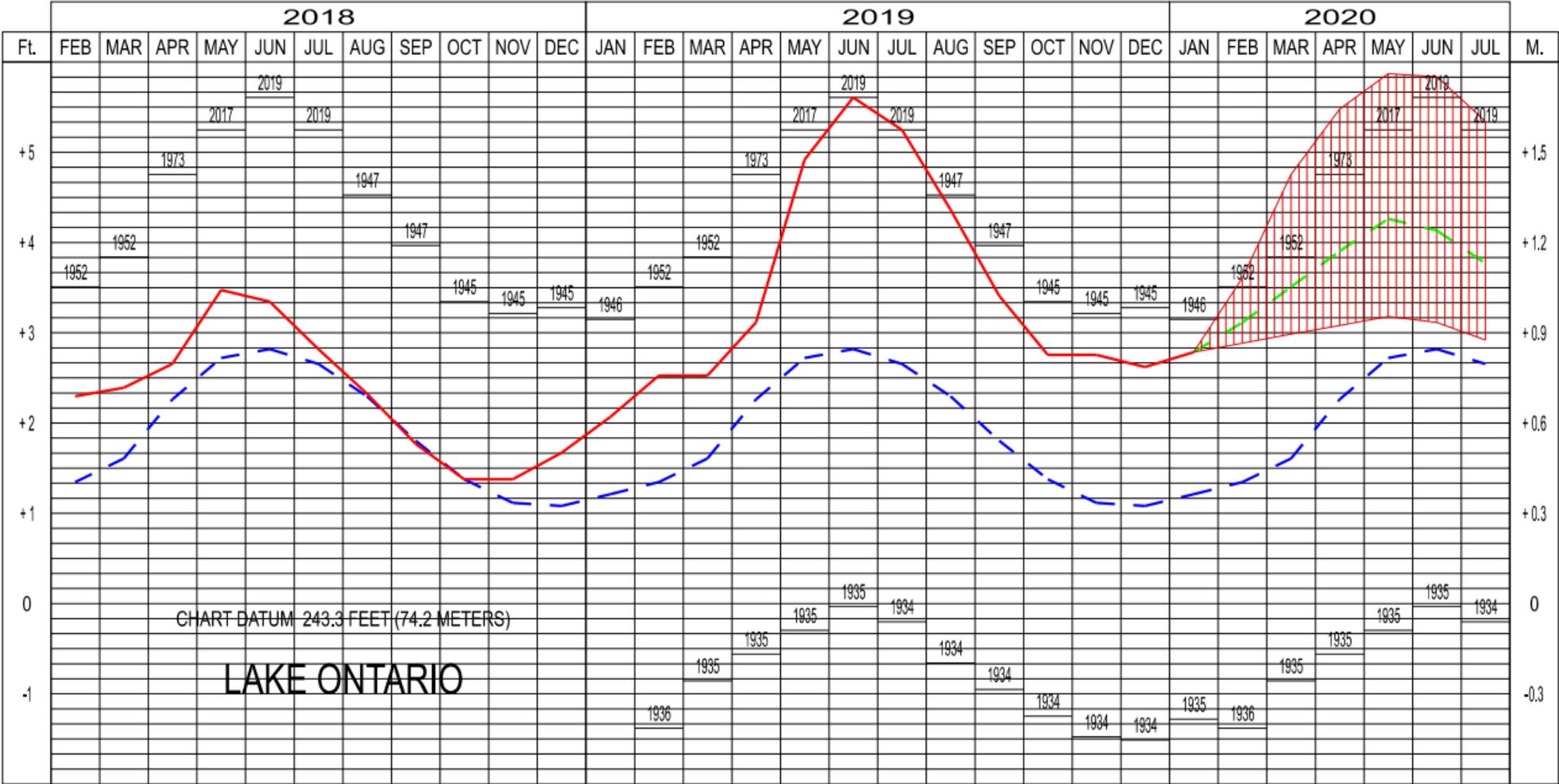


<https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/Monthly-Bulletin-of-Great-Lakes-Water-Levels/>



# Great Lakes Levels

## LAKE ONTARIO WATER LEVELS - FEBRUARY 2020



<https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/Monthly-Bulletin-of-Great-Lakes-Water-Levels/>



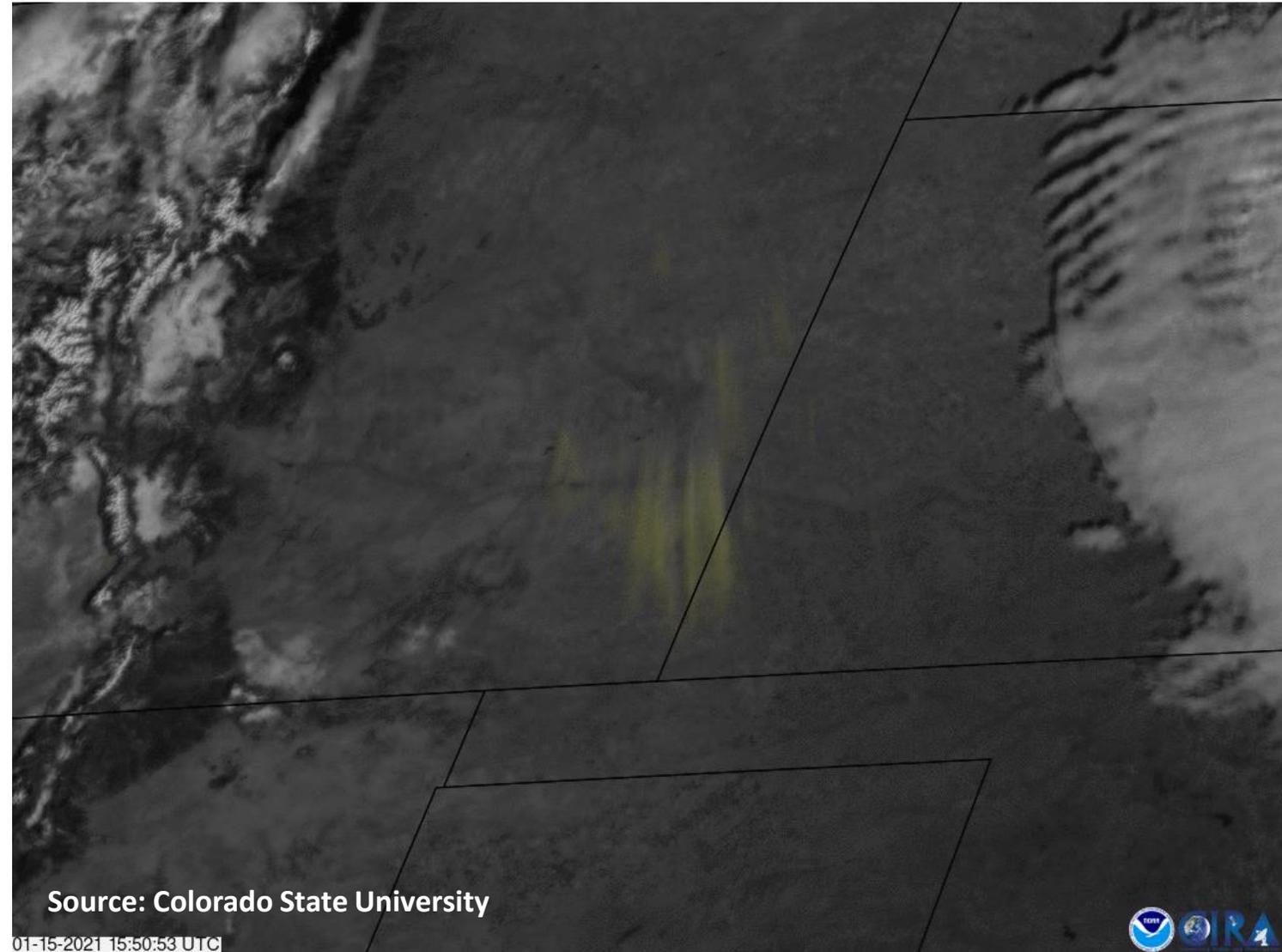
# Impacts

---



# Earth

- Dust storm across eastern CO into KS and OK on January 15<sup>th</sup>
- Ongoing drought + strong winds



# Wind

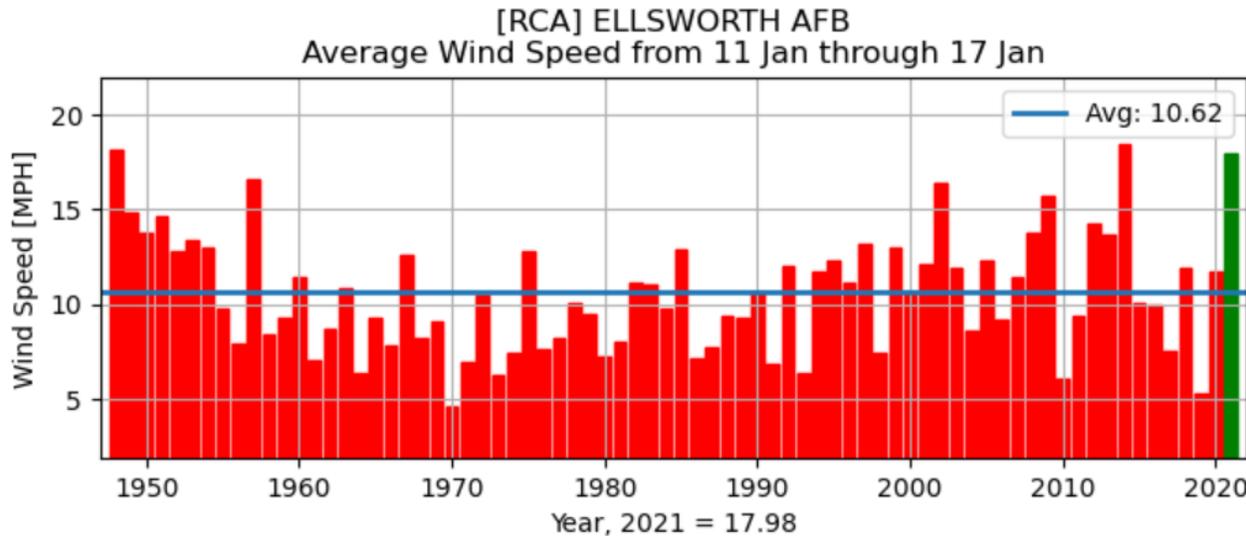
- 90+ mph wind gusts recorded from Wyoming to Iowa last week
- Average wind speed from 01/11 – 01/17 was 2<sup>nd</sup> highest at Ellsworth AFB in SD

 <b>Wind Reports (mph)</b>			
11 Wsw Warren Af Base	<b>105</b>	5 Nw Arlington	<b>94</b>
9 Sse Crystal Lake Camp	<b>92</b>	3 Ese Elk Mountain	<b>89</b>
1 Nw Cheyenne	<b>89</b>	4 E Scottsbluff	<b>86</b>
2 E Torrington	<b>86</b>	1 N Granite Springs Cam	<b>85</b>
3 W Van Tassell	<b>85</b>	13 S Glendo	<b>84</b>
1 Nnw Arlington	<b>83</b>	1 Sse Bordeaux	<b>83</b>
12 Sse Horse Creek	<b>82</b>	Douglas	<b>82</b>
1 Ene Buford	<b>82</b>	4 W Laramie	<b>81</b>
2 Ne Granite Springs Re	<b>80</b>	5 Se Alliance	<b>78</b>
2 Wnw Buford	<b>78</b>	1 Nnw Whitaker	<b>78</b>

data valid as of Wed 10:21 pm - NWS Cheyenne



Source: South Dakota Highway Patrol

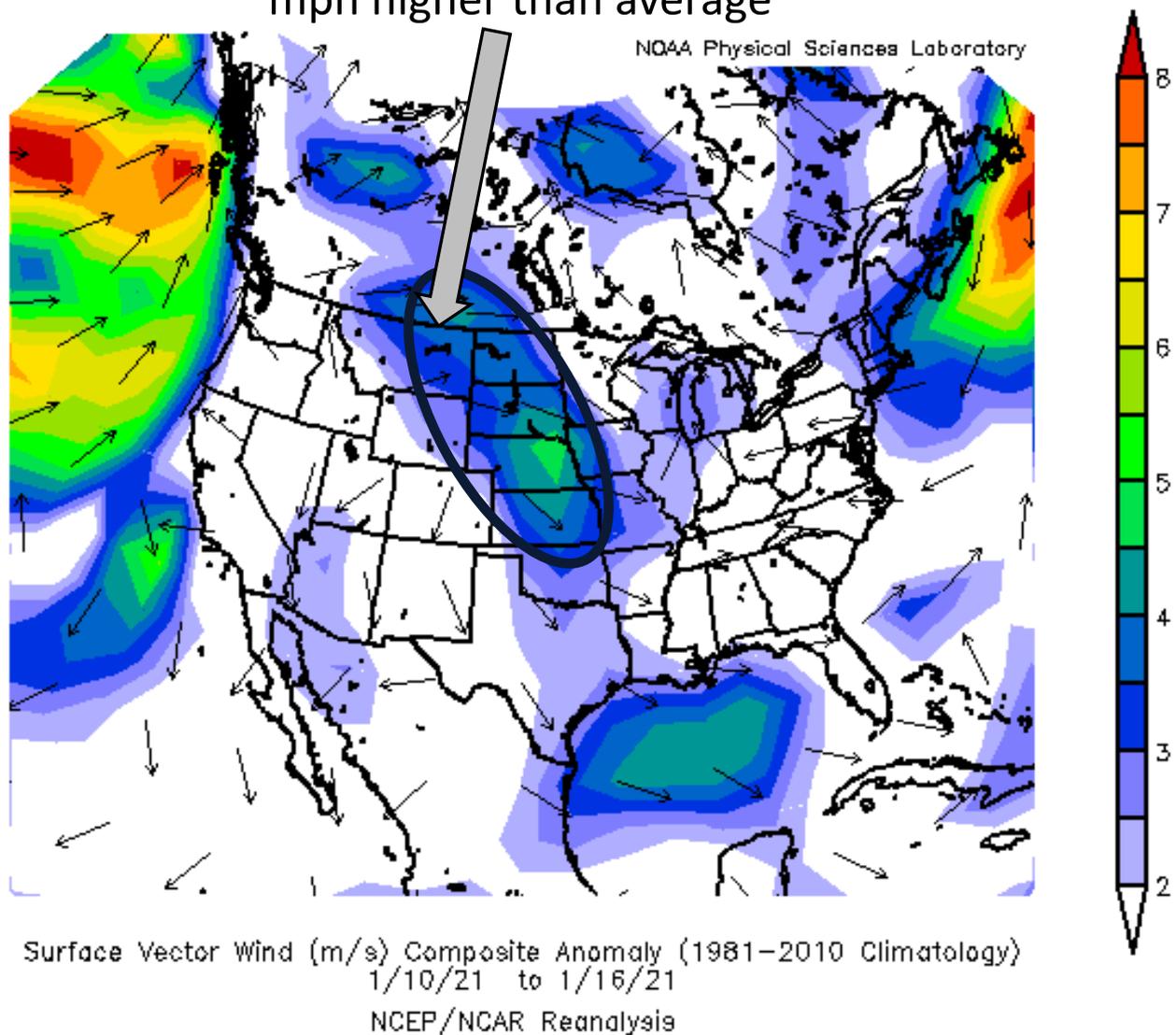


Source: North Dakota Highway Patrol



# Wind

7-day average wind speed 7 to 12 mph higher than average



<https://psl.noaa.gov/data/composites/day/>



Credit : South Dakota Highway Patrol



Credit: North Dakota Highway Patrol



# Fire

- American Center Fire in Black Hills
  - Burned 50 acres, 2<sup>nd</sup> largest December wildfire in Black Hills (since 1987)
- Large wildfire caused evacuation of Benkelman, NE early morning January 15<sup>th</sup>
- Large wildfire near Lemmon, SD started January 14<sup>th</sup>
  - Estimated near 20,000 acres burned



...

Evacuation needed for Benkelman, Nebraska per Emergency Management due to large wildfire. Evacuate to the east or to the west of town. Use caution while evacuating due to low visibility due to smoke [#newx](#)



Credit : Perkins County (SD) Sherrif's Office

# Agriculture Impacts

- Concerns about drought, winter warmth/lack of snow increasing soil evaporation
- Positive: reduction of feed needs, easier to get to animals without heavy snowpack
- Reduction in fuel costs, heating needs
- Mild winter increases risk of early green-up, bud break, risk of freeze damage to stone fruit, berries, perennials
- Concern of winter wheat breaking dormancy in Kansas



# Other Impacts

- Thin lake ice: folks and vehicles falling through ice in SD and MN (multiple deaths)
- Ice rinks in SD closing more often because of warm weather
- Snowmobile activity has been affected by lack of snowcover
- Some ski resorts lacking snow
- Ice jams in Montana

**SAFETY ON ICE**

Ice is never 100% safe. If you don't know, don't go!

NOAA  
weather.gov

- It takes a minimum of 4 inches of ice to support a person!
- Cycles of thawing and refreezing will make areas of ice appear safe when in reality the ice is still quite thin!

**Minimum ice thickness guidelines for new clear ice only**

Ice Thickness	Supported Activity/Vehicle
<2"	STAY OFF!!!
4"	Supports ice fishing and walking
5"	Supports small groups ice skating
6"	Supports snow mobile ATV
9"	Supports cars
12"	Supports medium size trucks

Stay away from any cracks and melting ice.

Credit: NWS Green Bay

# Outlooks

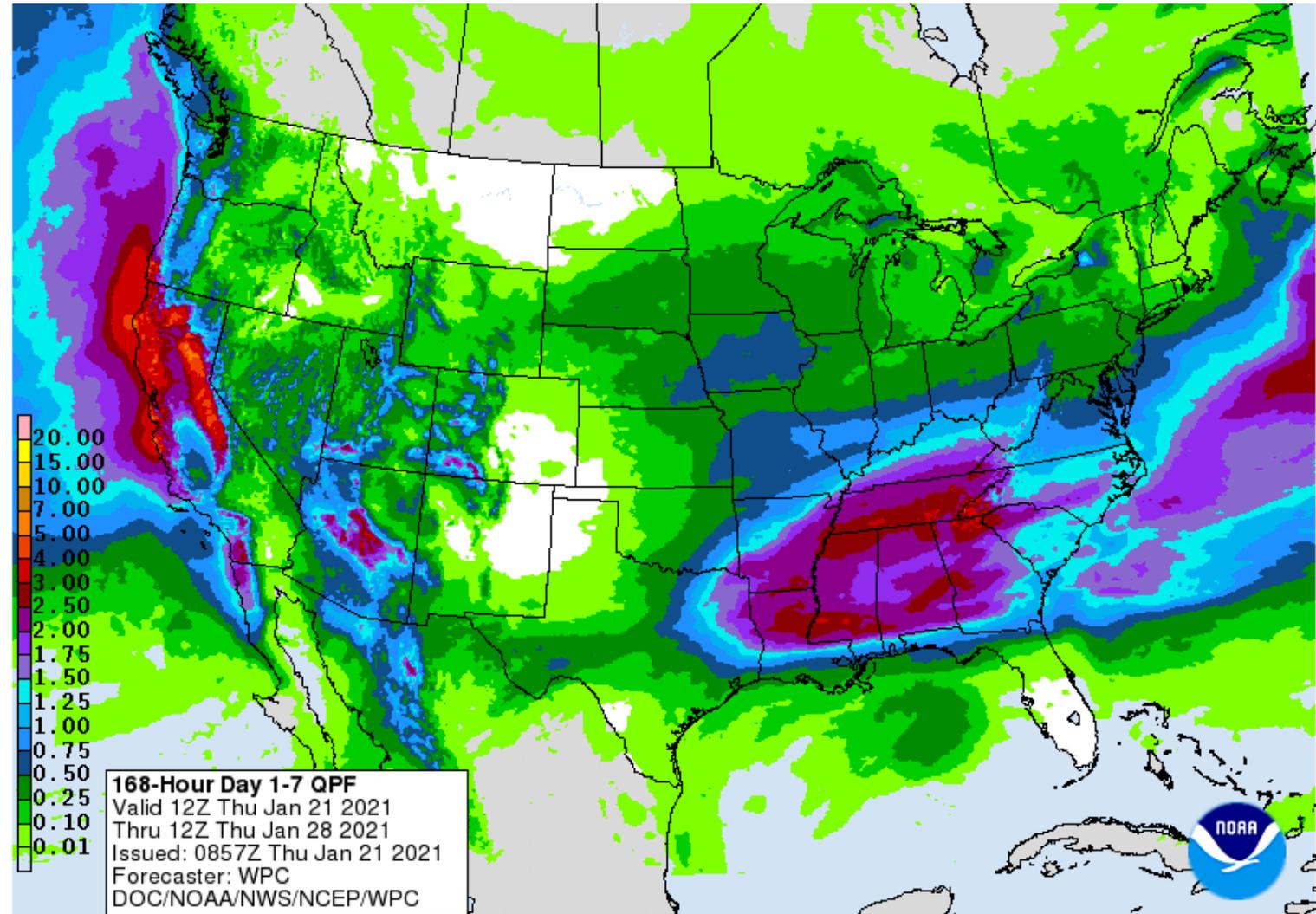
---



# 7-day Precipitation Forecast

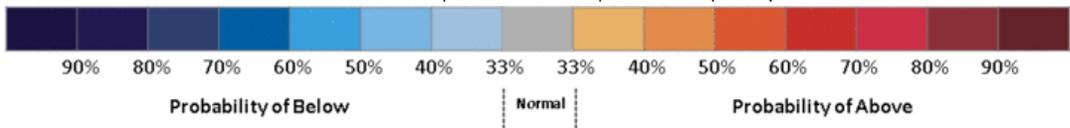
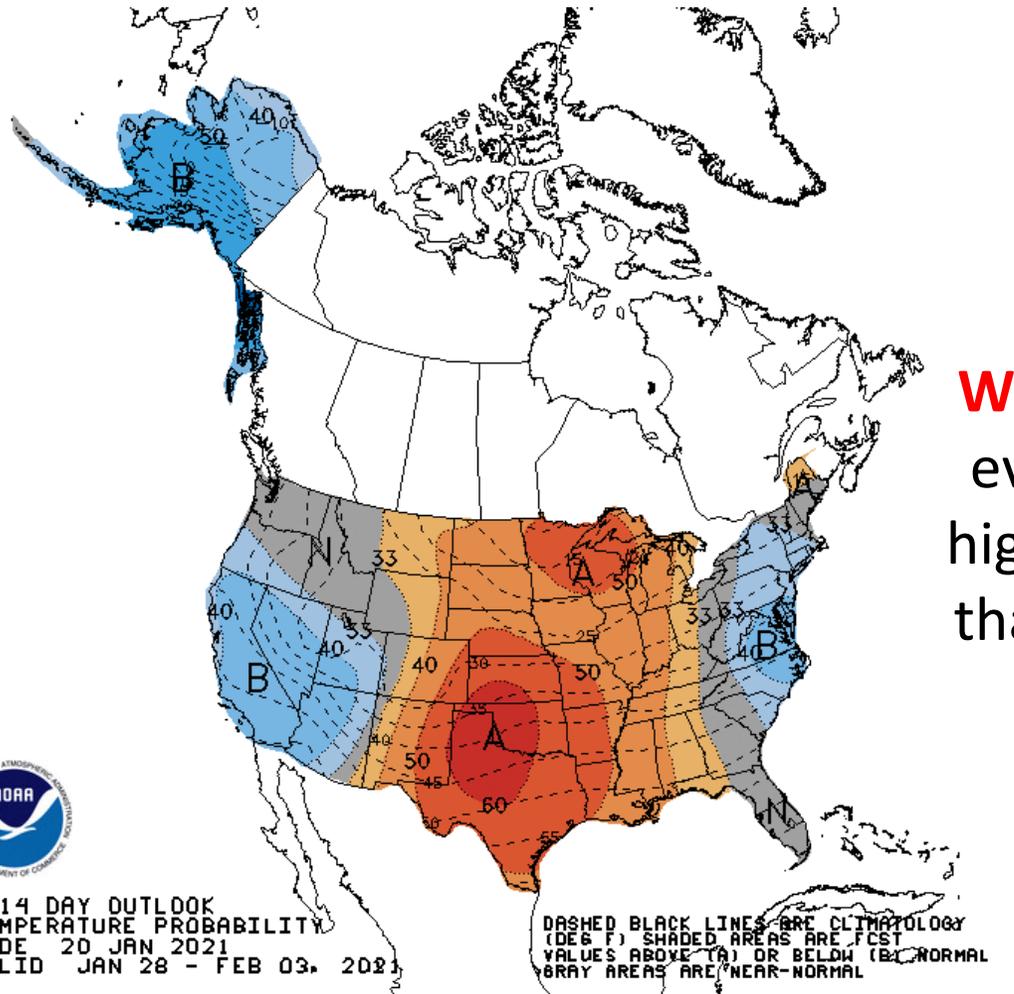
Source: [wpc.ncep.noaa.gov/qpf/](https://wpc.ncep.noaa.gov/qpf/)

- Wet week forecasted for southeast part of the region
- 7-day totals between 0.25" and 0.50" forecasted from OH to central SD
- Mostly dry week forecasted for western part of the region

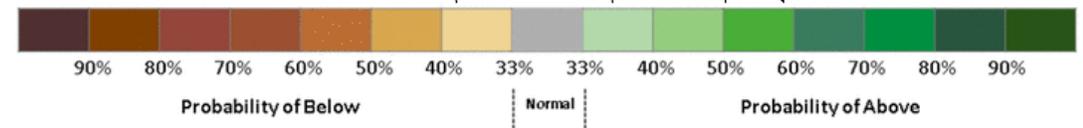
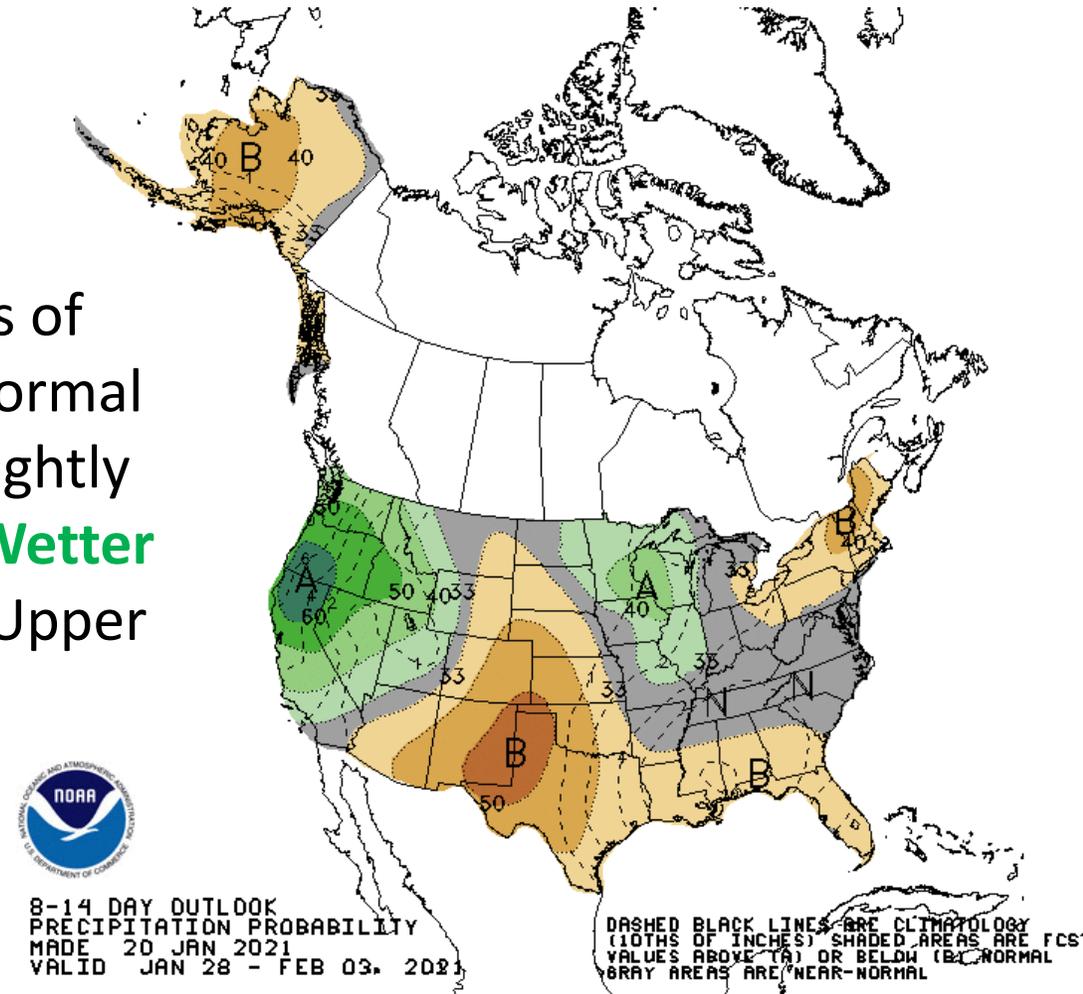


# 8-14 Day Outlooks

Source: [cpc.ncep.noaa.gov/products/predictions/814day/](https://cpc.ncep.noaa.gov/products/predictions/814day/)

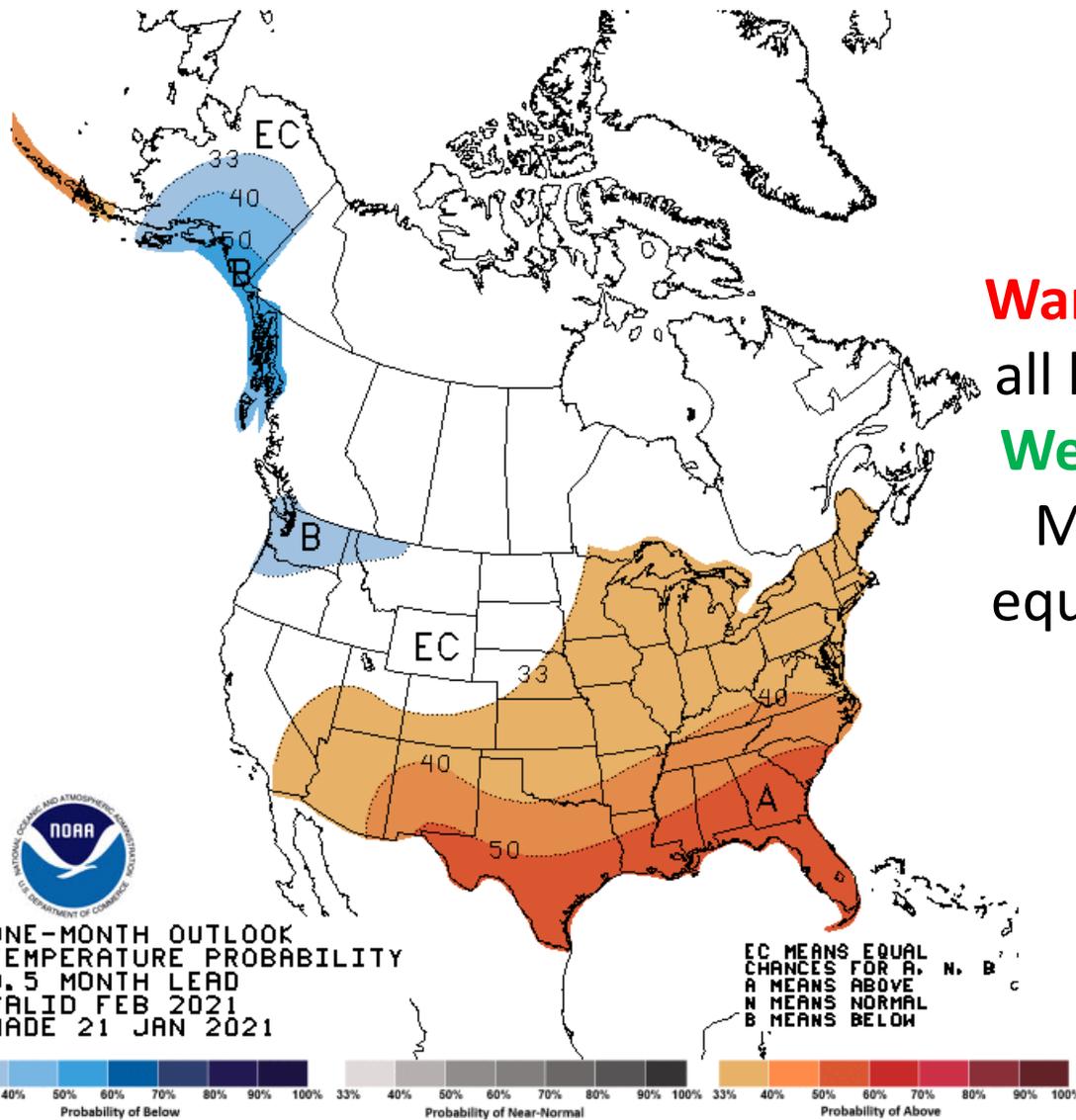


Elevated odds of **Warmer** than normal everywhere. Slightly higher odds of **Wetter** than normal in Upper Midwest

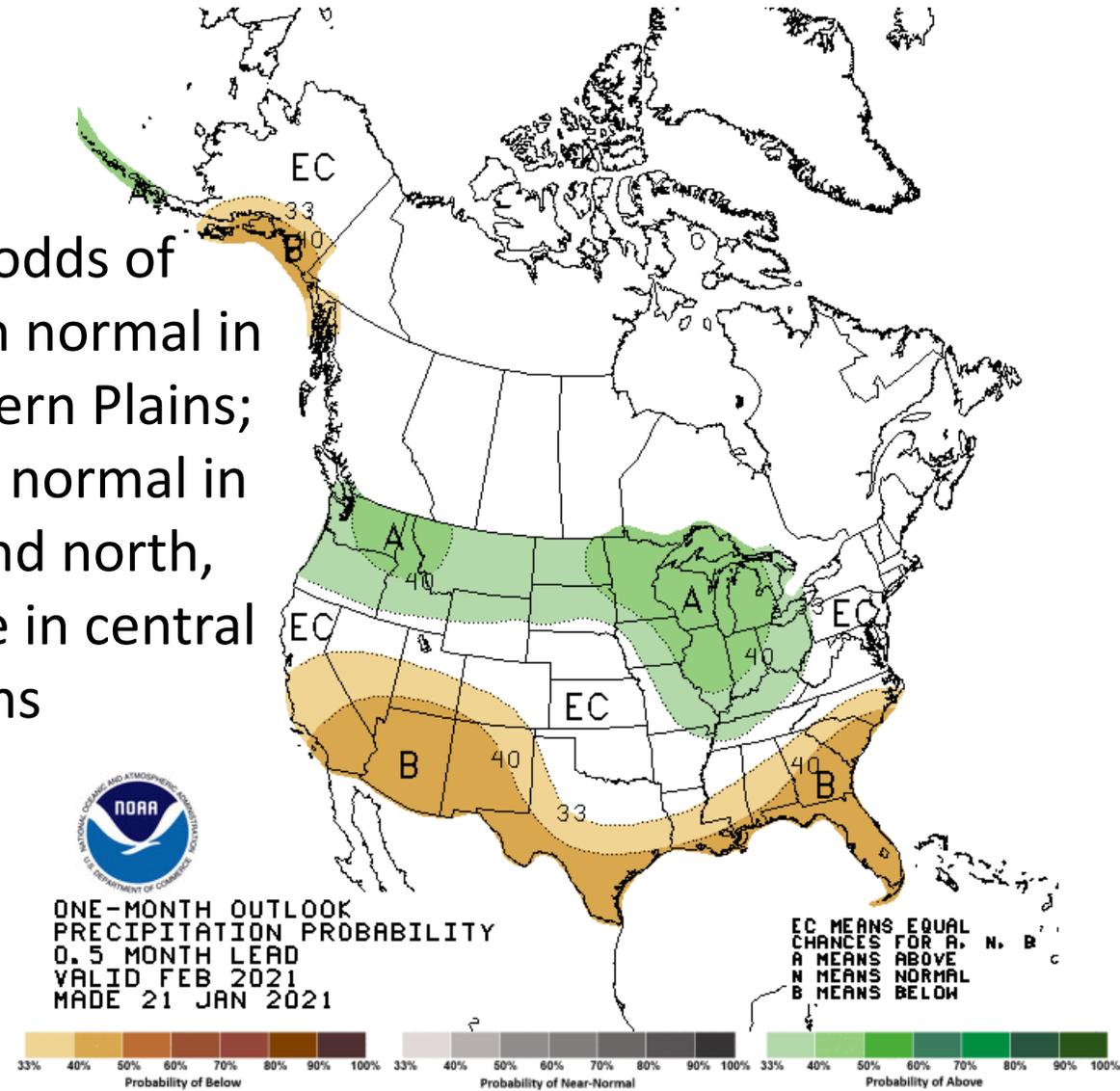


# February Outlooks

Source: [cpc.ncep.noaa.gov/products/predictions/814day/](https://cpc.ncep.noaa.gov/products/predictions/814day/)

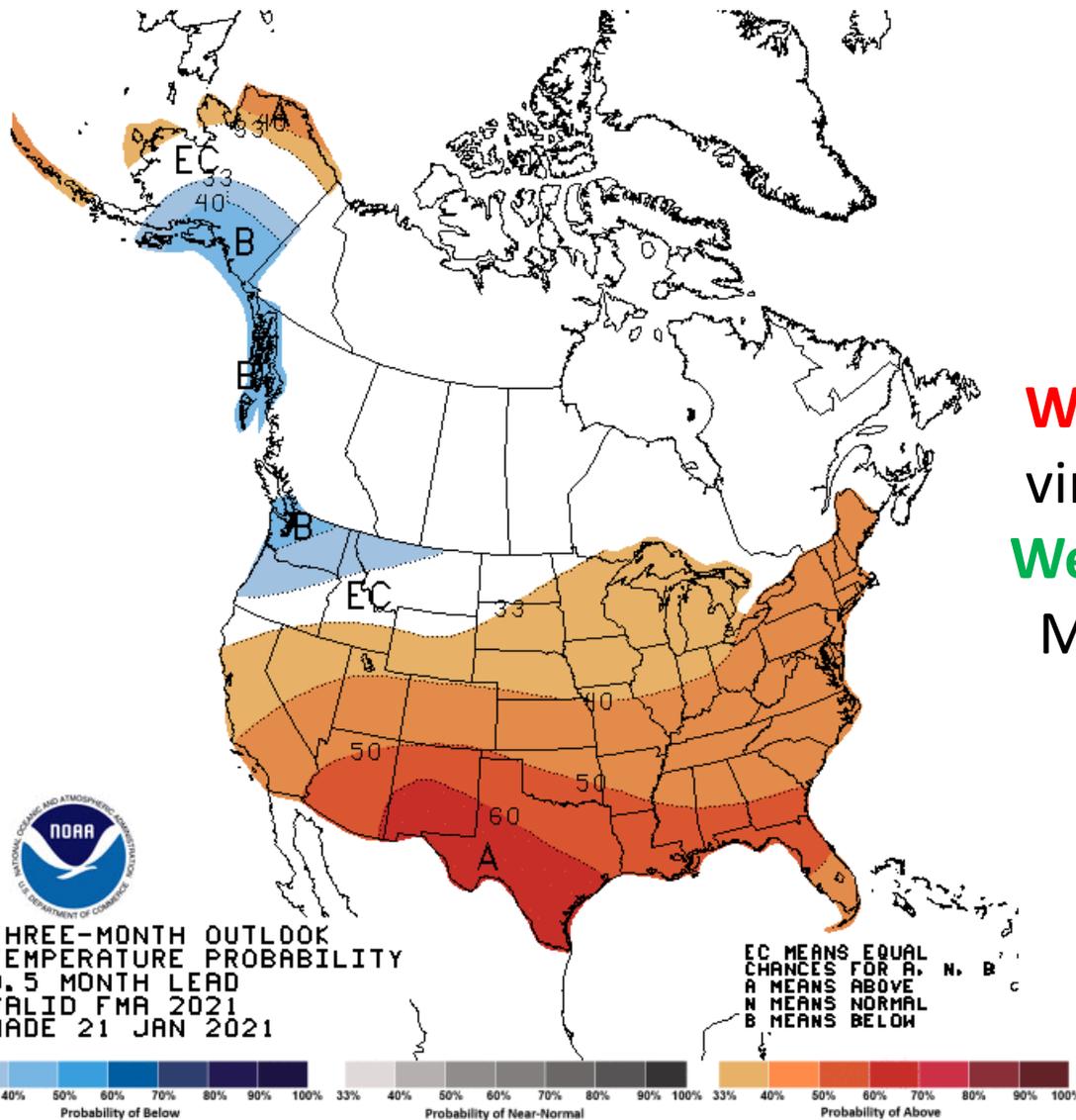


Elevated odds of **Warmer** than normal in all but northern Plains; **Wetter** than normal in Midwest and north, equal chance in central Plains

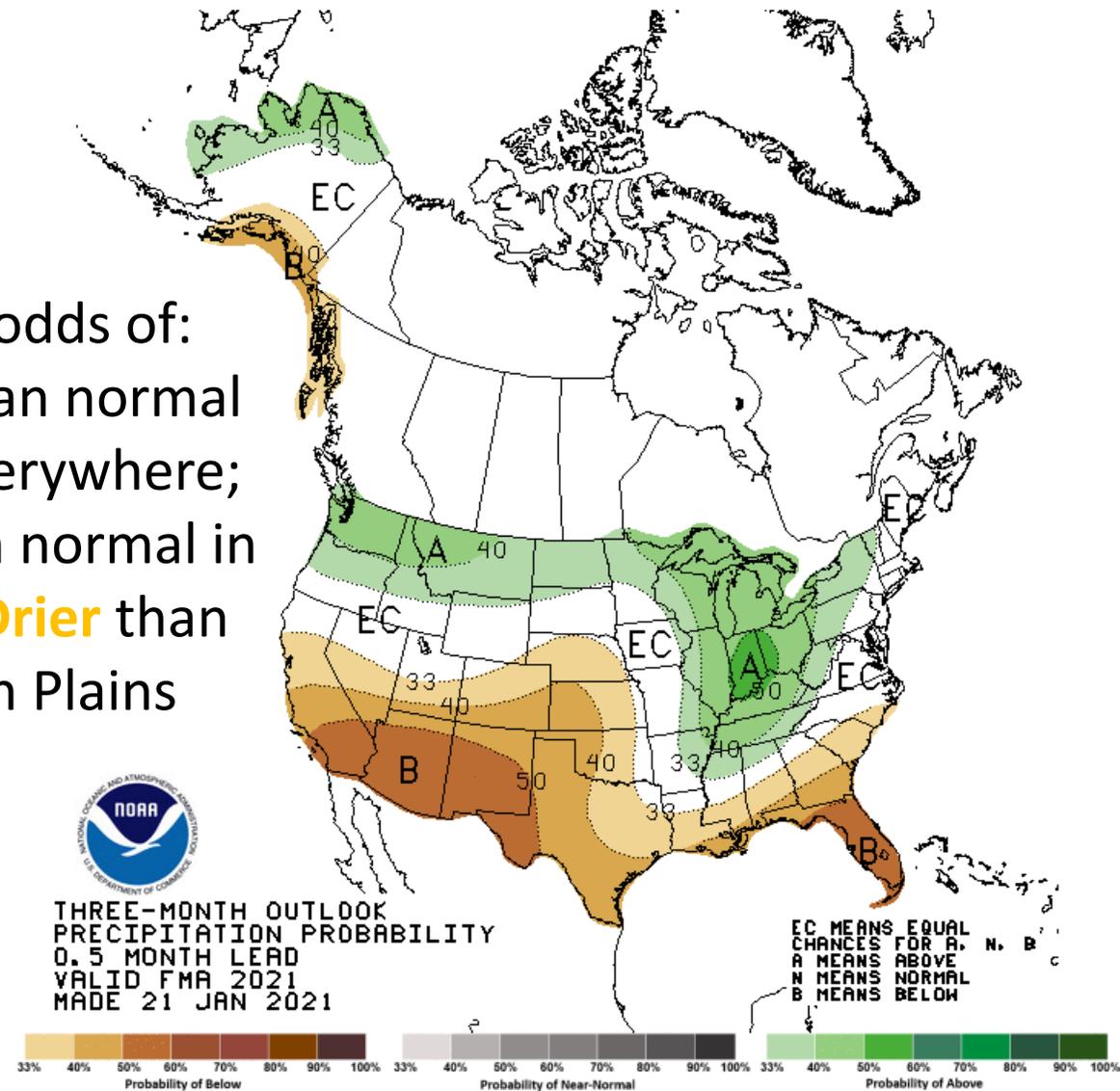


# Seasonal Outlook – FMA

Source: [cpc.ncep.noaa.gov/products/predictions/814day/](https://cpc.ncep.noaa.gov/products/predictions/814day/)

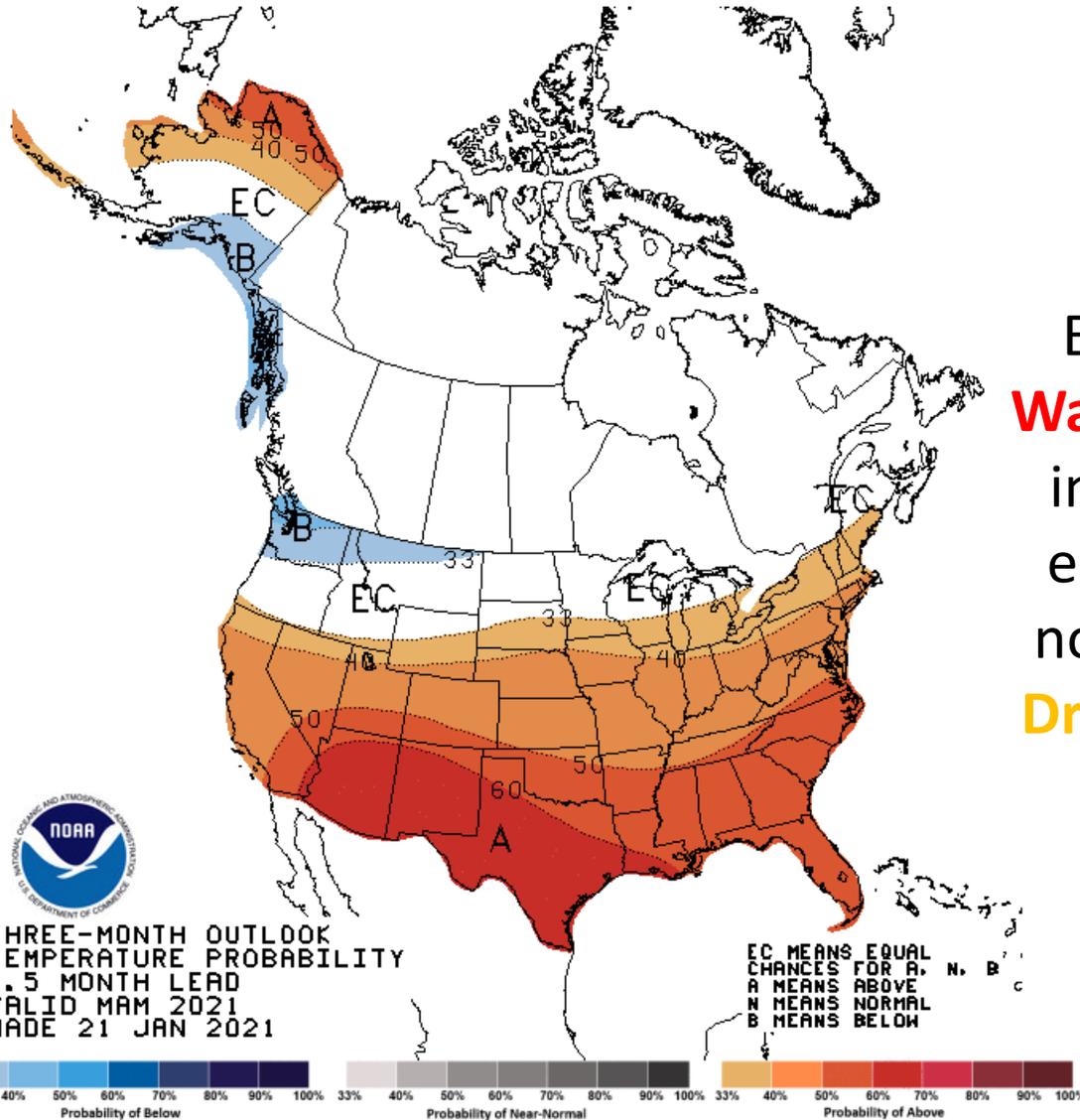


Elevated odds of:  
**Warmer** than normal  
virtually everywhere;  
**Wetter** than normal in  
Midwest, **Drier** than  
normal in Plains

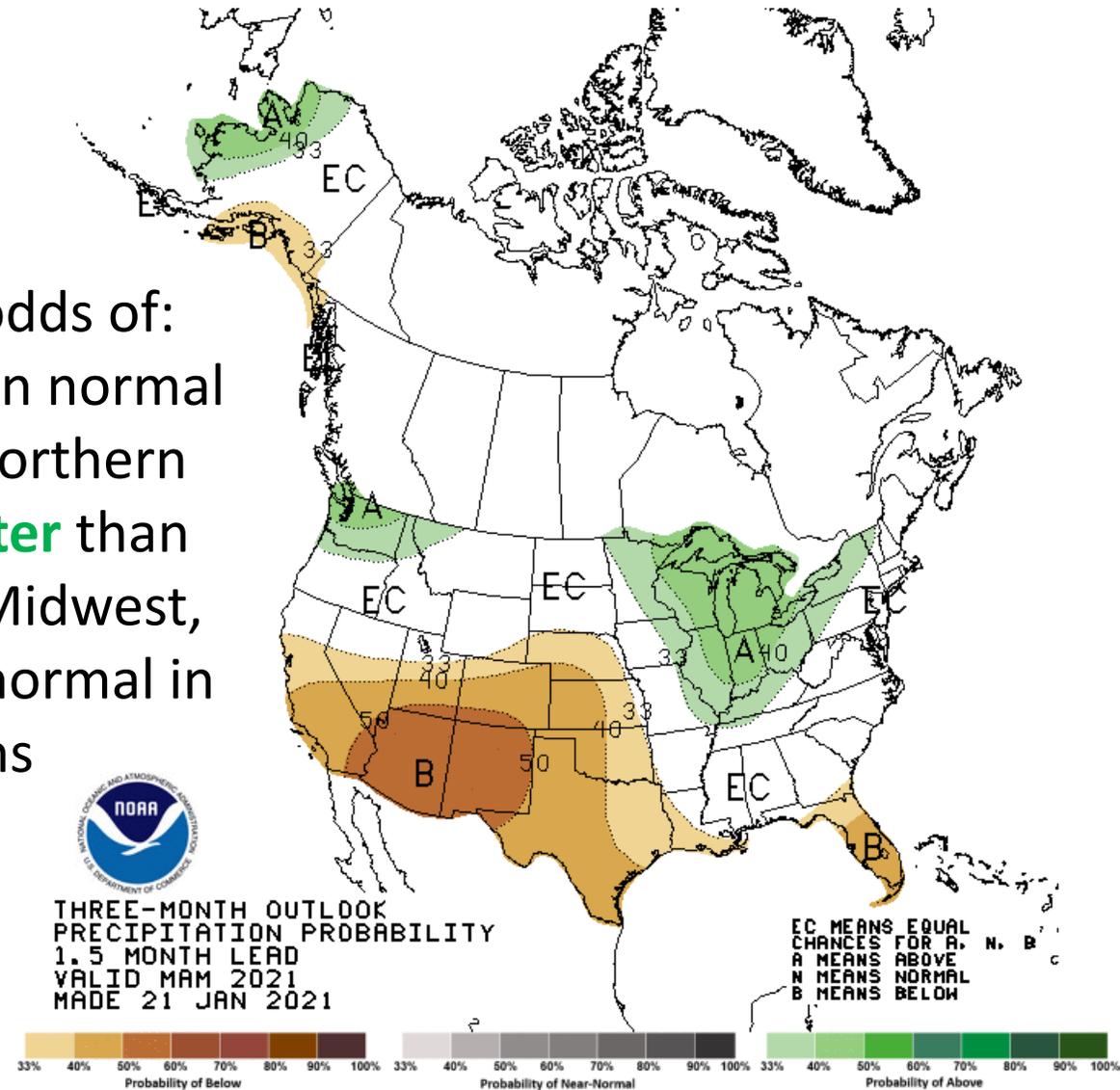


# Seasonal Outlook – MAM

Source: [cpc.ncep.noaa.gov/products/predictions/814day/](https://cpc.ncep.noaa.gov/products/predictions/814day/)



Elevated odds of:  
**Warmer** than normal  
in all but northern  
edge; **Wetter** than  
normal in Midwest,  
**Drier** than normal in  
Plains



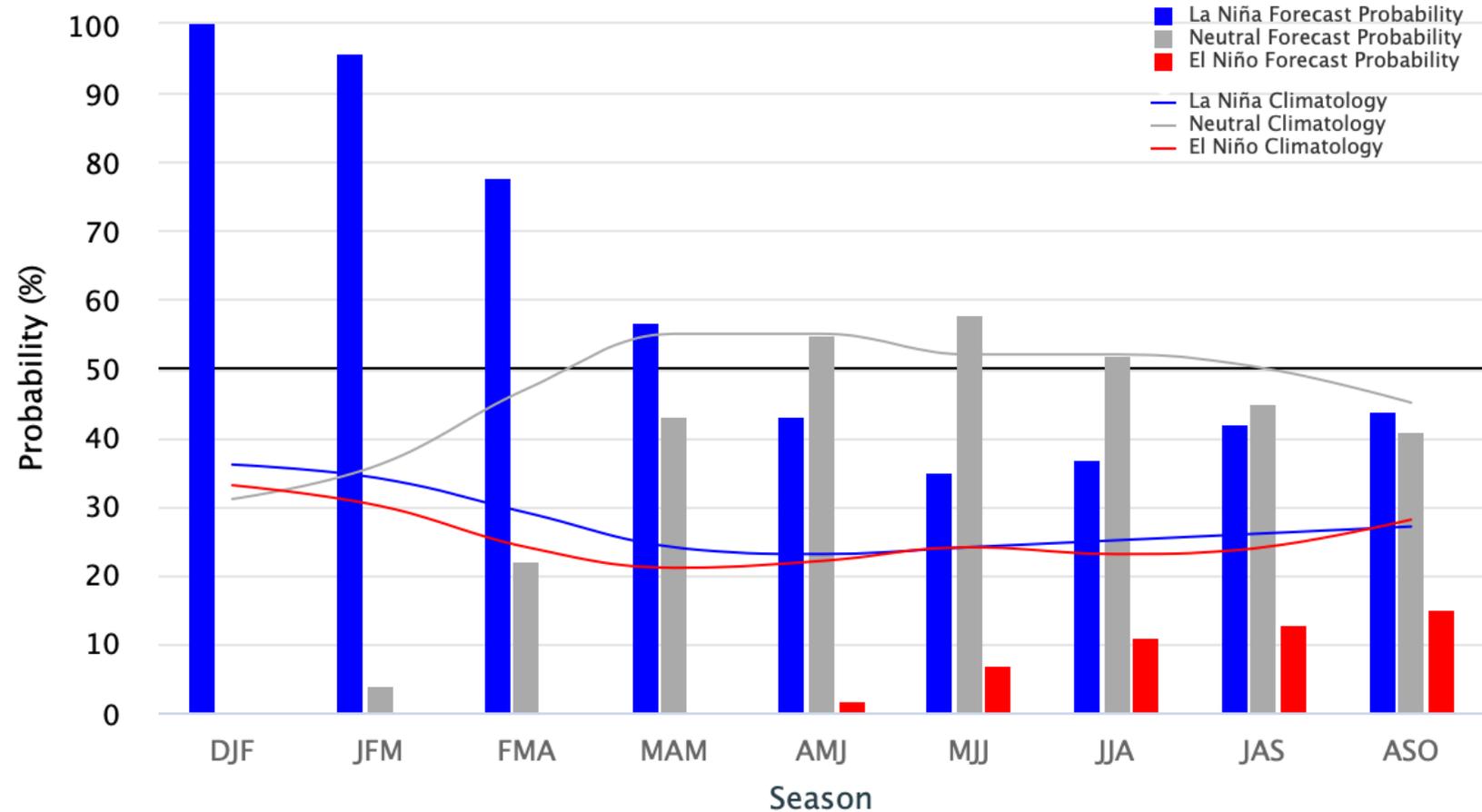
# El Niño-Southern Oscillation (ENSO) Outlooks

## Forecasts:

- Greater than 50% probability of La Niña persisting into spring
- Better chances of transition to ENSO-Neutral in late spring/summer
- Potential for La Niña re-emergence in Fall

Early-January 2021 CPC/IRI Official Probabilistic ENSO Forecasts

ENSO state based on NINO3.4 SST Anomaly  
Neutral ENSO:  $-0.5\text{ }^{\circ}\text{C}$  to  $0.5\text{ }^{\circ}\text{C}$



# Summary

- Winter has been drier, warmer than normal across the region
- Considerable soil moisture deficit throughout the Plains, parts of MO, IL, IN
- 82% of the High Plains, 11% of Midwest regions remain in drought
- Great Lakes: reduced ice cover, above average levels, not as close to record as last year
- Snowpack: below normal in most of the region; 50 – 80% in MO headwaters
- Short-term outlooks: much of the same – warmth continues, not much opportunity for soil moisture recharge in Plains
- Longer-term outlooks: Maybe La Niña kicking in? Continued higher odds of warmer than normal conditions persisting, stronger odds for wet east/dry west
- **More concern of drought persistence into spring in the Plains**



# Further Information – Partners

- Today's & Past Recorded Presentations at:
  - <https://mrcc.illinois.edu/multimedia/webinars.jsp>
  - <https://hprcc.unl.edu/webinars.php>
- NOAA National Centers for Environmental Information: [www.ncei.noaa.gov](http://www.ncei.noaa.gov)
- Monthly climate reports (US & Global): <https://www.ncdc.noaa.gov/sotc/>
- NOAA Climate Prediction Center: [www.cpc.ncep.noaa.gov](http://www.cpc.ncep.noaa.gov)
- Climate Portal: [www.climate.gov](http://www.climate.gov)
- U.S. Drought Portal: [www.drought.gov](http://www.drought.gov)
- National Drought Mitigation center: <https://drought.unl.edu>
- State Climatologists: <http://www.stateclimate.org>
- Regional Climate Centers:
  - Midwestern – <https://mrcc.isws.illinois.edu>
  - High Plains – <https://hprcc.unl.edu>
- USDA Midwest Climate Hub: <https://www.climatehubs.usda.gov/hubs/midwest>



# Thank You, Questions?

- Questions – Climate
  - Trent Ford: [twford@illinois.edu](mailto:twford@illinois.edu), 217-244-1330
  - Dennis Todey: [dennis.todey@ars.usda.gov](mailto:dennis.todey@ars.usda.gov), 515-294-2013
  - Doug Kluck: [doug.kluck@noaa.gov](mailto:doug.kluck@noaa.gov), 816-994-3008
  - Ray Wolf: [ray.wolf@noaa.gov](mailto:ray.wolf@noaa.gov), 563-386-3976
  - Mike Timlin: [mtimlin@illinois.gov](mailto:mtimlin@illinois.gov), 217-333-8506
  - Natalie Umphlett: [numphlett2@unl.edu](mailto:numphlett2@unl.edu), 402-472-6764
  - Brian Fuchs: [bfuchs2@unl.edu](mailto:bfuchs2@unl.edu), 402-472-6775
- Questions – Weather
  - [crhroc@noaa.gov](mailto:crhroc@noaa.gov)

