NWS FORM E-5 U.S. DEPARTMENT OF COMMERCE NOAA, NATIONAL WEATHER SERVICE **MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS** TO: NATIONAL WEATHER SERVICE (W/OH12x1) HYDROMETEOROLOGICAL INFO CENTER 1325 EAST-WEST HIGHWAY, RM 7116 SILVER SPRING, MD 20910	HSA OFFICE: **Marquette, MI** REPORT FOR (MONTH / YEAR): **December 2019** DATE: **January 14, 2020** SIGNATURE: **Robin J. Turner, MIC** **Ryan Connelly, Hydrology Team Member**

When no flooding occurs, include miscellaneous river conditions, such as significant rises, record low stages, ice conditions, snow cover, droughts, and hydrologic products issued (WSOM E-41).

X An X inside this box indicates no flooding occurred within this Hydrologic Service Area.

December Precipitation Summary

December featured above-normal precipitation across most of Upper Michigan, with much of the area seeing 1 to 3 inches more than normal for the month, which is 150 to 300% of normal. This led to above-normal streamflow, with high streamflow observed in western Gogebic County. This precipitation fell in the form of snow, as well as in the form of at least one significant rain storm, which is somewhat unusual for December in this area. Most of the precipitation fell in just two events – one at the beginning of the month and one at the end – with a streak of drier than normal conditions for about two to three weeks in the middle of the month.

A major snow storm occurred from the evening of November 30 into the afternoon of December 1. This snow storm featured relatively wet, low-ratio snow. At WFO Marquette on the calendar day December 1, 15.1 inches of snow fell with 1.94 inches of liquid equivalent, for a snow-to-liquid ratio of 8:1. The greatest snowfall amounts were generally south along Lake Michigan – one of the highest snowfall totals was 28.2 inches at Rapid River on 2.32 inches of precipitation (a 12:1 ratio) – whereas Copper Harbor did not record any precipitation from this event.

The month was then bookended by a two-round heavy precipitation event. The first round was mostly if not all rain, with 1 to 2 inches of rain measured across the area December 28 and 29, though there was some freezing rain over the colder, higher-elevations areas of interior western Upper Michigan. On December 30, rain transitioned to wet, dense snow, with most areas seeing generally 4 to 12 inches of snow on 1 to 1.5 inches of liquid equivalent, with the far western U.P. and Keweenaw Peninsula seeing 12 to 20 inches of snow on 1.5 to 2.5 inches of liquid equivalent.

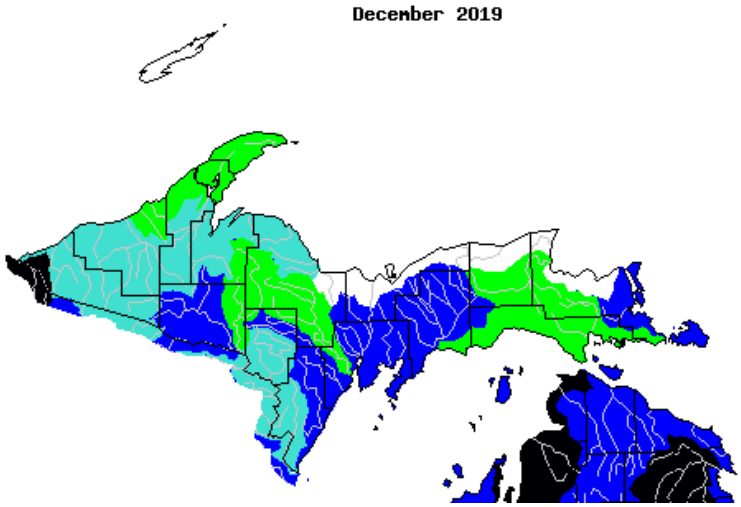
Location	Precipitation	% of normal	Snowfall
WFO Marquette	5.52”	215%	48.6”
Marquette City	3.56”	181%	43.3”
Quincy Hill	4.82”	255%	61.6”
Ironwood	5.26”	249%	61.0”
Iron Mountain	4.47”	288%	29.0”
Manistique	5.37”	336%	40.5”
Munising	5.19”	138%	55.4”
Stambaugh	3.86”	299%	23.3”

NOTE: Rainfall and snowfall after 8am EST Nov. 30 was counted in November stats for all but the NWS Marquette site due to the reporting structure of our cooperative observers.

December Flooding Conditions
Rivers did not reach flood stage in the Upper Peninsula.

December River Conditions

River levels across the NWS Marquette Hydrologic Service Area remained generally near normal over the last month; however, the Manistique, Sturgeon, and Whitefish Basin remained at or above normal throughout the month. This is partly to do with a late November system that produced widespread 1 to 2 inches of rain along the Bay of Green Bay and Lake Michigan shorelines.



Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		

December Drought Discussion

No drought conditions are depicted in the Upper Peninsula. For the latest drought status, please go to
http://www.drought.gov.

Media Links

No media links

December Products Issued

1 – Hydrologic Outlook (ESF)
0 – Flood Watch (FFA)
0 – Flood Warning (FLW)
0 – Flood Advisories and Statements (FLS)
0 – Flash Flood Warning (FFW)
0 – Flash Flood Statement (FFS)
31 – Hydrologic Summary (RVA)
0 – Daily River Forecasts (RVD)

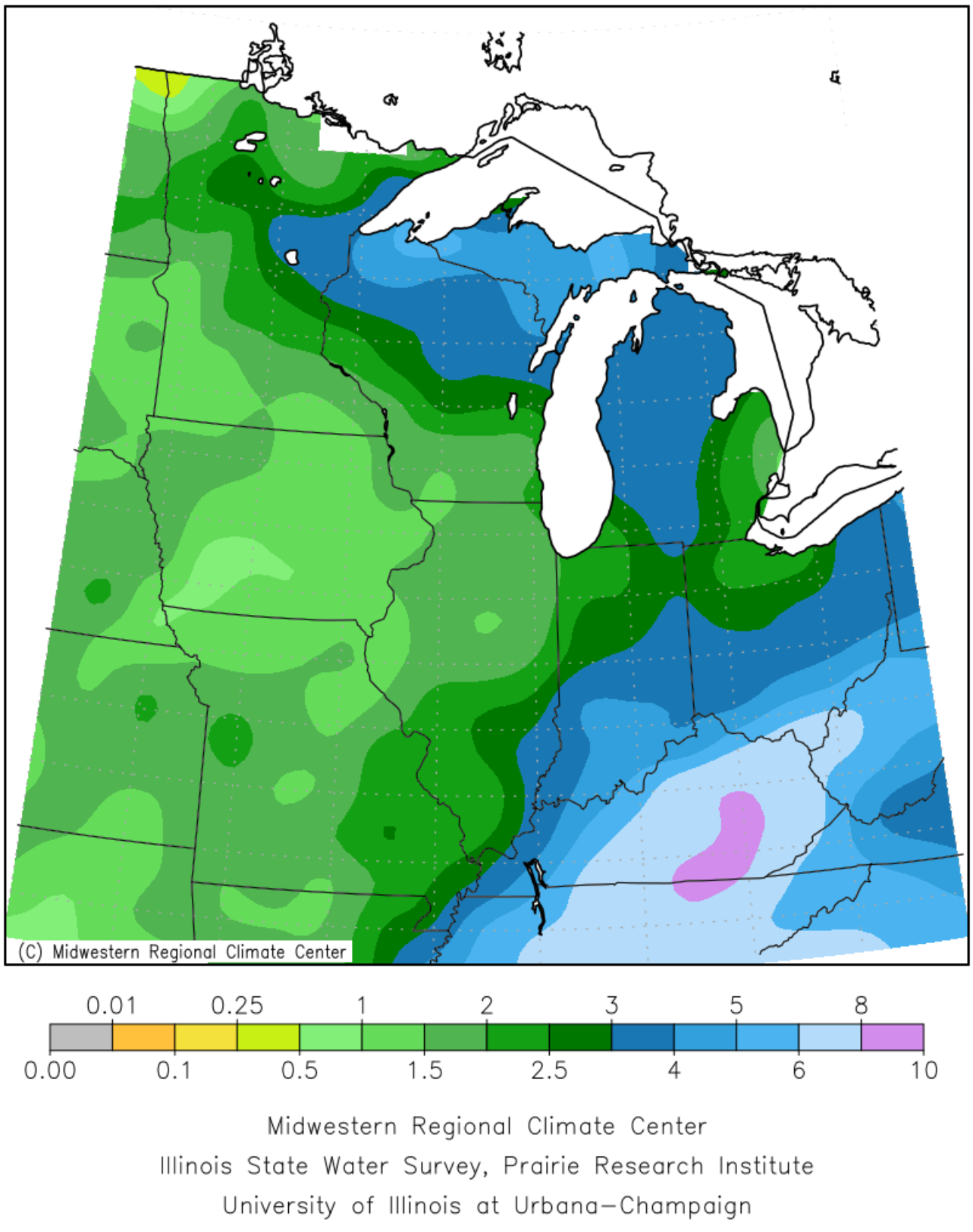


Figure 1. December 2019 Monthly Precipitation Totals.

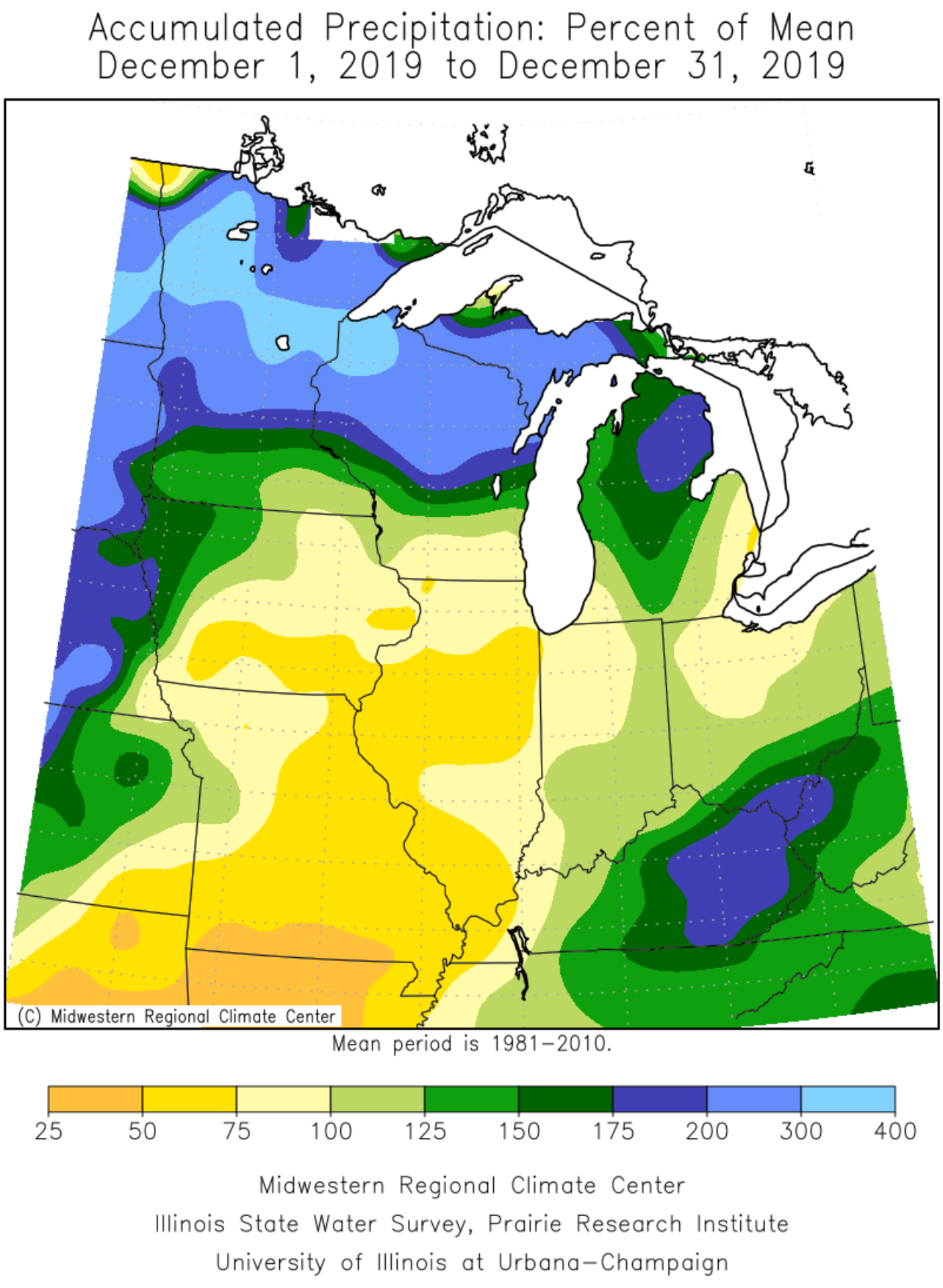


Figure 2. December 2019 Percent of Mean of Accumulated Precipitation

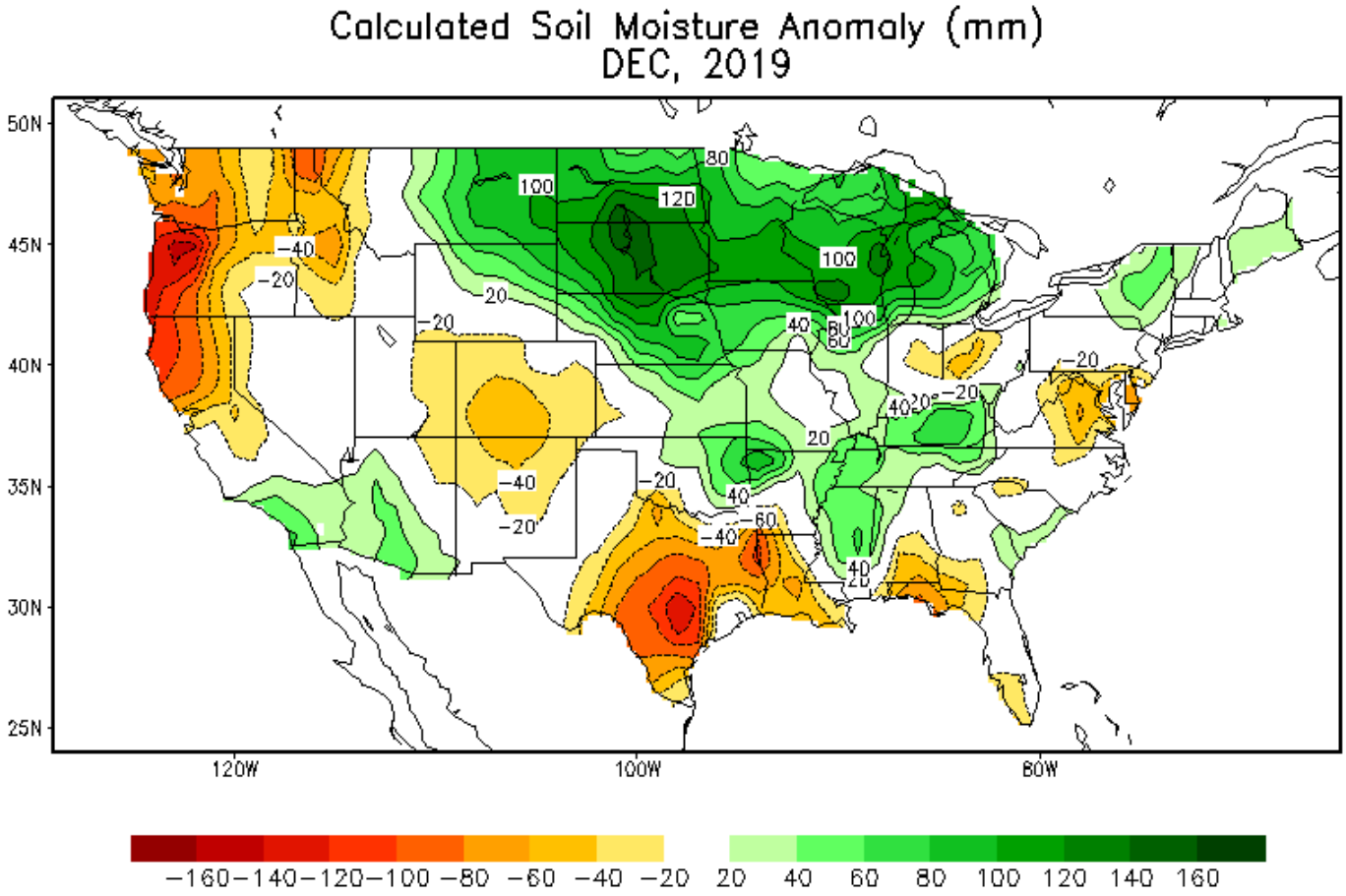


Figure 3: Climate Prediction Center monthly soil moisture anomaly for December 2019

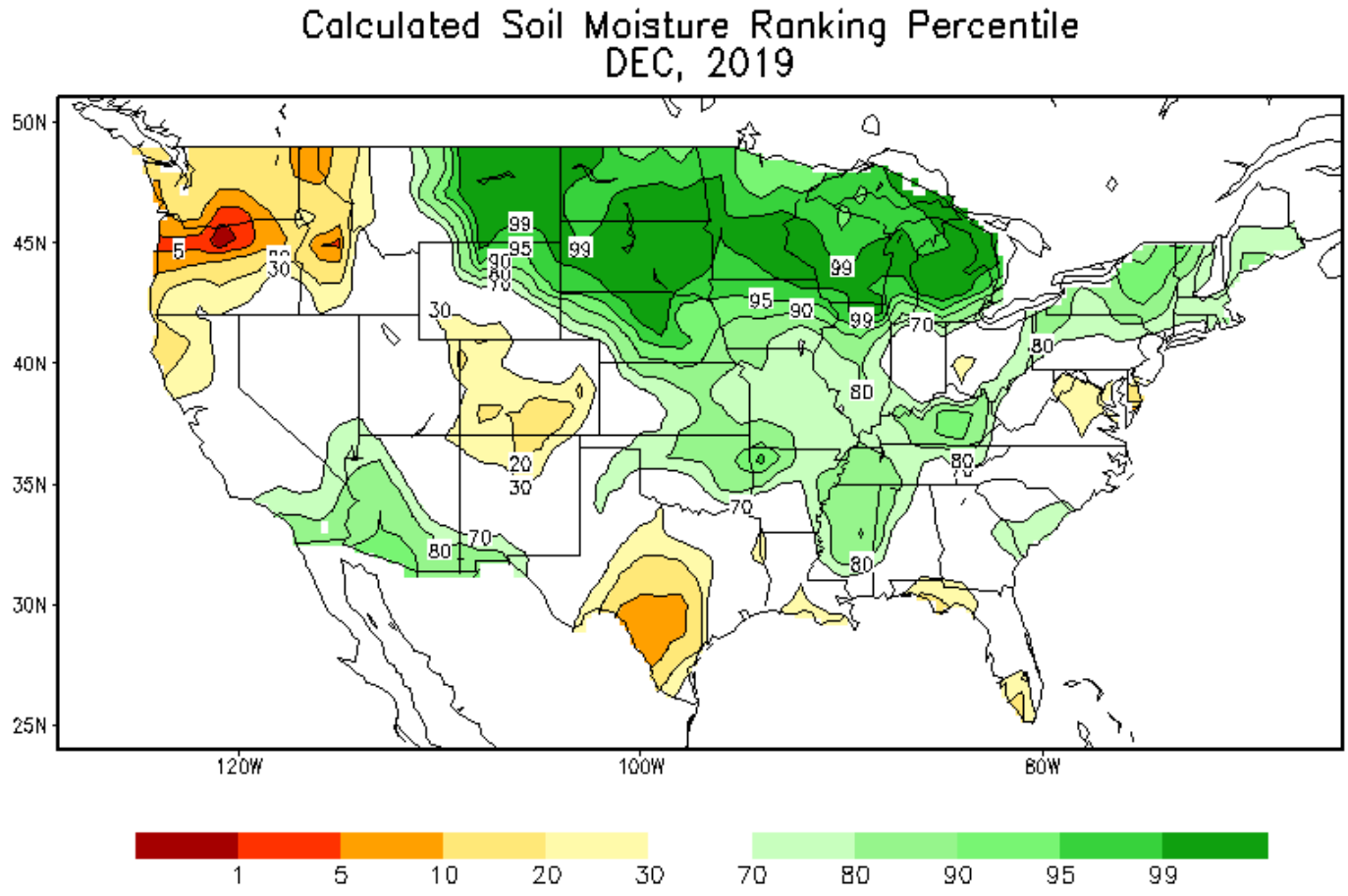


Figure 4: Climate Prediction Center monthly average soil moisture percentile for December 2019