

# SPRING 2019 MISSOURI RIVER BASIN FLOOD OUTLOOK

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March 12, 2019

*"The views, opinions and findings contained in this report are those of the authors(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation."*



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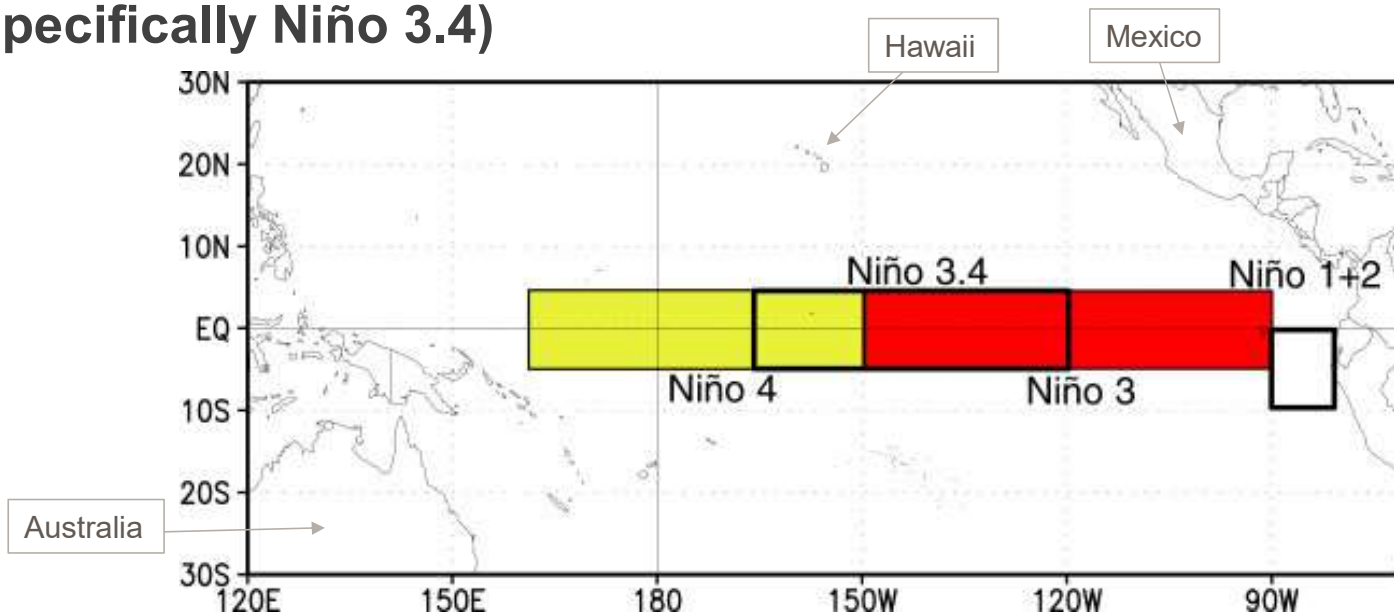
NOTE:  
TAMPER GATE

# FIRST – WHAT WAS THE WINTER FORECAST?

One of the Main Driving Winter Season Forecast is  
**El Niño Southern Oscillation (ENSO)**

\* Based on Sea Surface Temperatures (SST)  
across the south central Pacific Ocean  
(specifically Niño 3.4)

**Forecast  
Weak-Moderate El Niño**

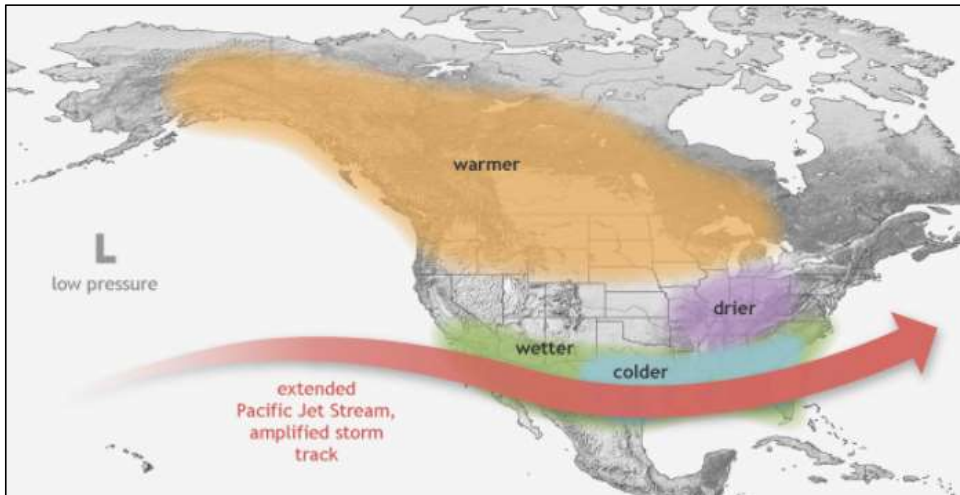


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# TYPICAL EL NIÑO AND LA NIÑA WINTER WEATHER PATTERNS

## Wintertime El Niño Pattern

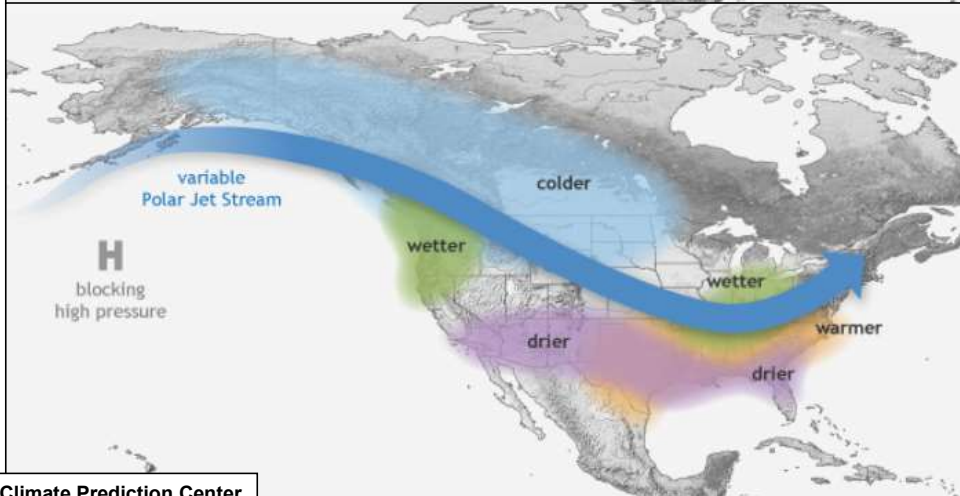


- **Warmer than normal**
- **Less upper basin snowfall**
- **Greater lower basin moisture**

Strong  
2015-2016

Weak  
2018-2019  
Delayed

## Wintertime La Niña Pattern



- **Colder than normal**
- **Greater upper basin snowfall**

Weak  
2016-2017

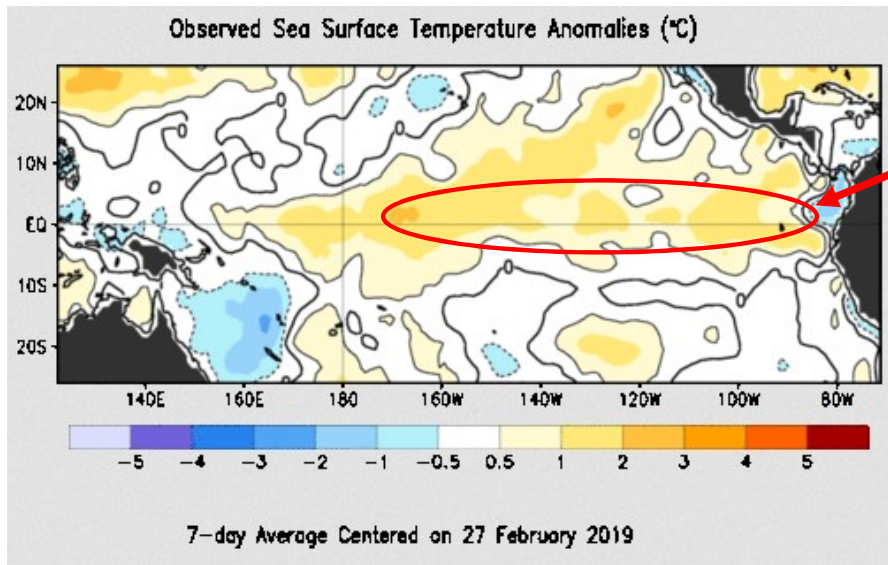
Moderate  
2017-2018



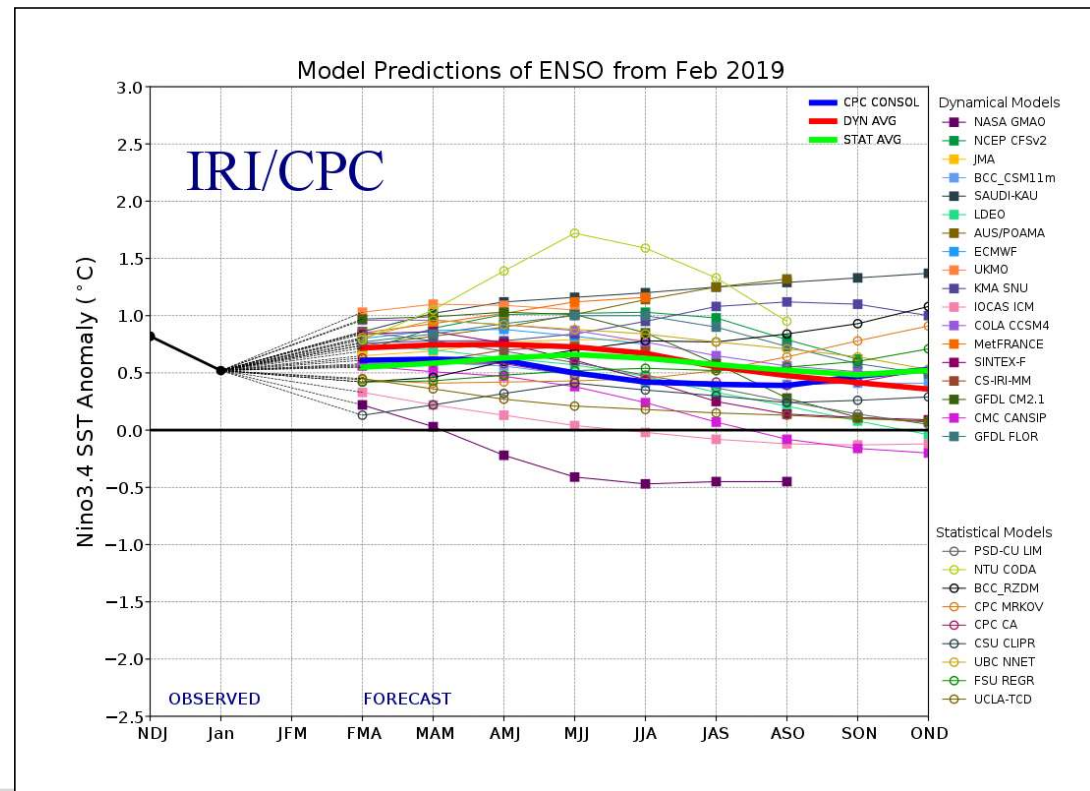
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# WEAK EL NIÑO – WHAT’S NEXT ??



Slightly above normal sea surface temperatures along the equatorial Pacific Ocean



**Current ENSO Conditions**  
**Weak El Niño**  
**Steady then Slowly Weaken**

**\*\*\*Forecast\*\*\***  
**“Dynamical Models”**  
**ENSO-Neutral** ——— (Red line)  
**“Statistical Models”**  
**Weak El Niño redevelops this fall** ——— (Green line)

Graphics courtesy of NOAA Climate Prediction Center

# SPRING FLOOD – WHAT TO LOOK AT?

## Temperature & Precipitation

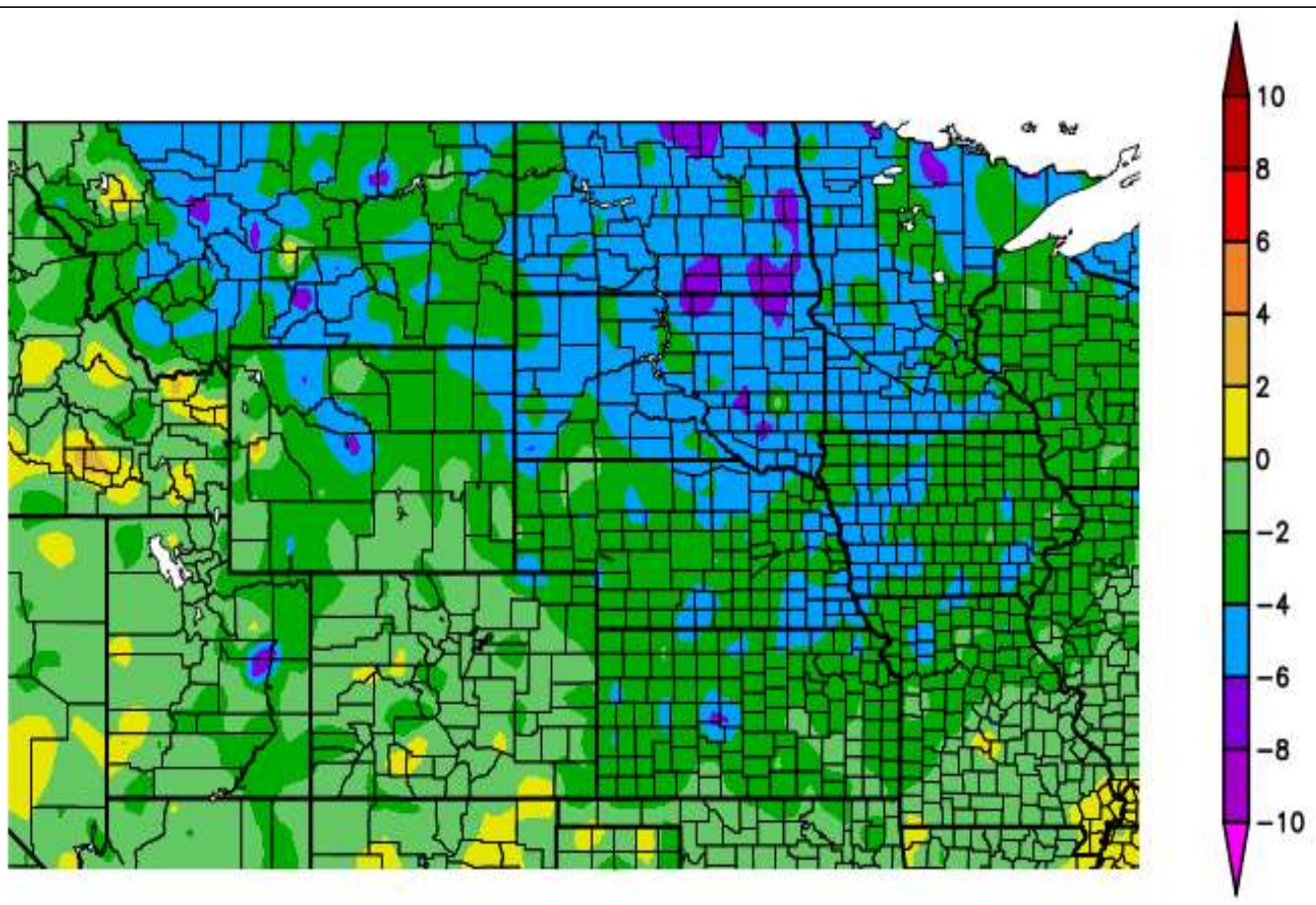
- Above Ground Conditions (Snowpack or Snow Water Equivalent)
  - Mountain Snowpack
  - Plains Snowpack
- Below Ground Conditions
  - Frost Depth
  - Soil Moisture
- River Conditions
  - Base Flow
  - Ice Thickness
- **Future Conditions - CRITICAL**



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# TEMPERATURE DEPARTURE FROM NORMAL (OCTOBER 1 – MARCH 10)



## Below Normal

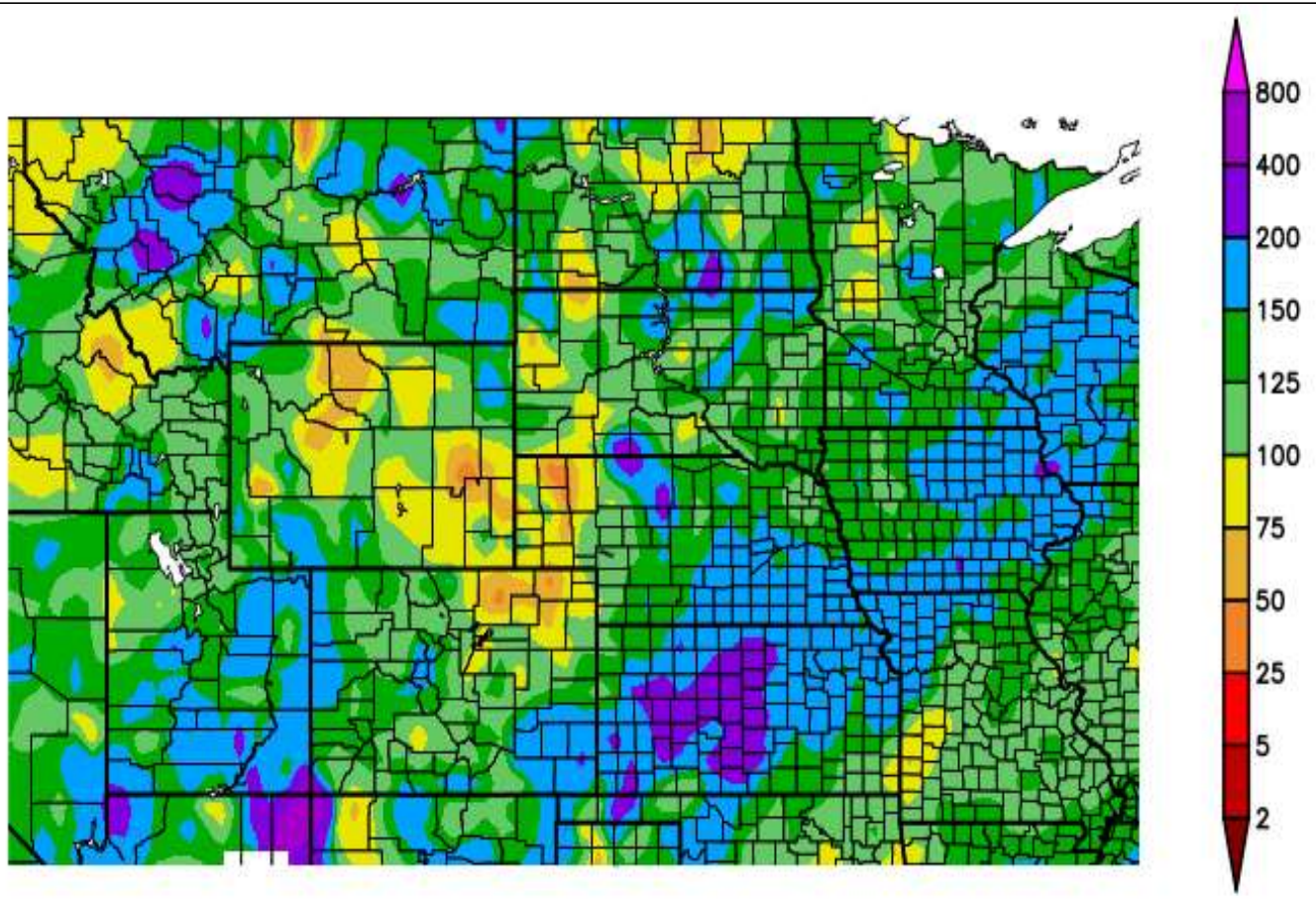
- Started out Cold – October/November
- Warm December part of January
- Been generally cold since the 3<sup>rd</sup> week of January



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# PRECIPITATION PERCENT OF NORMAL (OCTOBER 1 – MARCH 10)



## Above Normal

- Many locations > 150% of Normal
- Only small area of Below Normal

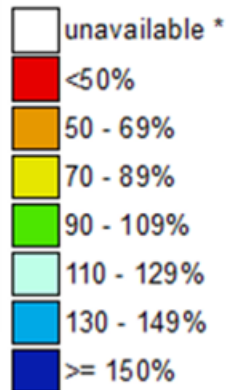


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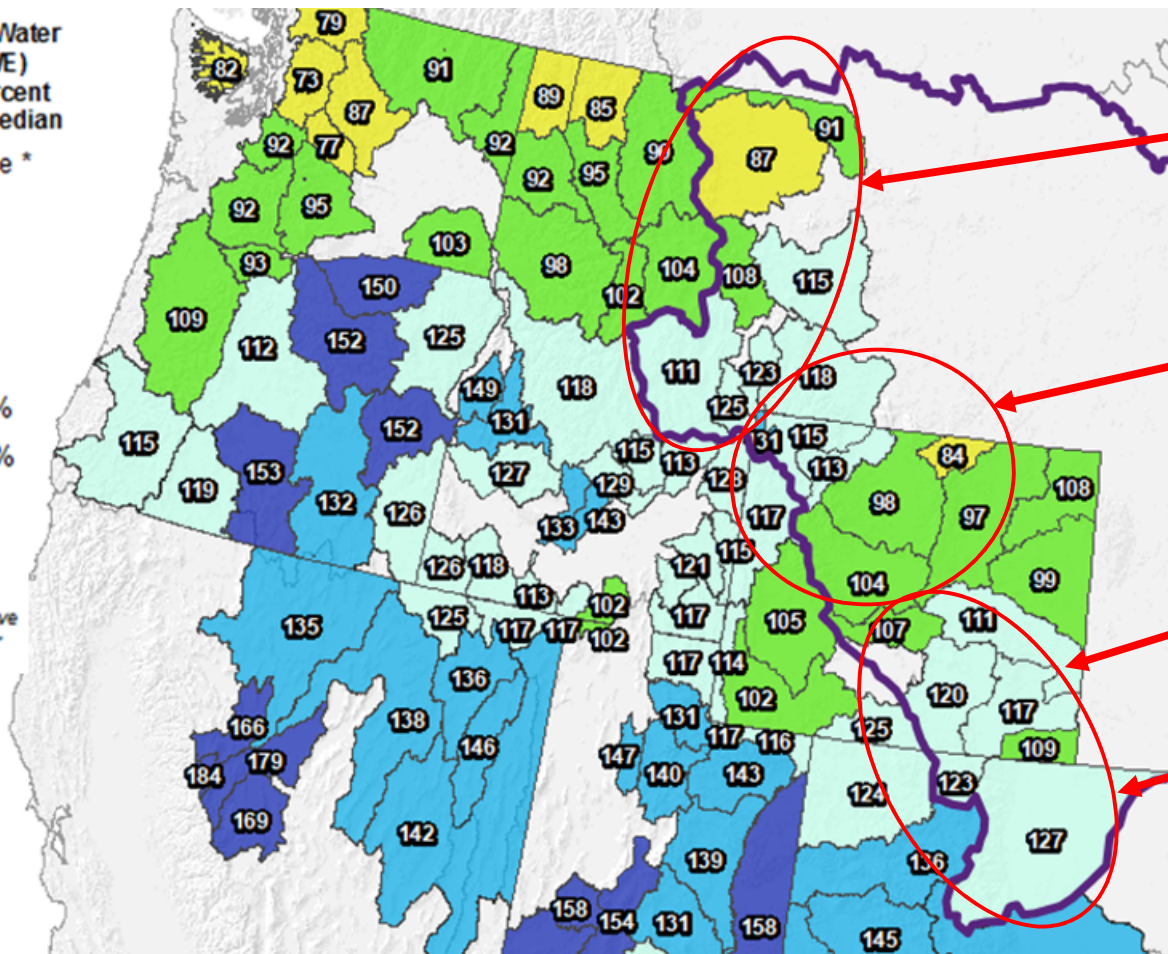


# MOUNTAIN SNOWPACK (ESTIMATED) – MARCH 11, 2019

Current Snow Water Equivalent (SWE)  
Basin-wide Percent of 1981-2010 Median



\* Data unavailable at time of posting or measurement is not representative at this time of year



**Missouri Headwaters**  
(119% overall)

**Yellowstone Basin**  
(118% overall)

**North Platte Basin**  
(117% overall)

**South Platte Basin**  
(127% overall)



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Graphics courtesy of USDA NRCS  
(Natural Resources Conservation Service)

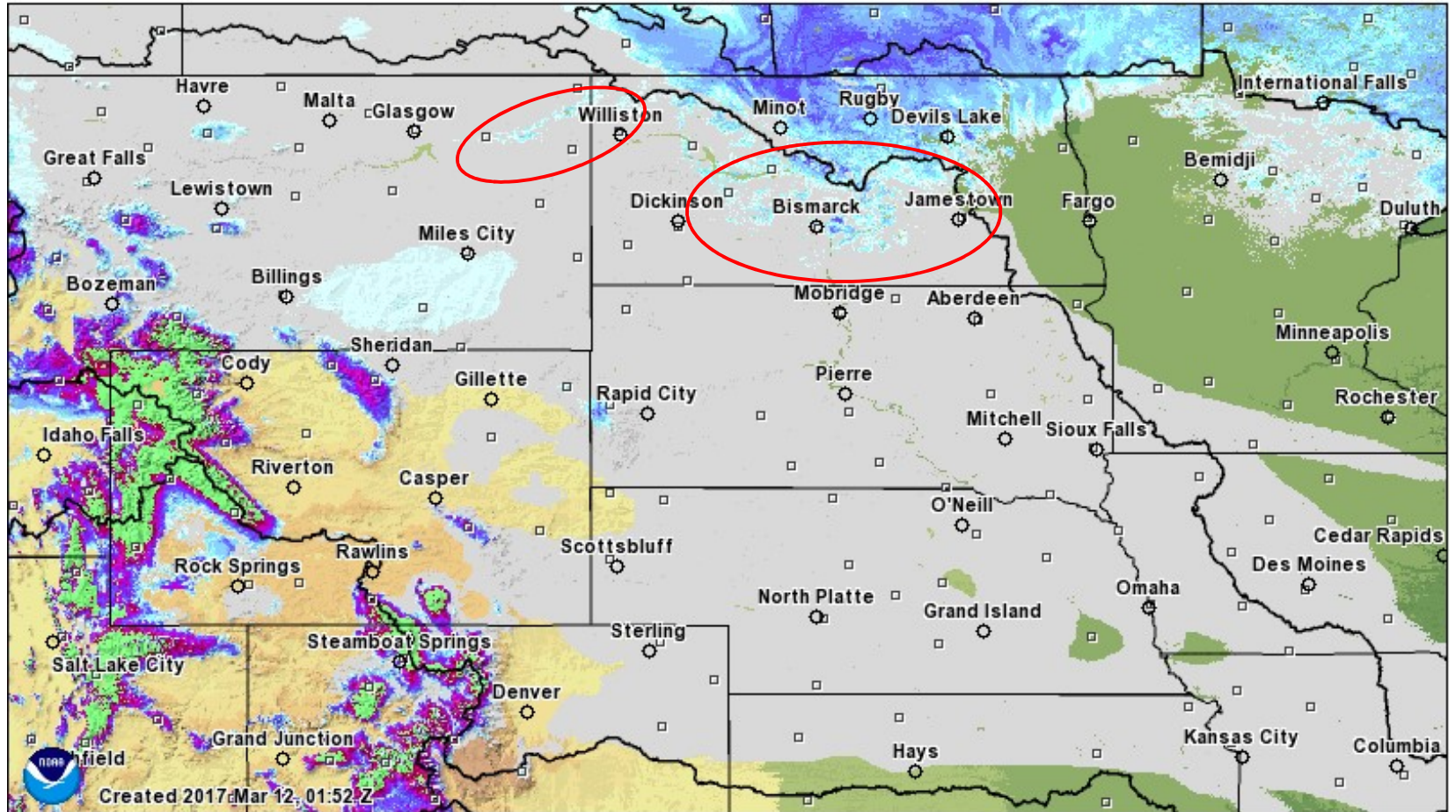
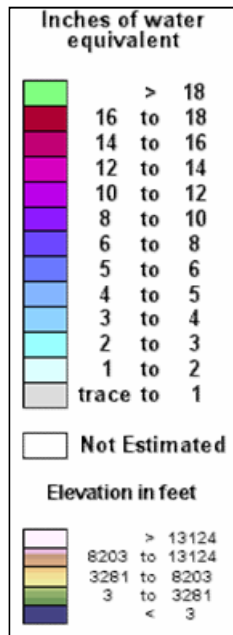


# PLAINS SNOWPACK (COMPARISON)

Modeled Snow Water Equivalent (Shallow-snow Legend) for 2017 March 11, 18:00 UTC

**March 11, 2017**

- 2"-4" South Central ND
- 1"-2" Northeast MT



Graphics courtesy of National Weather Service NOHRSC  
(National Operational Hydrologic Remote Sensing Center)

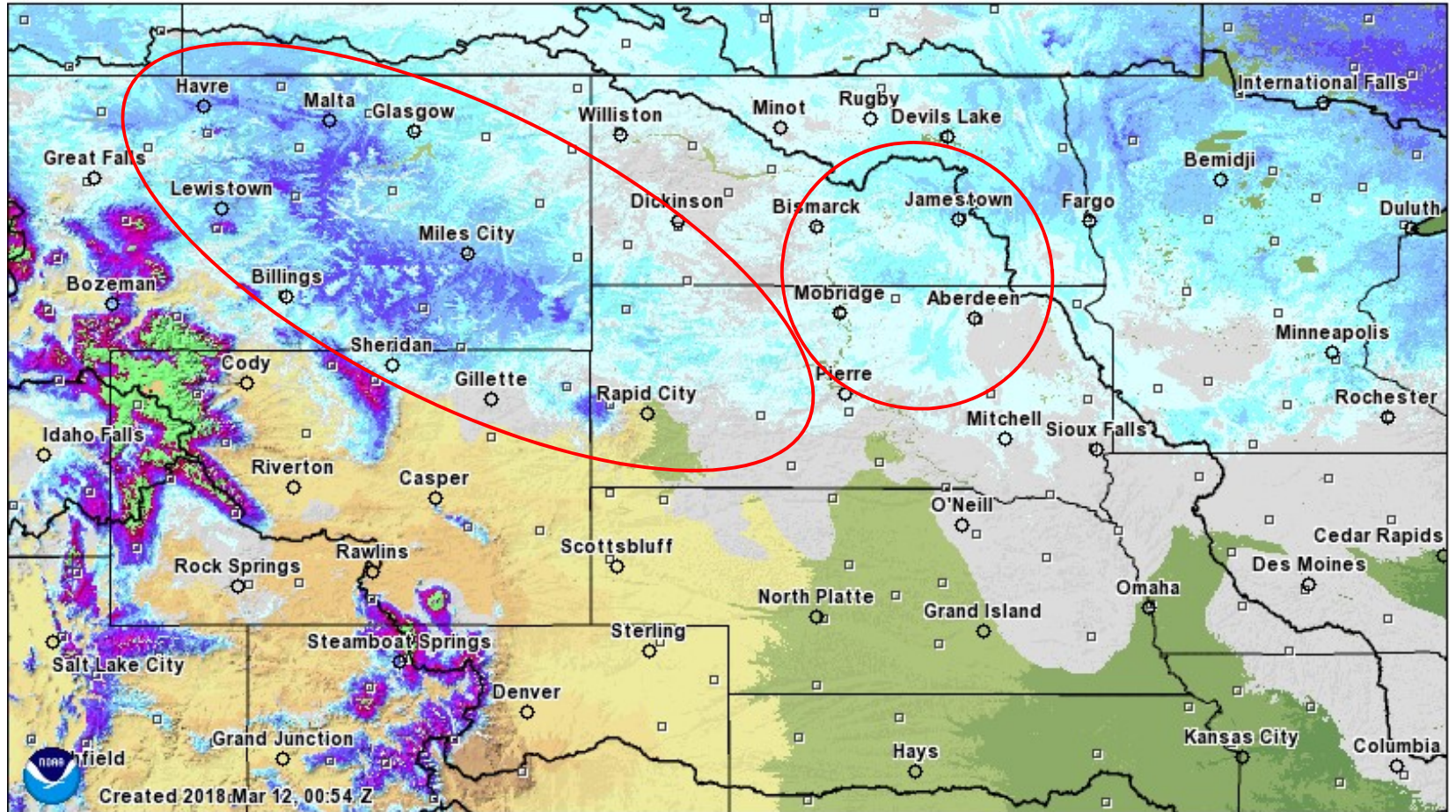
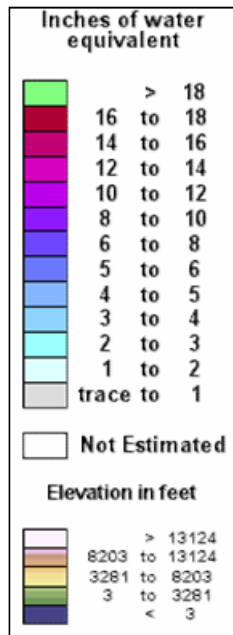
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# PLAINS SNOWPACK (COMPARISON)

Modeled Snow Water Equivalent (Shallow-snow Legend) for 2018 March 11, 18:00 UTC

**March 11, 2018**

- 3"-6" Central/Southeast MT
- 1"-3" Northwest SD
- 1"-3" South Central ND



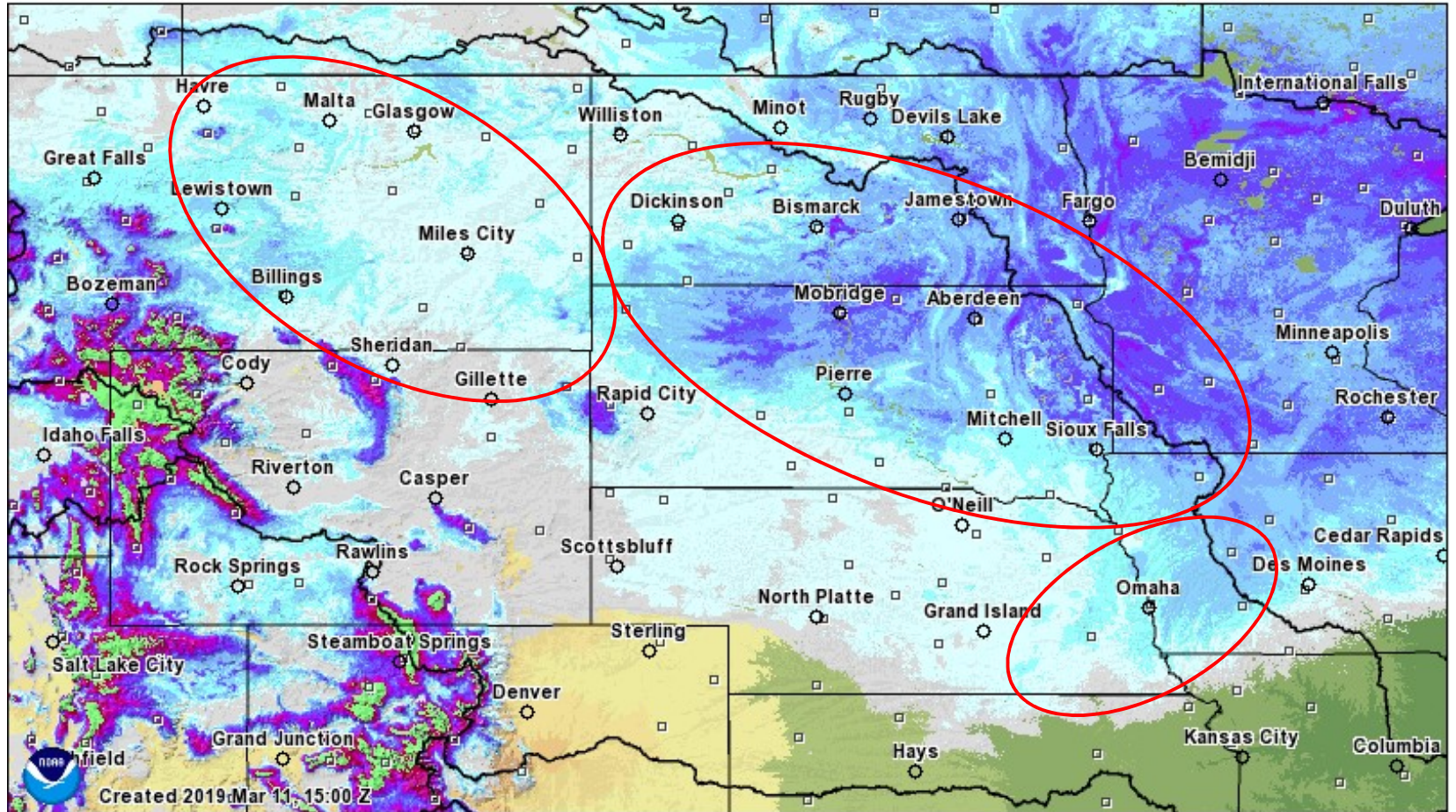
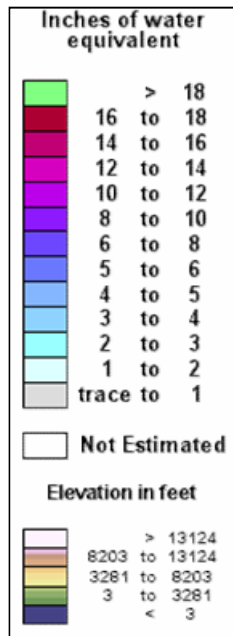
Graphics courtesy of National Weather Service NOHRSC (National Operational Hydrologic Remote Sensing Center)

# PLAINS SNOWPACK (COMPARISON)

Modeled Snow Water Equivalent (Shallow-snow Legend) forecasted for 2019 March 11, 18:00 UTC

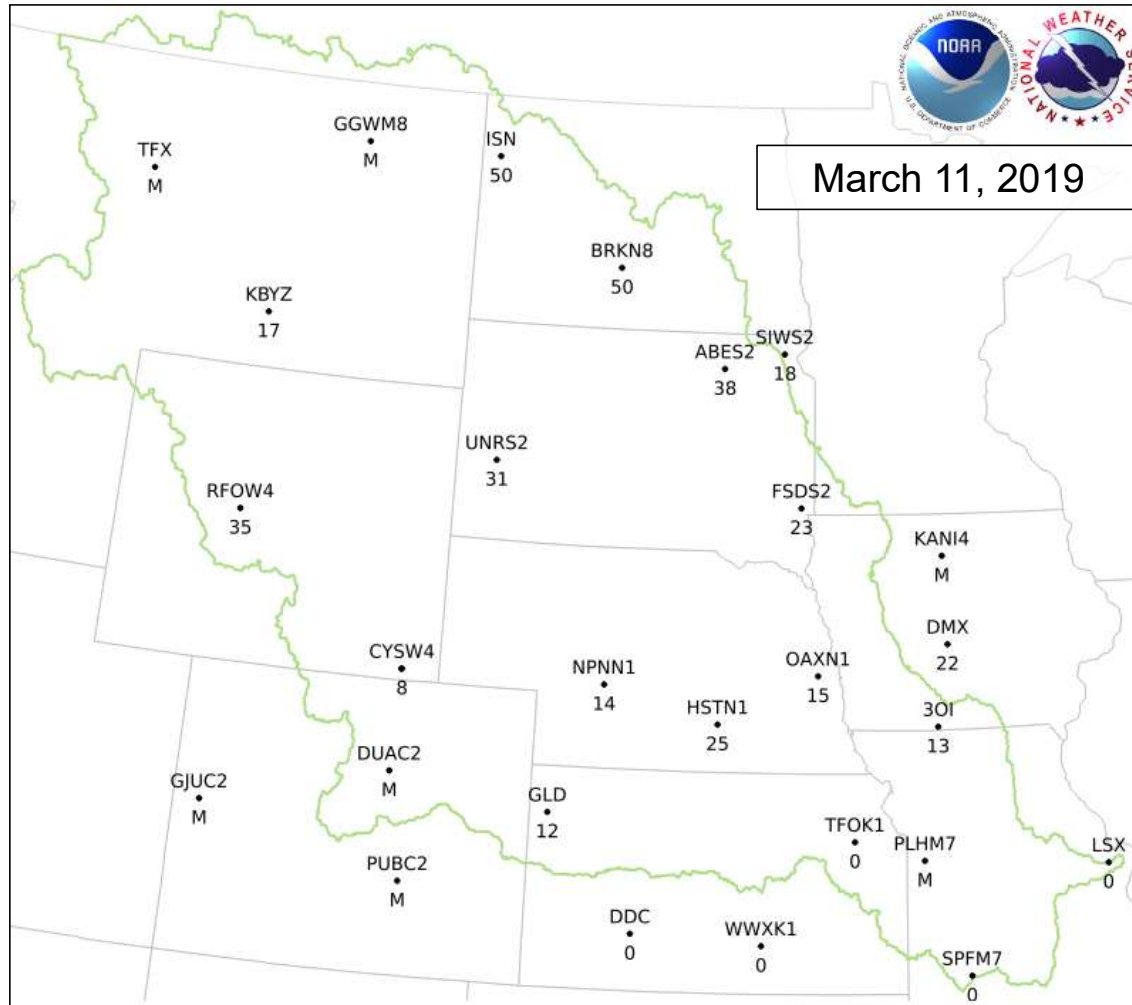
**March 11, 2019**

- 3"-6" Southern ND/SD
- 1"-4" East MT
- 2"-4" East NE, West IA



Created 2019:Mar 11, 15:00 Z

# FROST DEPTH

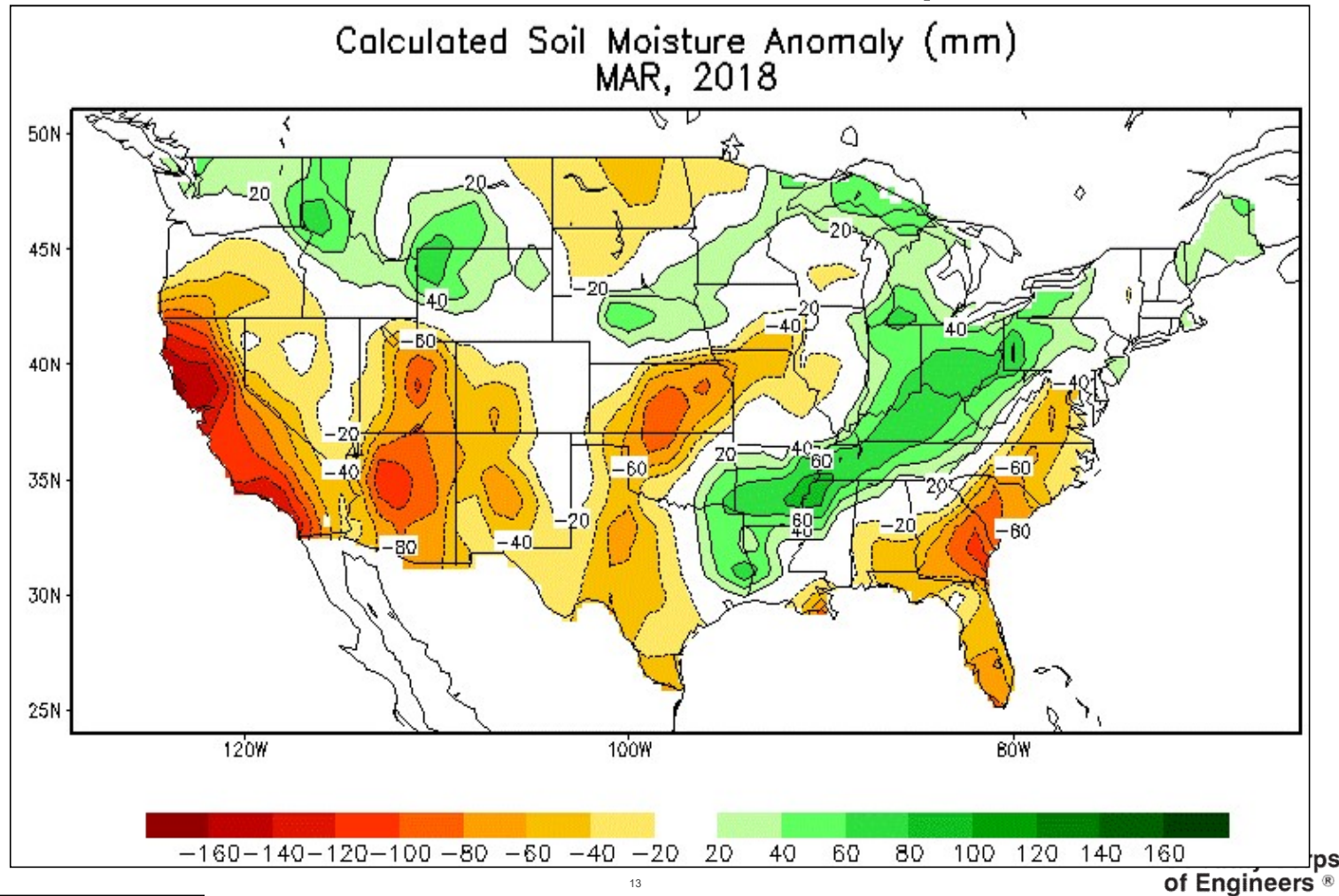


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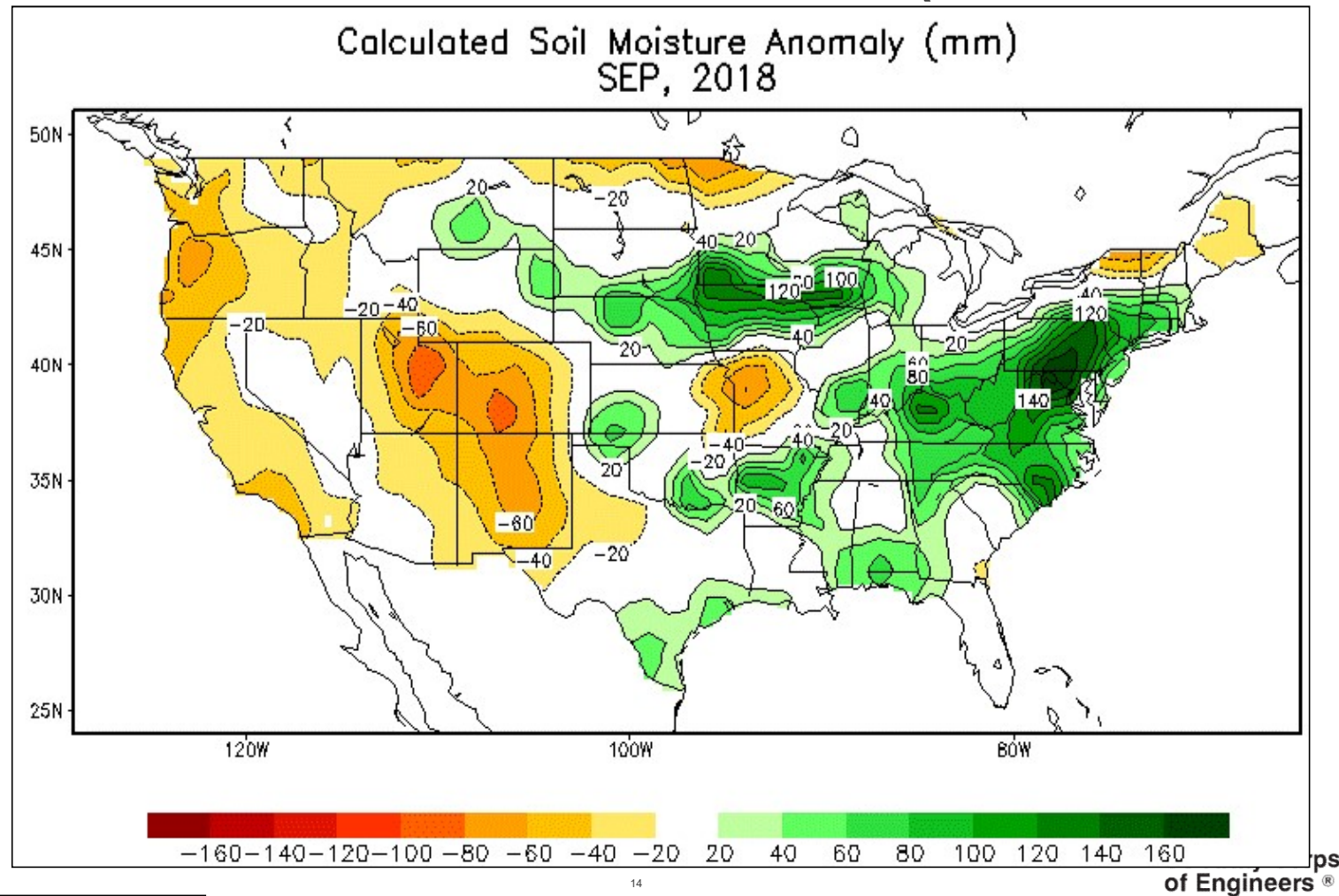


Graphics courtesy of NOAA Missouri Basin River Forecast Center

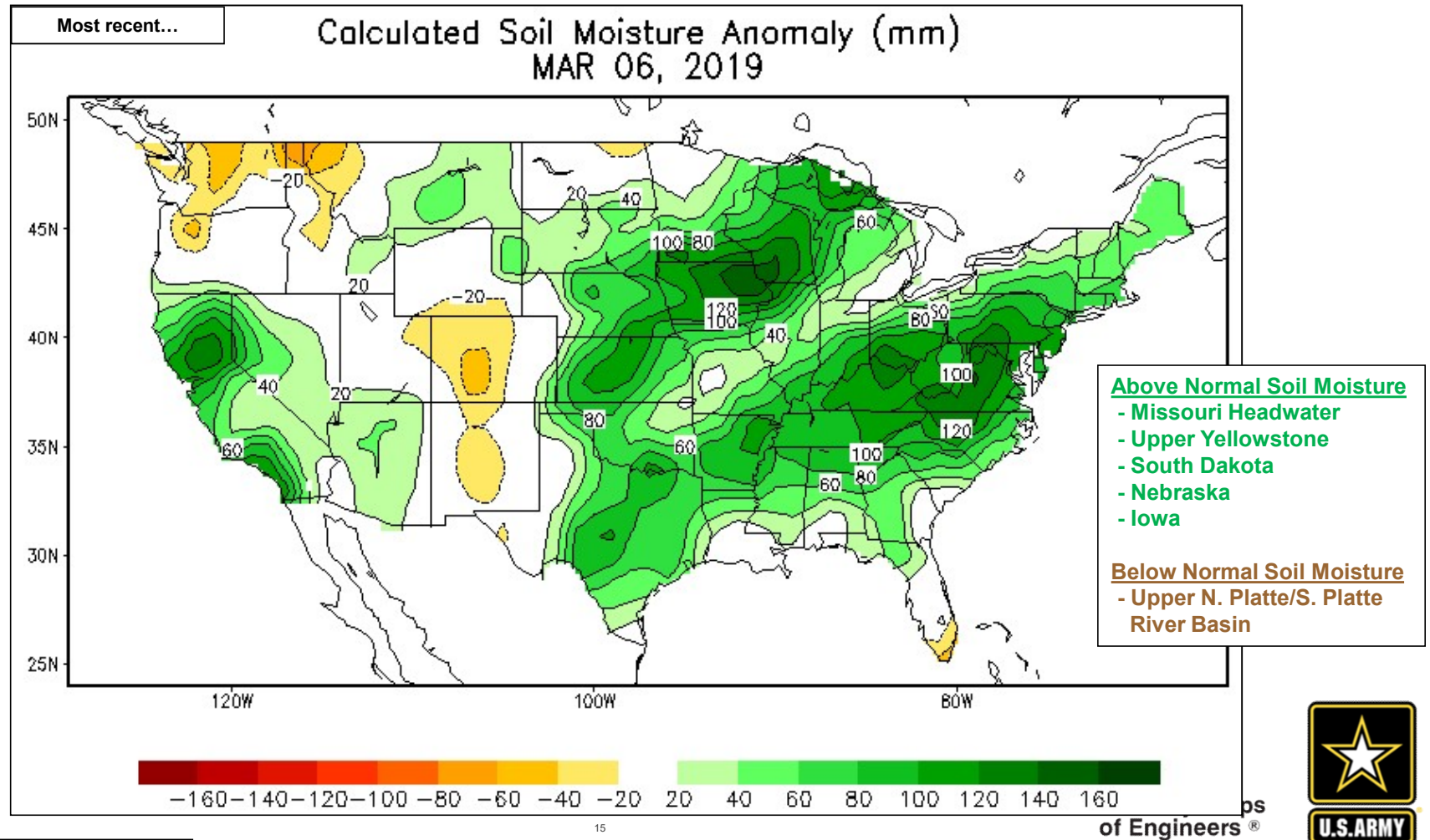
# U.S. SOIL MOISTURE ANOMALY (COMPARISON)



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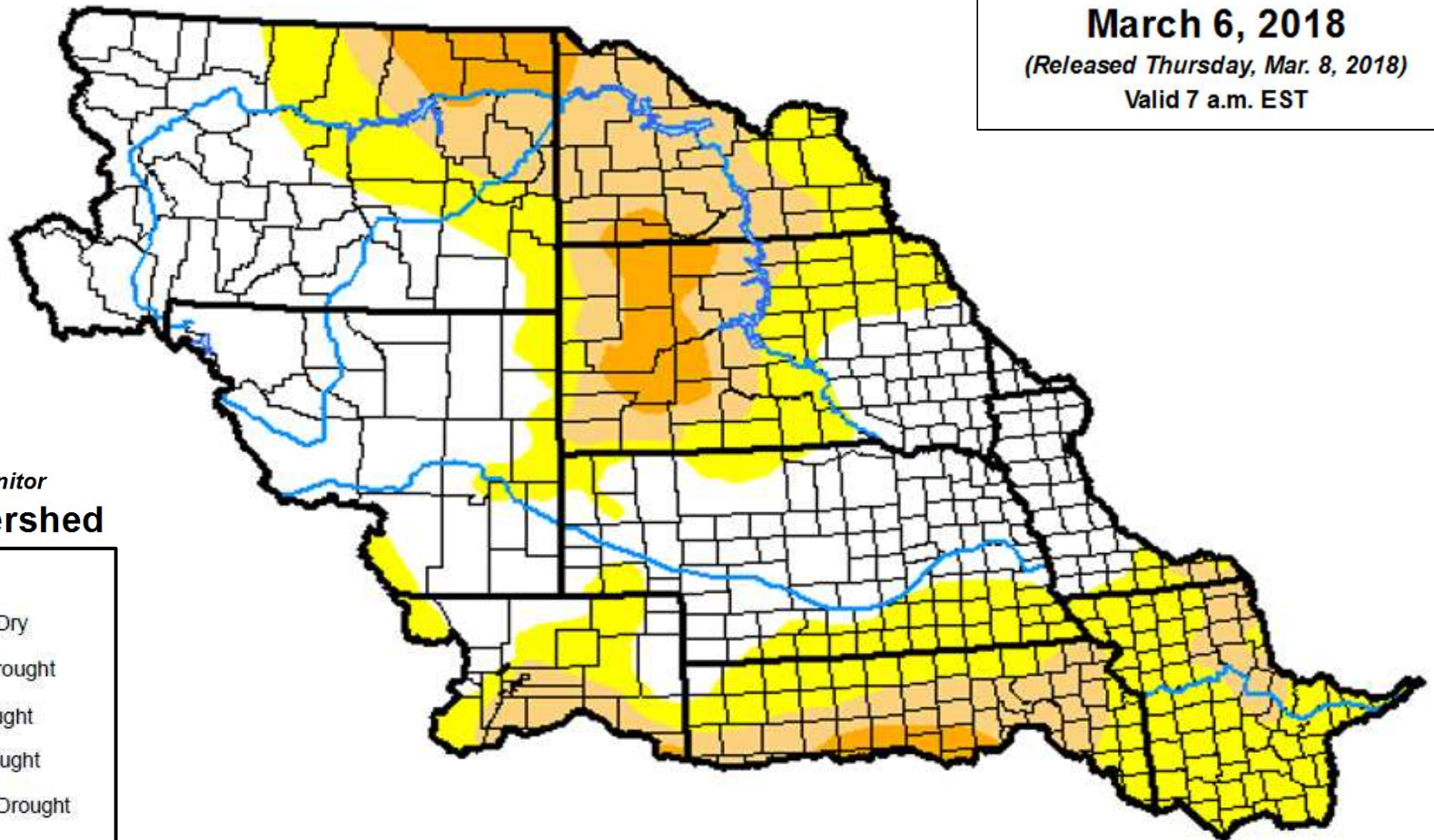
Graphics courtesy of NOAA Climate Prediction Center

# U.S. DROUGHT MONITOR (COMPARISON)

**March 6, 2018**

*(Released Thursday, Mar. 8, 2018)*

Valid 7 a.m. EST



*U.S. Drought Monitor*

## Missouri Watershed

Intensity:

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

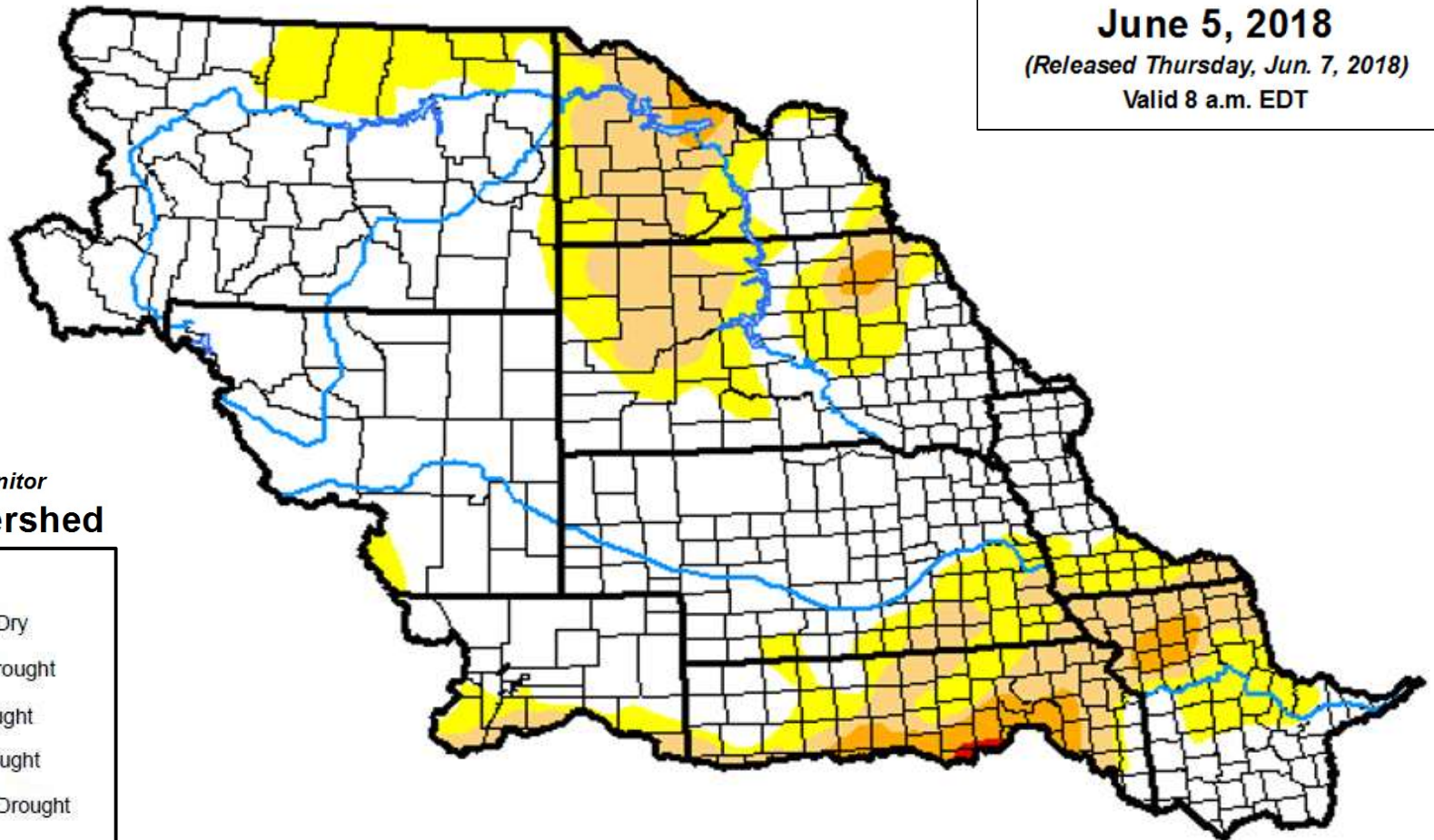


# U.S. DROUGHT MONITOR (COMPARISON)

**June 5, 2018**

*(Released Thursday, Jun. 7, 2018)*

Valid 8 a.m. EDT



*U.S. Drought Monitor*

## Missouri Watershed

Intensity:

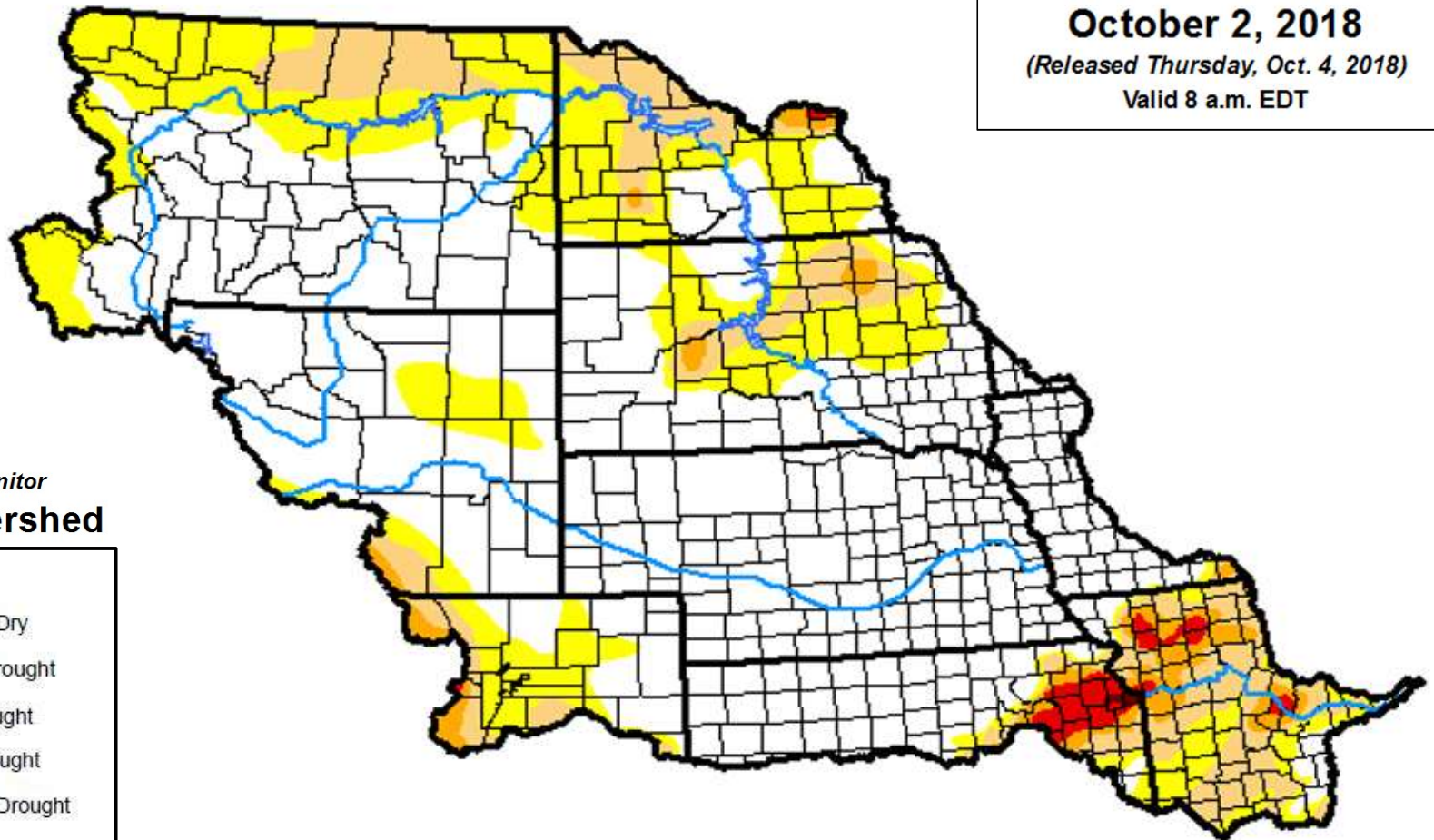
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

# U.S. DROUGHT MONITOR (COMPARISON)

**October 2, 2018**

*(Released Thursday, Oct. 4, 2018)*

Valid 8 a.m. EDT



*U.S. Drought Monitor*

## Missouri Watershed

Intensity:

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

# U.S. DROUGHT MONITOR (COMPARISON)

**March 5, 2019**

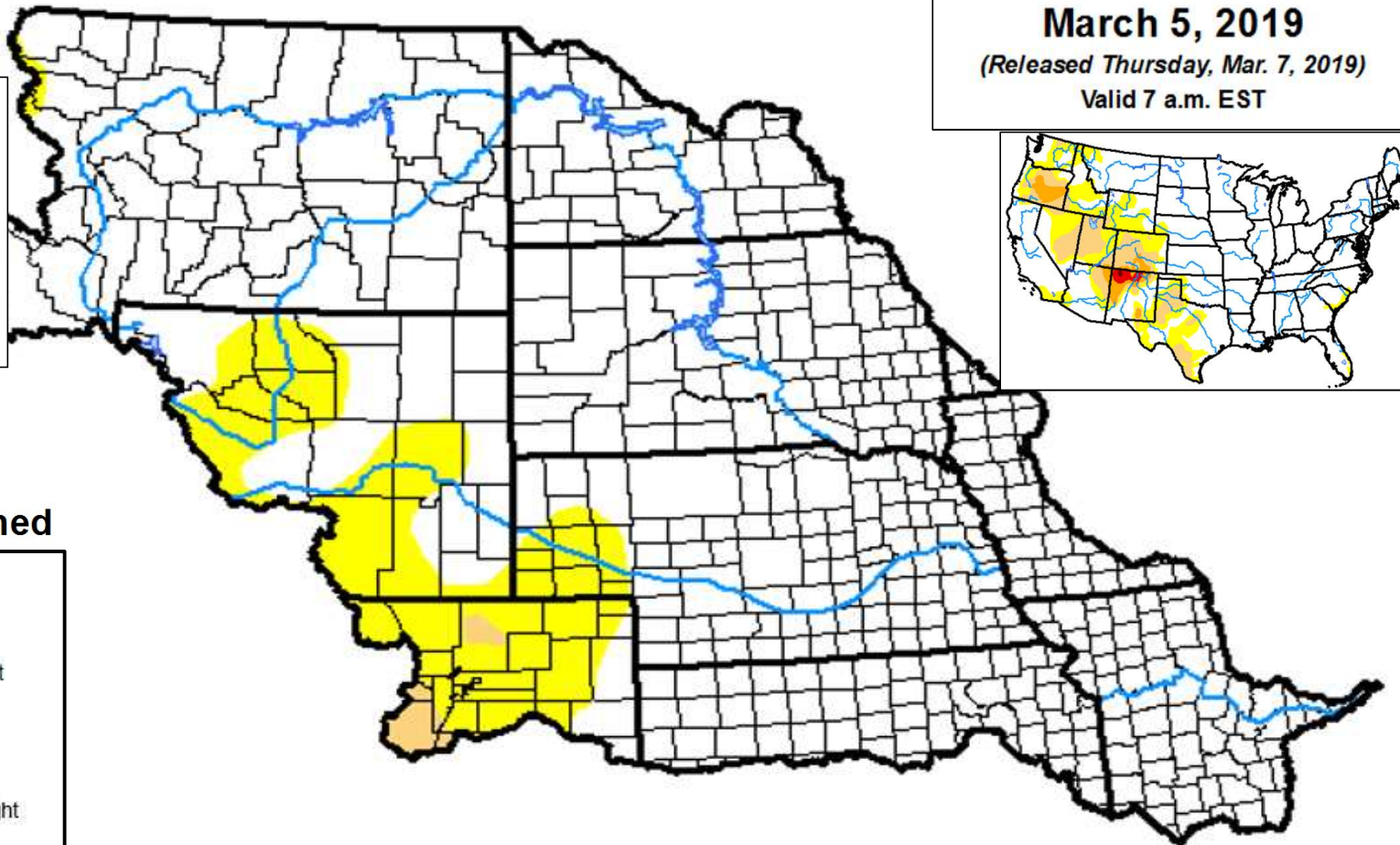
(Released Thursday, Mar. 7, 2019)

Valid 7 a.m. EST

## **Current Conditions**

**Moderate (D1) Drought  
northeast CO**

- Conditions have improved
- Developing/persisting across the southwestern portion of the basin
- Generally Abnormally Dry.



U.S. Drought Monitor

## Missouri Watershed

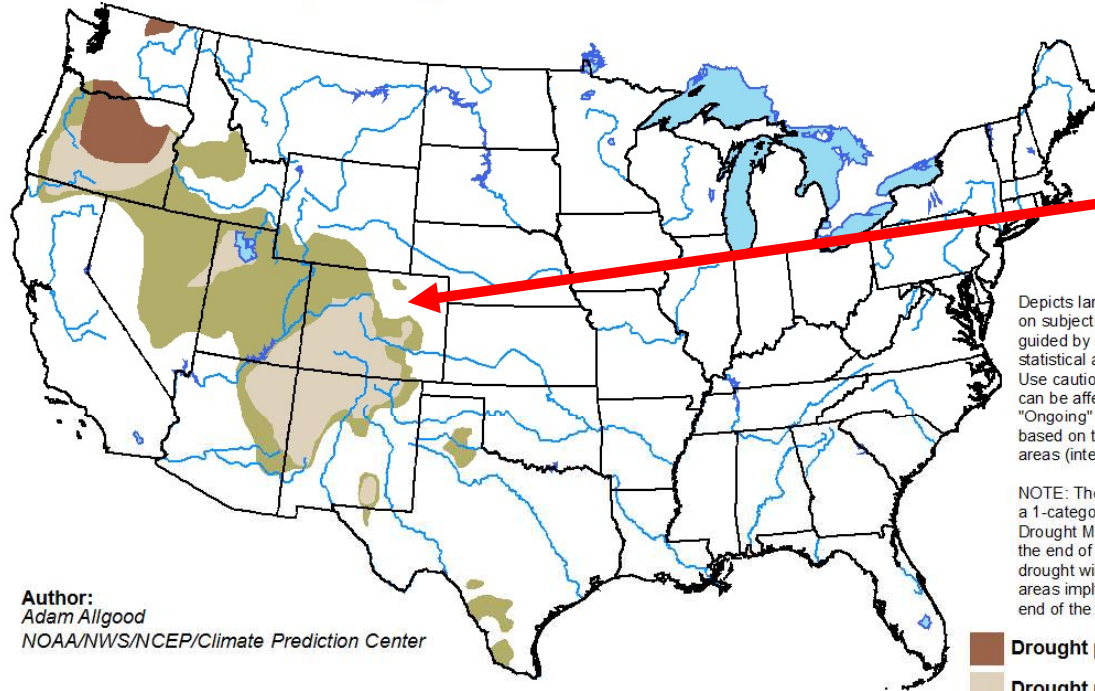
### Intensity:

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

# U.S. DROUGHT FORECAST

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

Valid for February 21 - May 31, 2019  
Released February 21

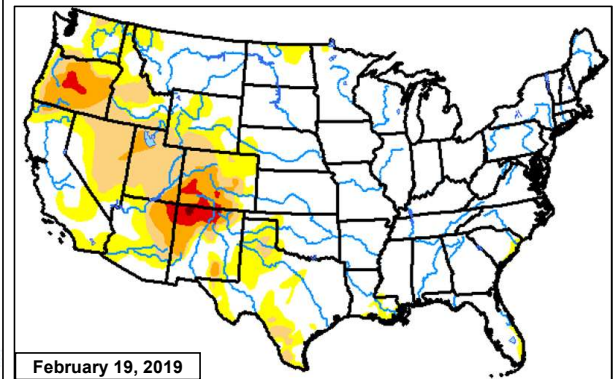


**Drought conditions  
(what little there is)  
expected to  
improve/removal**

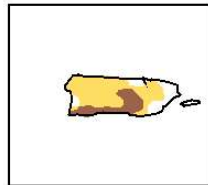
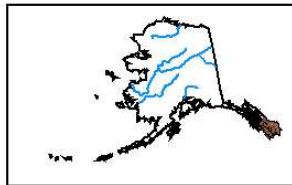
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to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

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



Author:  
Adam Allgood  
NOAA/NWS/NCEP/Climate Prediction Center



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



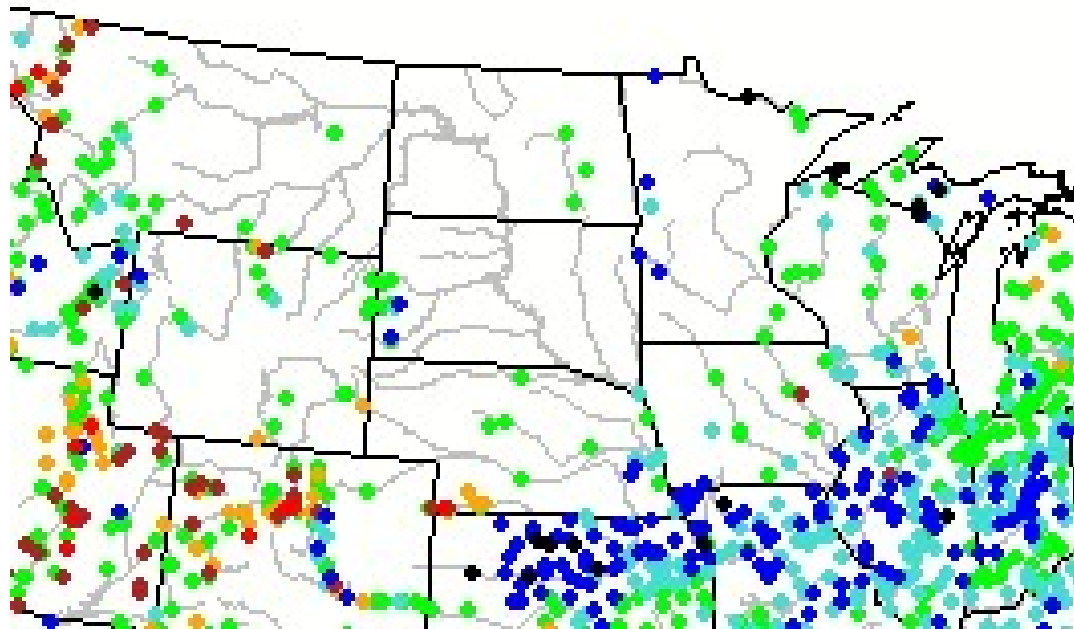
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# STREAM FLOW

(MANY NOT REPORTING DUE TO ICE)

Monday, March 11, 2019 17:30ET



| Explanation - Percentile classes |                          |                       |                 |                       |                          |      |            |
|----------------------------------|--------------------------|-----------------------|-----------------|-----------------------|--------------------------|------|------------|
|                                  |                          |                       |                 |                       |                          |      |            |
| Low                              | <10<br>Much below normal | 10-24<br>Below normal | 25-75<br>Normal | 76-90<br>Above normal | >90<br>Much above normal | High | Not-ranked |

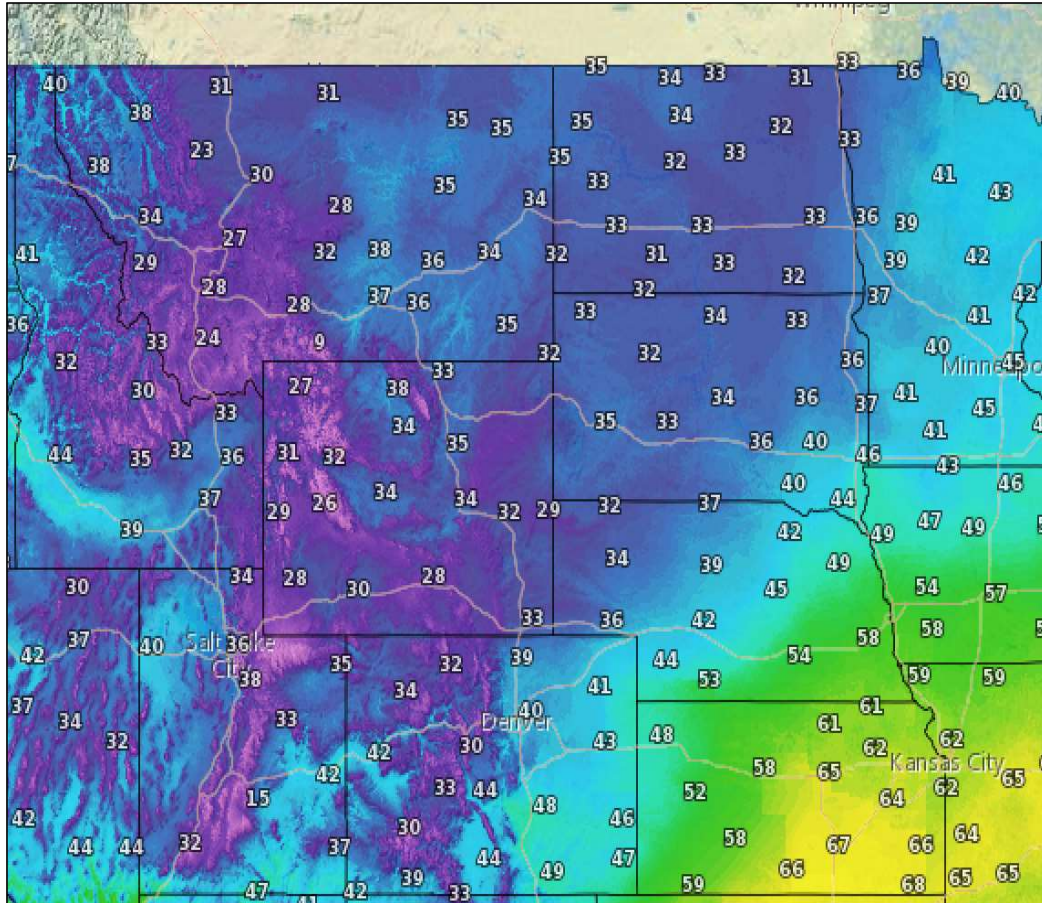


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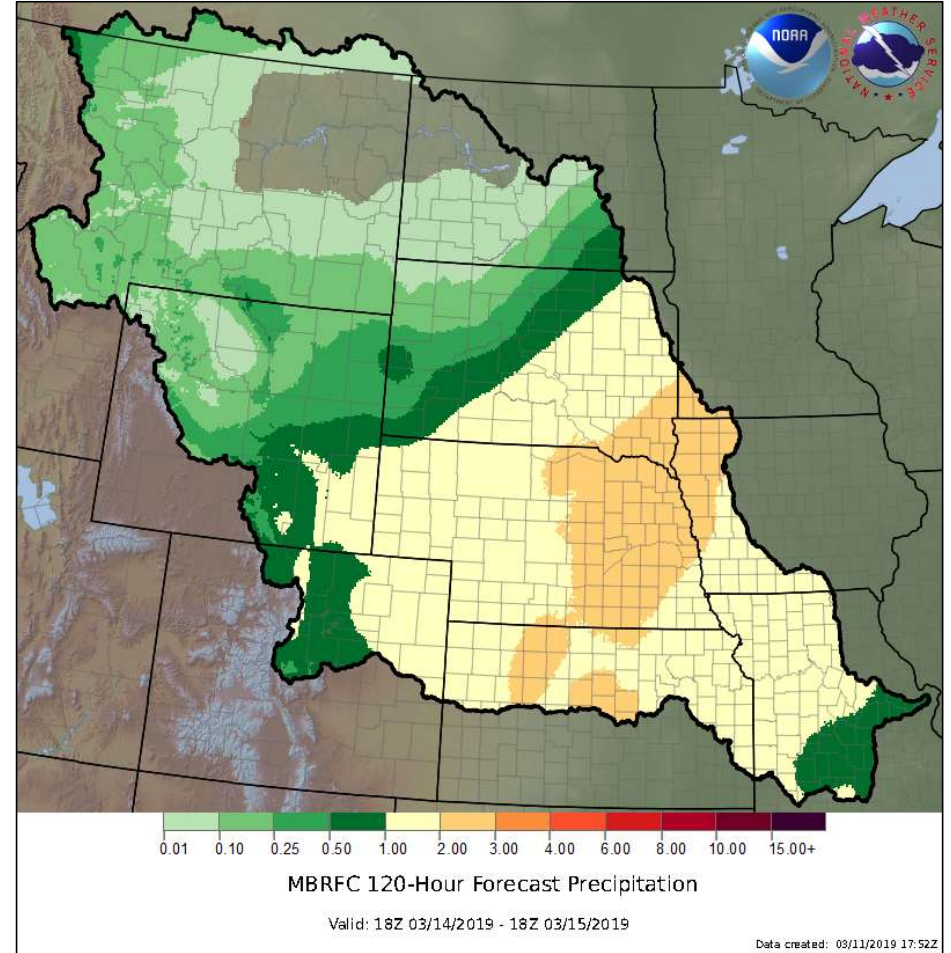
# THIS WEEK (ISSUED MAR 11, 2019)

Wednesday High Temperature



22

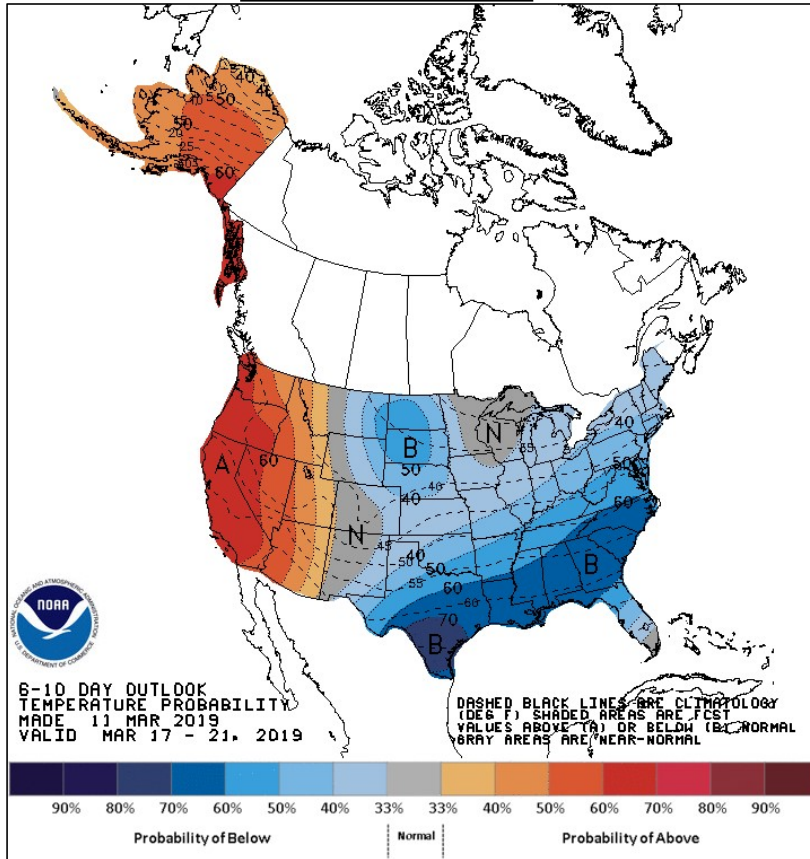
5 Day Total Precipitation



Data created: 03/11/2019 17:52Z

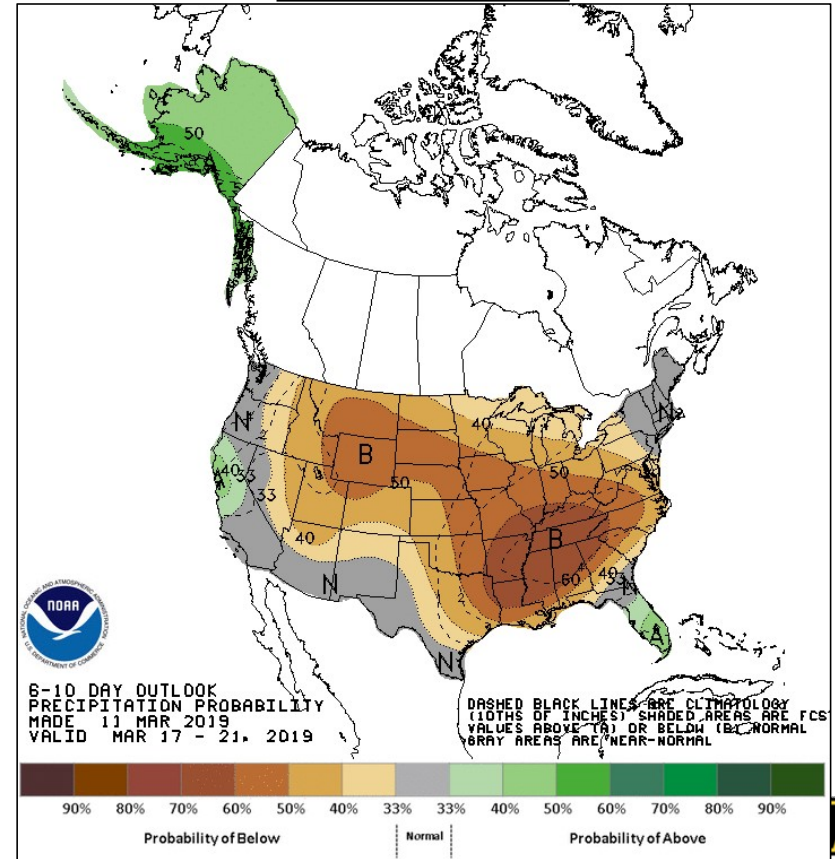
# CPC 6-10 DAY OUTLOOK (MARCH 17-21, 2019) (ISSUED MAR 11, 2019)

Temperature



• Entire Missouri River Basin – Below Normal

Precipitation



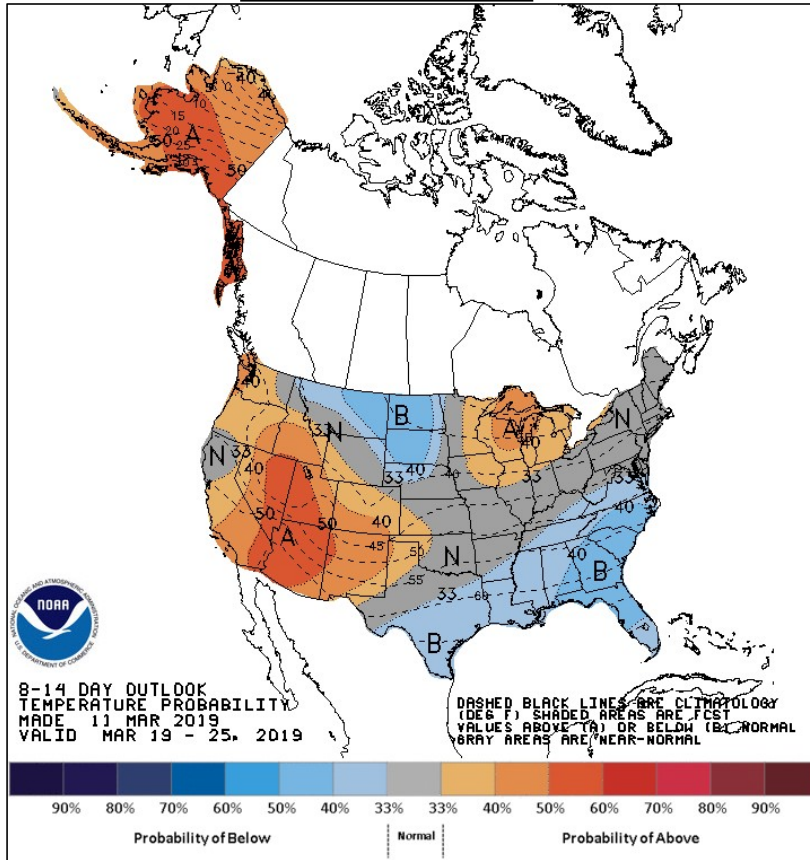
• Entire Missouri River Basin: Below Normal  
• Welcome News!

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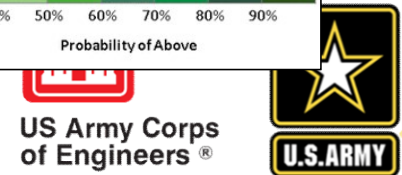
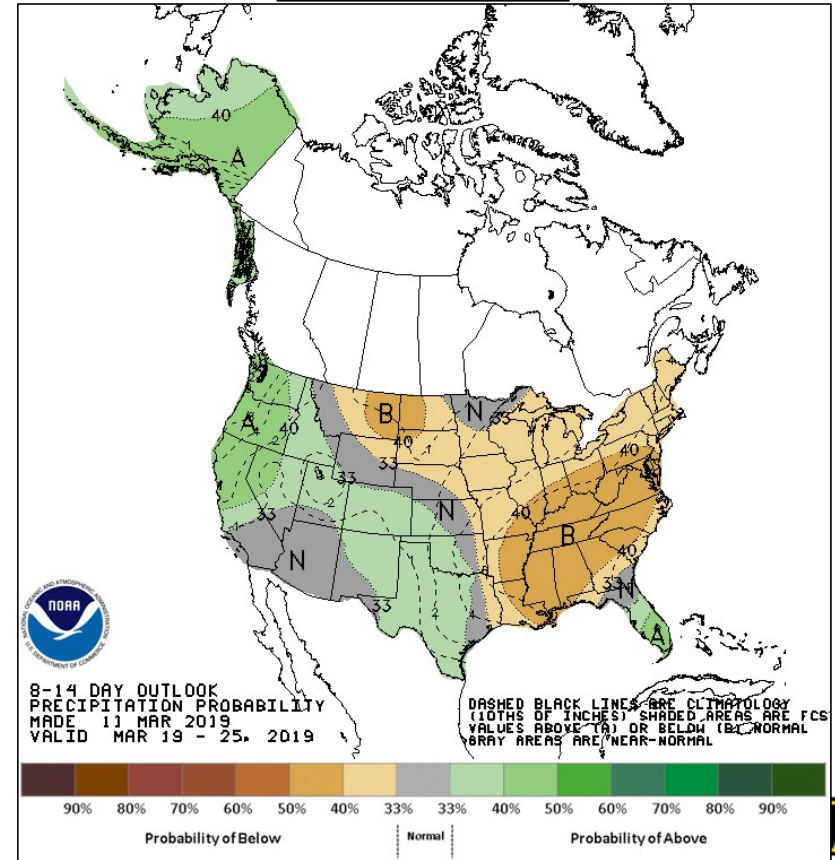


# CPC 8-14 DAY OUTLOOK (MARCH 19-25, 2019) (ISSUED MAR 11, 2019)

Temperature



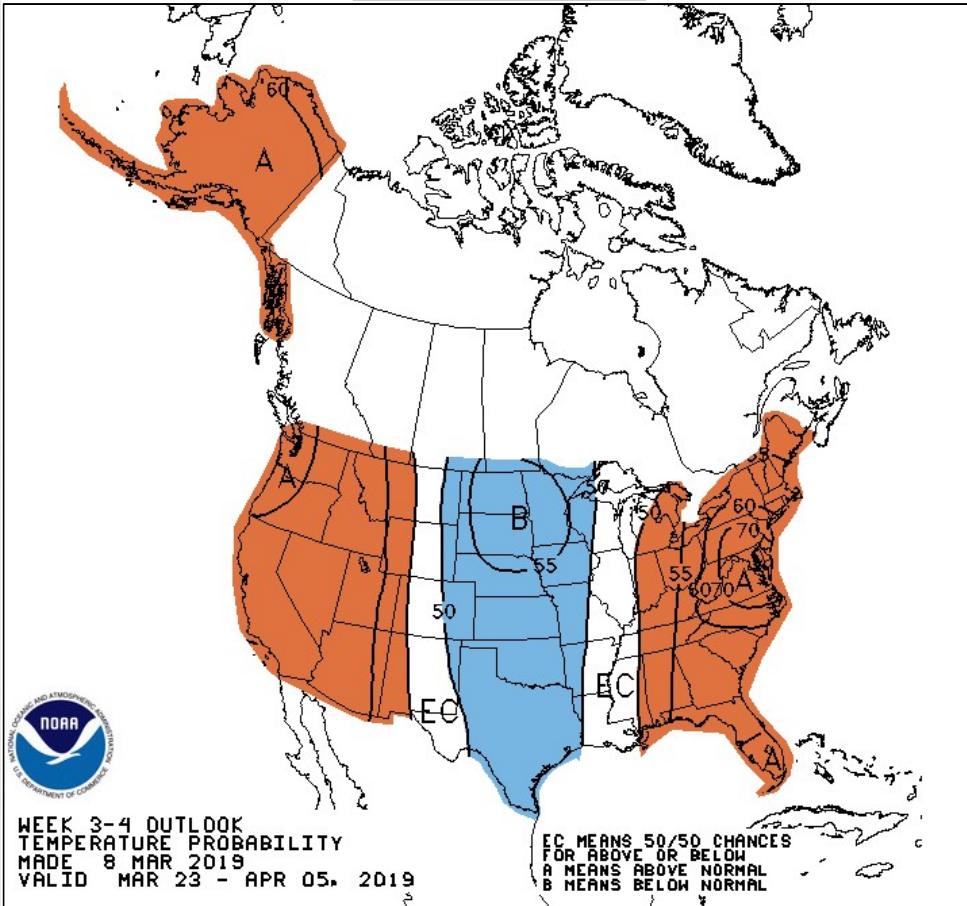
Precipitation



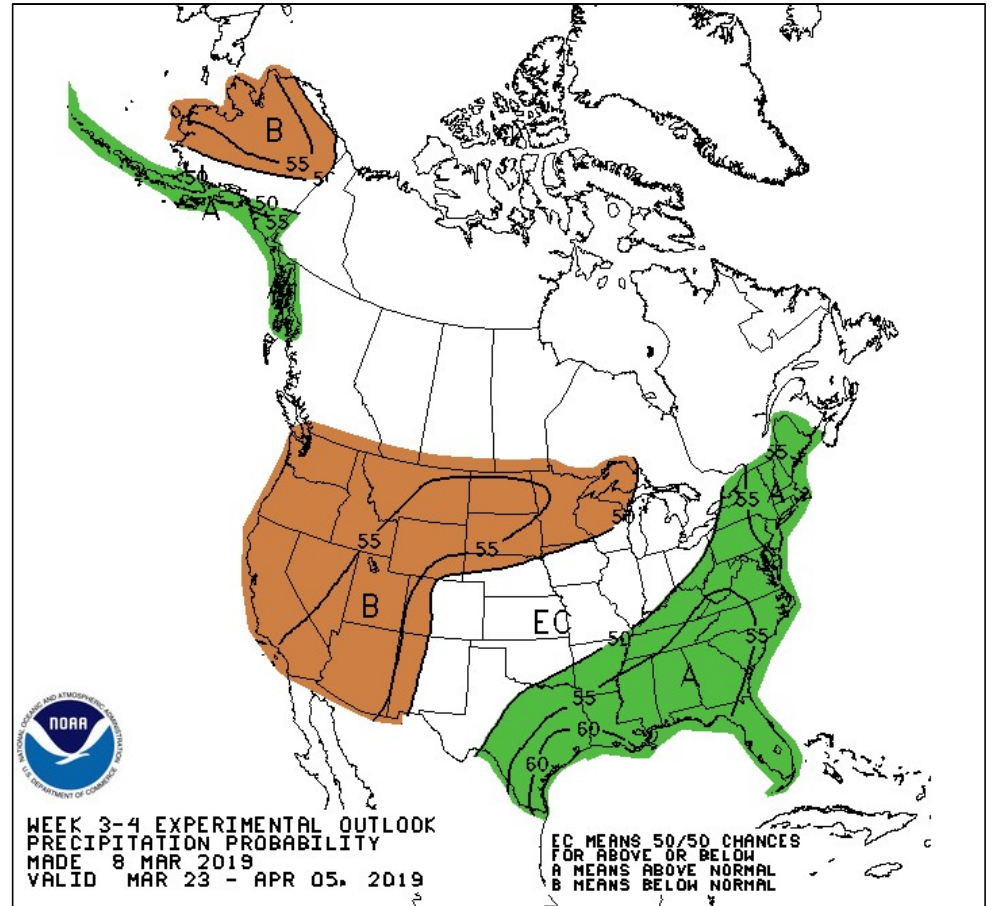


# CPC WEEK 3-4 OUTLOOK (MARCH 23-APRIL 5) (ISSUED MAR 8, 2019)

Temperature



Precipitation



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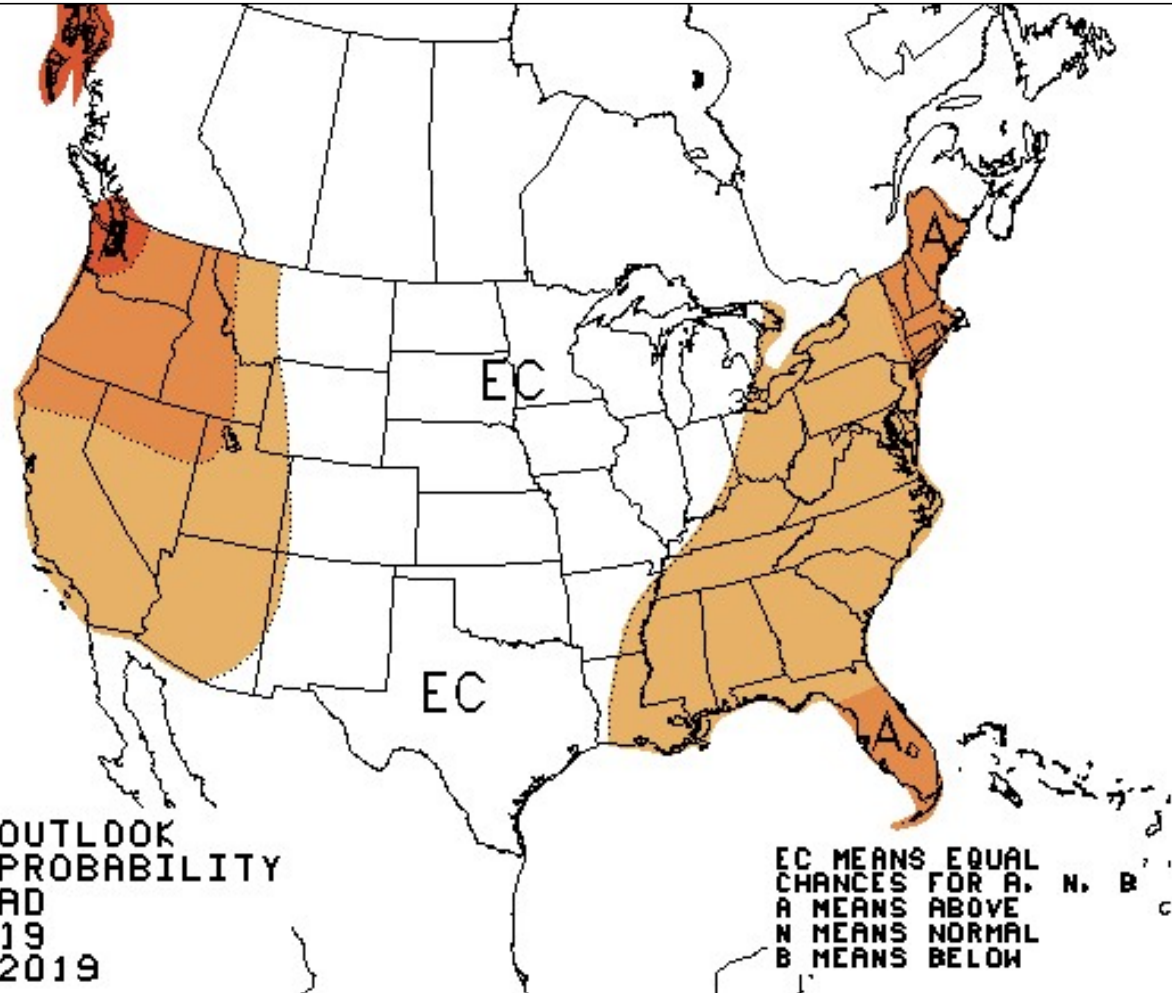


# CPC 3-MONTH TEMPERATURE OUTLOOKS (ISSUED FEB 21, 2019)

March-April-May  
"Spring"



THREE-MONTH OUTLOOK  
TEMPERATURE PROBABILITY  
0.5 MONTH LEAD  
VALID MAM 2019  
MADE 21 FEB 2019

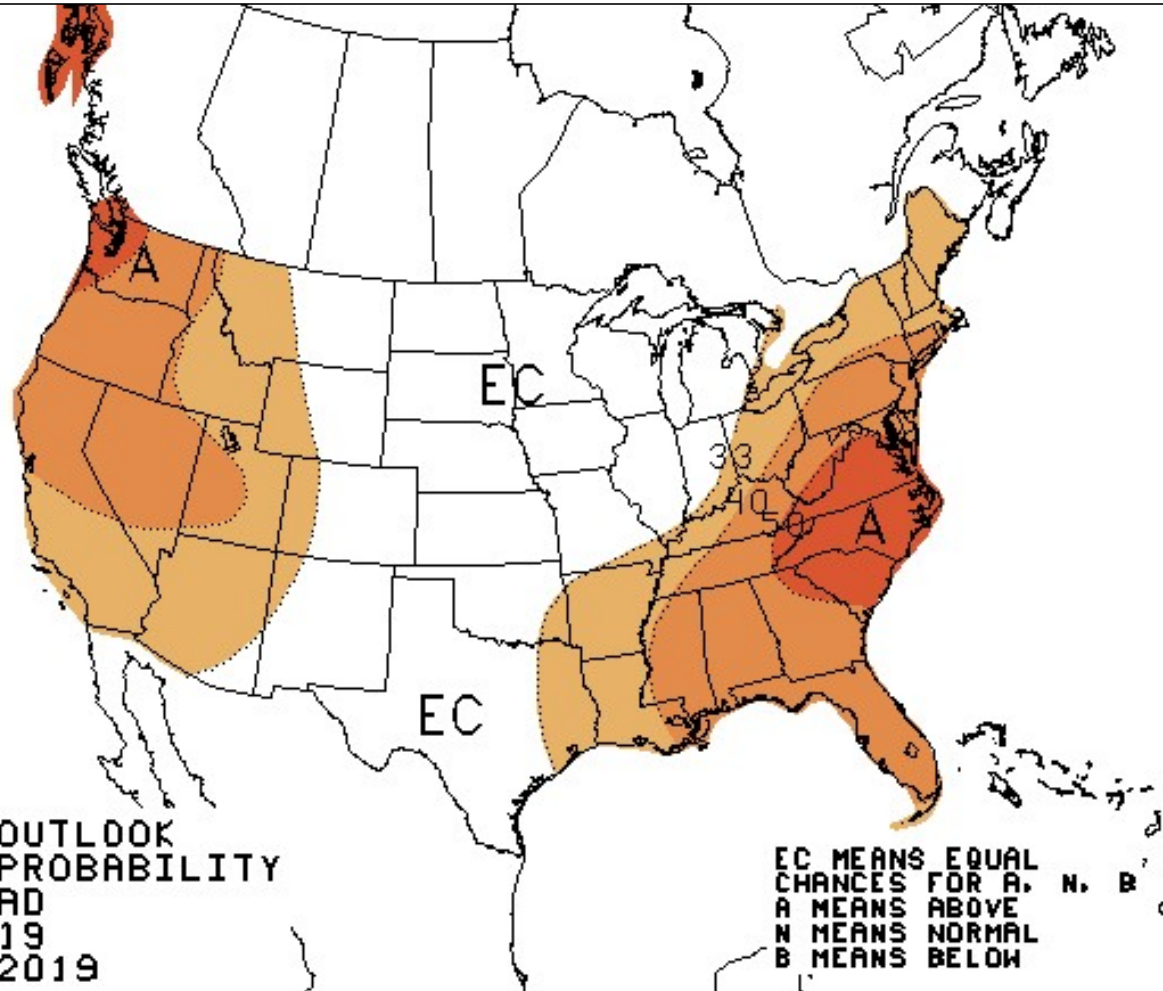


# CPC 3-MONTH TEMPERATURE OUTLOOKS (ISSUED FEB 21, 2019)

April-May-June  
"Late Spring"



THREE-MONTH OUTLOOK  
TEMPERATURE PROBABILITY  
1.5 MONTH LEAD  
VALID AMJ 2019  
MADE 21 FEB 2019

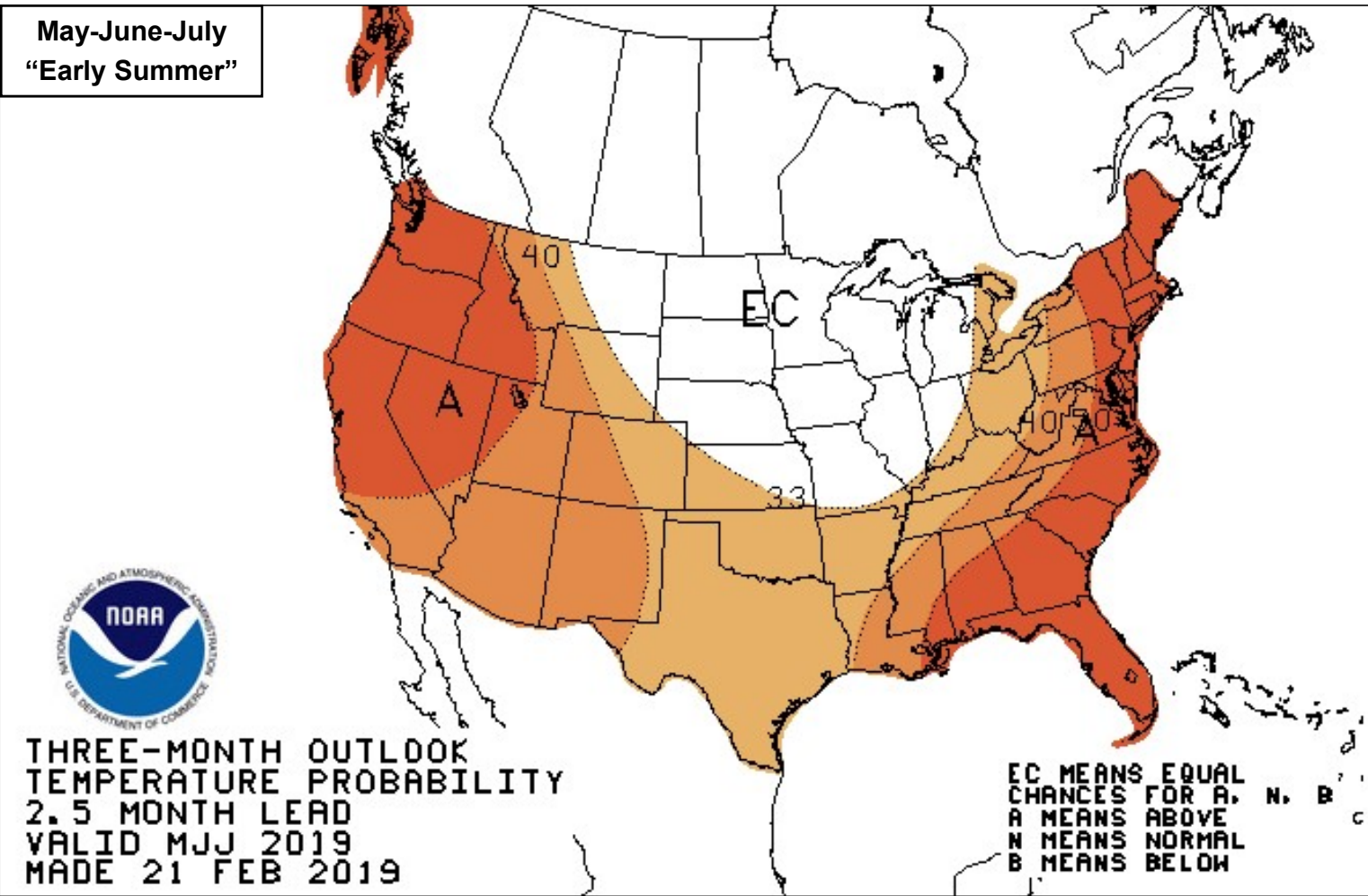


EC MEANS EQUAL  
CHANCES FOR A, N, B  
A MEANS ABOVE  
N MEANS NORMAL  
B MEANS BELOW

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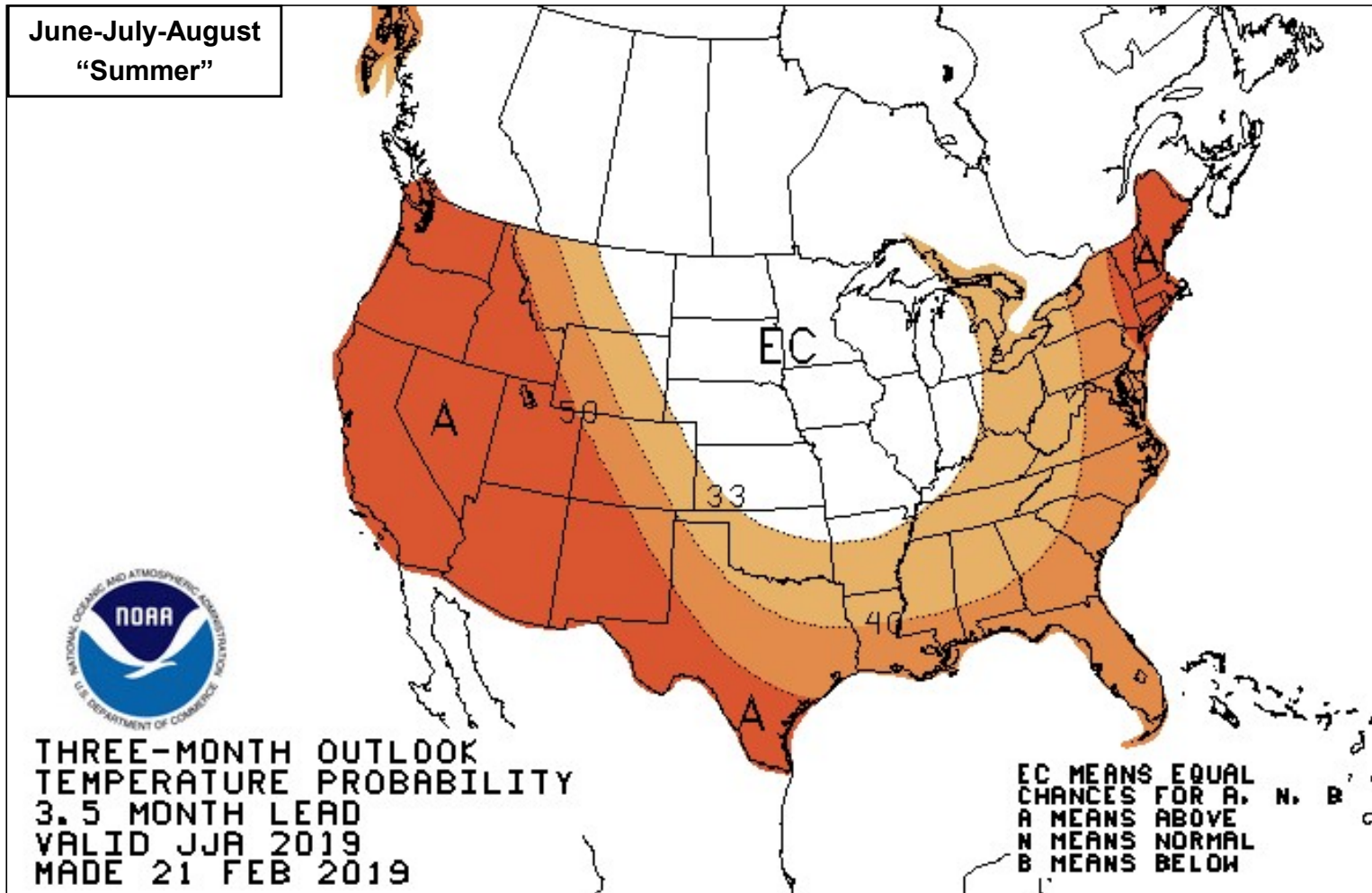


# CPC 3-MONTH TEMPERATURE OUTLOOKS (ISSUED FEB 21, 2019)



Graphics courtesy of NOAA Climate Prediction Center

# CPC 3-MONTH TEMPERATURE OUTLOOKS (ISSUED FEB 21, 2019)

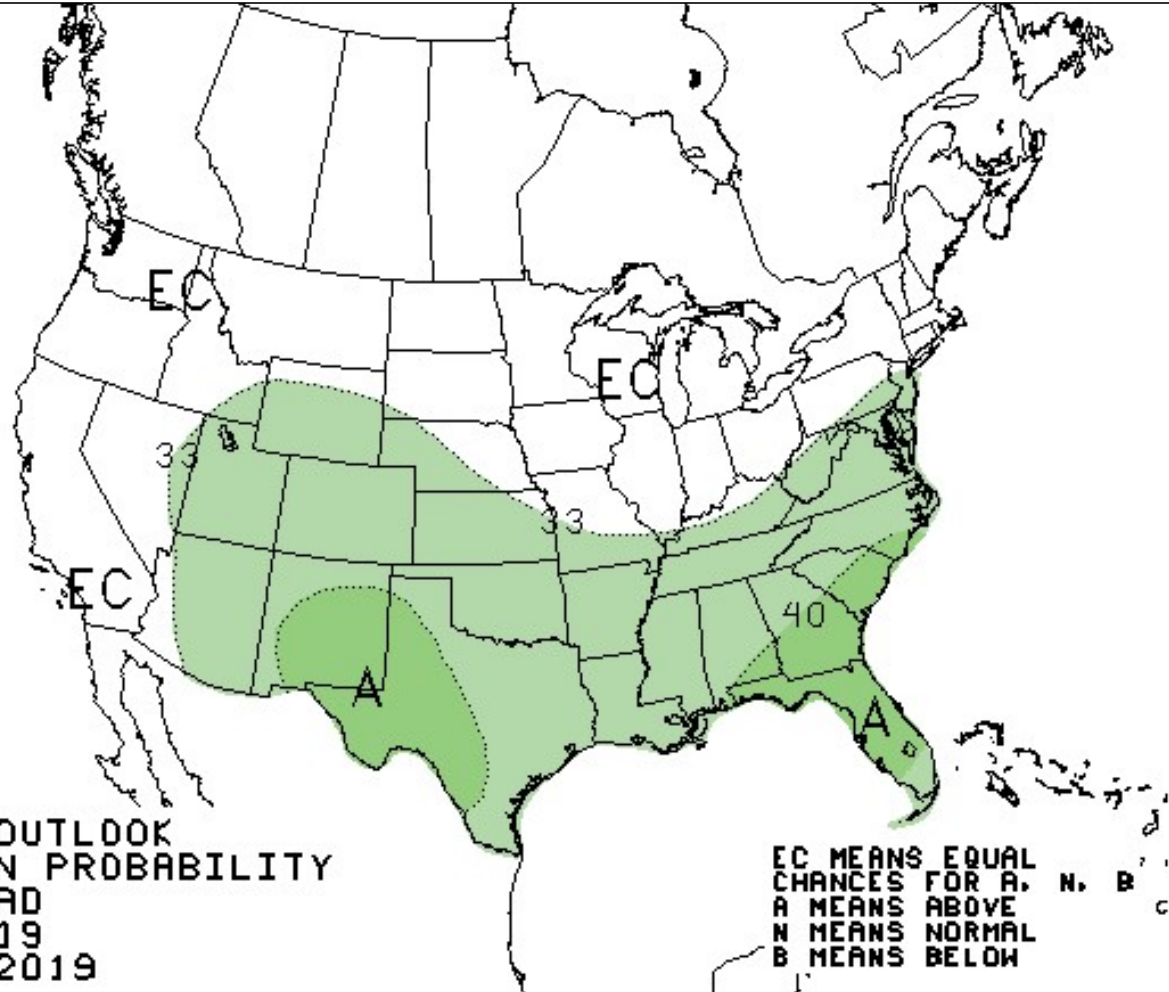


# CPC 3-MONTH PRECIPITATION OUTLOOKS (ISSUED FEB 21, 2019)

March-April-May  
"Spring"



THREE-MONTH OUTLOOK  
PRECIPITATION PROBABILITY  
0.5 MONTH LEAD  
VALID MAM 2019  
MADE 21 FEB 2019



EC MEANS EQUAL  
CHANCES FOR A, N, B  
A MEANS ABOVE  
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B MEANS BELOW



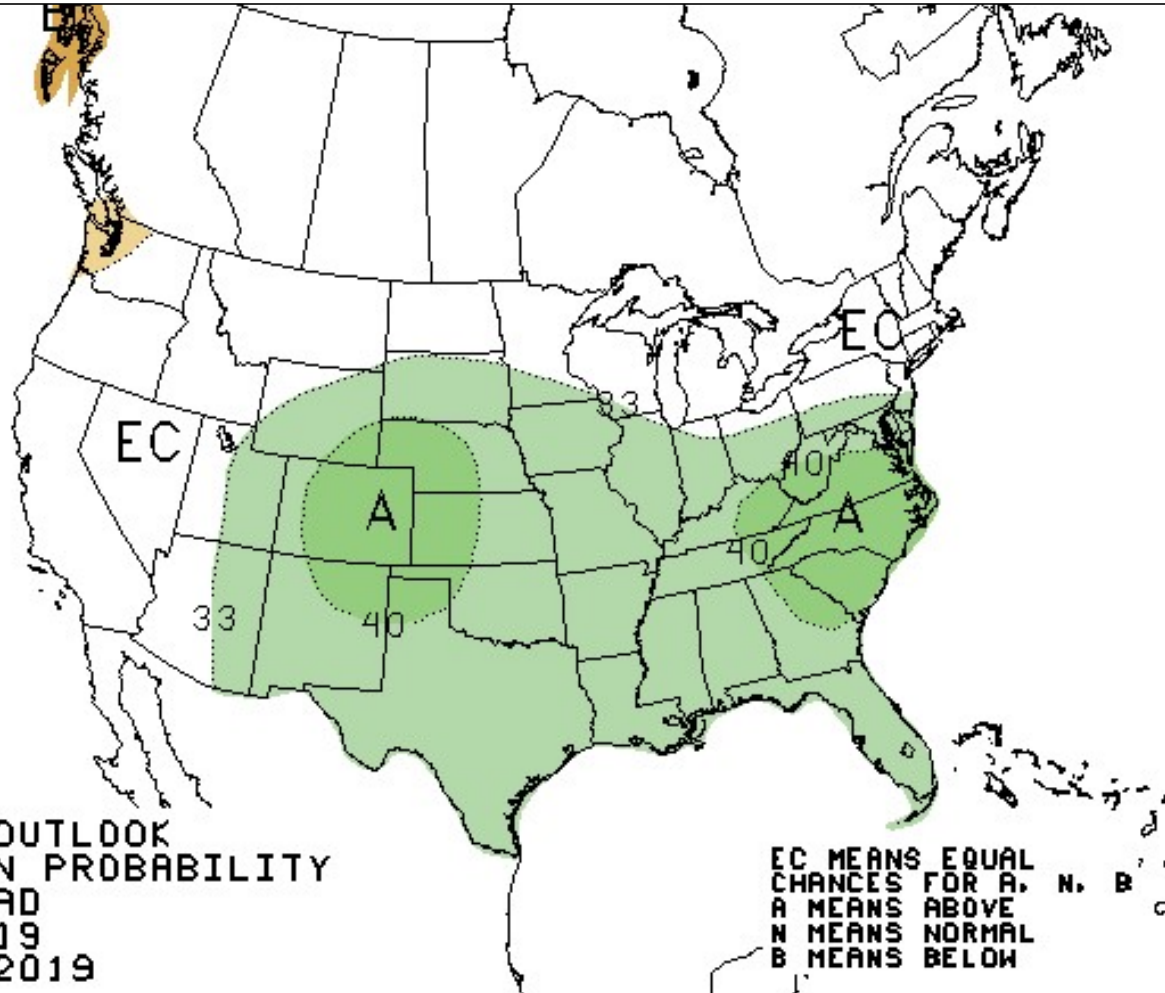
ps

# CPC 3-MONTH PRECIPITATION OUTLOOKS (ISSUED FEB 21, 2019)

April-May-June  
"Late Spring"



THREE-MONTH OUTLOOK  
PRECIPITATION PROBABILITY  
1.5 MONTH LEAD  
VALID AMJ 2019  
MADE 21 FEB 2019

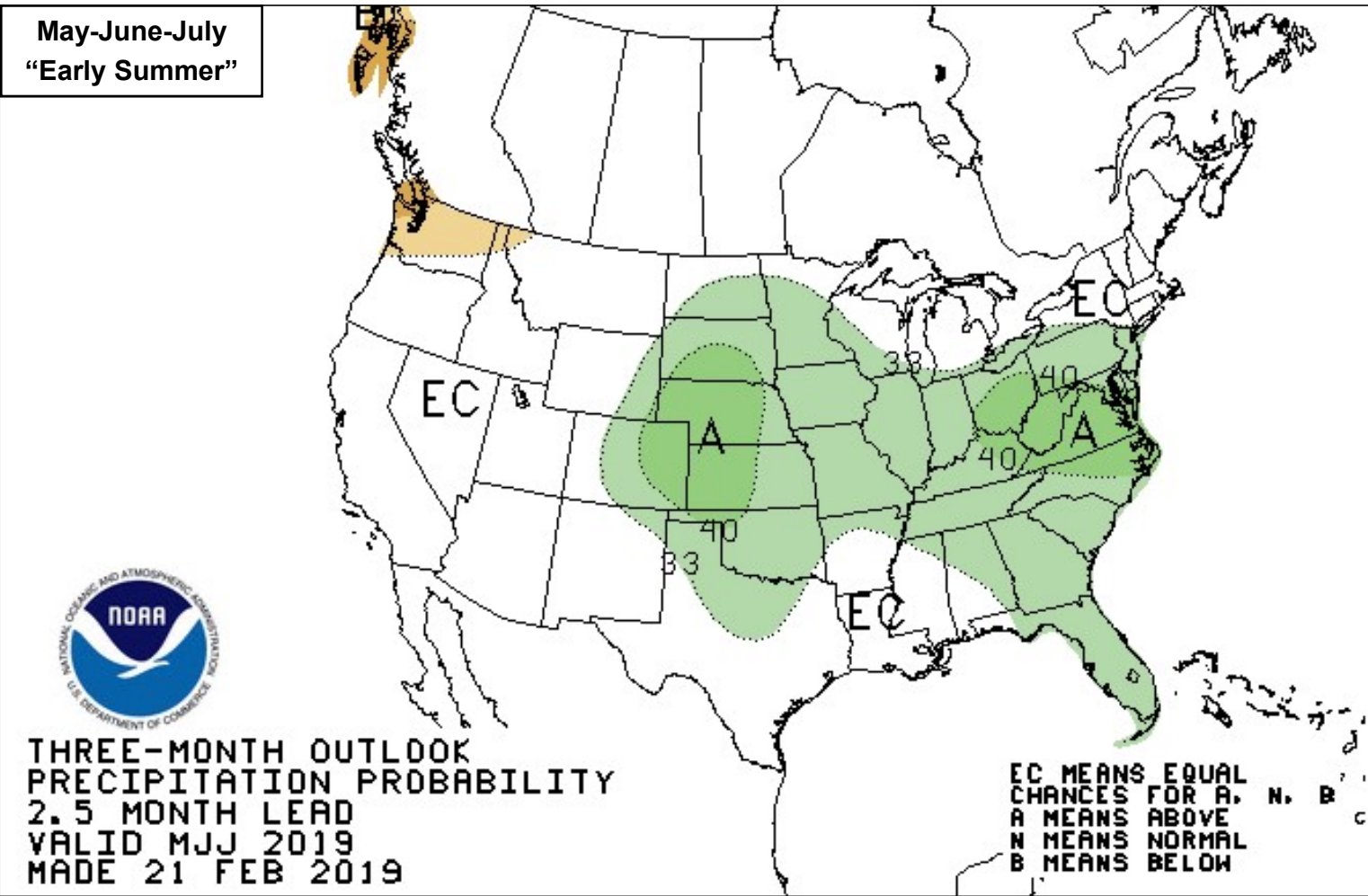


EC MEANS EQUAL  
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ps

# CPC 3-MONTH PRECIPITATION OUTLOOKS (ISSUED FEB 21, 2019)

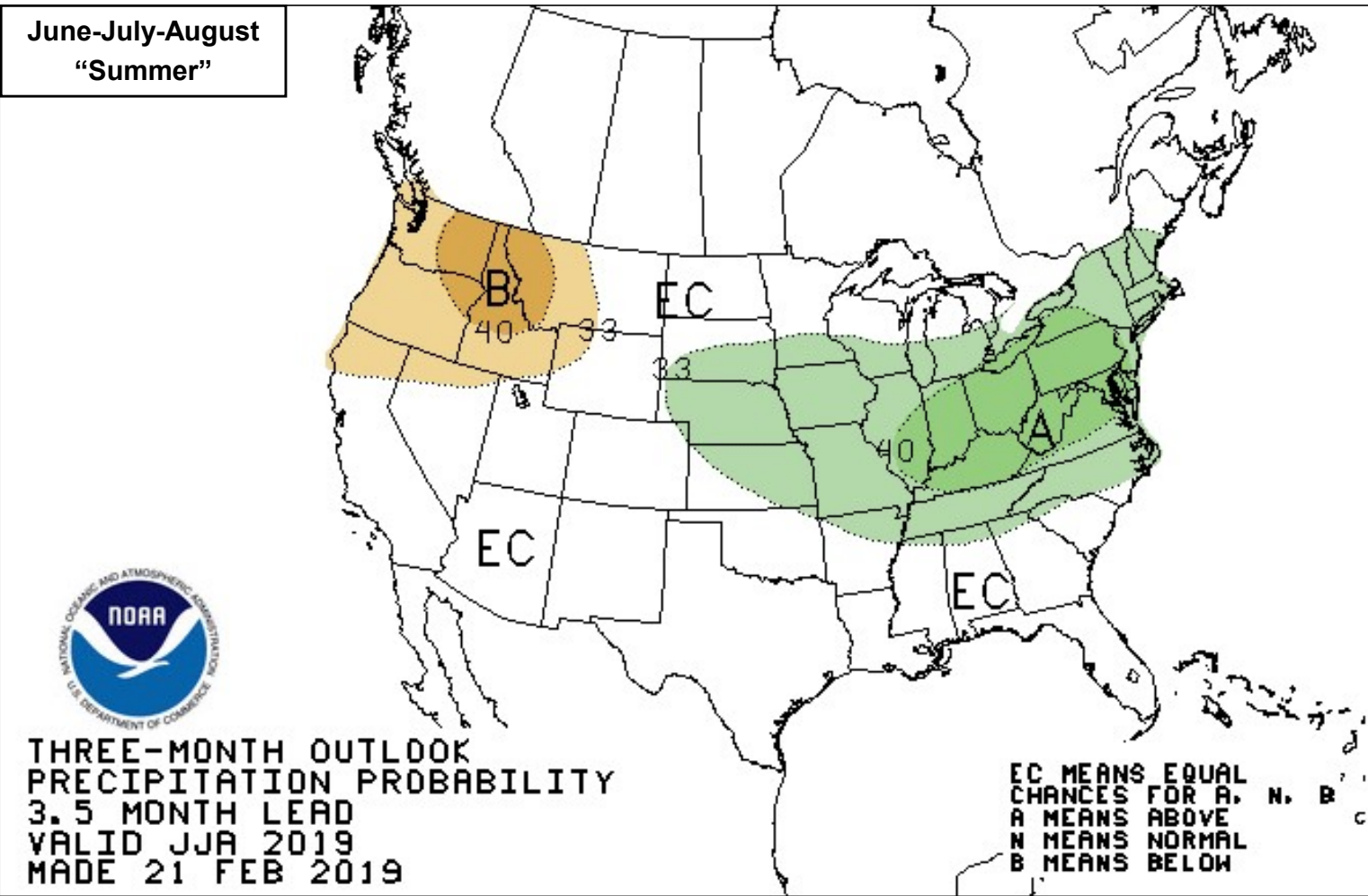


Graphics courtesy of NOAA Climate Prediction Center



# CPC 3-MONTH PRECIPITATION OUTLOOKS (ISSUED FEB 21, 2019)

June-July-August  
"Summer"



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Graphics courtesy of NOAA Climate Prediction Center

### Major Flood Stage

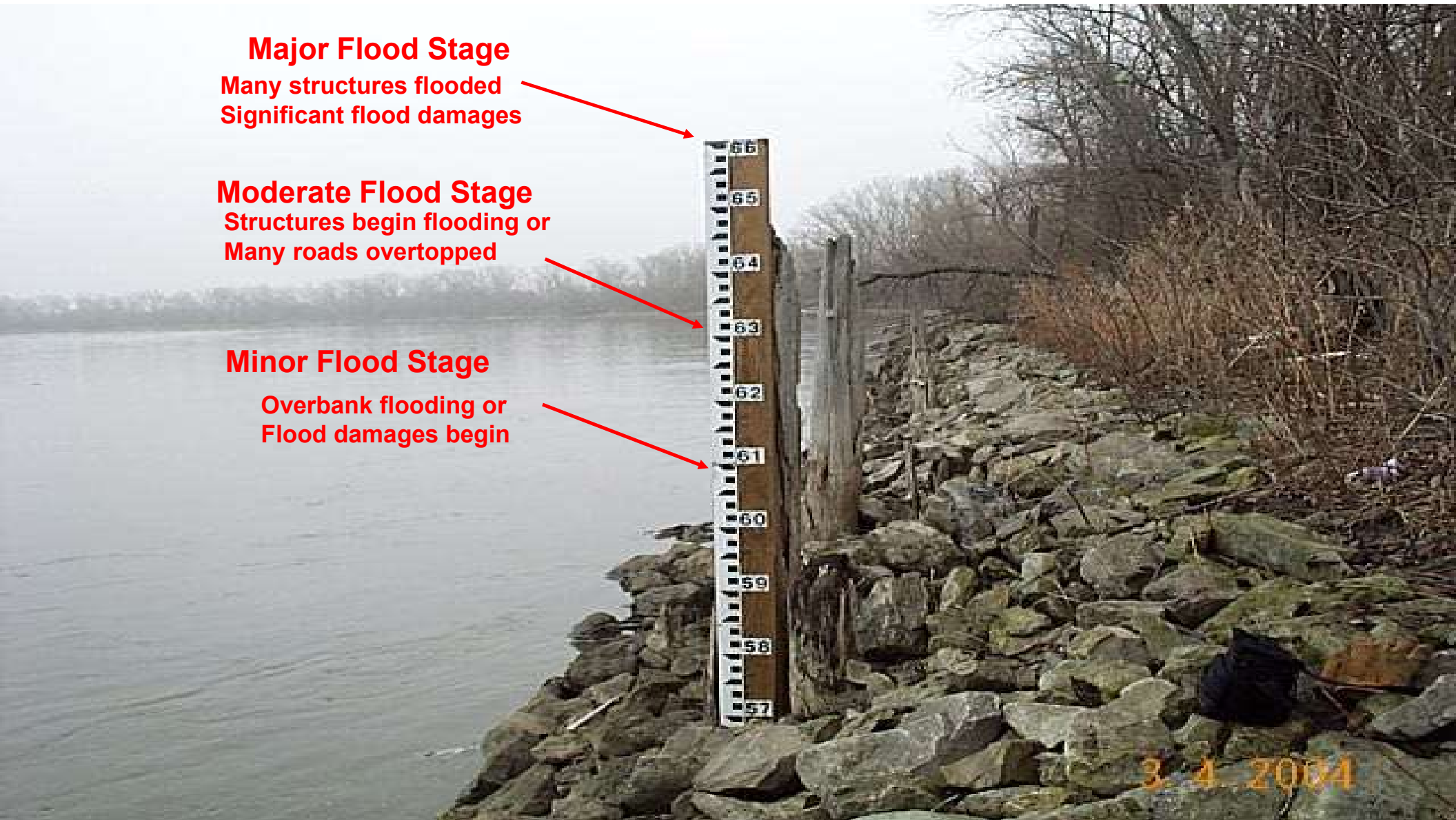
Many structures flooded  
Significant flood damages

### Moderate Flood Stage

Structures begin flooding or  
Many roads overtopped

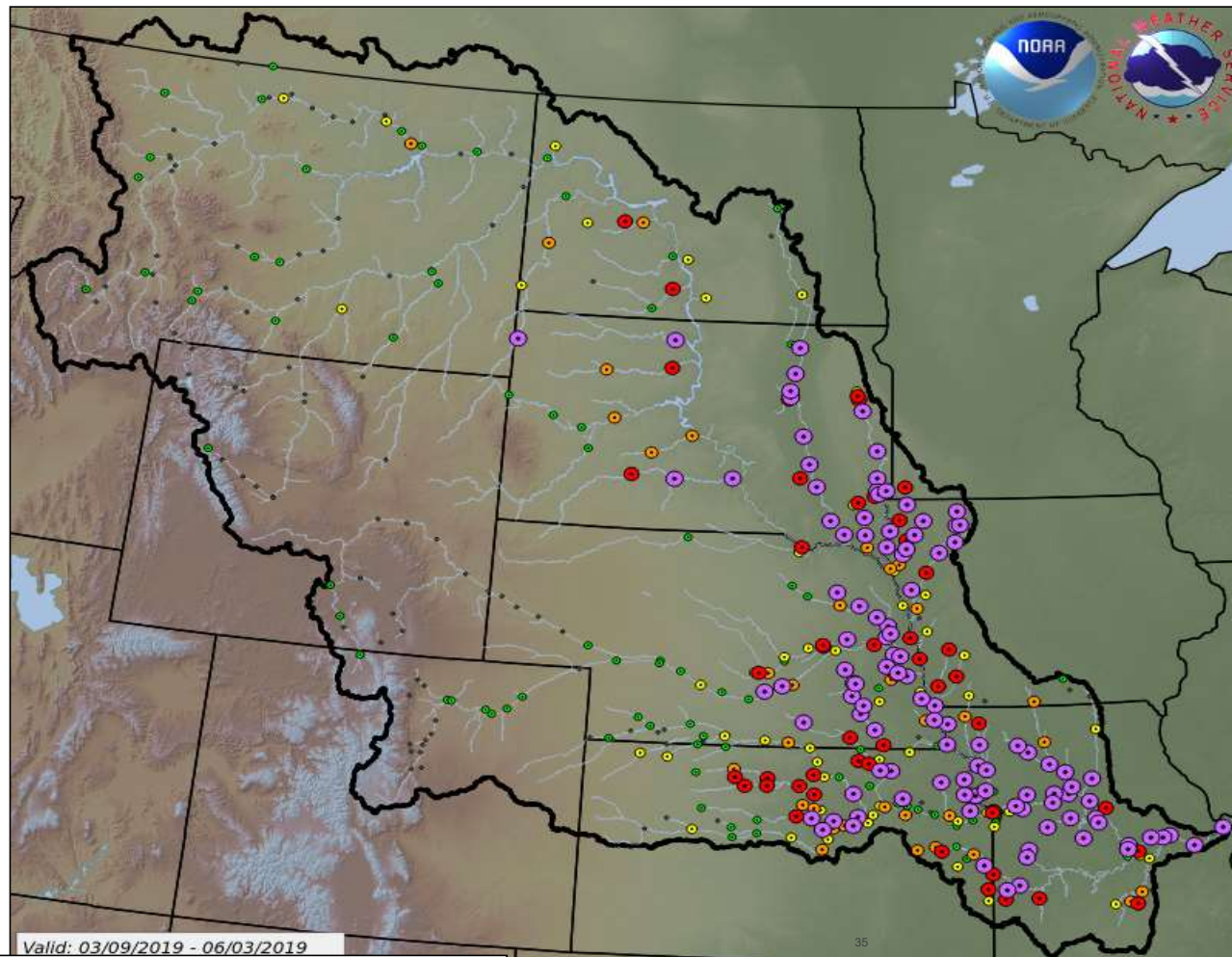
### Minor Flood Stage

Overbank flooding or  
Flood damages begin



3 4 2004

# MBRFC MODELED % CHANCE OF **MINOR** FLOODING



## Percent Chance of Minor Flooding

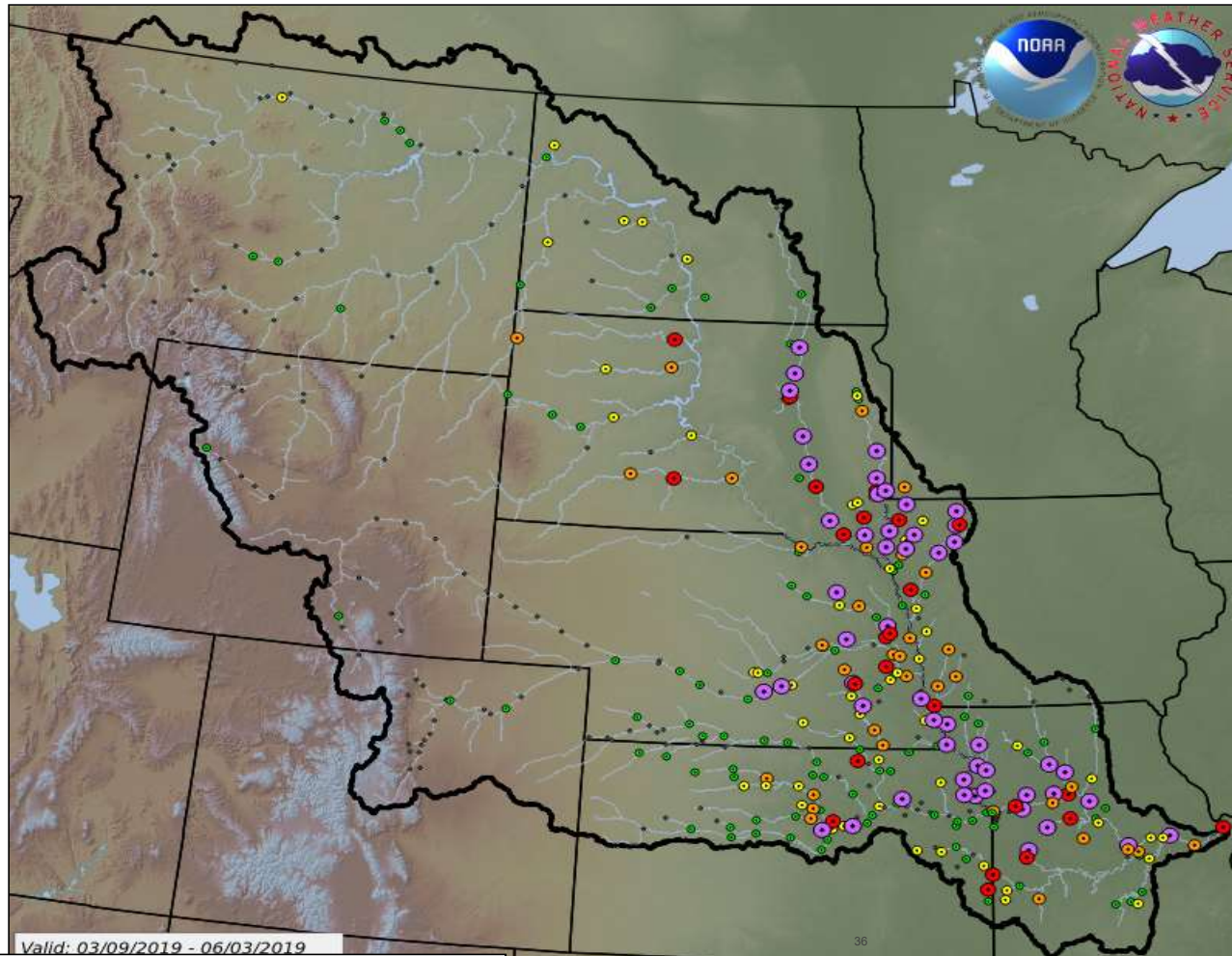
- < 5%
- 5% - 20%
- 21% - 40%
- 41% - 60%
- 61% - 80%
- > 80%



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# MBRFC MODELED % CHANCE OF MODERATE FLOODING



## Percent Chance of Moderate Flooding

- < 5%
- 5% - 20%
- 21% - 40%
- 41% - 60%
- 61% - 80%
- > 80%



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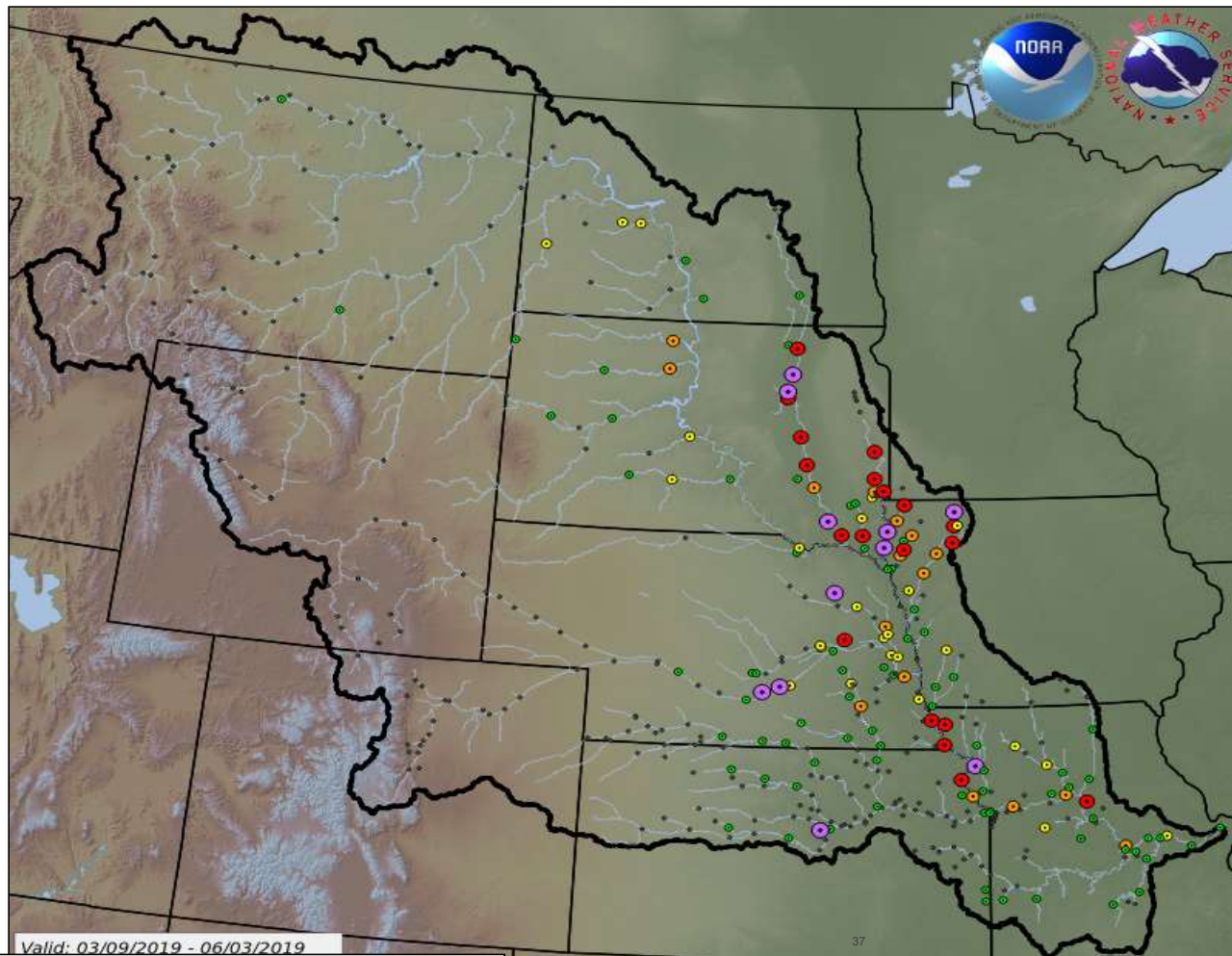


Valid: 03/09/2019 - 06/03/2019

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Graphics courtesy of NOAA Missouri Basin River Forecast Center

# MBRFC MODELED % CHANCE OF MAJOR FLOODING



## Percent Chance of Major Flooding

- < 5%
- 5% - 20%
- 21% - 40%
- 41% - 60%
- 61% - 80%
- > 80%



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Valid: 03/09/2019 - 06/03/2019

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Graphics courtesy of NOAA Missouri Basin River Forecast Center

# QUESTIONS ???



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