

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): February 2019
	DATE: March 4, 2018
	SIGNATURE: Robin J. Turner, MIC Keith White, Hydrology Program Manager
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).	



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

February Precipitation

February 2019 will go down in the history books as one of the wettest months in recorded history in the Upper Peninsula. The first significant event was only 4 weeks ago, though it seems like forever. On February 4th, a strong storm system brought the most significant ice storm in recent memory to central Upper Michigan, with the worst impacts centered in Marquette County where many locations received more than an inch of liquid equivalent precipitation mainly accumulating as ice. As colder air wrapped into the system, some snow, generally less than 5 inches, fell across the west and north. But the majority of this event was a cold rain south and east with around half an inch recorded near Lake Michigan and higher amounts up to an inch along the Lake Superior shores east of Marquette. There was already a snowpack of greater than 8" across the entirety of the UP, so most of this rainwater likely absorbed into the snowpack.

Light precip stuck around on the 5th and 6th, but another significant storm came through Upper Michigan on February 7th. This system dropped another 6-12" of snow across the west and north, with lesser amounts closer to Lake Michigan where again there was initially more rain/wintery mix before changing to all snow. Blizzard conditions were reported in Alger County. Liquid equivalents ranged from about a third of an inch south to three quarters of an inch or so north with this system.

After another brief reprieve, a third strong storm brought impressive snow totals to the vast majority of the UP the 12th and 13th. Two-day storm total snows were widespread greater than 8 inches except for the Keweenaw Peninsula, and some locations in the north central saw closer to 2 FEET of snow as a lake effect/enhanced band of heavy snow in addition to upslope enhancement brought truly incredible snowfall rates to portions of Marquette and Alger Counties. Liquid equivalents from this event ranged from only a quarter inch over portions of the Keweenaw to around 1-1.5" in the north central UP.

Another moderate snow event brought 5 to 8 inches of snow over the east half of the UP. Not to be outdone, the northwest Upper Peninsula saw some impressive lake effect snow in the days following. From the 14th into the 15th, a crack opened up in the ice over the western lake and led to enhanced convergence and reports of 12-18 inches of snow accumulation along a line from Mass City to Twin Lakes to Herman despite forecasts calling for only a few inches. These events added another 0.25-0.5+" of water to the existing snowpack.

On Feb 20th, a system that in any other month would have seemed significant brought a widespread 5-8" of snow with higher amounts of 8-12" in some higher terrain areas. This again brought 0.25-0.5" of widespread liquid equivalent with isolated higher amounts near 0.75".

Finally, we get to the widespread blizzard event on the 24th. In the very early morning hours as the storm moved in, much of central and eastern Upper Michigan was in the warm sector, with heavy sleet and freezing rain falling briefly before changing over to a very heavy, wet snow. As

the system pulled off the northeast, moderate snow continued in many locations through the day and incredibly gusty winds picked up through the afternoon and evening. Although there were again lower amounts in the south-central and east, widespread snow exceeding 8" again fell, with generally greater than a foot north and west and isolated reports again near 2 feet. This translated to liquid equivalents greater than 1" across most of the area and exceeding 2" in a few spots.

Event write-ups: [Feb 4th ice storm.....Feb 7th winter storm/Alger County Blizzard.....](#)
[Feb 12th winter storm.....February 24th Blizzard](#)

Below is a chart of some of the larger cities in the Upper Peninsula, with monthly precipitation in inches and the percent of normal for the month. Any notable monthly ranks are also included. See figures 1 and 2 below for a smoothed out aerial view of these data. The Keweenaw Peninsula and far Northeastern Upper Peninsula is not well analyzed during the winter months due to poor radar coverage of shallow precipitation.

Location	Precipitation	% of normal	Rank	Snowfall	Above/Below	Rank
WFO Marquette	6.88"	321	1	89.9"	+54"	2
Marquette City	4.95"	378	2	55.9"	+35.2"	2
Houghton Airport	5.68"	378	1	61.8"	+30.9"	
Ironwood	3.62"	281	5	61.9"	+33.7"	1
Iron Mountain	4.61"	461	1	43.7"	+35"	1
Manistique	3.45"	303	3	38.0"	+23.1"	2
Munising	6.00"	299	1	75.8"	+49.3"	1
Newberry	3.70"	199	2	41.5"	+17.8"	2
Stambaugh	3.99"	469	1	39.8"	+29.1"	1

Snowpack Discussion

Figure 3 below is the latest analysis of snow water equivalent (SWE). Based off of gamma snow survey flights in the Iron/Dickinson county area on March 3 and some area snow cores, these values appear to be quite accurate. Figure 4 shows the mean +1 standard deviation SWE for early March from a 1999 study by Paul Crocker at Michigan Technological University, and an eyeballed comparison shows we are at or above these values currently across much of the area. Below are a few recent cores taken by cooperative observers and NWS staff. Note: * denotes that the SWE measurement may have some error due to subpar equipment.

March 1:	Depth	SWE	March 4:	Depth	SWE
Copper Harbor	41"	11.5"	Ironwood*:	37"	5.9
Mohawk	42"	8.0"	Harvey*:	32"	5.8"
Painesdale	58"	14.1"	NWS Marquette:	47"	10.9"
Rockland	46"	11.2"	Stambaugh*	31"	6.5"
Bruce Crossing	31"	6.5"	Norway	27"	6.9"

Drought Discussion

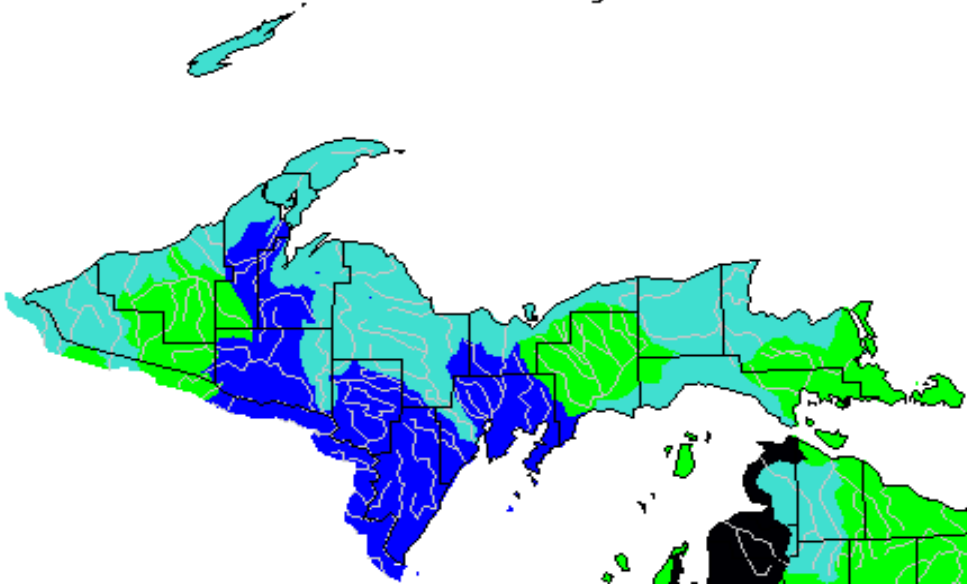
The February 28th update of the US Drought Monitor continues to indicate no drought conditions across the MWS MQT Hydrologic Service Area (HSA). For the latest drought status, please go to <http://www.drought.gov>.

February Flooding

No flooding was reported across Upper Michigan in February. Monthly average streamflows (below) remain near or above normal, with the highest values in the south central UP.

February River Levels

February 2019

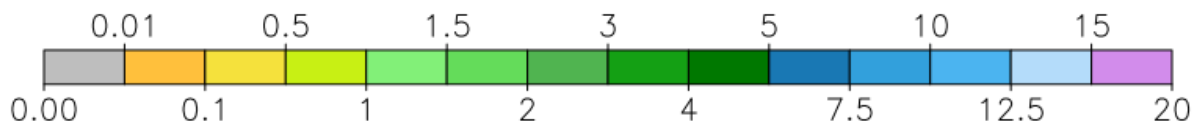
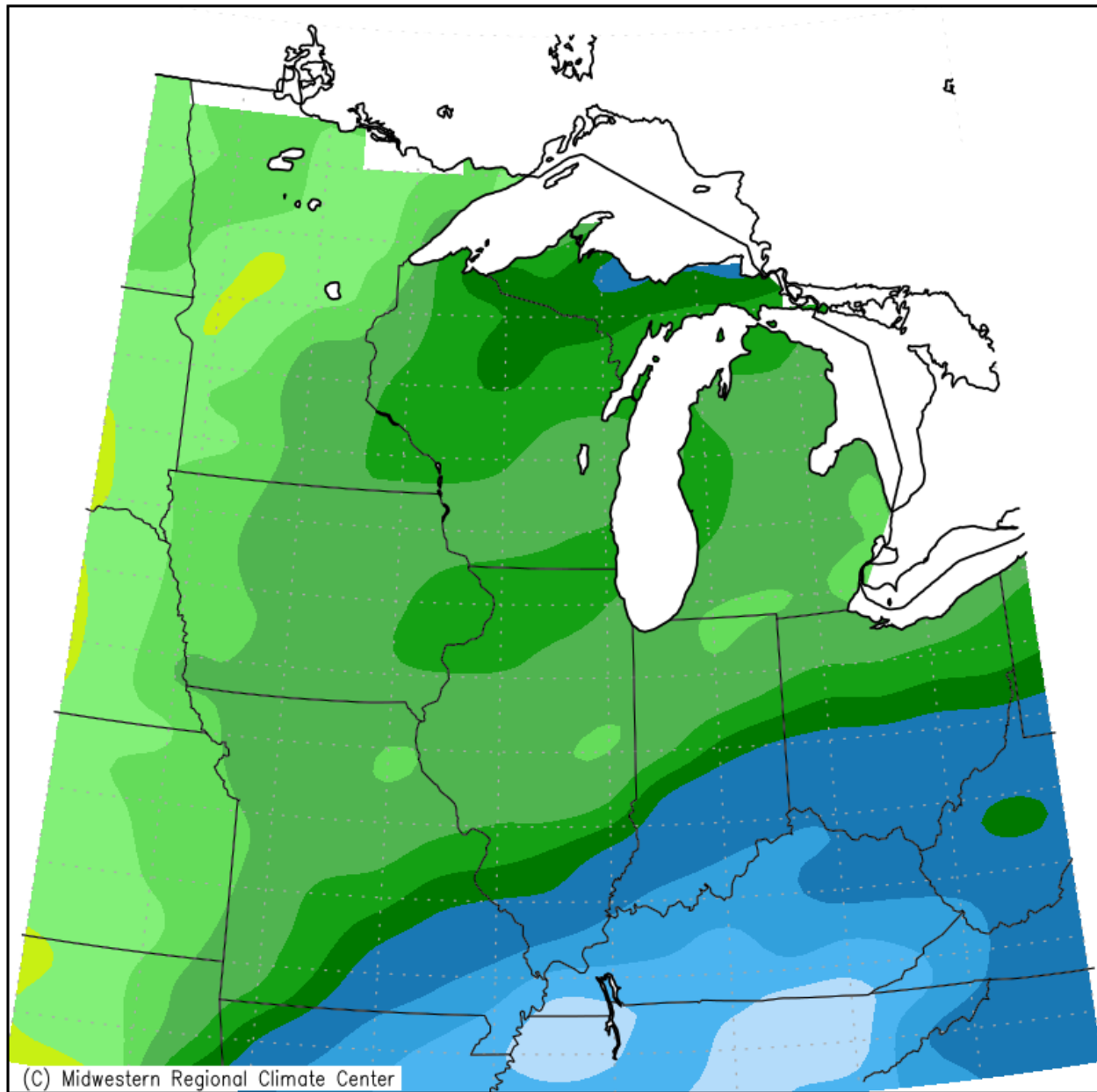


Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		

February Products Issued

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

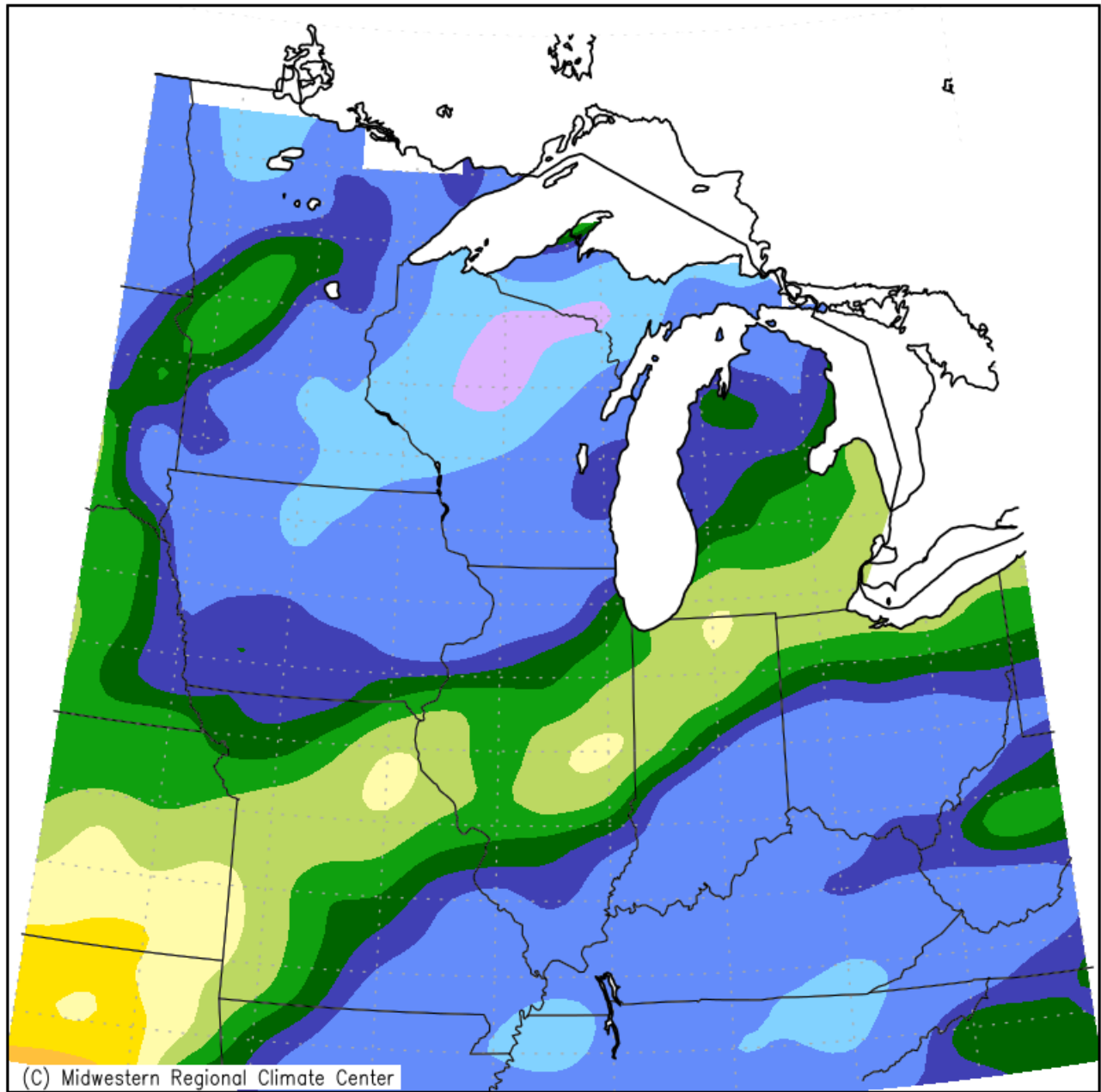
Accumulated Precipitation (in)
February 1, 2019 to February 28, 2019



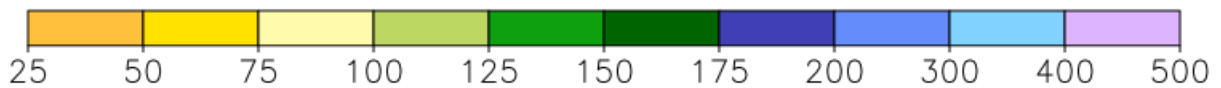
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Illinois State Water Survey, Prairie Research Institute
University of Illinois at Urbana–Champaign

Figure 1. February 2018 Monthly Precipitation Totals. Precipitation over the Keweenaw Peninsula and far northeastern UP are underanalyzed during the winter months.

Accumulated Precipitation: Percent of Mean February 1, 2019 to February 28, 2019



Mean period is 1981–2010.



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Figure 2. February 2018 Percent of Mean of Accumulated Precipitation

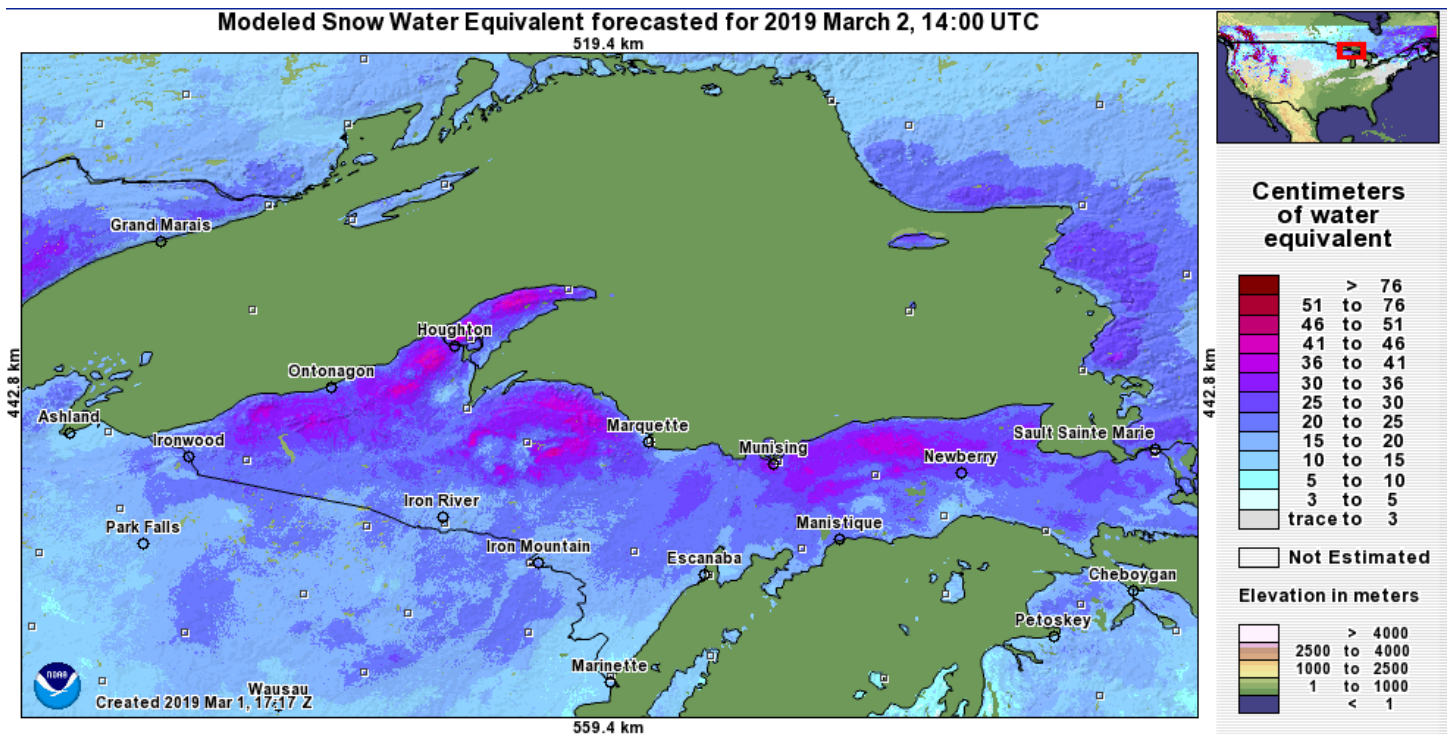


Figure 3: March 2nd Snow water equivalent (in centimeters for purposes of comparison to Figure 4) from NOHRSC.

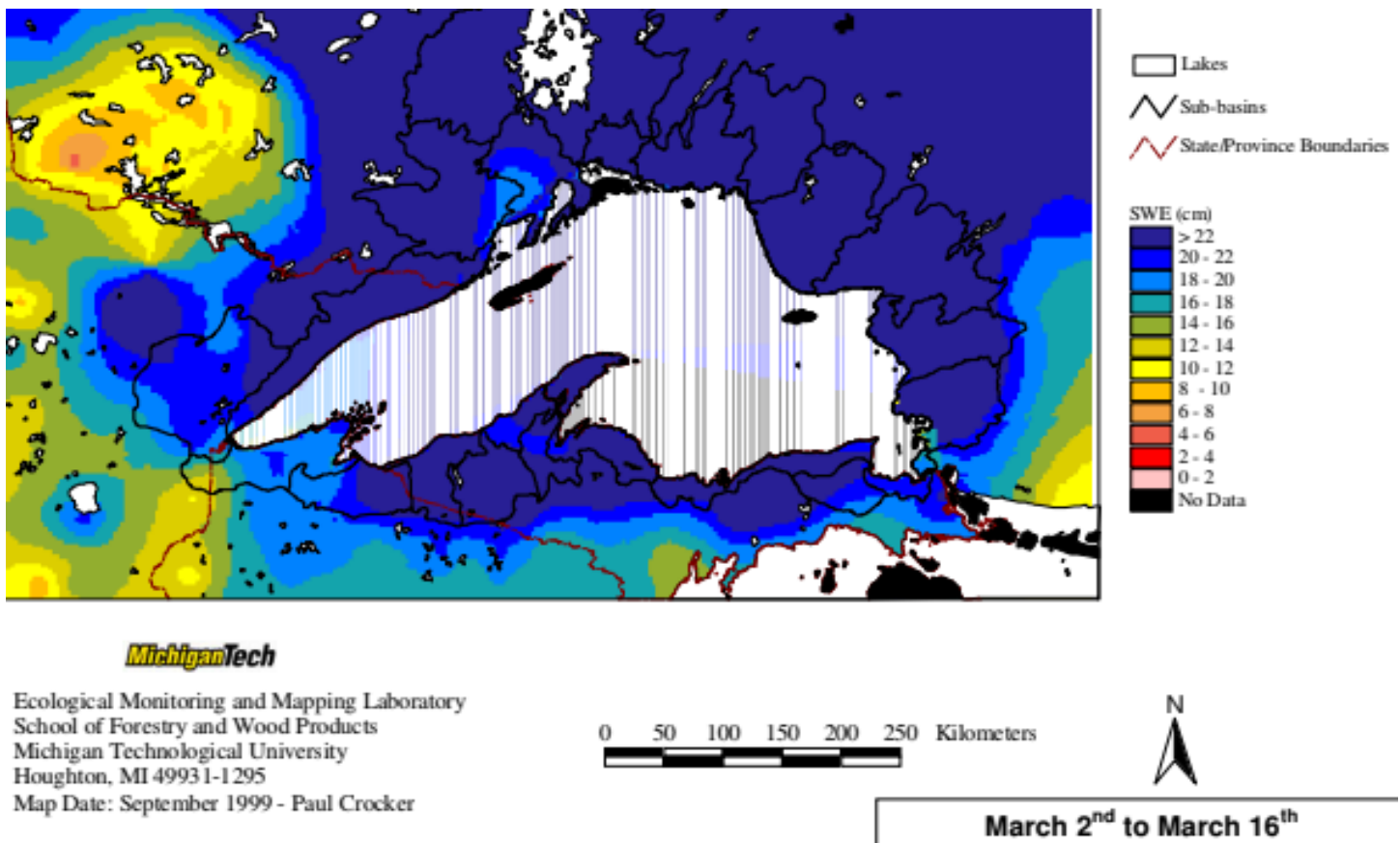


Figure 4: Mean+1 standard deviation snow water equivalent for the first half of March. From a 1999 Michigan Technological University Masters Thesis study by Paul C. Crocker titled "Compilation and Analysis of Snowpack Data for the Lake Superior Basin."