

# Snow Melt Flood

## March 14<sup>th</sup>, 2019



# Overview

- 3 rounds of thunderstorms moved through parts of Central Lower Michigan on March 14, with total rainfall amounts between 0.75 and 1.5 inches
- Before the storm moved in, 1-2 ft of snow was on the ground north of I-96, with snow water equivalent values around 4 inches. About 2.5 inches of this SWE melted off during the storm.
- In addition, frozen ground led to extremely efficient runoff to rivers and other low spots
- These 3 factors all resulted in rapid non-river flooding north of I-96 and south of US-10, with the worst impacts observed around Newaygo County.

# Reports from Newaygo County

- More than 50 homes and 9 businesses were flooded, none of which were near the Muskegon River
- Closure of more than 100 roads
- Complete washout of more than 30 roads
- A series of private dams on Penoyer Creek were damaged
- Very few of the homes impacted had flood insurance
- In the days after the storm, minor flooding develop along the Muskegon River, resulting in flooding impacts to an additional 105 homes.
- Total damage across the county exceeded \$1.7 million

# Why was Newaygo County hardest hit?

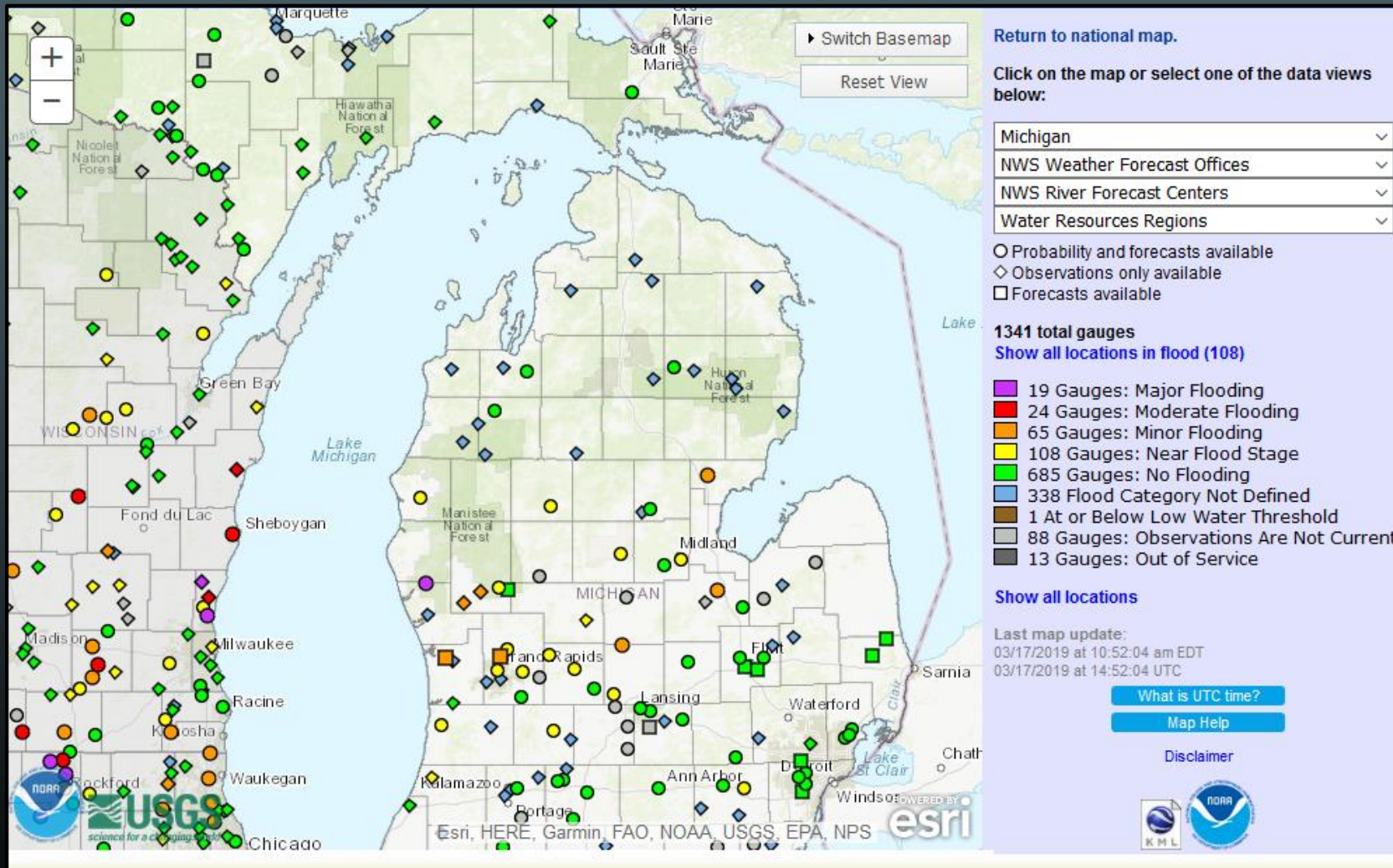
- The 3 big factors during this storm were 1) rainfall, 2) snowpack, and 3) frozen ground/frost depth
- While Newaygo County was not the highest/worst for any of these 3 factors, they were a close 2<sup>nd</sup> for all 3 factors
- While other counties had deeper frost depth, or slightly more snow, or a little bit more rainfall, no county had all 3 of the factors working against it the way Newaygo County did

# Other reports received

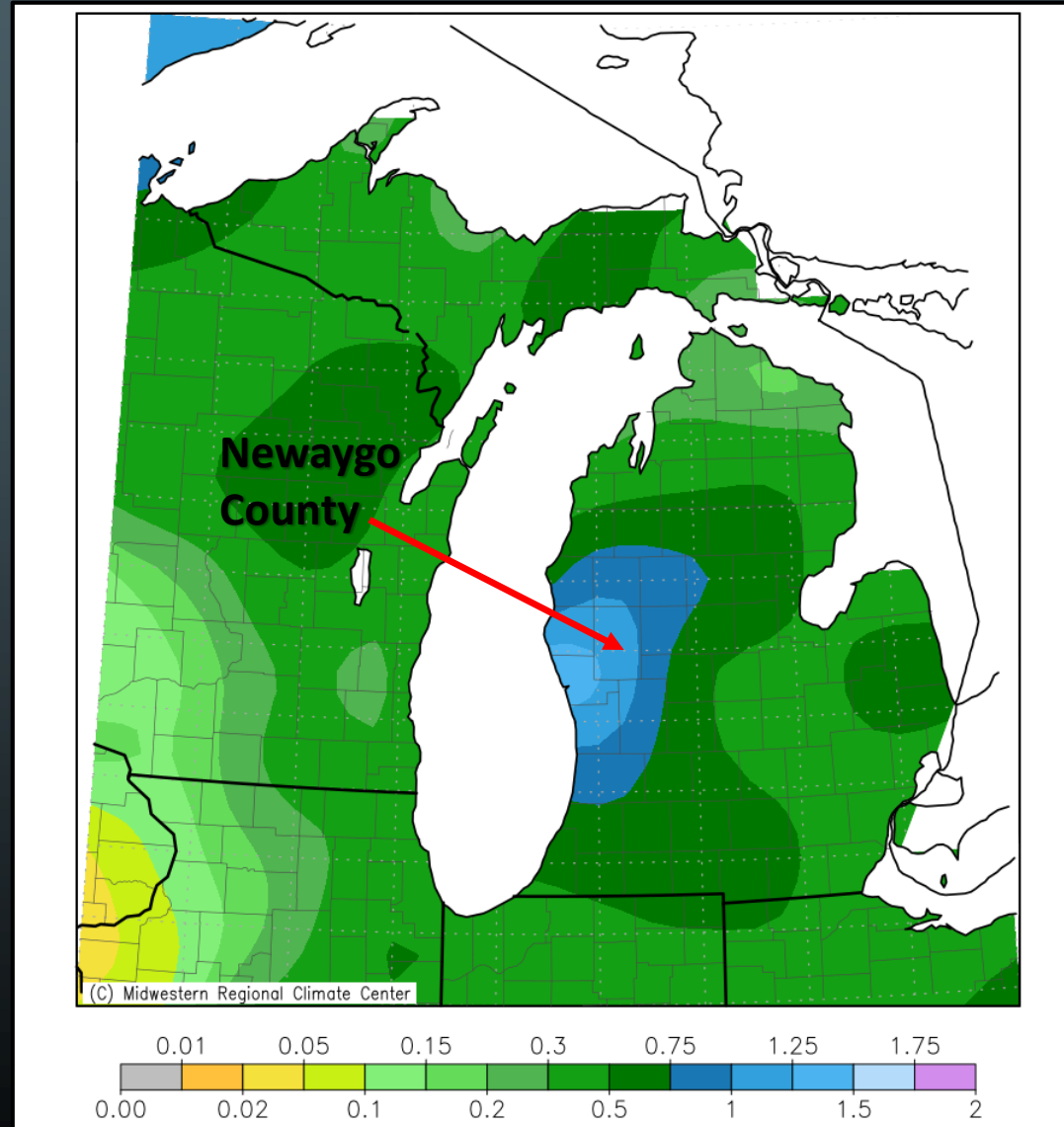
- Dispatch from Mecosta, Newaygo and Montcalm Counties reported some subdivisions entrances were blocked by flooding
- Parts of Oceana County Airport were underwater
- Many homes in these counties had taken on water, some homes evacuated
- Many roads were closed and some roads partly washed out or have culvert damage



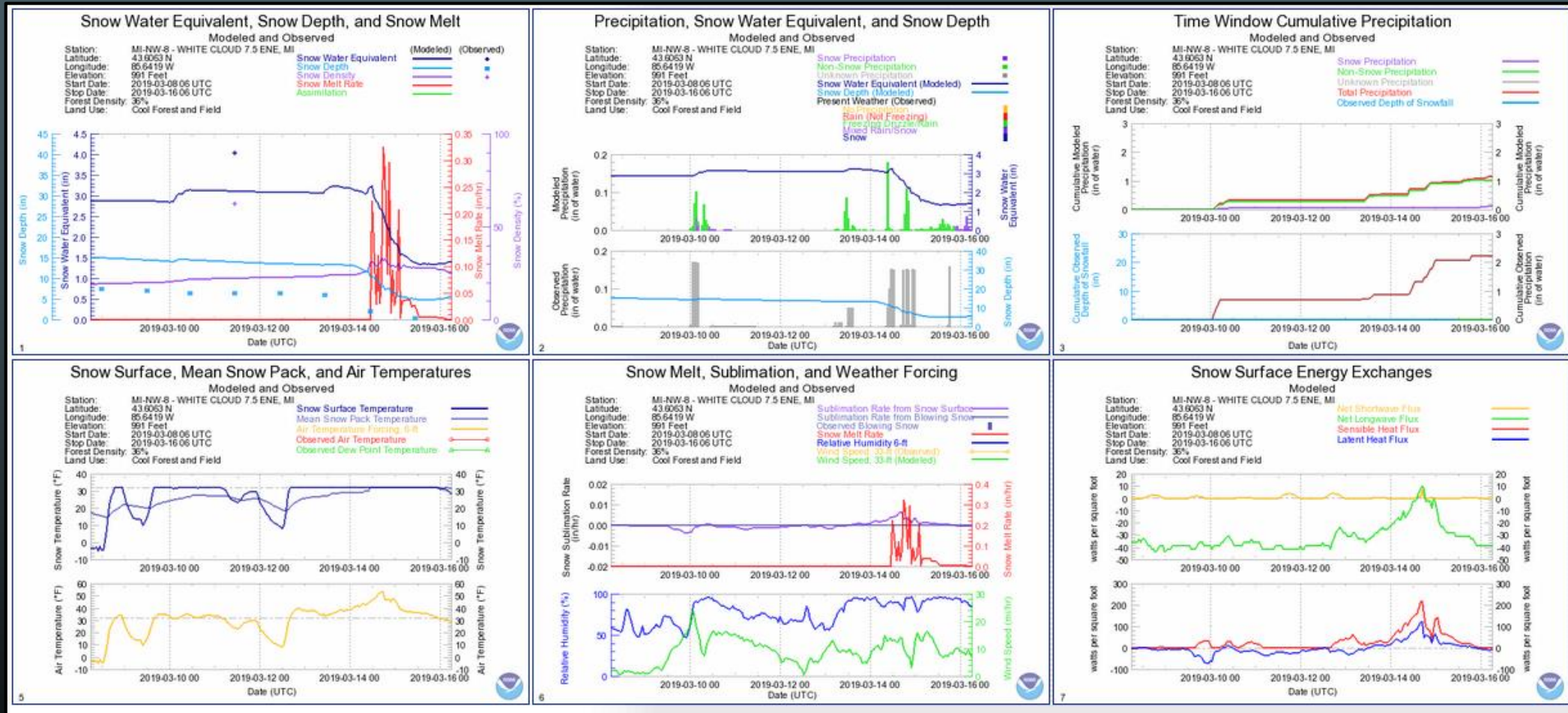
# Most of the rivers north of I-96 were near or above Action stage, with some above flood stage



# Precipitation March 14<sup>th</sup> -15<sup>th</sup> 8 am to 8 am



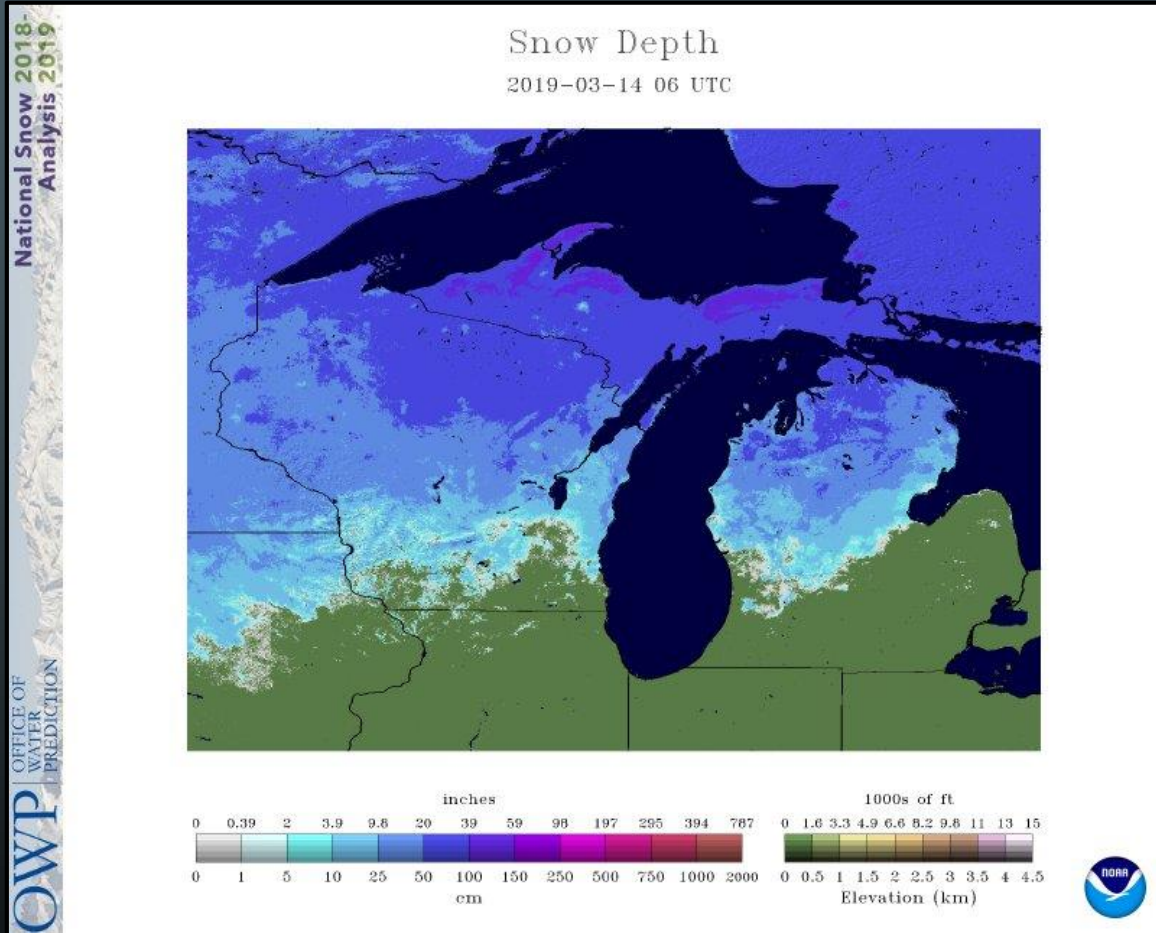
# Newaygo County Snow / Snow Water Change March 8<sup>th</sup> through the 16<sup>th</sup>



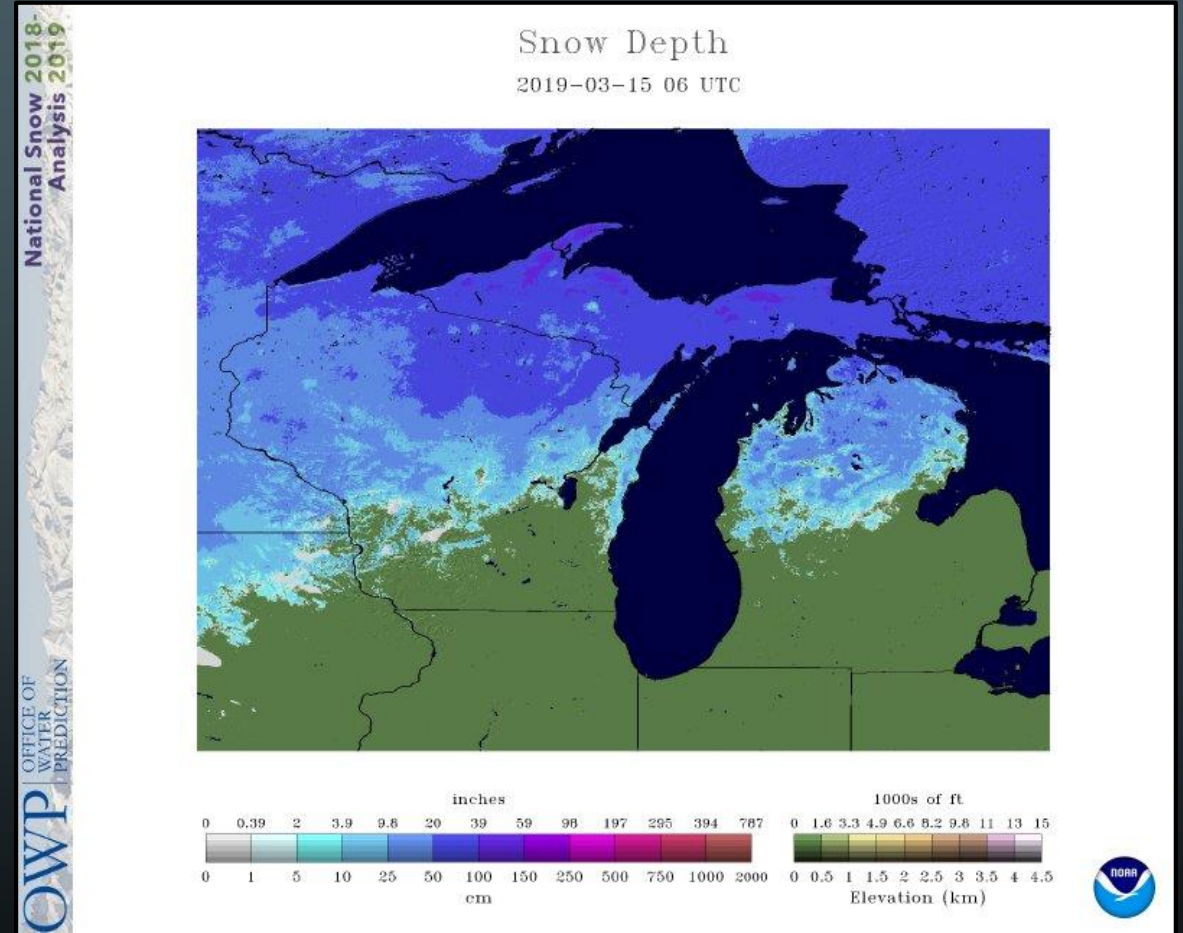
The water in the snow decreased from 3" to 1 ½", while about an inch of rain fell between the 13<sup>th</sup> and the 15<sup>th</sup> of March. The snow depth decreased from 15 " to 7".



# Note the change in snow depth from before the event and after the event



Before (March 14)

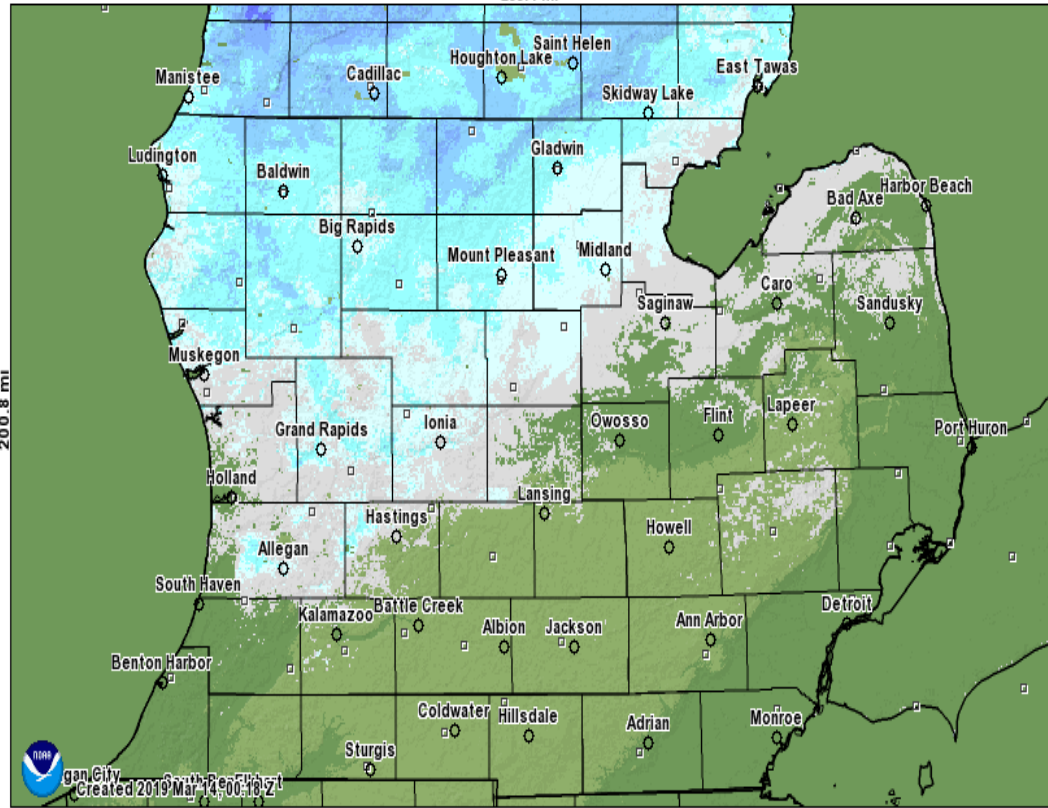


After (March 15)

# Note the change in snow water equivalent from before the event and after the event

Modeled Snow Water Equivalent for 2019 March 13, 12:00 UTC

255.4 mi

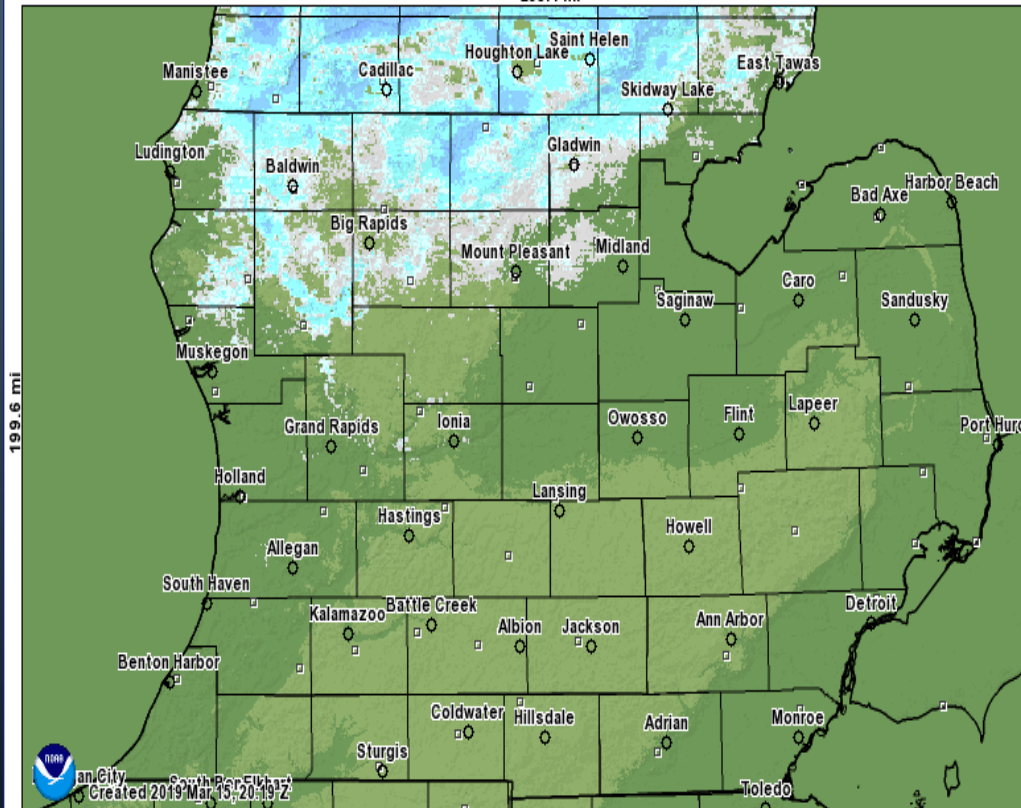


267.8 mi

Before (March 14)

Modeled Snow Water Equivalent for 2019 March 15, 12:00 UTC

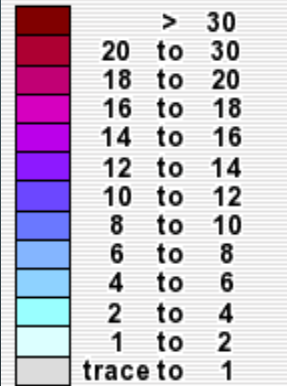
253.4 mi



265.6 mi

After (March 15)

## Inches of water equivalent



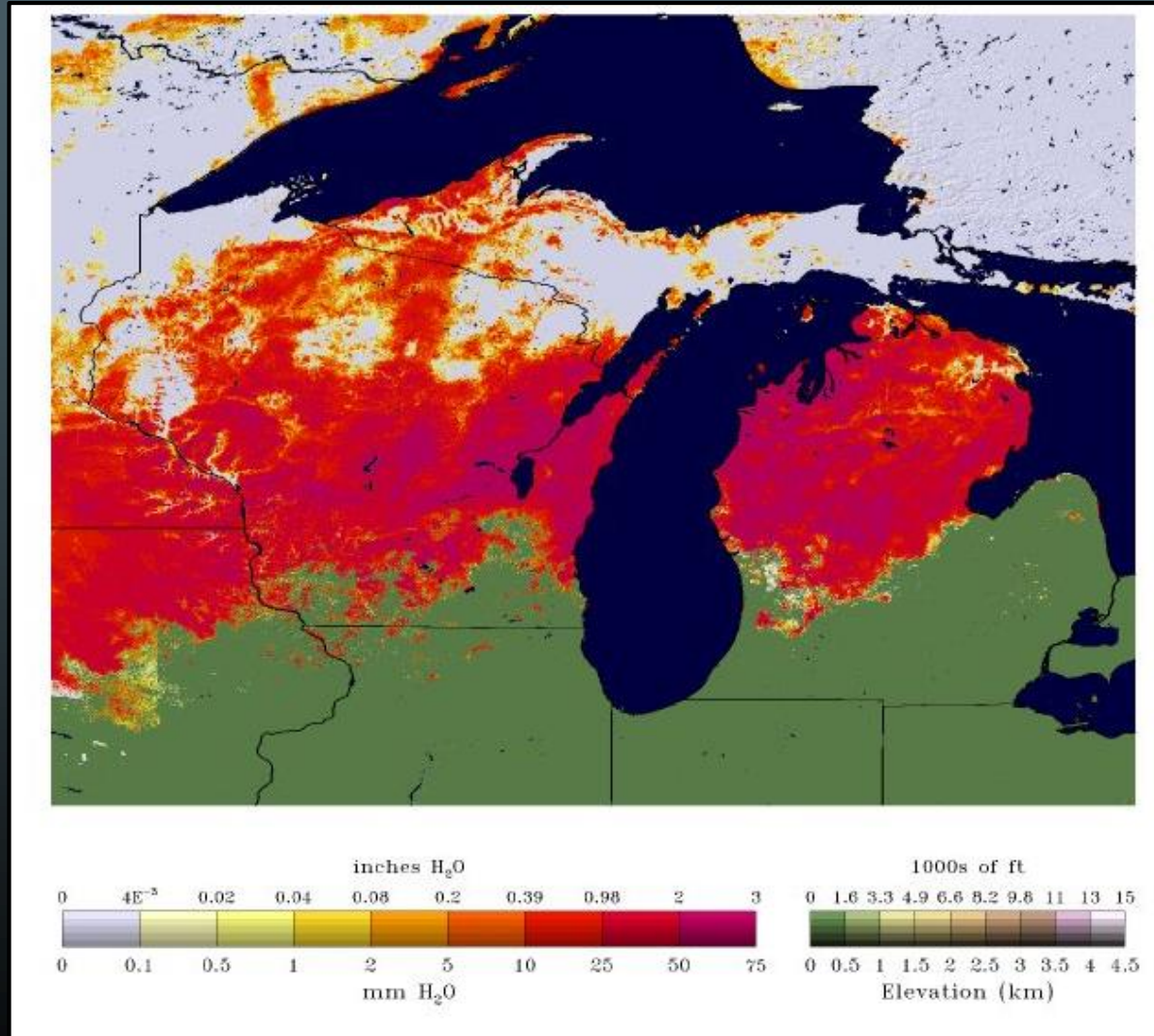
Not Estimated

## Elevation in feet

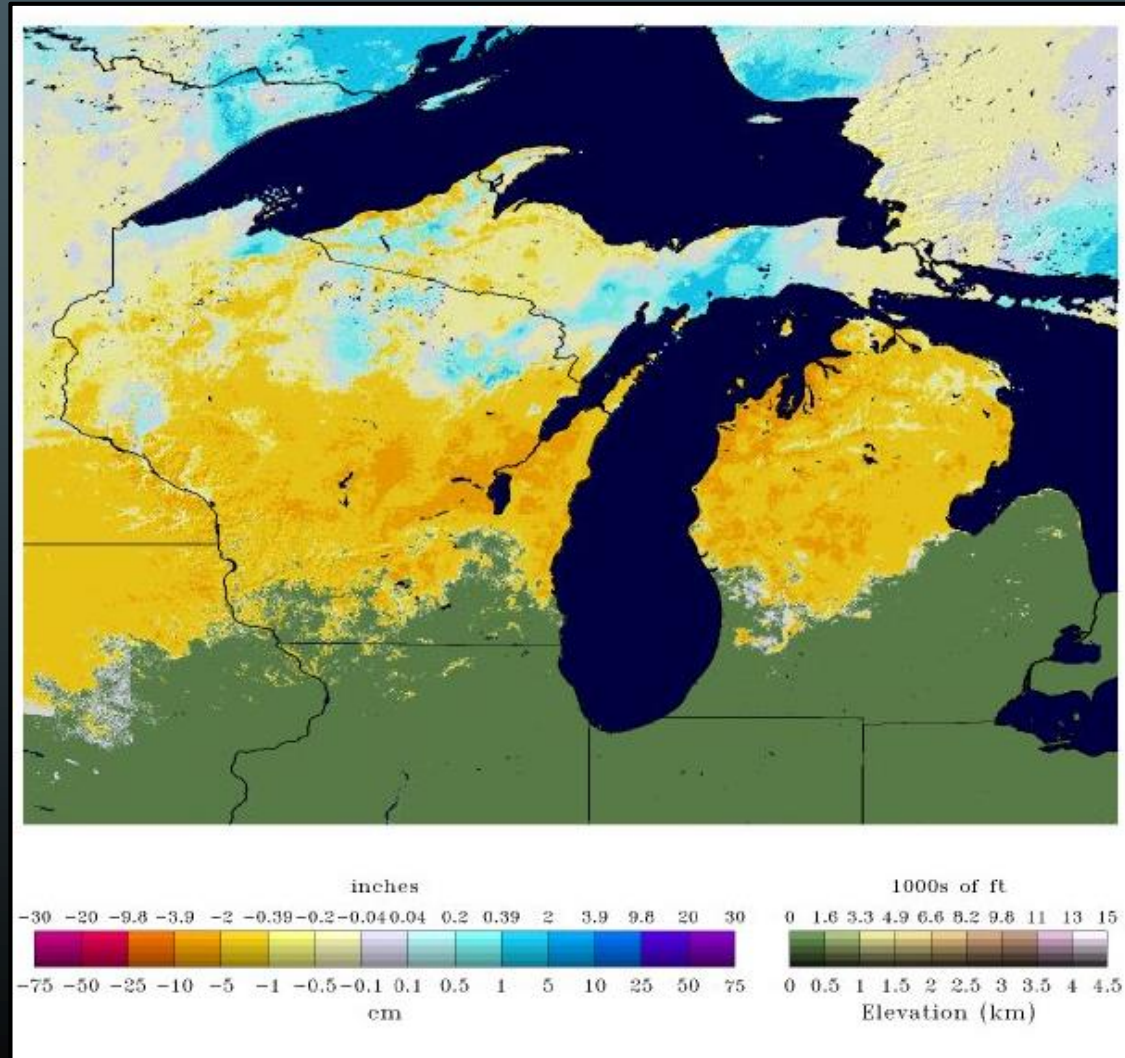




Here is an image of how much snow melted in 24 hours

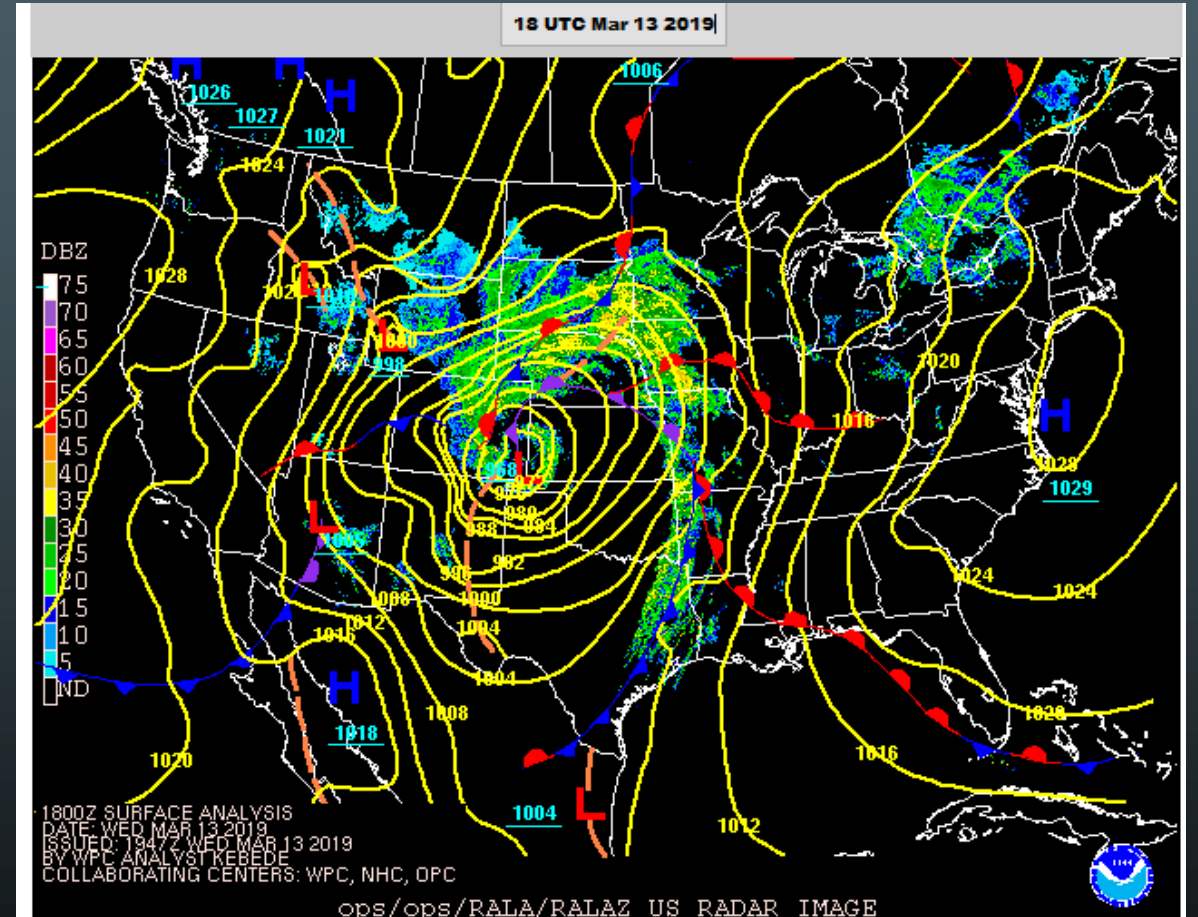
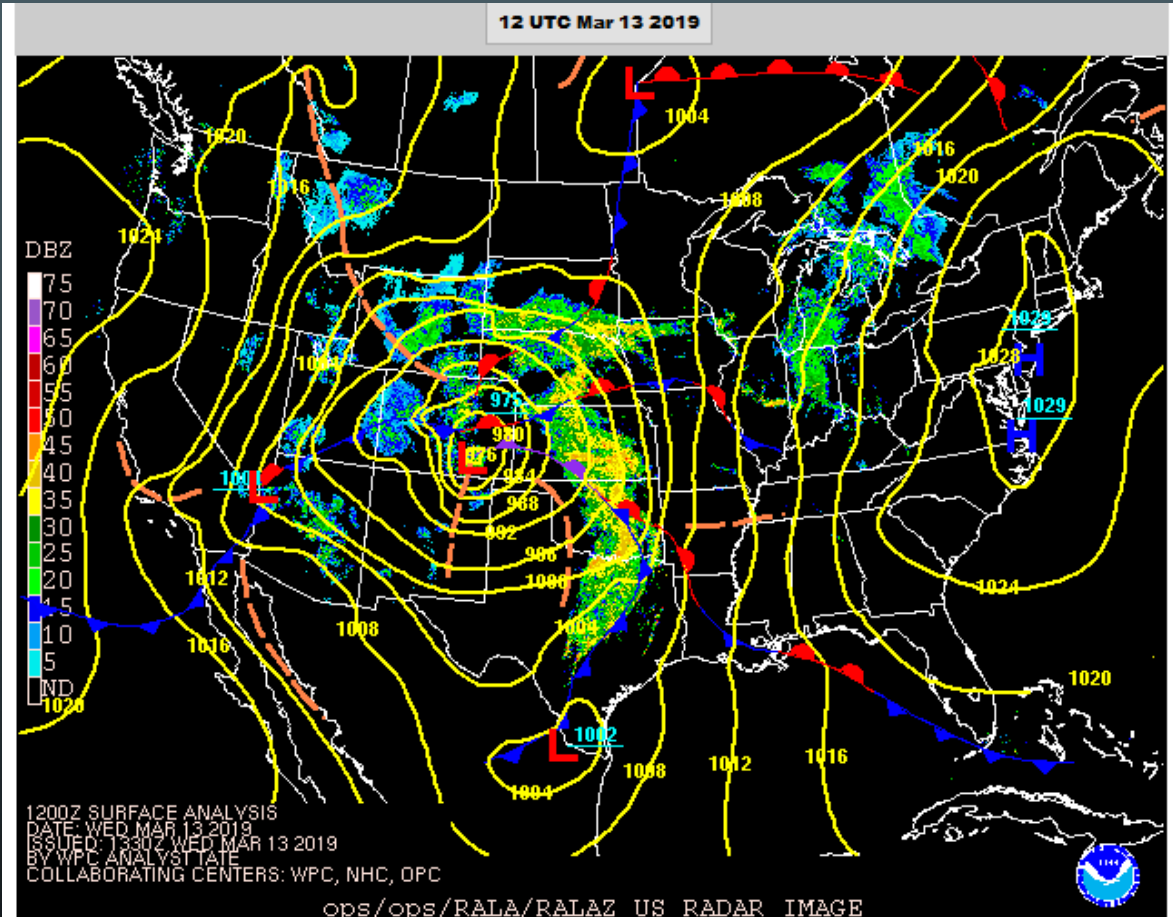


Here is an image of the loss of snow water equivalent in 24 hours

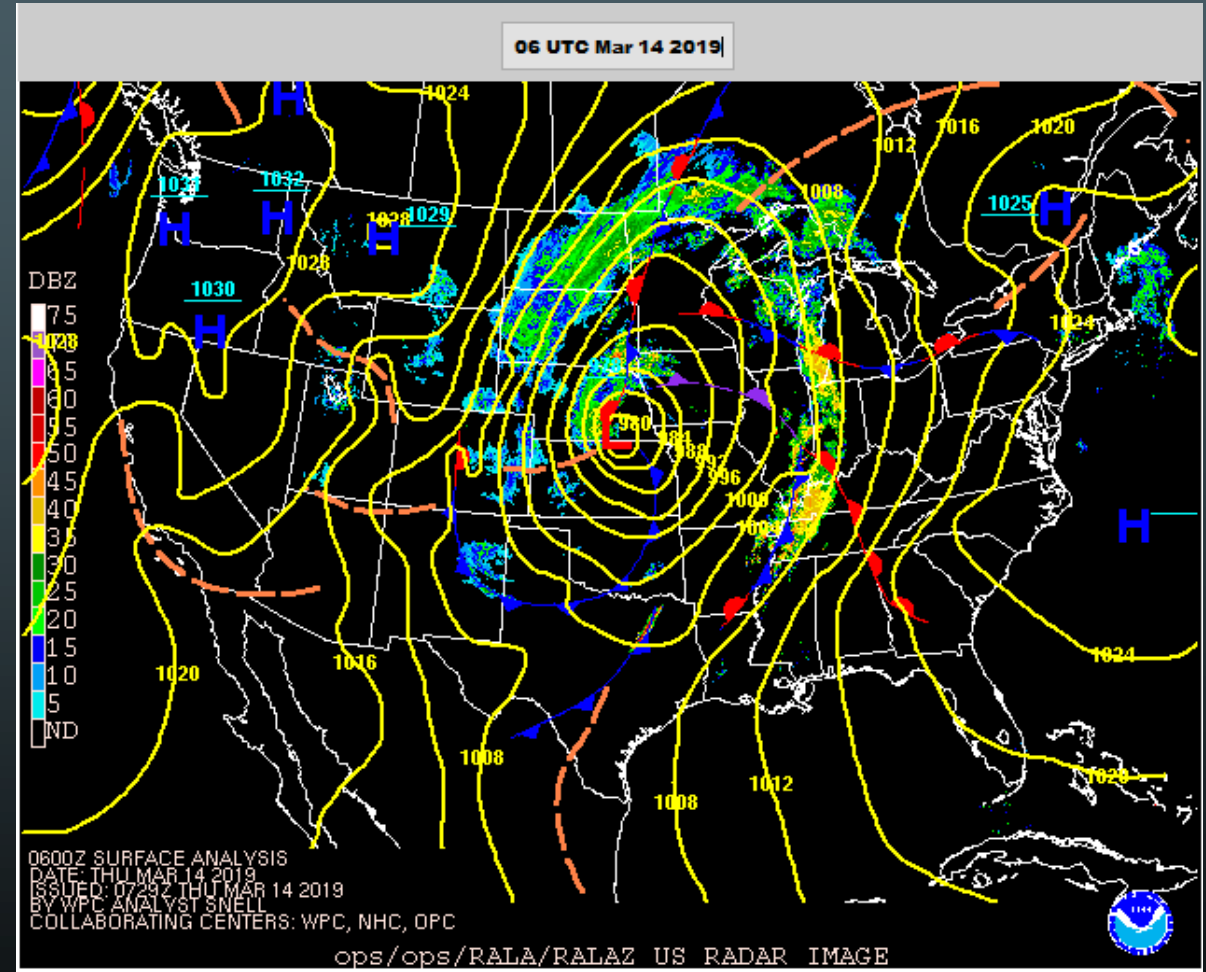
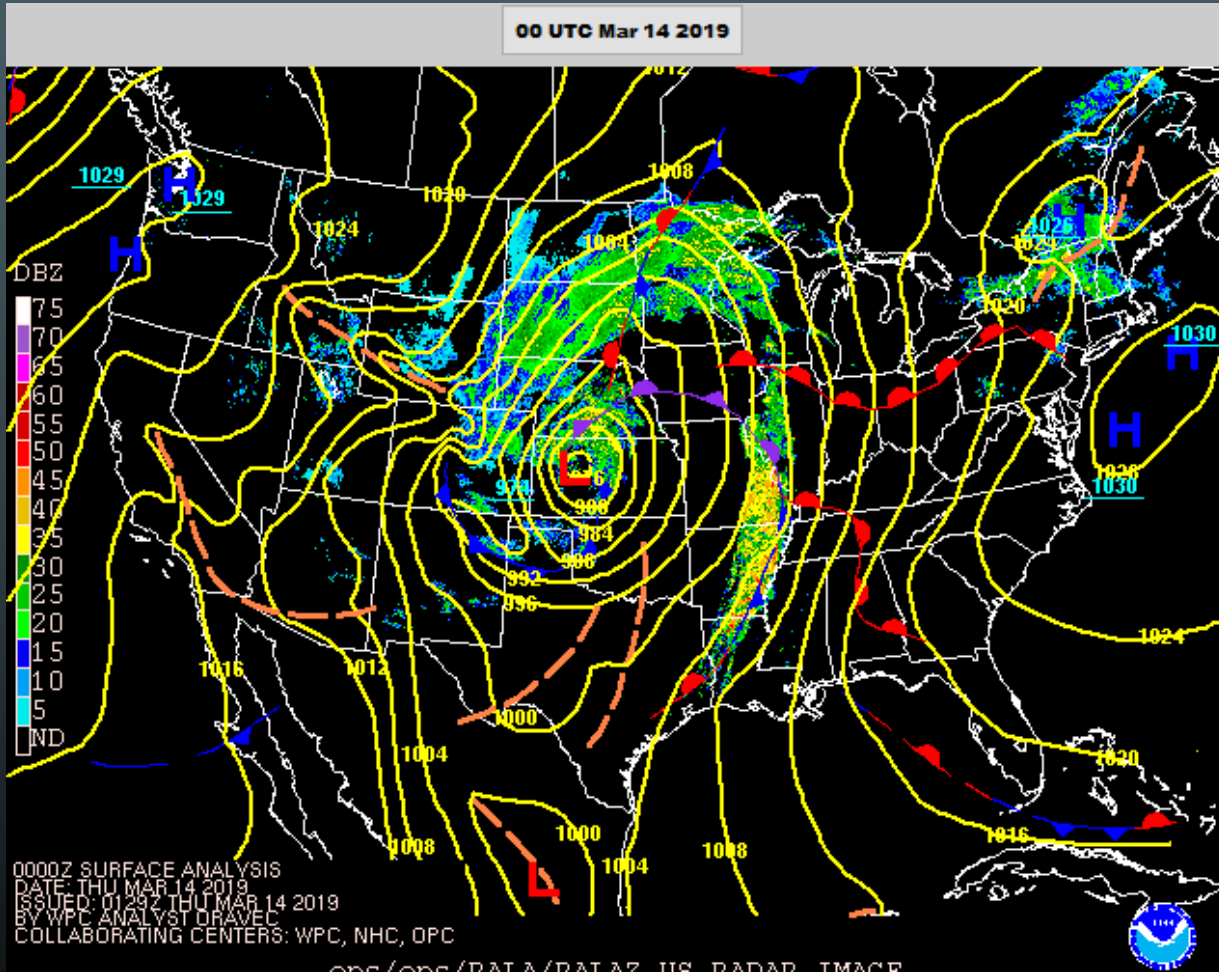




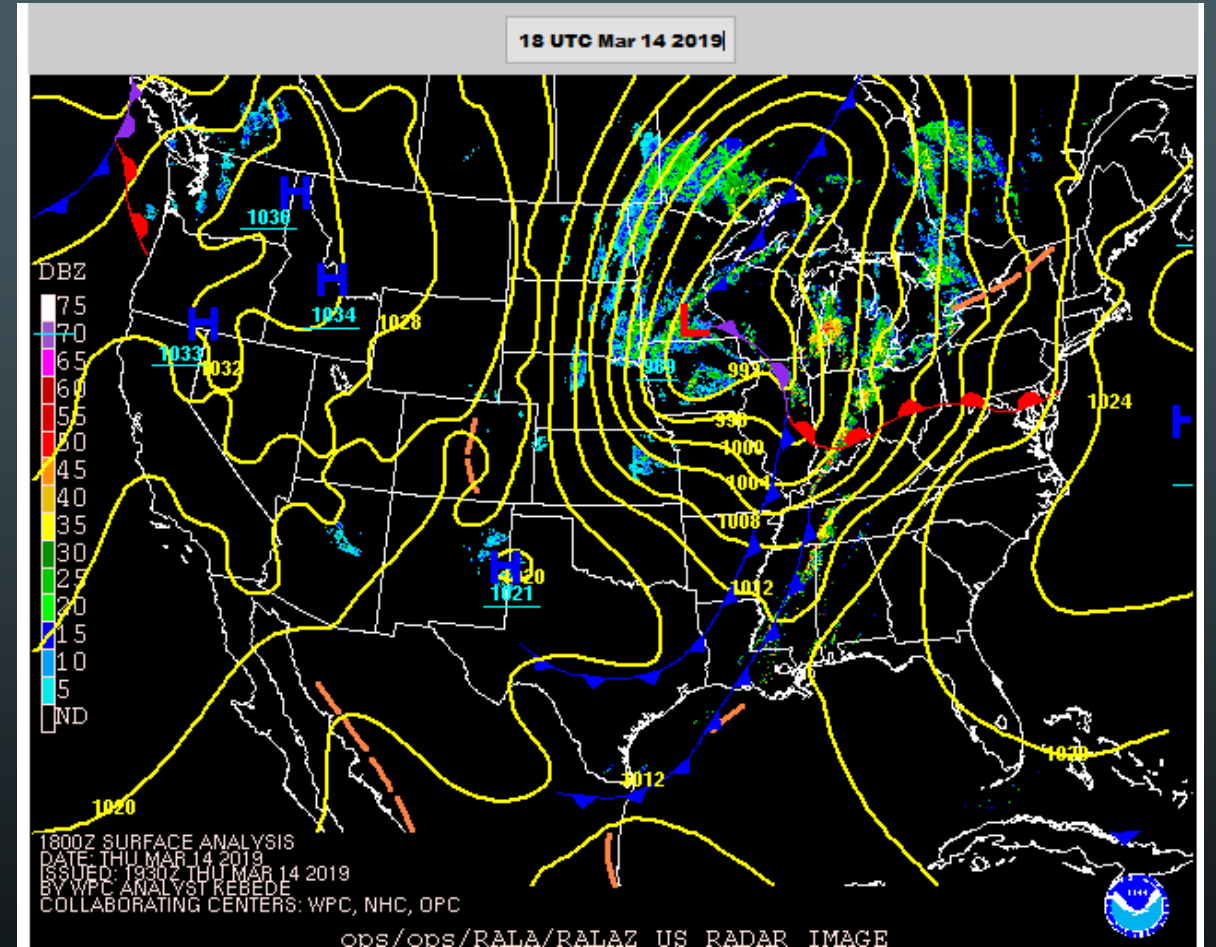
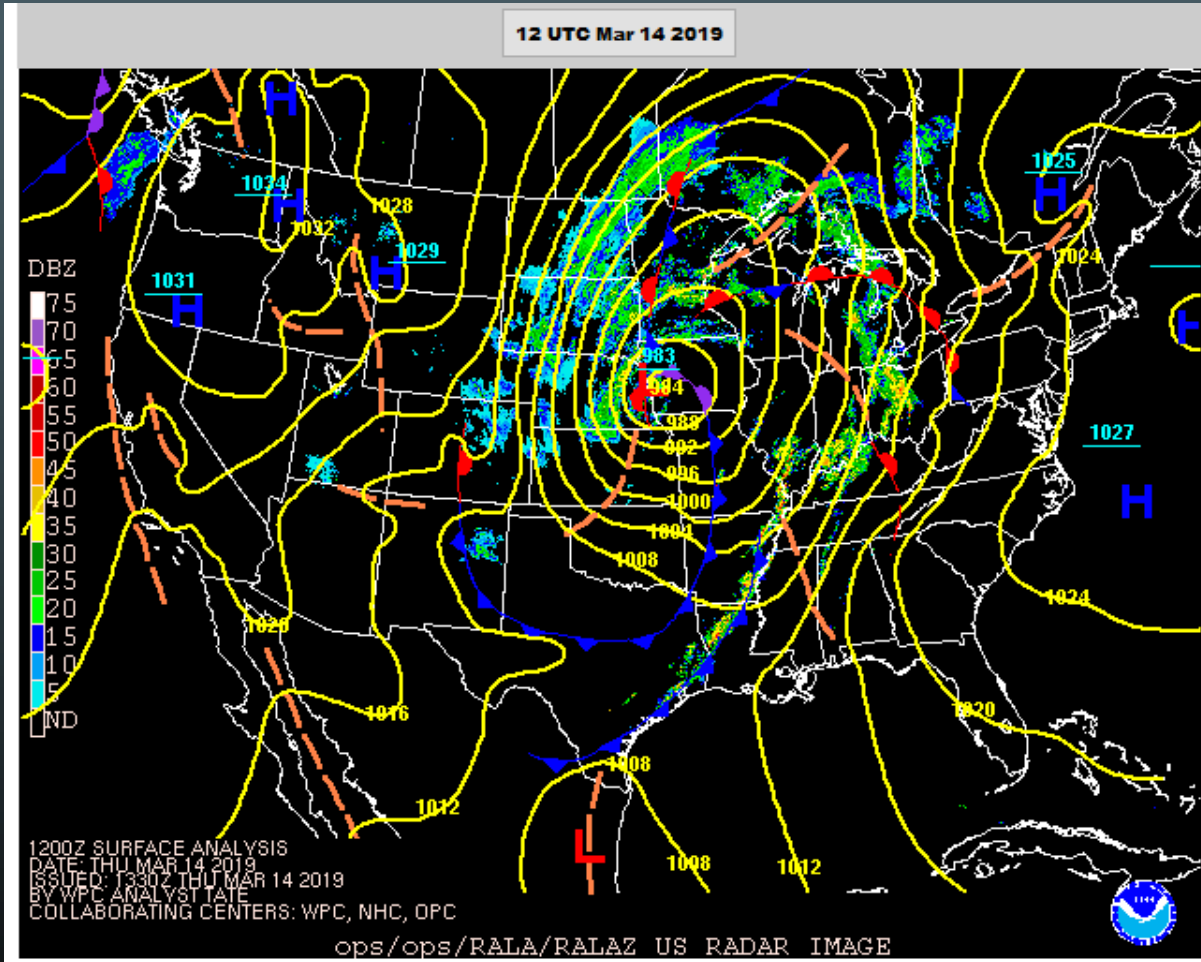
# Surface Weather Maps March 13 2019 12z /18z



# Surface Weather Maps March 14<sup>th</sup> 2019 00z /06z



# Surface Weather Maps March 14<sup>th</sup> 2019 12z/18z





# Surface Weather Maps March 15<sup>th</sup> 2019 00z/06z

