



Pre-Christmas 2022 Lake Erie Seiche of Extraordinary Proportions: A Collaborative Event Review Between National Weather Service Cleveland and Buffalo

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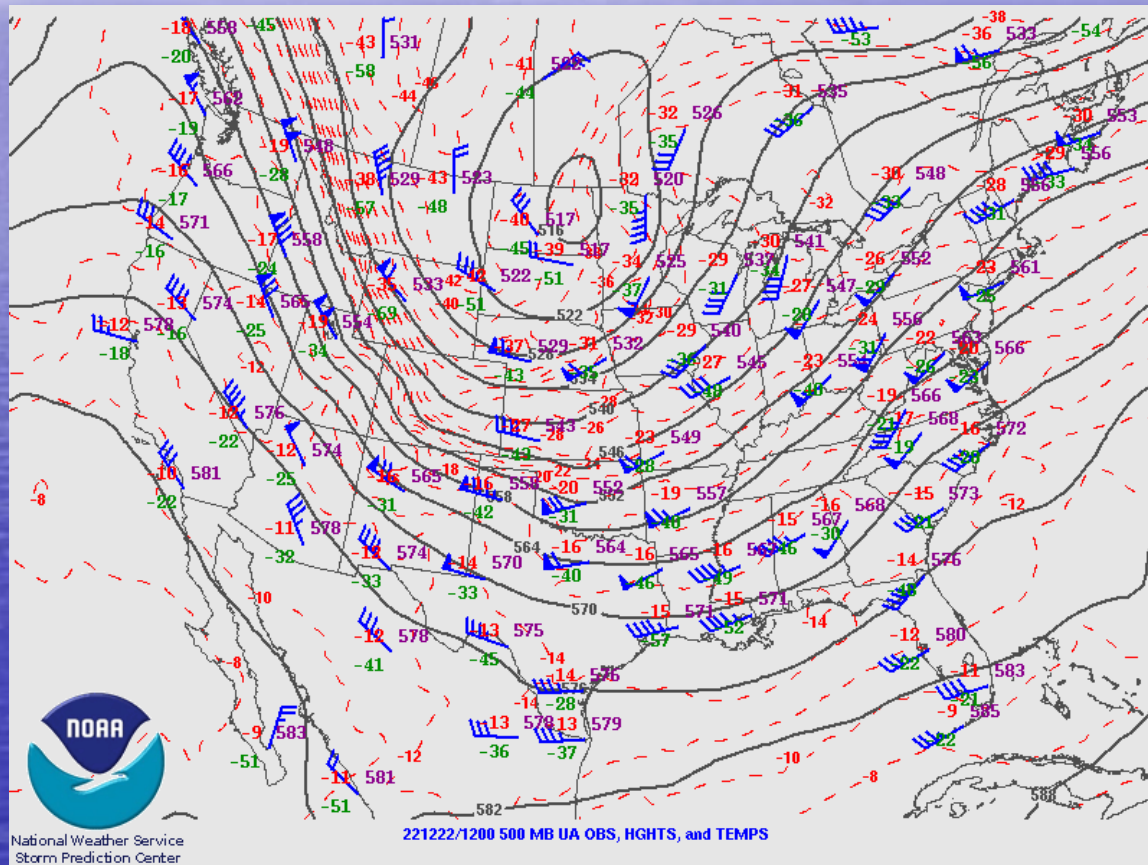
Robert LaPlante

National Weather Service – Cleveland, Ohio



500 MB Plot

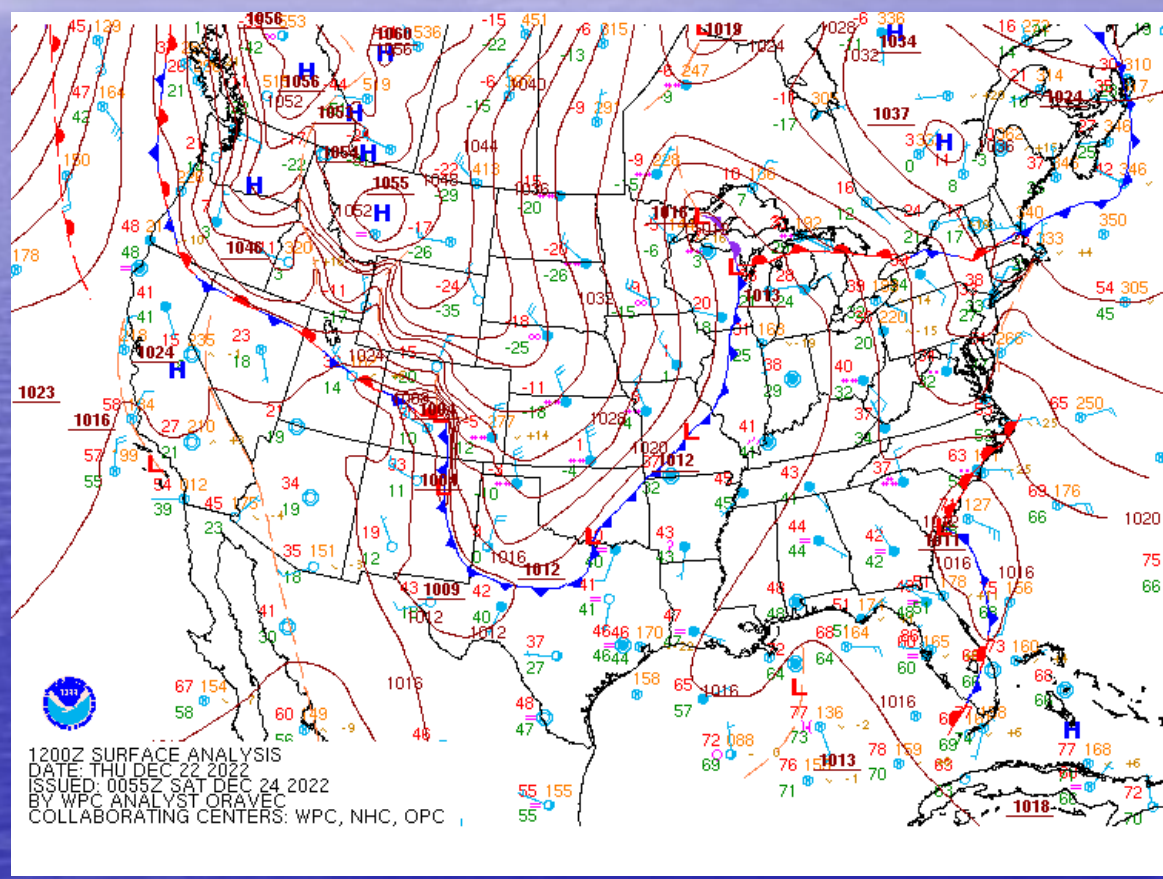
12Z Dec 22 – 12Z Dec 25



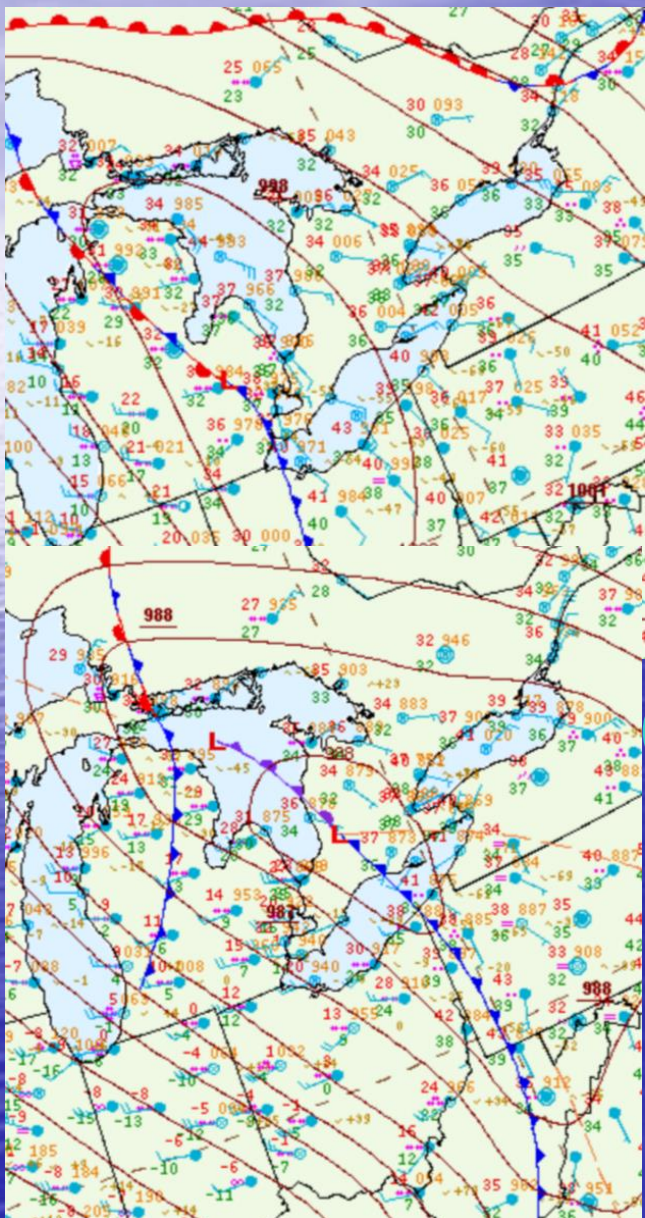


Surface Plot

01Z Dec 23 – 14Z Dec 25



Meteorological Setup



Surface Pressure
21z 12/22
1005 hPa

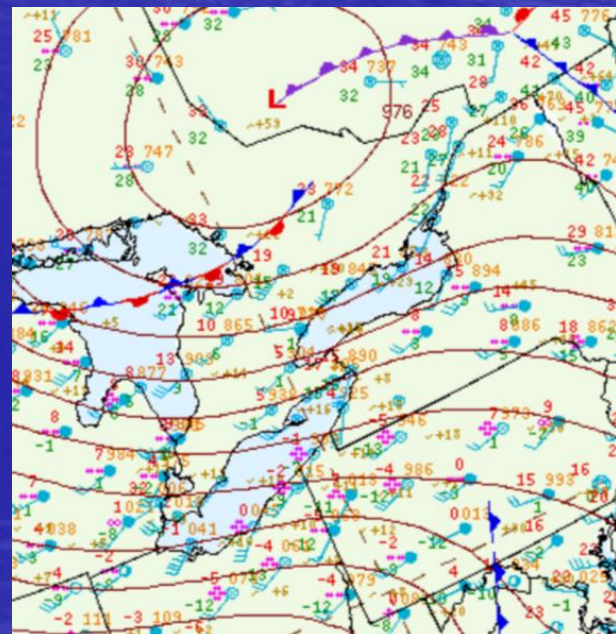
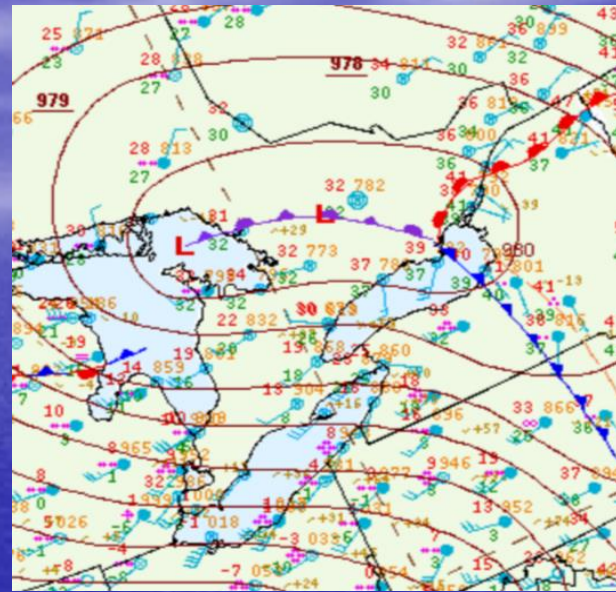
03z 12/23
998 hPa

15z 12/23
978 hPa

**31 hPa
pressure
drop in 24
hours!**

09z 12/23
987 hPa

21z 12/23
974 hPa





Comparison to Blizzard '78



Christmas Storm 2022

963 hPa

United States Weather Prediction Center

Surface Analysis

12/24/2022 09Z

Southwest Quebec

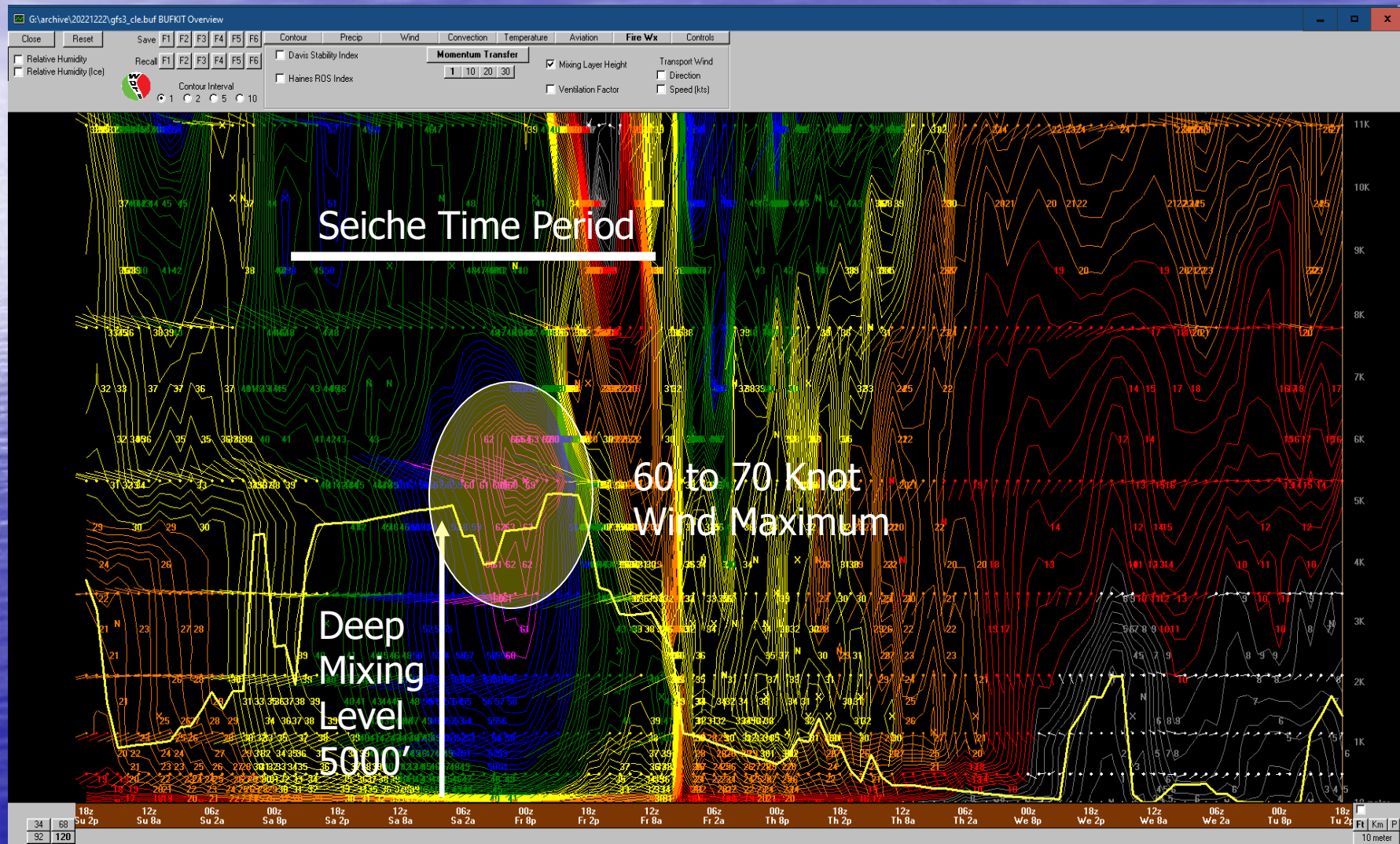
**26 Jan 1978
958 hPa**

1300Z SFC STATION PLOTS (DBF F)

January 26 1978 13 UTC

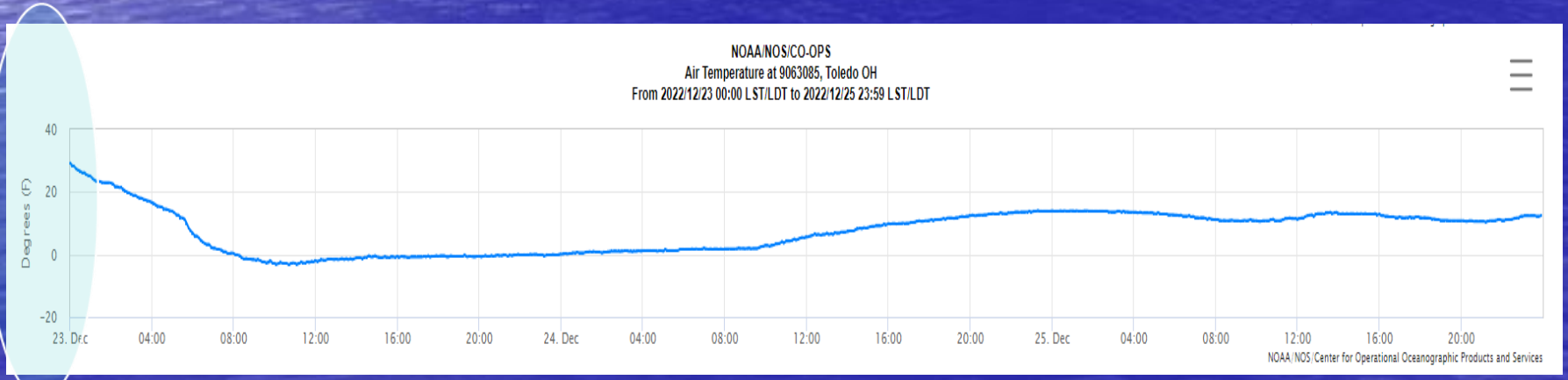
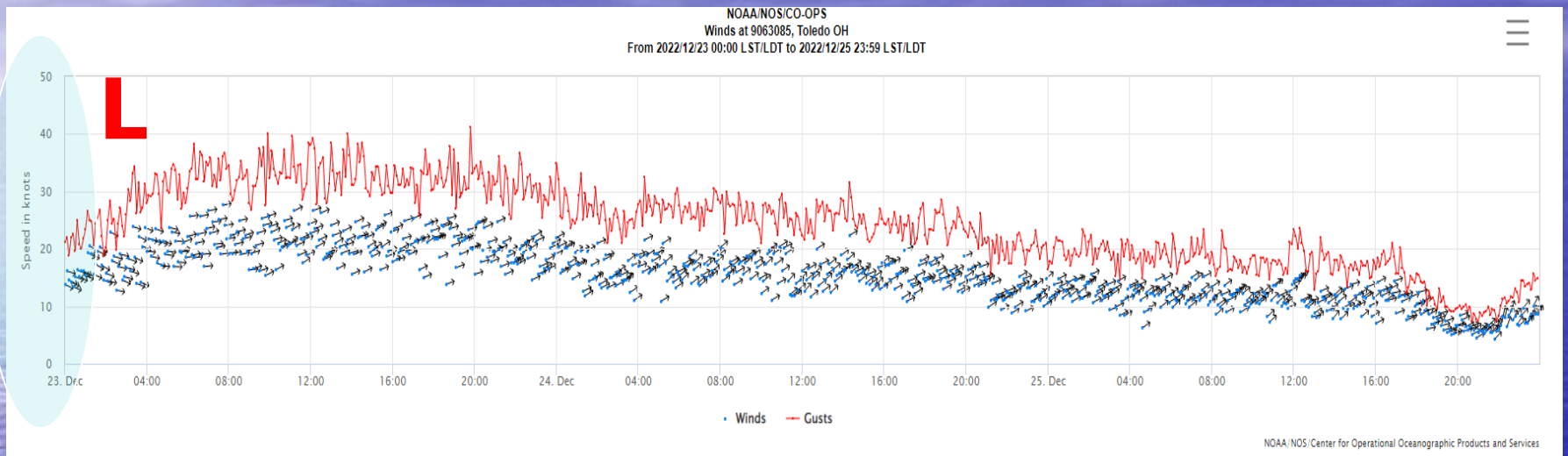


BUFKIT GFS Forecast Model Sounding KCLE 20 December 2022



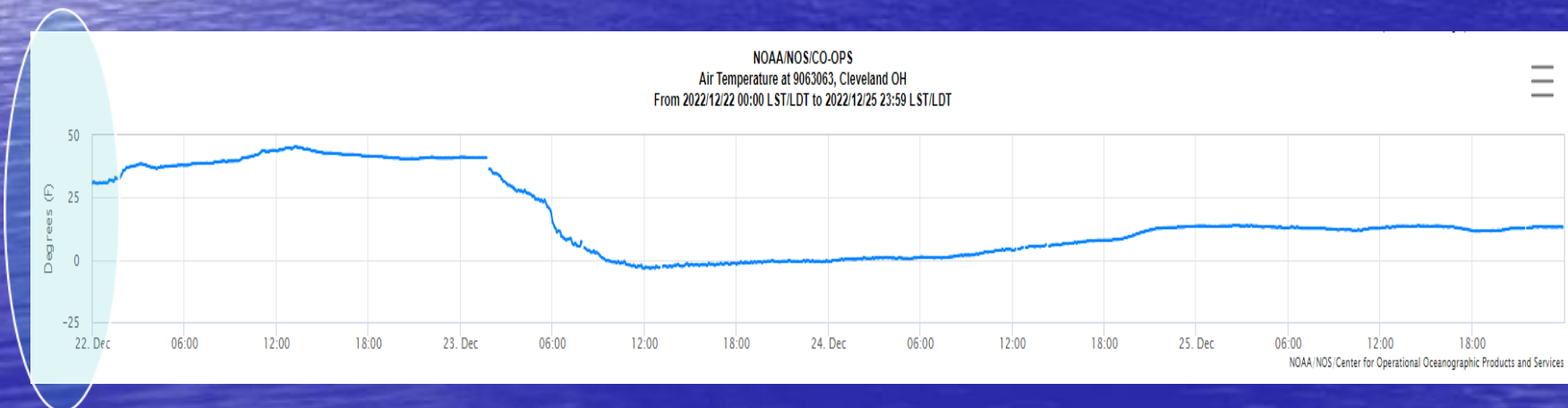
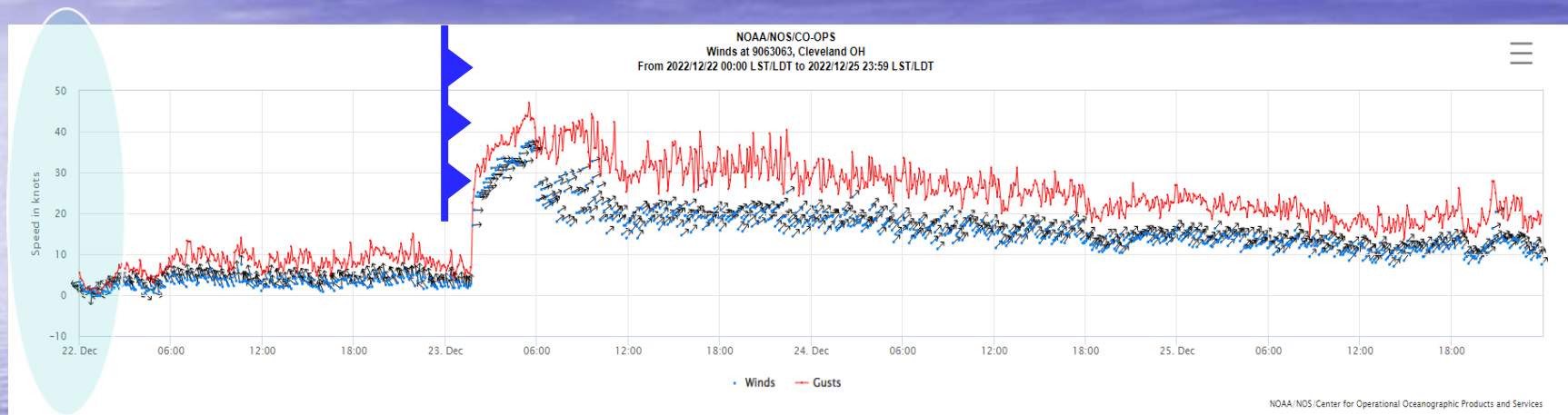


Toledo, Ohio





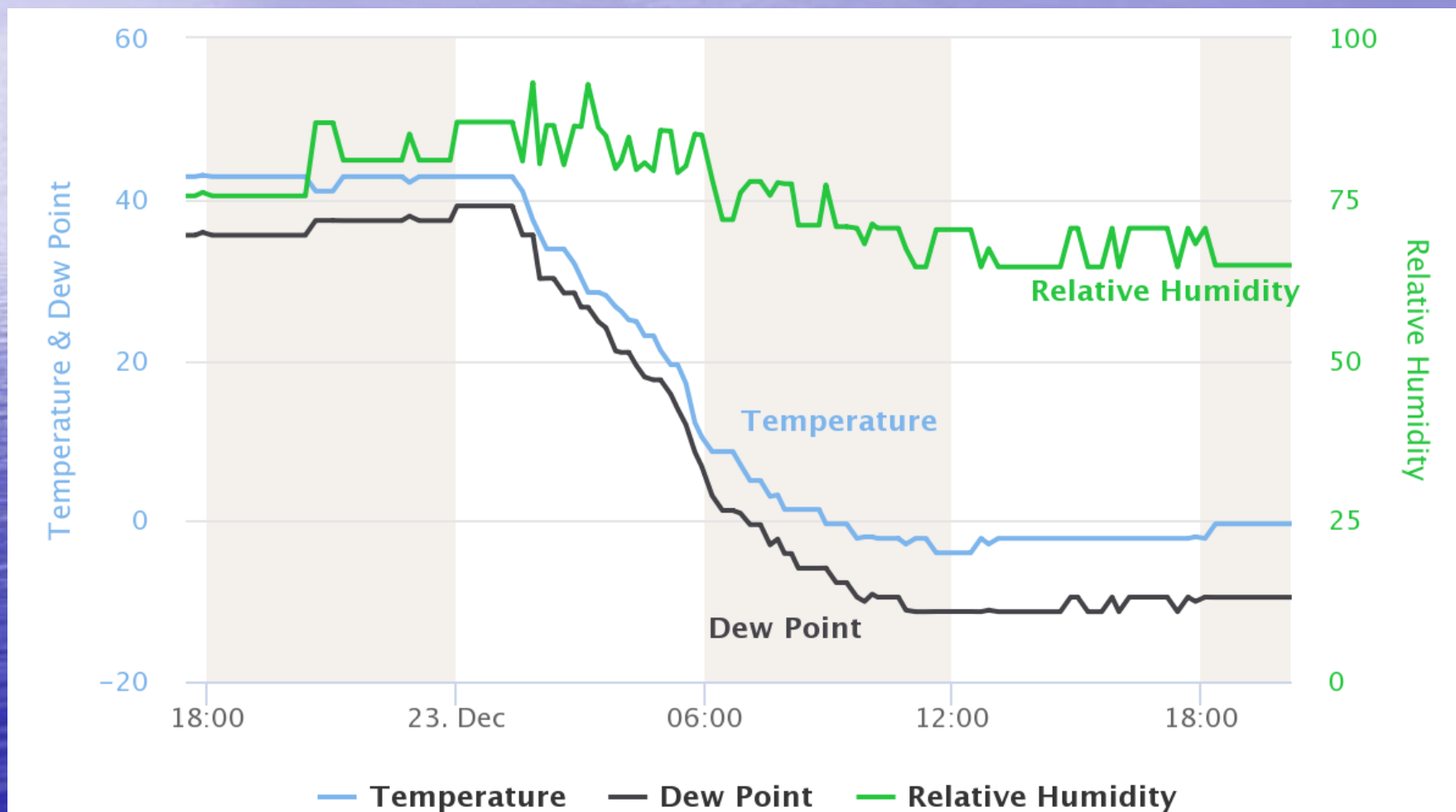
Cleveland, Ohio



Wind speed and Temperature Scales Adjusted Slightly Between Toledo and Cleveland

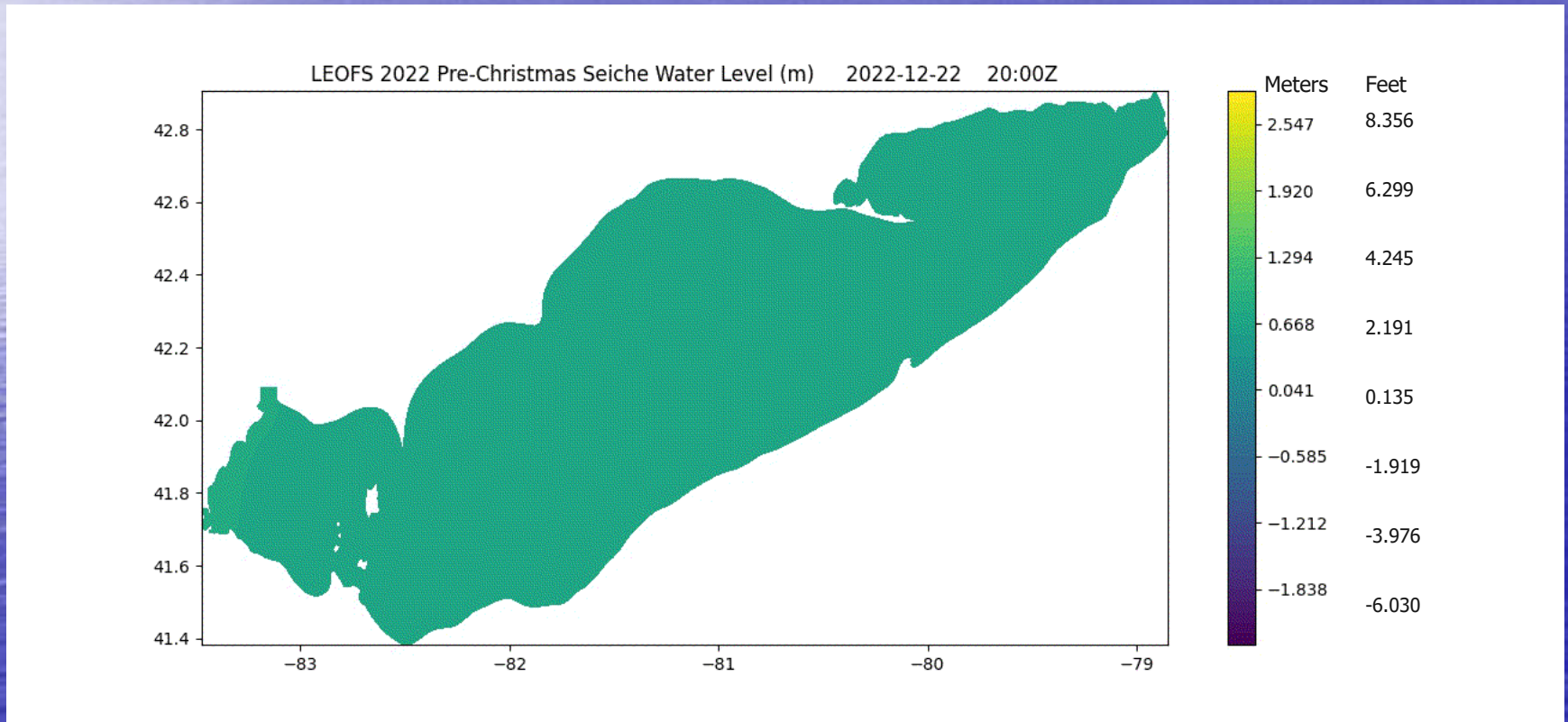


Cleveland





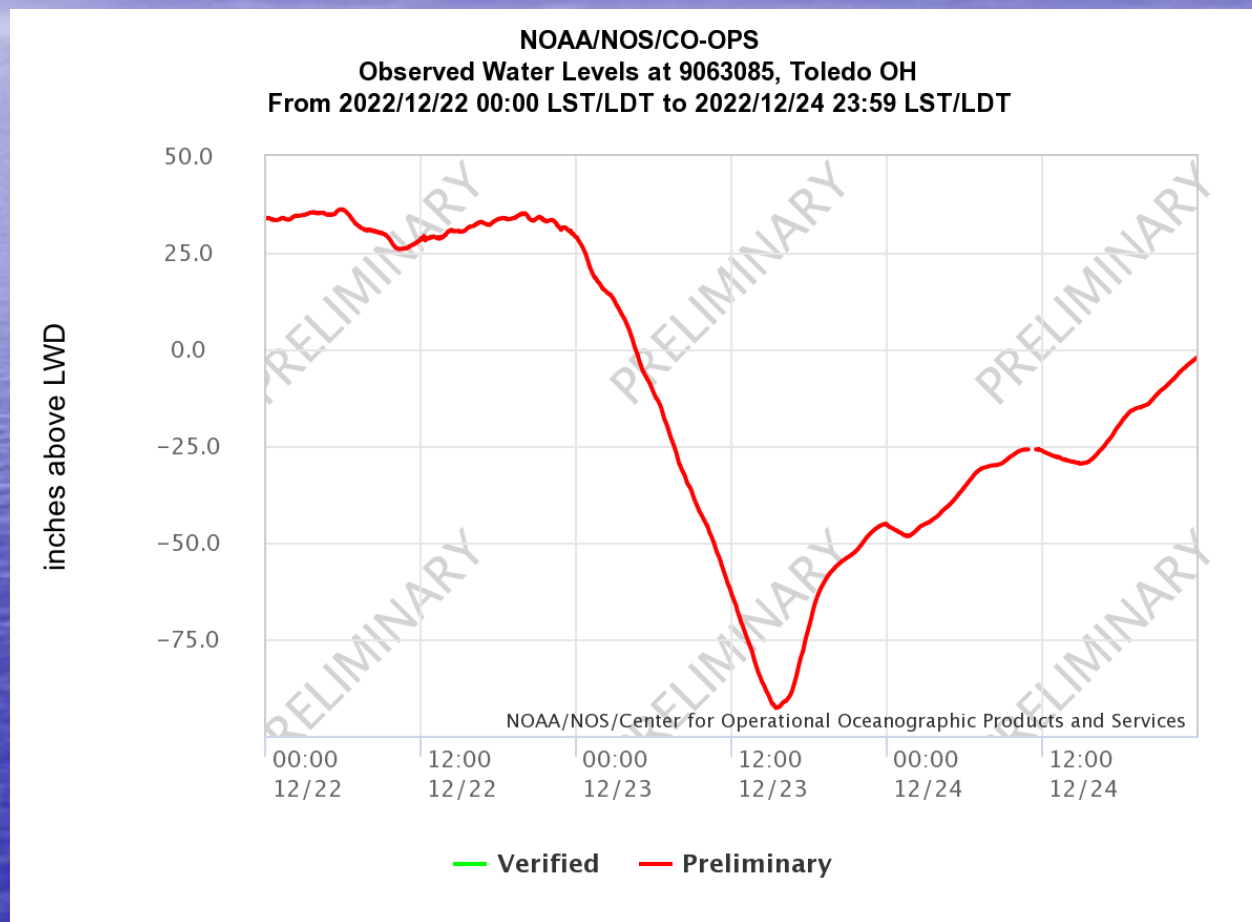
Lake Erie Water Level Displacement



Courtesy of Machuan Peng – National Ocean Service
Center for Operational Oceanographic Products and Services (CO-OPS)
Silver Spring, Maryland



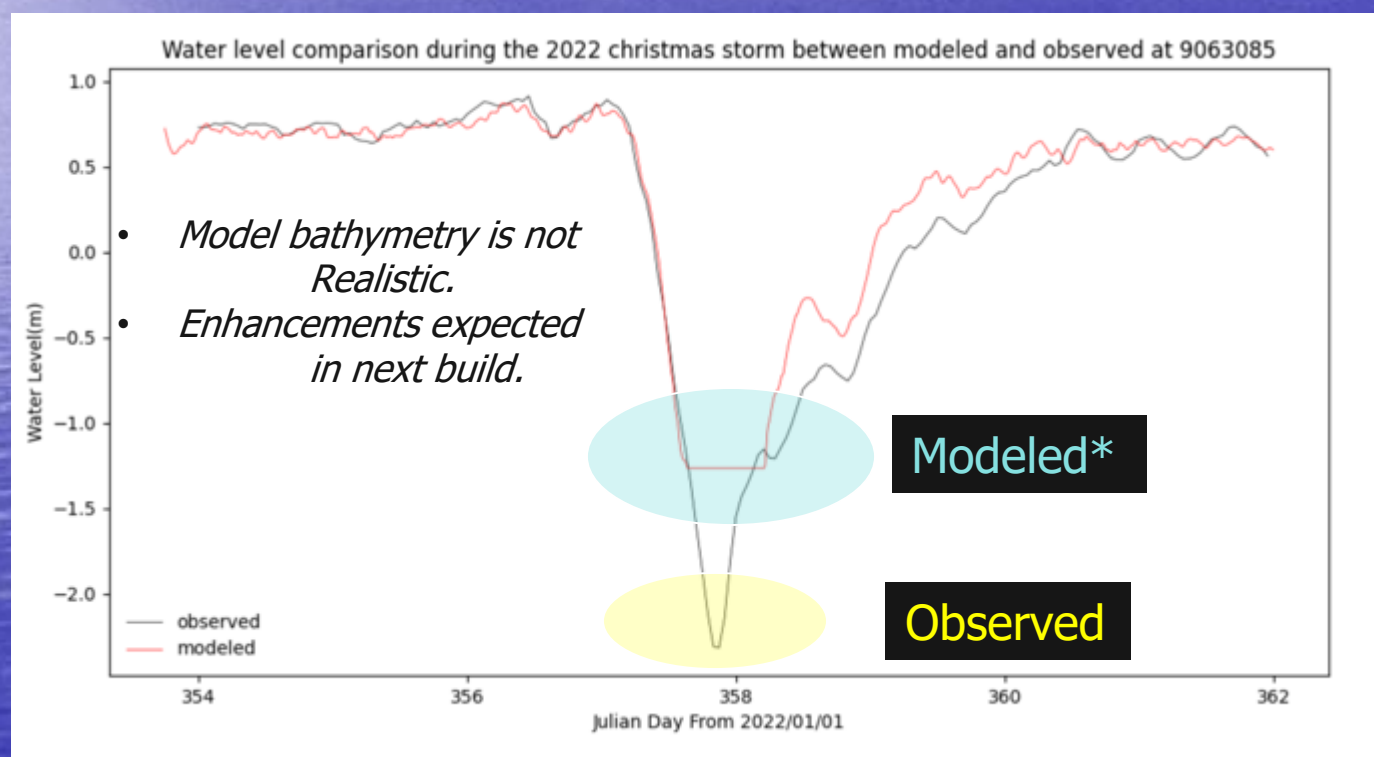
Water Level Displacement Toledo, Ohio



Time Period of Seiche – 03Z 12/23 through 12Z 12/24



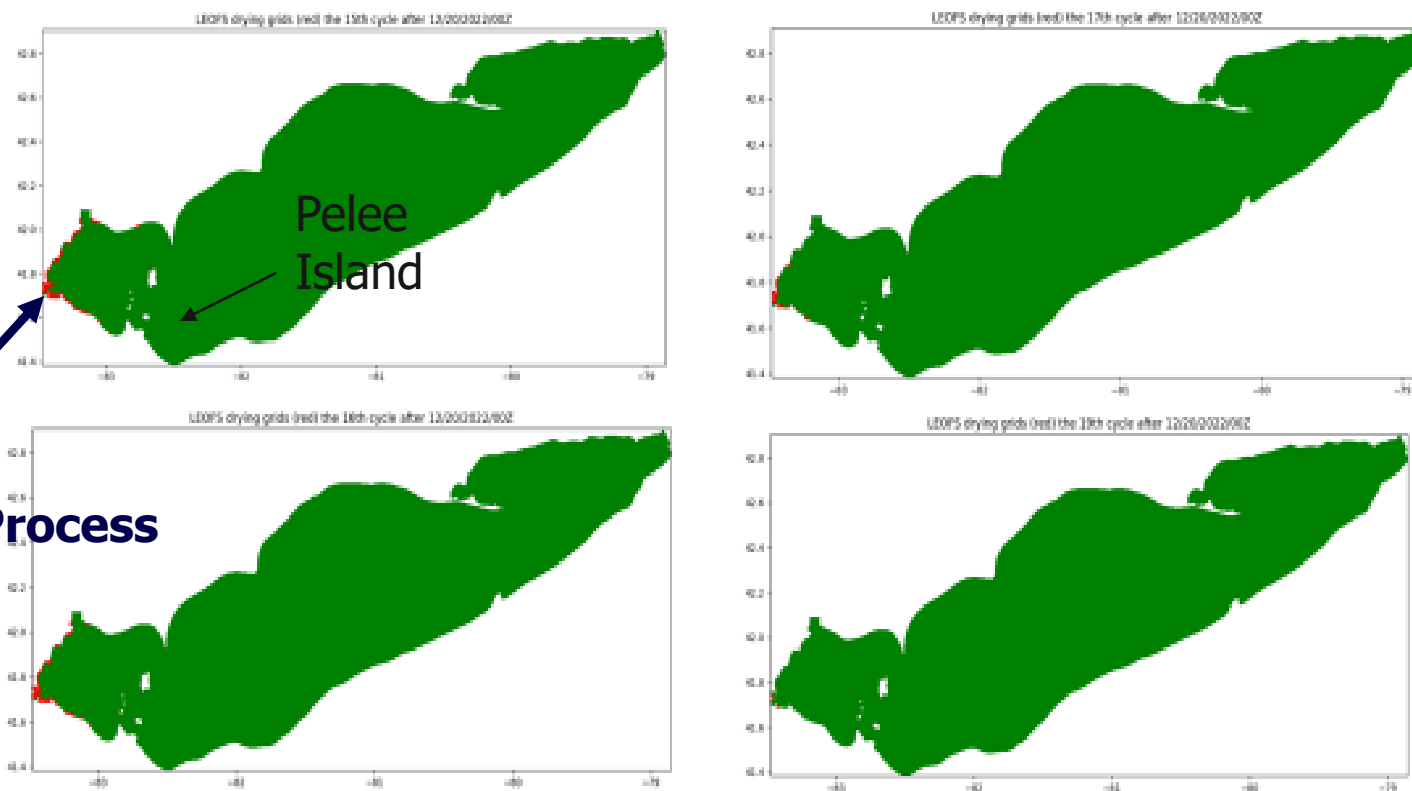
Toledo, Ohio Lake Erie Operational Forecast System (LEOFS)



*Model assumed water level would not fall below -1.0 meter

Courtesy of Machuan Peng – National Ocean Service
Center for Operational Oceanographic Products and Services (CO-OPS)
Silver Spring, Maryland

LEOFS drying process only occurred in a very small western shore area near Toledo and there was no drying near Pelee Island



*Drying process a manifestation of incorrect bathymetry

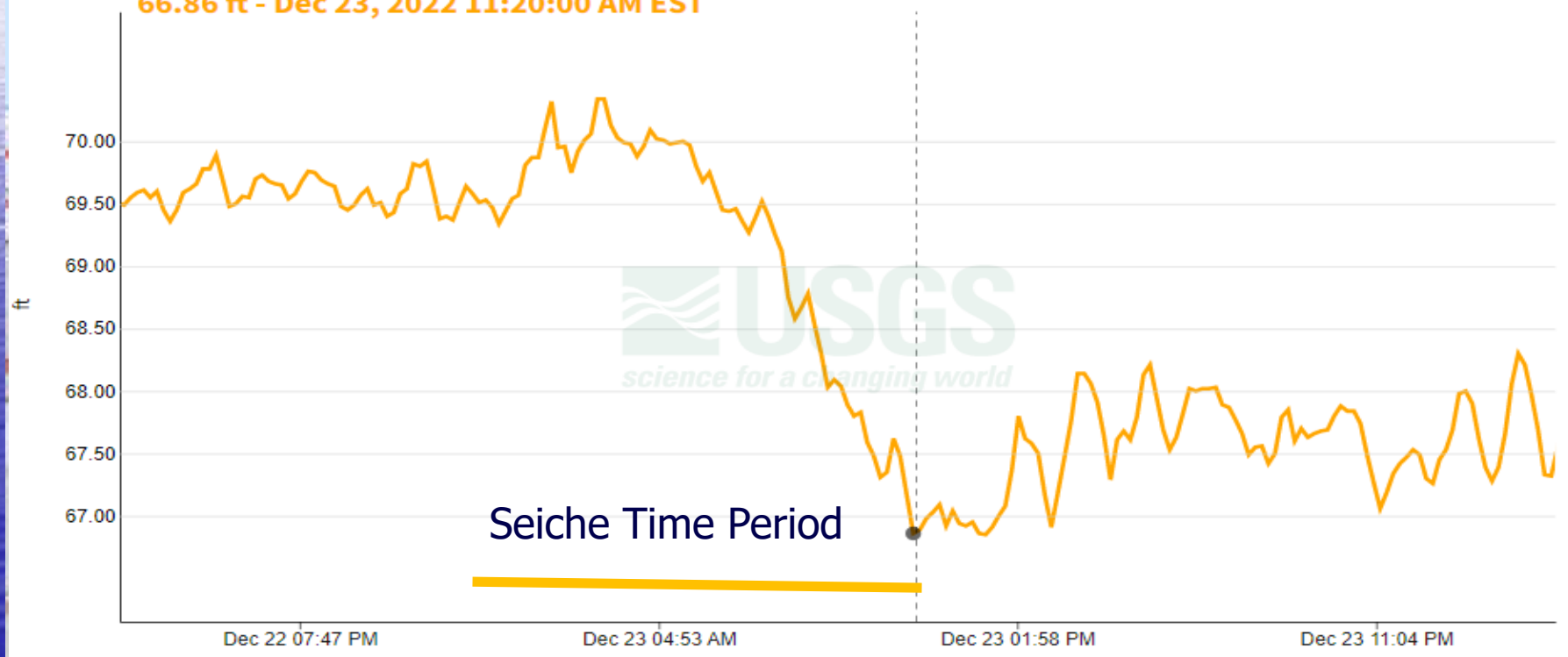


Cuyahoga River Level Drop

Cuyahoga River Near Newburgh Heights OH - 04208504

December 22, 2022 - December 24, 2022
Gage height, ft ⓘ

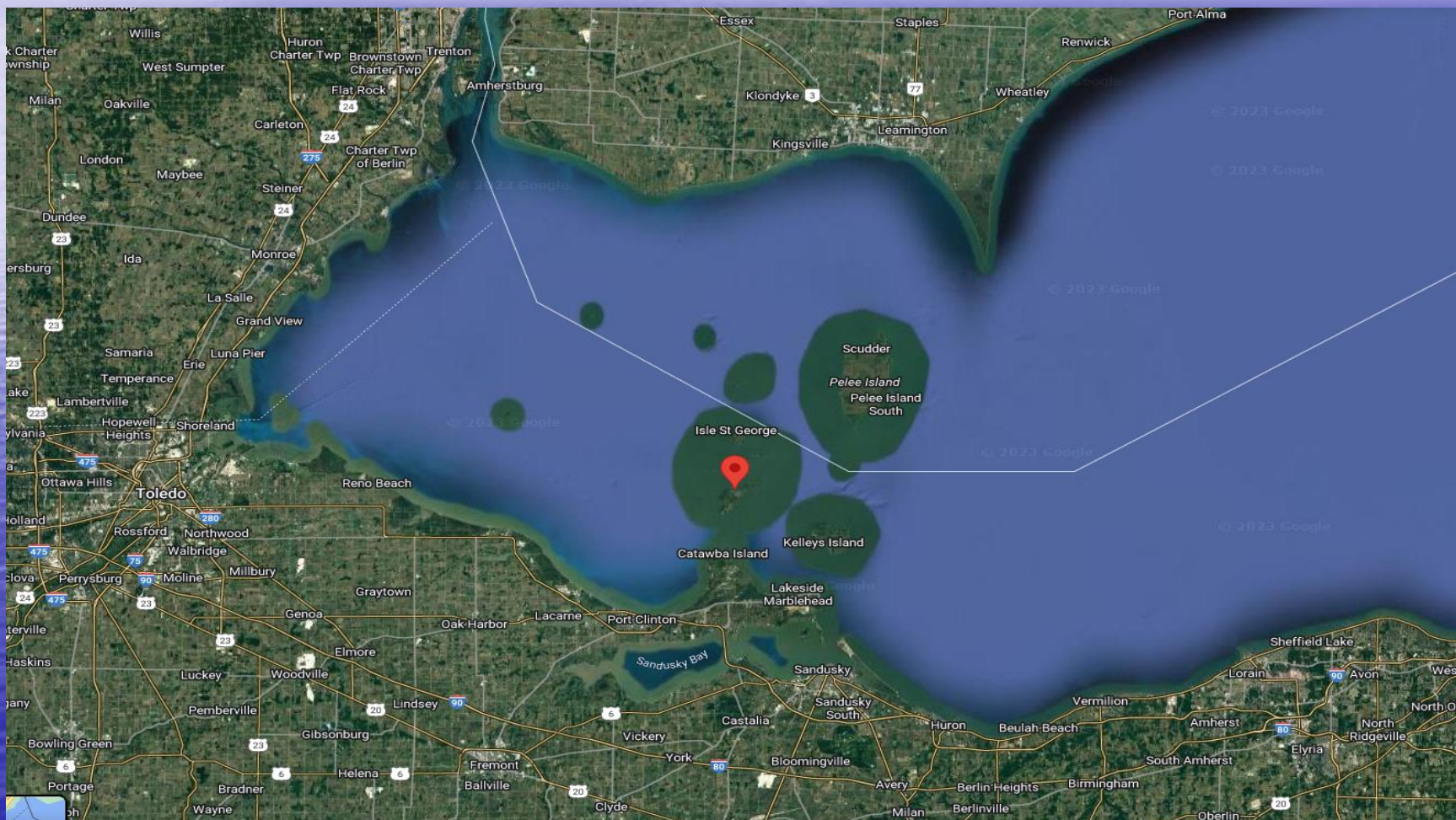
66.86 ft - Dec 23, 2022 11:20:00 AM EST



Courtesy Nicholas Greenawalt – Cleveland National Weather Service Hydrologist

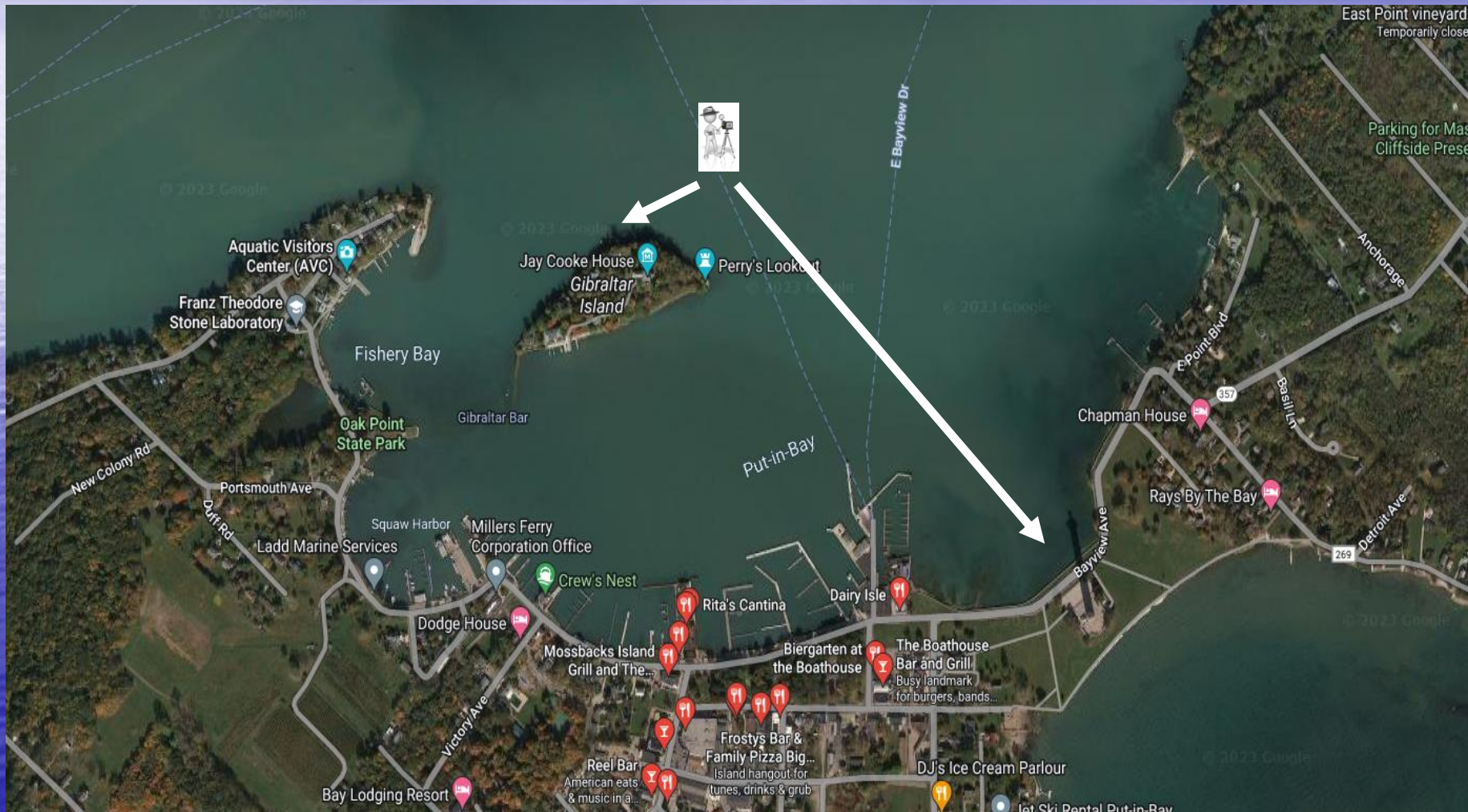


Gibraltar Island Lake Erie Islands



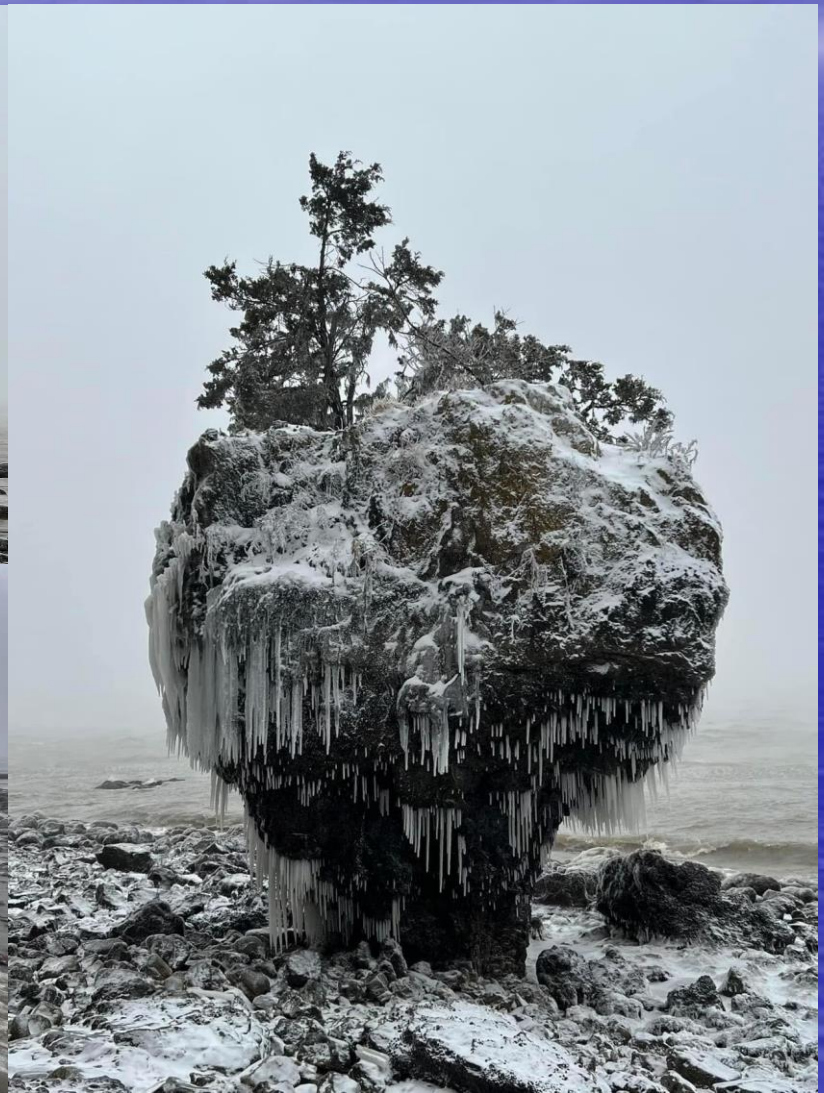


Gibraltar Island Photographer Viewpoint





Gibraltar Island



Photos Courtesy of Barry Koehler



Perry's Monument from the Lake

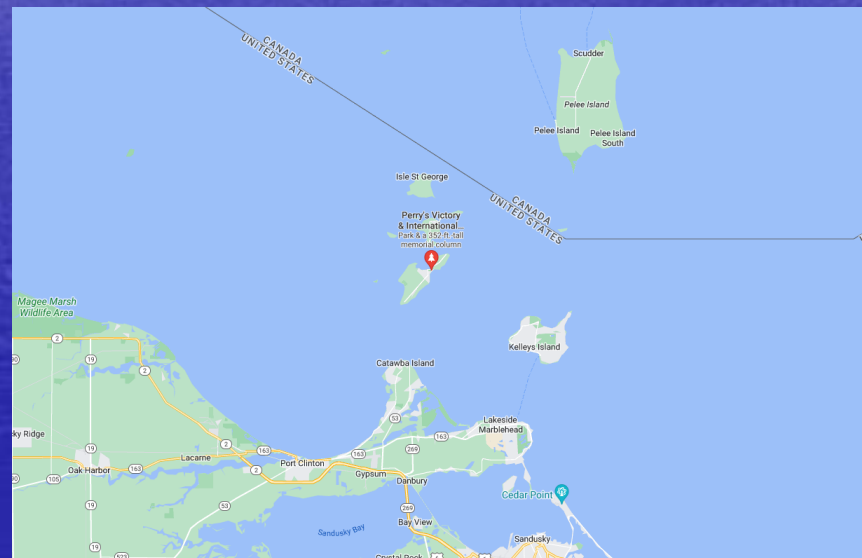
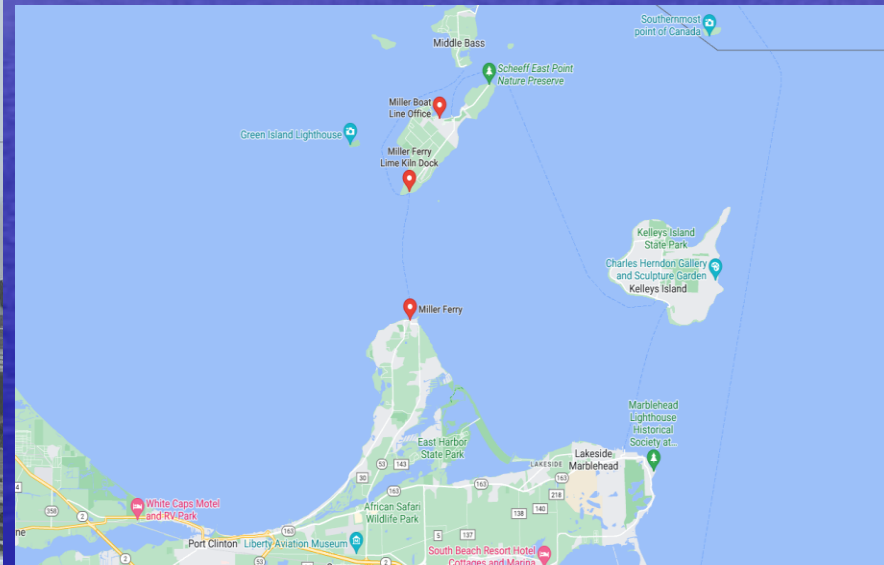


Photo Courtesy of Barry Koehler



Miller's Ferry





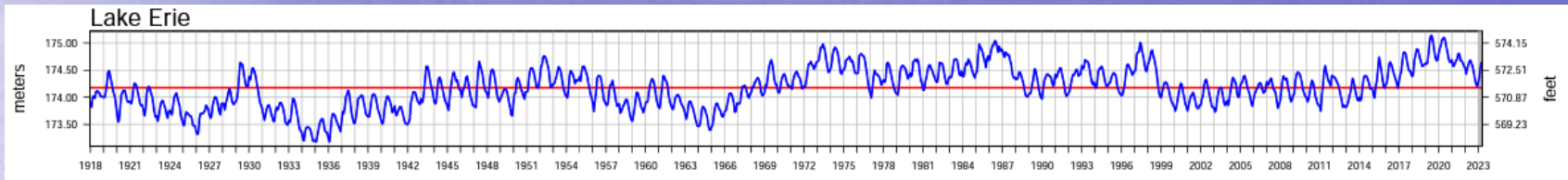
Buffalo's Perspective and Impacts



Historical Perspective



- Levels on Lake Erie have varied more than 6 feet in the past 100 years



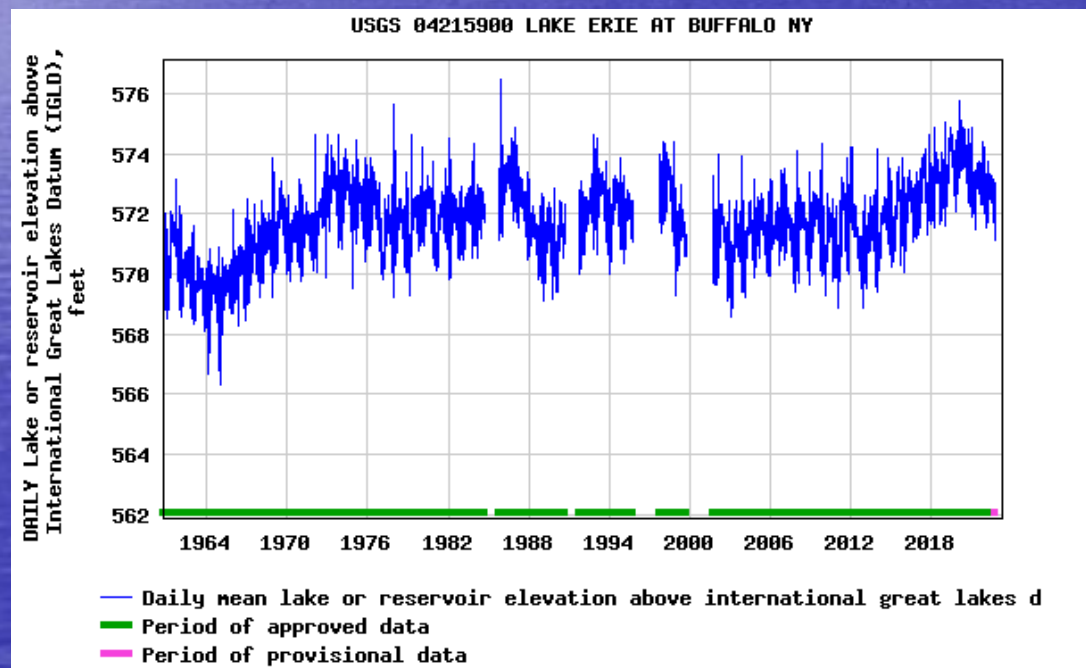
- Record lake levels for 10 out of 12 months were sent in 2019 and 2020
- Late December 2022 state was about 6 inches above average
 - Minimum lake level for 2022
 - More than 2 feet below the levels of 2019/2020



Historical Perspective in Downtown Buffalo



- Records go back to 1860 with the USGS
 - Those since 1960 are available online



Source:

https://waterdata.usgs.gov/ny/nwis/dv?cb_72214=on&format=gif_default&site_no=04215900&legacy=&referred_module=sw&period=&begin_date=1960-10-01&end_date=2023-05-07



Pre-Record Catastrophic Flooding



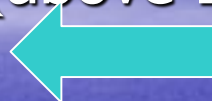
- Great Flood of October 1844
 - Several days of NE wind shifted SW abruptly
 - Water level rose 22 feet (from previous day)
 - Before the current system of reference
 - Put most of downtown under 2 to 8 feet of water
 - 200 boats destroyed, one 2 miles inland
 - 78 confirmed dead from the flooding of downtown plus innumerable lost at sea



Downtown Buffalo Data

- Events of record 1960-2021 (above LWD)

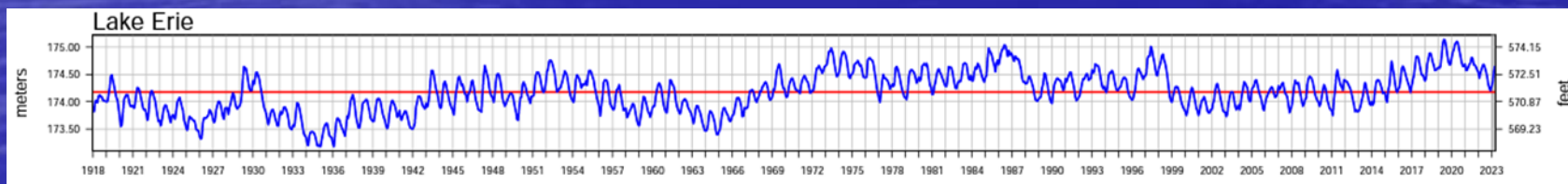
- 12.08 ft on 12/2/1985
- 11.12 ft on 11/15/2020
- 11.06 ft on 1/30/2008
- 10.65 ft on 11/1/2019
- 10.65 ft on 4/6/1979
- 10.57 ft on 12/11/2021
- 10.36 ft on 12/12/2020
- 10.31 ft on 11/10/1975



When lake was at its previous highest level



When lake was at or near a record high for the month





Flooding Impacts

- 11 feet
 - First Ward of South Buffalo, Riverworks, Hamburg St, Hoover Beach, South Grand Island, Dunkirk, Van Buren Point, Silver Creek, Old Lakeshore Road, lake walls also impacted.
- 10 feet
 - USCG Sector Buffalo (10.4), Canalside, Sunset Beach, Hoover Beach, Ralph Wilson Park, Niagara St, Tonawanda St, North Grand Island Bridge ramps to I-190, LaSalle Expressway, Niagara Parkway, Colony, Bronson, and East River Rds, the mouth of Buffalo River, Key Bank Arena parking garage. Dunkirk lake wall impacted.
- 9 feet
 - Flooding begins at Canalside, Sunset Beach, Lakefront Blvd, Dunkirk City Pier, Crooket Brook Dr, and Rt. 5 in Hamburg. Minor flooding begins on Cayuga Island.
- 8 feet
 - Minor flooding and splash over along the immediate Lake Erie shoreline. Rt. 5 in Hamburg may be impacted.



Hurricane Force Wind Gusts

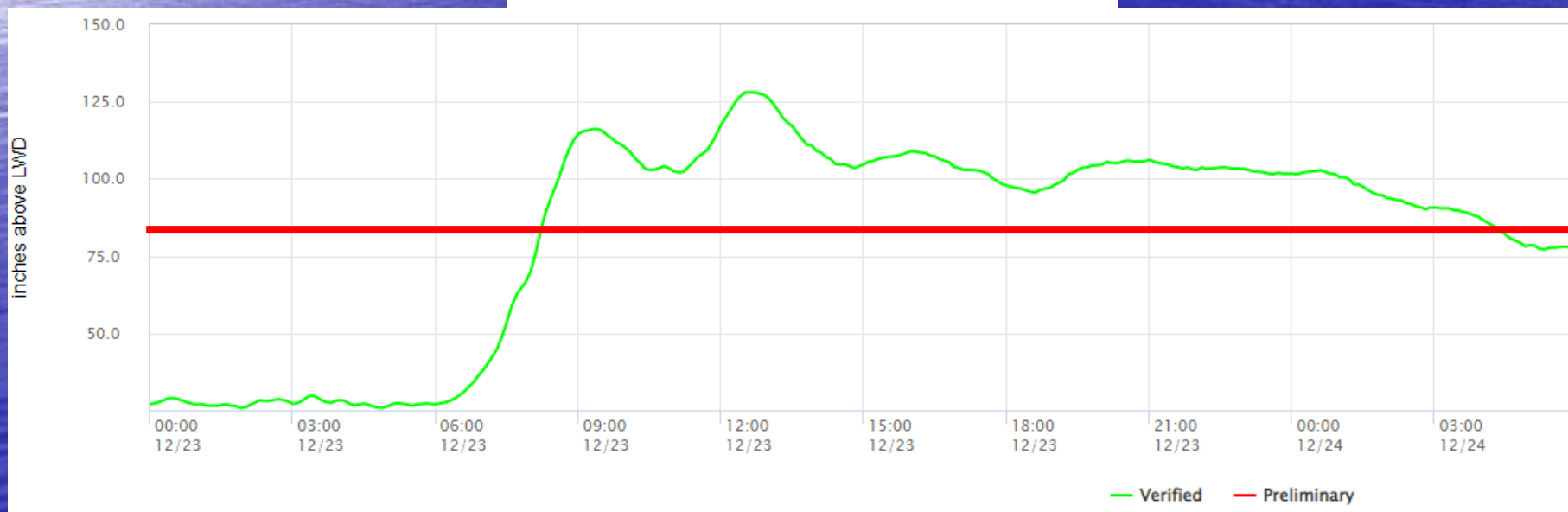
- Period of E and SE winds abruptly shifted SW and increased to over 70 mph
 - Buffalo Downtown 79 mph
 - Buffalo Int'l 72 mph
 - Niagara Falls 74 mph
 - Warsaw 71 mph
 - Fredonia 70 mph
 - Rochester 69 mph



Dramatic Lake Erie Seiche

- Lake Erie peaked at 10.7 feet above LWD
- New #4 all time
- In flood for a full 17 hours

NOAA/NOS/CO-OPS
Observed Water Levels at 9063020, Buffalo NY
From 2022/12/23 00:00 LST/LDT to 2022/12/24 23:59 LST/LDT





Wind & Seiche Combo

- Hurricane force wind gusts led to heavy freezing spray on Lake Erie
 - Warnings were issued for this (a rare event for NWS BUF)
- Spray extended inland, encapsulating nearshore homes and businesses
- Lake water inundated inland areas, then froze as temperatures fell into the single digits



The following pictures are courtesy of
City of Buffalo Fire Department
Town of Hamburg Emergency Services
US Coast Guard Sector Buffalo



Hamburg, NY





Hamburg, NY





Route 5, Hamburg, NY





Buffalo Inner Harbor





Erie Basin Marina





Erie Basin Marina...Days Later





Canalside...Before





Canalside...During





Ice Accumulation Freezing Spray





Questions?