NOAA Great Lakes CoastWatch Program

CoastWatch is a nationwide National Oceanic and Atmospheric Administration (NOAA) program within which the Great Lakes Environmental Research Laboratory (GLERL) functions as the Great Lakes regional node. In this capacity, GLERL obtains, produces, and delivers environmental data and products for near real-time observation of the Great Lakes to support environmental science, decision making, and supporting research. This is achieved by providing Internet access to near realtime and retrospective satellite observations, in-situ, and modeled Great Lakes data. Clients include Federal, state, and local (decision-making and regulatory) agencies, academic institutions, and the public. The goals and objectives of the CoastWatch Great Lakes Program directly support NOAA's statutory responsibilities in estuarine and marine science, living marine resource protection, and ecosystem monitoring and management.

G. Leshkevich

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National Oceanic and Atmospheric Administration
Ann Arbor, Michigan 48108
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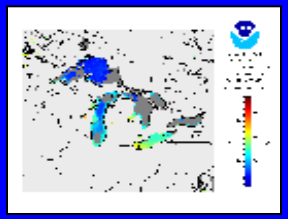
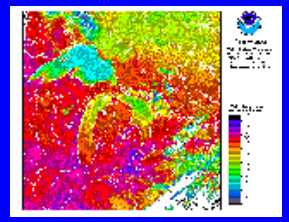
E-mail: george.leshkevich@noaa.gov

CoastWatch Great Lakes Node

http://coastwatch.glerl.noaa.gov

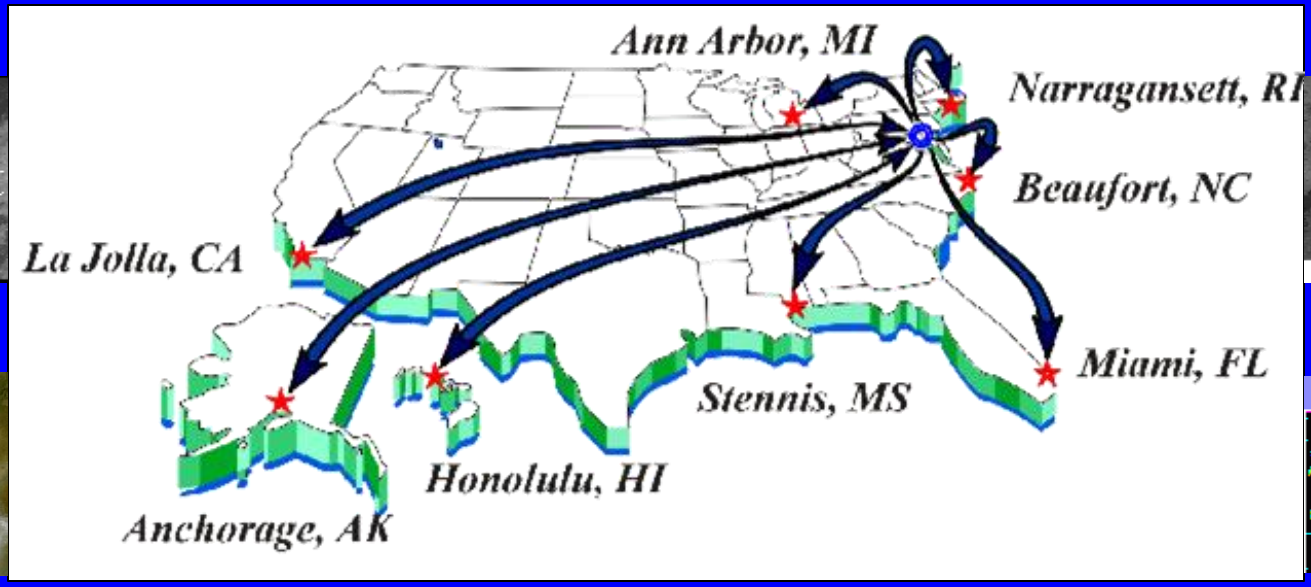


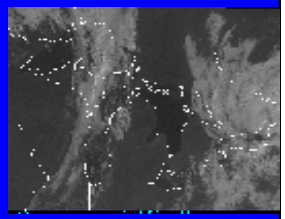
Goes SST



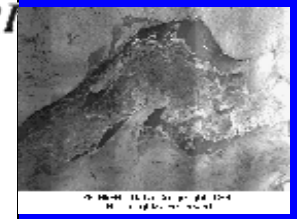
AVHRR SST

CoastWatch Regional Nodes



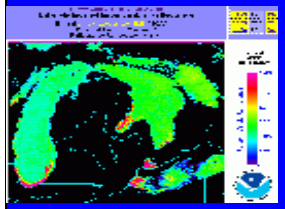


Goes VIS/IR

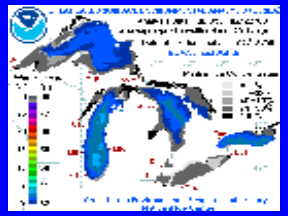


RADARSAT

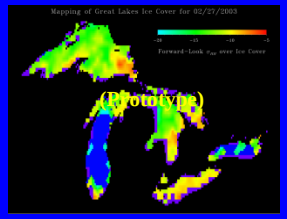
MODIS True Color



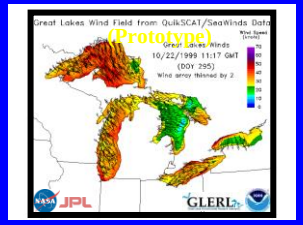
Turbidity



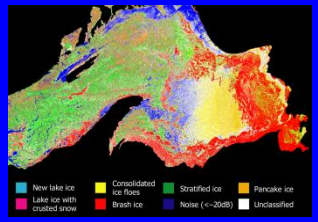
GLSEA



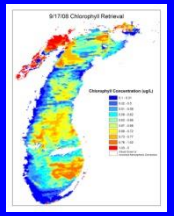
Scatterometer Ice (prototype)



Scatterometer Winds (prototype)



SAR Ice (prototype)



Chl, CDOM, Mineral (prototype)

CoastWatch Great Lakes Home Page

NOAA Great Lakes CoastWatch - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://coastwatch.glerl.noaa.gov/

Google

What's New
About

AVHRR Imagery
GLSEA
Contour Maps
GOES Imagery
RADARSAT
MODIS Imagery
Ocean Color
Image Products
In Situ Data
GLCFS
Statistics

JAVA GIS
Image Archive
Software
Documentation
Validation

Welcome to the NOAA CoastWatch Great Lakes Node

CoastWatch

Great Lakes CoastWatch Node
NOAA/Great Lakes Environmental Research Laboratory
4840 S. State Rd.
Ann Arbor, MI 48108-9719
Fax: 734-741-2055
http://coastwatch.glerl.noaa.gov

George A. Leshkevich, Manager

Songzhi Liu, Operations Assistant

Done

CoastWatch Great Lakes Products

CoastWatch Great Lakes Image Products Received

AVHRR

- Sea Surface Temperature SST
- Visible Channel 1
- Infrared Channel 2
- Channel 3
- Channel 4
- Channel 5
- Solar Zenith Angle ZA
- Satellite Zenith Angle ZS
- Cloud Masks CM

GOES

- Visible channel (Ch.1)
- Infrared channel (Ch.2)
- Water vapor
- SST Imagery

MODIS

- MODIS True Color 250 m Resolution

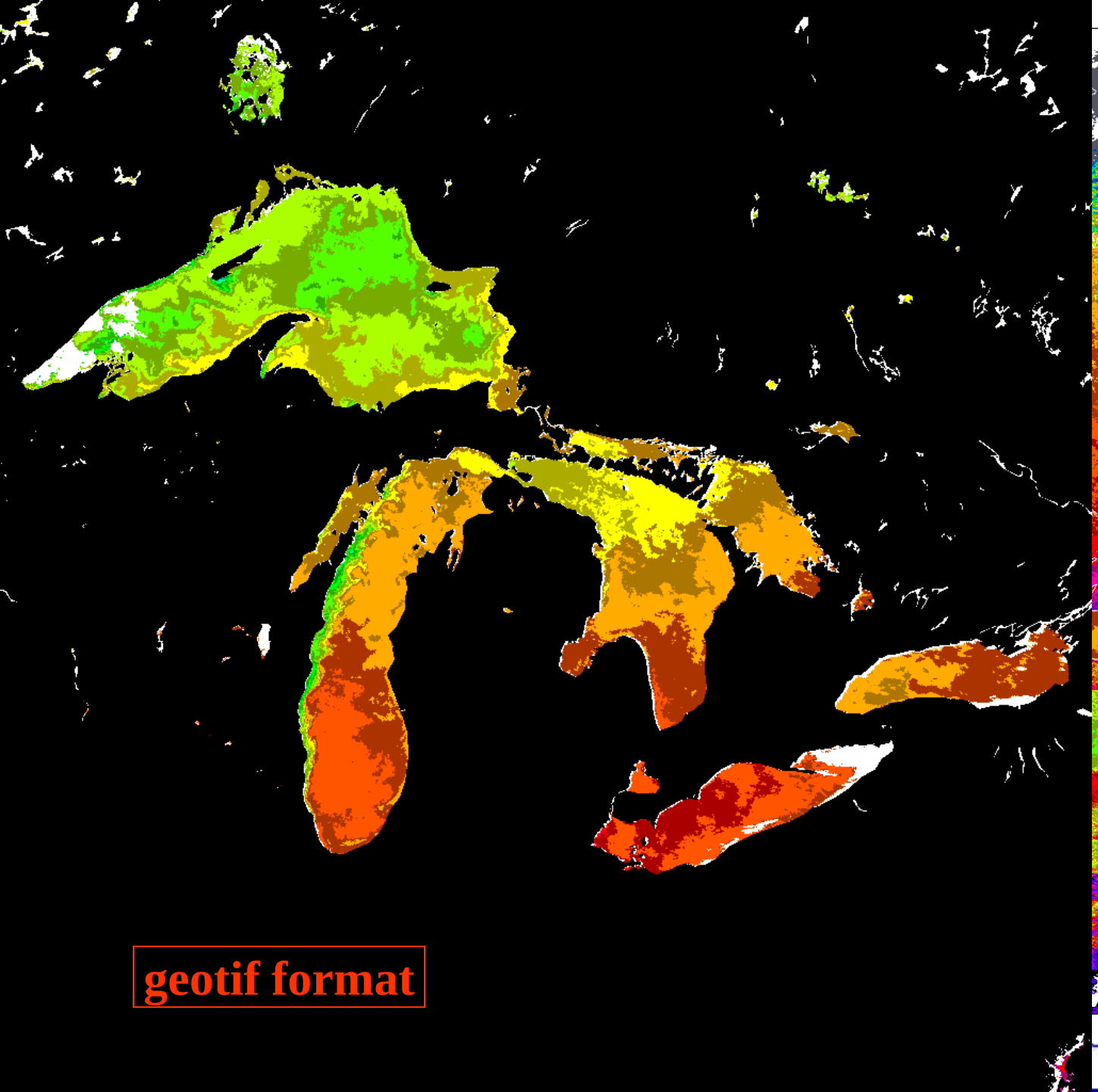
NPP VIIRS

- Sea Surface Temperature (SST)
  1.3 km and 750 m

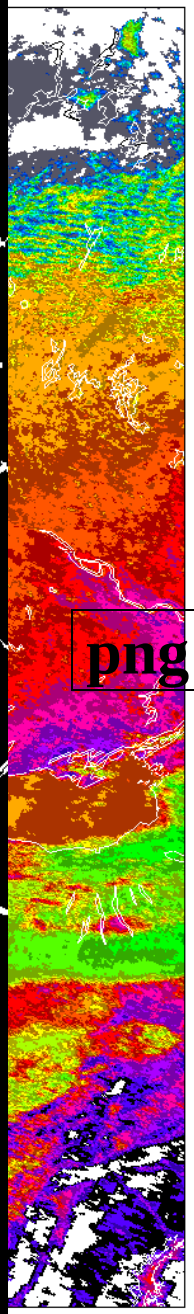
CoastWatch Great Lakes Products

CoastWatch Great Lakes Regional Products

- GLSEA (with Ice Cover during winter months), .dat, .png, .asc, .kmz
  - Night Time Only GLSEA, .asc (1996 – present)
  - 1024x1024 (1995 – pressent – netCDF)
- AVHRR Ch1 – Ch2 Subtraction (Blooms and Plumes)
- AVHRR Ch1 Histogram Equalized (Ice Cover)
- NOAAPORT (hourly Buoy, CMAN, USCG Stations, Ship, Other Marine)
  - GLCFS Nowcast/Forecast Analyzed Wind Field
  - Long Term Average SST Compared to Current Year
- Great Lakes Average Surface Water Temperature (Data and Graph)
- Great Lakes Hydro-optical Model
- RADARSAT (Government only)
- MODIS True Color 250 m Resolution
- Java GIS
  - AVHRR SST, CH1
  - GLSEA (1024x1024)
  - ICE (NIC)
  - BATHYMETRY
  - MODIS



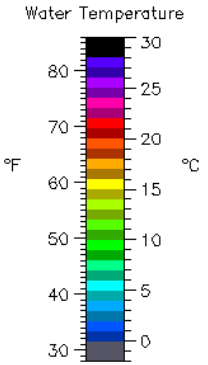
geotif format



CoastWatch
Water Surface Temperature
2013_275_1556_M02_GR_D1.PNG
10/02/2013 15:56 GMT

Satellite: METOP-2
Sensor: AVHRR
Projection type: Mercator
Map projection: 1.8 km/pixel
Latitude : 38 N -> 52 N
Longitude: 93 W -> 75 W

png format



GREAT LAKES SURFACE ENVIRONMENTAL ANALYSIS (GLSEA)

Analysis Date: JD 104 04/14/2014

Percent Pixels with Data within +/-10 Days: 88.1%

Date of last ice analysis: 4/14/2014

NOAA CoastWatch

Google Earth

Search

Search

ex: 15213

Get Directions History

Places

The Titanic
Located in the North Atlantic Ocean

The Forbidden City
Located in China

Mount Fuji
Located near Tokyo, Japan

Google Headquarters
Located in Mountain View, California

Temporary Places

2014_104_glsea.kmz

Great Lakes Surface En

2014-04-14

Layers

Earth Gallery

Primary Database
Borders and Labels
Places
Photos
Roads
3D Buildings
Ocean
Weather
Gallery
Global Awareness
More

Sign in

Lake Nipigon

Woods

Water Temperature
40 50 60 70 80 °F
0 5 10 15 20 25 30 °C

Lake Superior

Green Bay

Georgian Bay

Lake Huron

Ottawa

Michigan

Wisconsin

Lake Michigan

Toronto

Lake Ontario

Chicago

Lake Erie

Pennsylvania

Image NOAA
© 2014 Google
Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Illinois

Ohio

Indiana

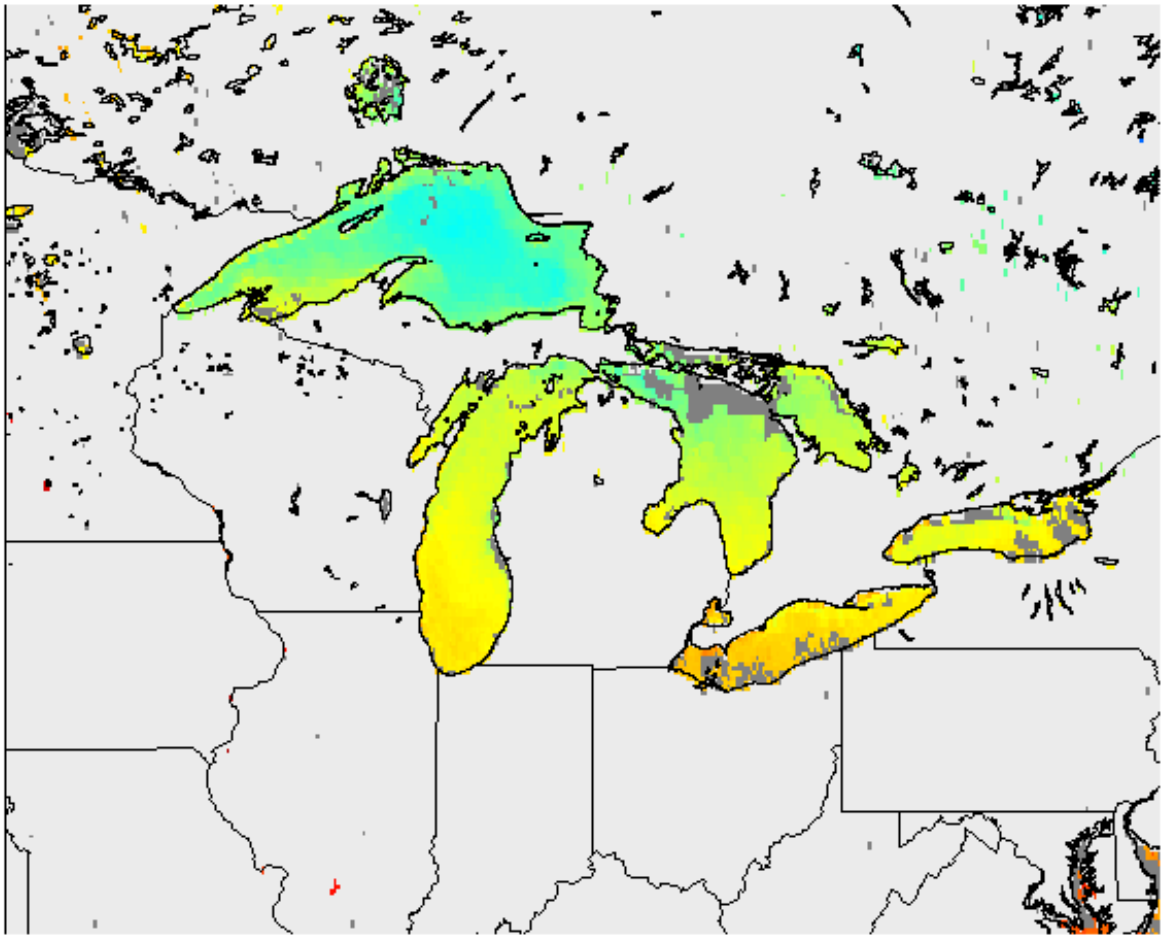
Philadelphia

Google earth

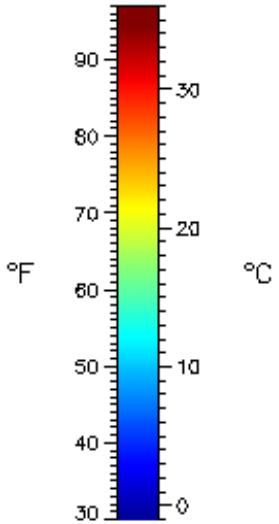
Tour Guide

Imagery Date: 4/9/2013 45°10'48.01" N 84°12'00.00" W elev 1084 ft eye alt 773.81 mi

Great Lakes GOES – 13 Satellite Imagery



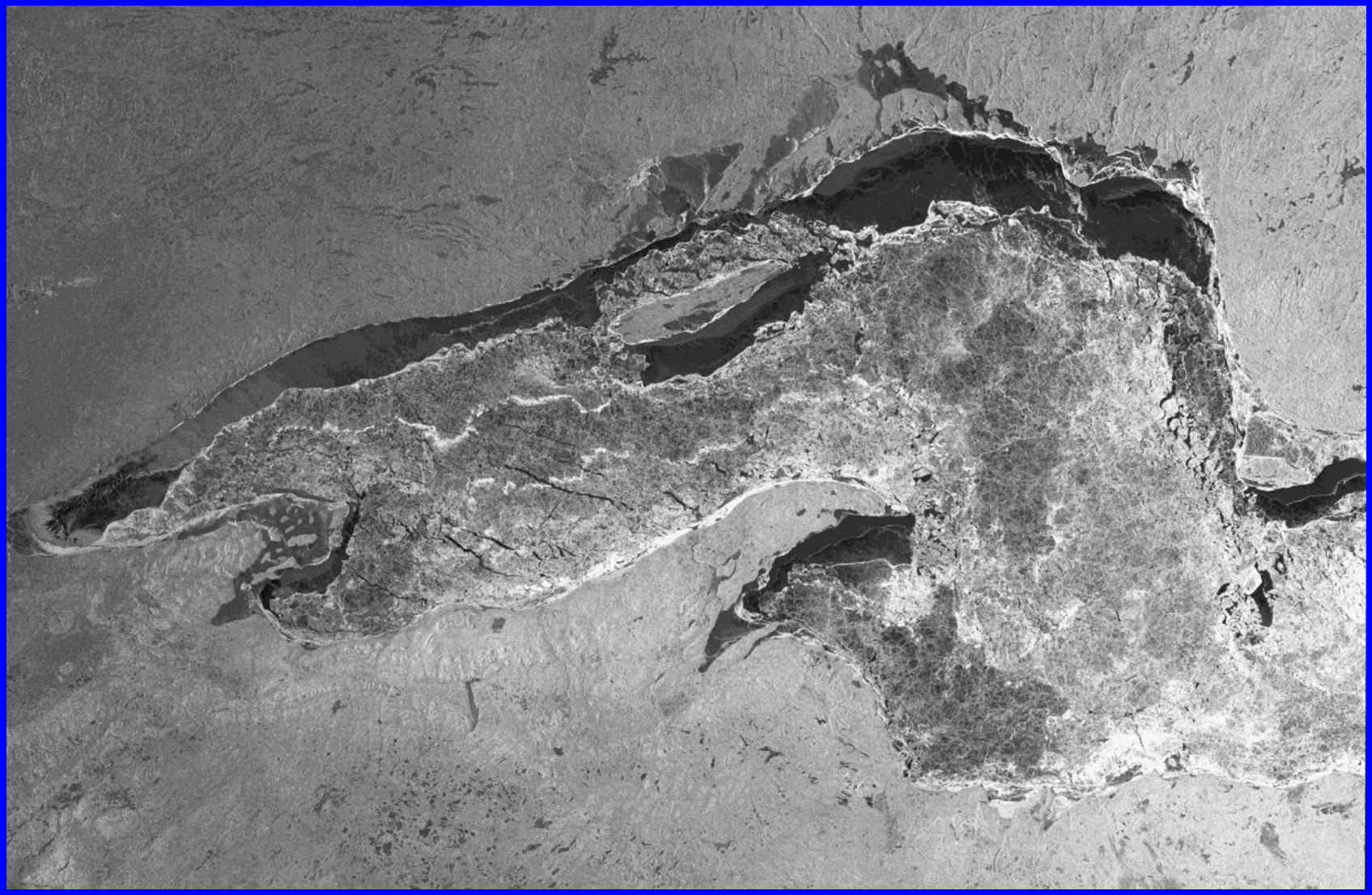
NOAA CoastWatch
GOES – 13 Res: 6 km
Sea Surface Temperature
3–hour composite
DN: 248 (9/5/2013)
Time: 21:00 – 00:00GMT



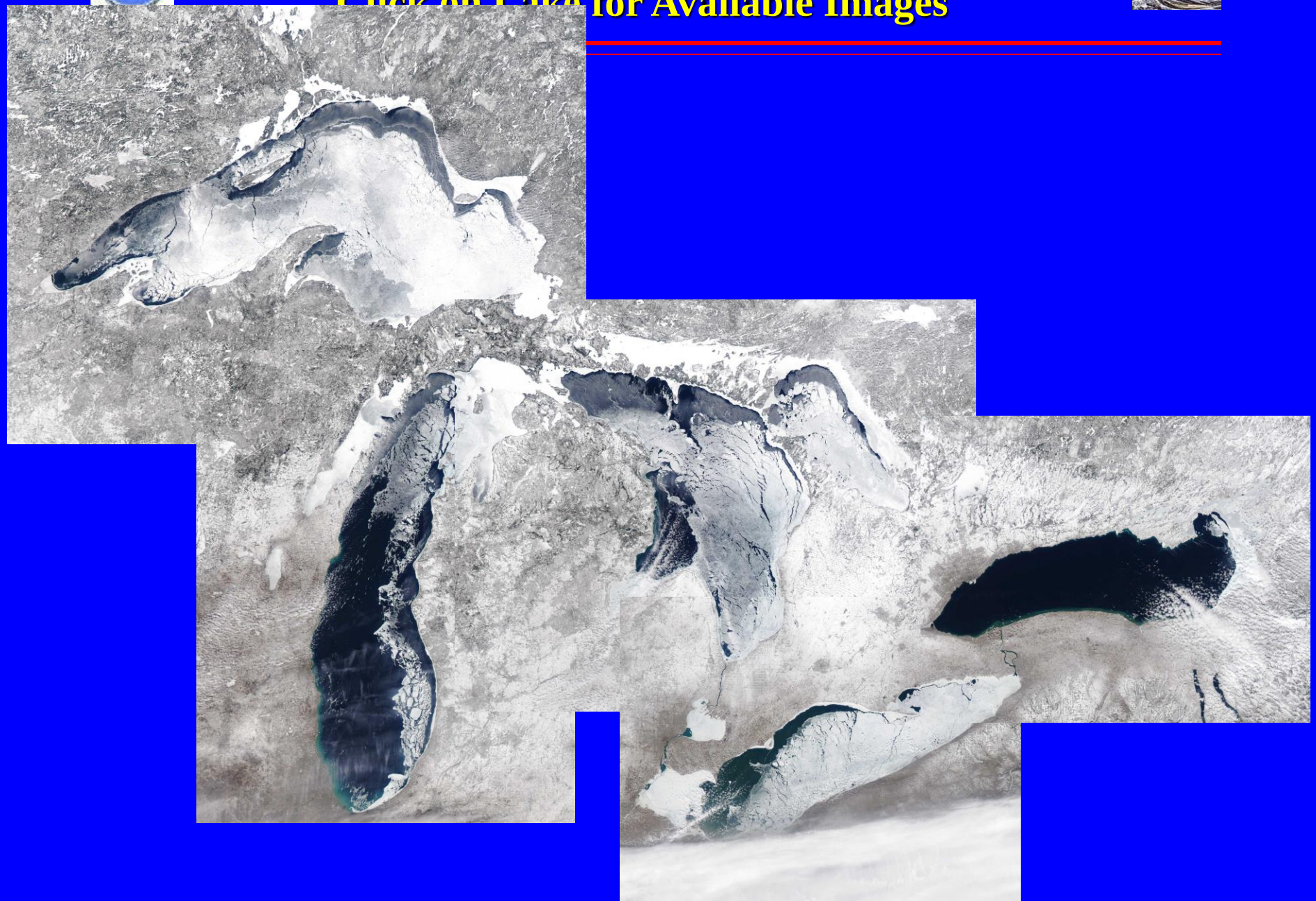
Information

WATER VAPOR	3	km	4	29	2014	2145Z NOAA
IR	3	km	4	29	2014	2115Z NOAA
VISIBLE	3	km	4	29	2014	2115Z NOAA

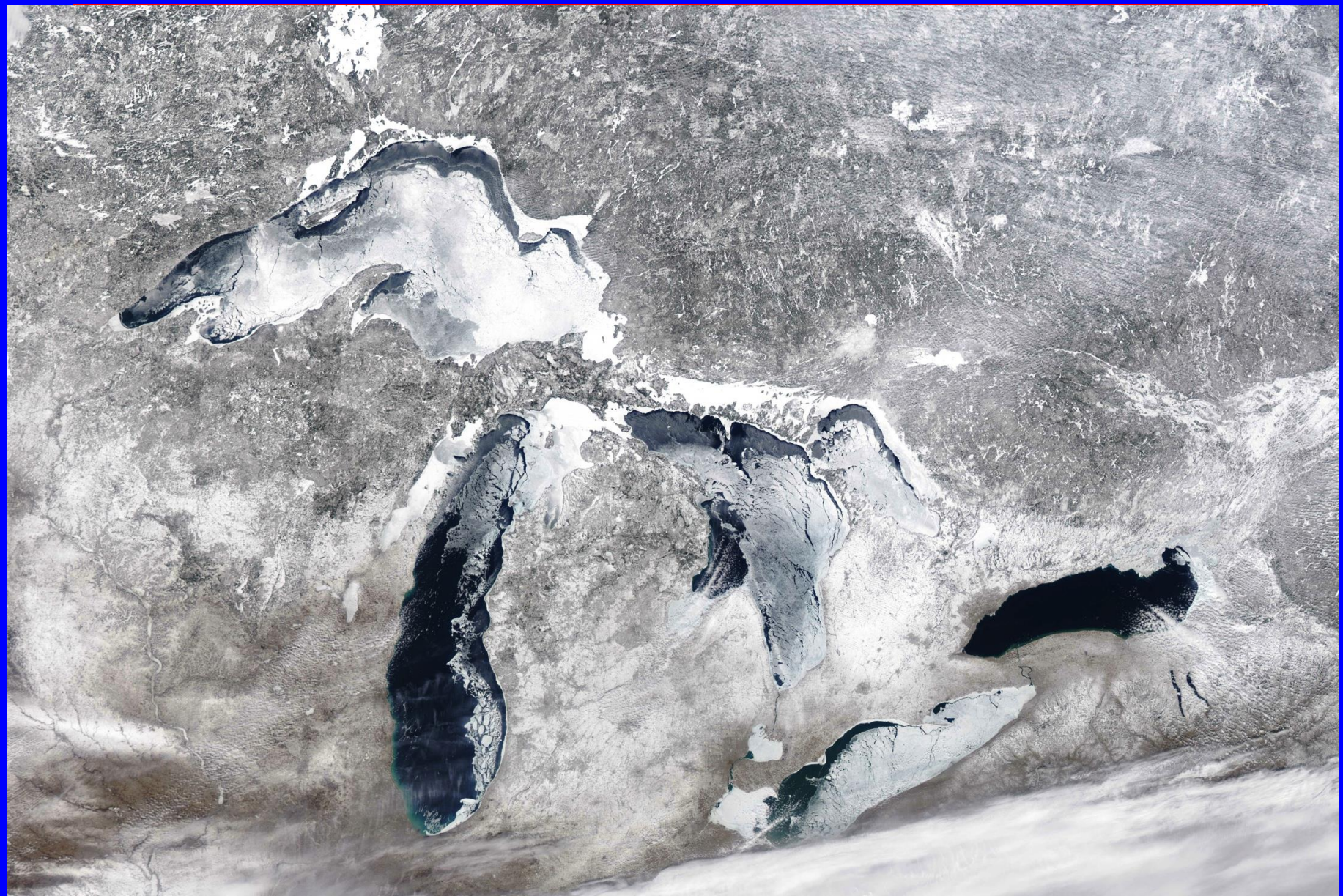
RADARSAT-2 Data Copyright CSA
All rights reserved March 23, 2014



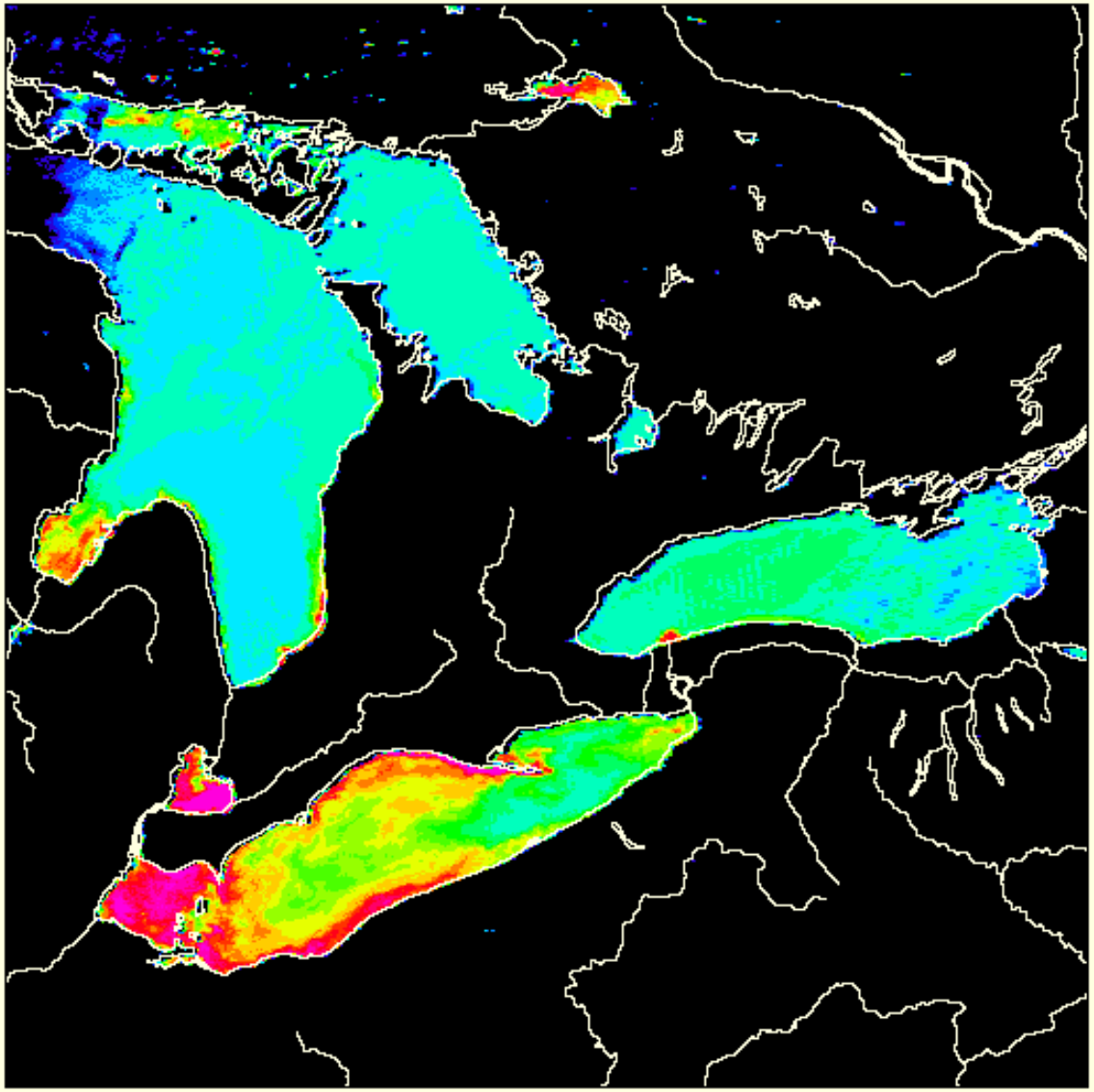
MODIS (Aqua and Terra) Near Real-time Imagery
Click on Lake for Available Images



Synoptic Scene MODIS Imagery – True Color, 250 m Resolution
March 16, 2014



AVHRR Ch1 - Ch2 Subtraction (Blooms and Plumes)



CoastWatch

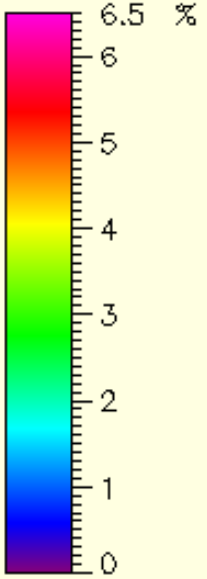
Channel 1 minus Channel 2

e2013_112_1905.png

NOAA-19

04/22/2013 19:05 GMT

Reflectance

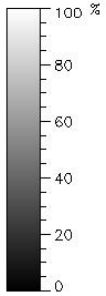


AVHRR Ch1 Histogram Equalized (Ice Cover)

CoastWatch
Channel 1 Visible
2014_065_1838_N19_GR_C1.PNG
03/06/2014 18:38 GMT

Satellite: NOAA-19
Sensor: AVHRR
Projection type: Mercator
Map projection: 1.8 km/pixel
Latitude : 38 N -> 52 N
Longitude: 93 W -> 75 W

Reflectance



NOAAPORT Realtime Great Lakes Weather Data and Marine Observations/Data Page

NOAAPORT Realtime Great Lake...

coastwatch.glerl.noaa.gov/marobs/php/data.php?sta=PNGW3&day=120&param=5&units=e

Most Visited | Getting Started | Holiday Lunch - ... | Bookmarks

Metadata | Description of Measurements (NDBC)

All 9s in field = missing data

Change Units to English | Metric

-------GMT-		AIR TMP	DEW PT	WND DIR	WND SPD	WND GST	CLD CVR	SOLAR RAD	BAR PRES	WAT TMP	WAV HGT	WAV PER
YYYYDDDHHMM#ID		F	F	Deg	kts	kts	%	W/m2	inHg	F	ft	s
201412000001PNGW3	09	33.4	999.9	60	15.9	21.0	999	9999.9	29.85	99.9	99.9	99.9
201412000101PNGW3	09	33.4	999.9	50	15.9	19.0	999	9999.9	29.84	99.9	99.9	99.9
201412000201PNGW3	09	34.2	999.9	40	18.1	21.0	999	9999.9	29.84	99.9	99.9	99.9
201412000301PNGW3	09	34.2	999.9	30	16.9	21.0	999	9999.9	29.84	99.9	99.9	99.9
201412000401PNGW3	09	34.3	999.9	40	18.1	20.0	999	9999.9	29.84	99.9	99.9	99.9
201412000501PNGW3	09	34.2	999.9	40	18.1	22.9	999	9999.9	29.84	99.9	99.9	99.9
201412001001PNGW3	09	34.2	999.9	40	18.1	22.9	999	9999.9	29.84	99.9	99.9	99.9
201412001101PNGW3	09	34.2	999.9	40	16.9	20.0	999	9999.9	29.84	99.9	99.9	99.9
201412001201PNGW3	09	34.0	999.9	40	15.9	21.0	999	9999.9	29.84	99.9	99.9	99.9
201412001301PNGW3	09	34.0	999.9	40	15.9	20.0	999	9999.9	29.84	99.9	99.9	99.9
201412001401PNGW3	09	34.0	999.9	40	13.0	20.0	999	9999.9	29.83	99.9	99.9	99.9
201412001501PNGW3	09	34.0	999.9	50	14.0	18.1	999	9999.9	29.83	99.9	99.9	99.9
201412002001PNGW3	09	34.0	999.9	50	15.9	19.0	999	9999.9	29.83	99.9	99.9	99.9
201412002101PNGW3	09	34.2	999.9	50	15.9	19.0	999	9999.9	29.83	99.9	99.9	99.9
201412002201PNGW3	09	34.2	999.9	40	14.0	19.0	999	9999.9	29.83	99.9	99.9	99.9
201412002301PNGW3	09	34.3	999.9	50	18.1	22.0	999	9999.9	29.82	99.9	99.9	99.9
201412002401PNGW3	09	34.3	999.9	40	15.9	20.0	999	9999.9	29.82	99.9	99.9	99.9
201412002501PNGW3	09	34.3	999.9	40	14.0	20.0	999	9999.9	29.82	99.9	99.9	99.9
201412003001PNGW3	09	34.3	999.9	40	14.0	16.9	999	9999.9	29.81	99.9	99.9	99.9
201412003101PNGW3	09	34.3	999.9	50	13.0	16.9	999	9999.9	29.81	99.9	99.9	99.9
201412003201PNGW3	09	34.7	999.9	50	14.0	20.0	999	9999.9	29.81	99.9	99.9	99.9
201412003301PNGW3	09	34.5	999.9	50	12.1	18.1	999	9999.9	29.81	99.9	99.9	99.9
201412003401PNGW3	09	34.7	999.9	50	13.0	15.9	999	9999.9	29.81	99.9	99.9	99.9
201412003501PNGW3	09	34.7	999.9	50	12.1	18.1	999	9999.9	29.80	99.9	99.9	99.9
201412004001PNGW3	09	34.7	999.9	50	12.1	20.0	999	9999.9	29.80	99.9	99.9	99.9
201412004101PNGW3	09	34.9	999.9	50	14.0	16.9	999	9999.9	29.80	99.9	99.9	99.9
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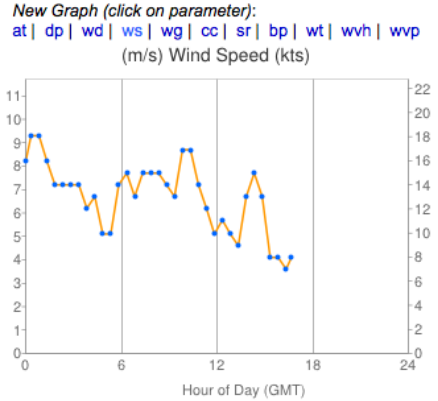
201412004301PNGW3	09	34.7	999.9	50	9.9	15.0	999	9999.9	29.79	99.9	99.9	99.9
201412004401PNGW3	09	34.5	999.9	50	9.9	15.0	999	9999.9	29.79	99.9	99.9	99.9
201412004501PNGW3	09	34.2	999.9	50	9.9	12.1	999	9999.9	29.79	99.9	99.9	99.9
201412005001PNGW3	09	34.2	999.9	50	9.9	13.0	999	9999.9	29.79	99.9	99.9	99.9
201412005101PNGW3	09	34.2	999.9	50	11.1	13.0	999	9999.9	29.78	99.9	99.9	99.9
201412005201PNGW3	09	34.2	999.9	50	9.9	13.0	999	9999.9	29.78	99.9	99.9	99.9
201412005301PNGW3	09	34.7	999.9	30	15.0	18.1	999	9999.9	29.78	99.9	99.9	99.9
201412005401PNGW3	09	34.7	999.9	20	13.0	18.1	999	9999.9	29.78	99.9	99.9	99.9
201412005501PNGW3	09	34.7	999.9	30	14.0	16.9	999	9999.9	29.78	99.9	99.9	99.9
201412006001PNGW3	09	34.9	999.9	30	14.0	18.1	999	9999.9	29.78	99.9	99.9	99.9
201412006101PNGW3	09	34.9	999.9	30	15.9	18.1	999	9999.9	29.77	99.9	99.9	99.9
201412006201PNGW3	09	34.9	999.9	30	15.0	18.1	999	9999.9	29.77	99.9	99.9	99.9
201412006301PNGW3	09	34.9	999.9	30	15.0	18.1	999	9999.9	29.77	99.9	99.9	99.9
201412006401PNGW3	09	34.9	999.9	30	15.0	18.1	999	9999.9	29.77	99.9	99.9	99.9
201412006501PNGW3	09	34.7	999.9	40	13.0	16.9	999	9999.9	29.77	99.9	99.9	99.9
201412007001PNGW3	09	34.7	999.9	40	14.0	15.9	999	9999.9	29.77	99.9	99.9	99.9
201412007101PNGW3	09	34.9	999.9	30	15.0	19.0	999	9999.9	29.77	99.9	99.9	99.9
201412007201PNGW3	09	34.9	999.9	30	15.0	19.0	999	9999.9	29.77	99.9	99.9	99.9
201412007301PNGW3	09	35.1	999.9	30	15.0	20.0	999	9999.9	29.77	99.9	99.9	99.9
201412007401PNGW3	09	35.1	999.9	30	15.9	19.0	999	9999.9	29.77	99.9	99.9	99.9
201412007501PNGW3	09	35.1	999.9	30	15.0	18.1	999	9999.9	29.77	99.9	99.9	99.9
201412008001PNGW3	09	35.1	999.9	30	15.0	18.1	999	9999.9	29.77	99.9	99.9	99.9
201412008101PNGW3	09	35.1	999.9	30	15.0	18.1	999	9999.9	29.76	99.9	99.9	99.9

New Graph (click on parameter):

at | dp | wd | ws | wg | cc | sr | bp | wt | wvh | wvp



[every 3rd data value plotted]

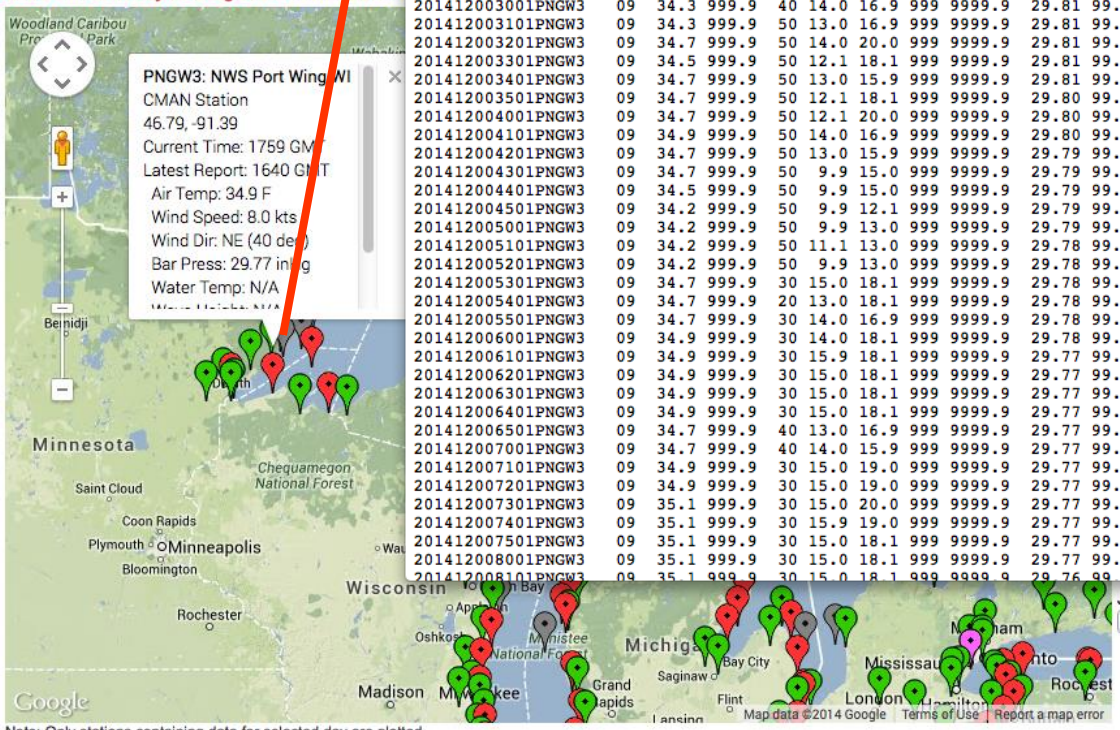
NOAAPORT -

Current Day and Time: Apr-30-2014 17:59 GMT

Station Labels = Off

Click on marker to view data for that station

Hold Down Shift Key for Drag Zoom or Return to Or



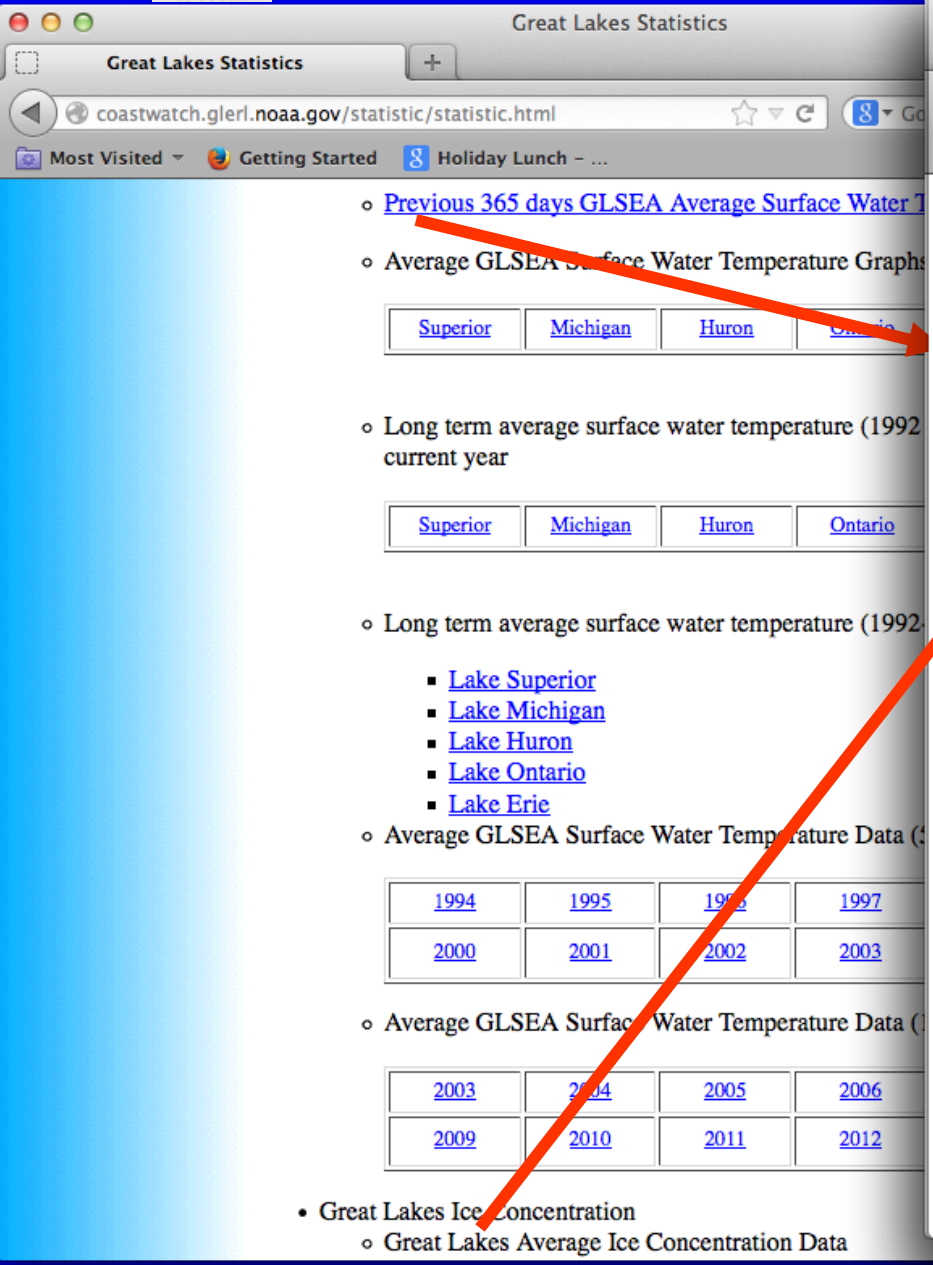
Jump To: Station (sorted by Name)

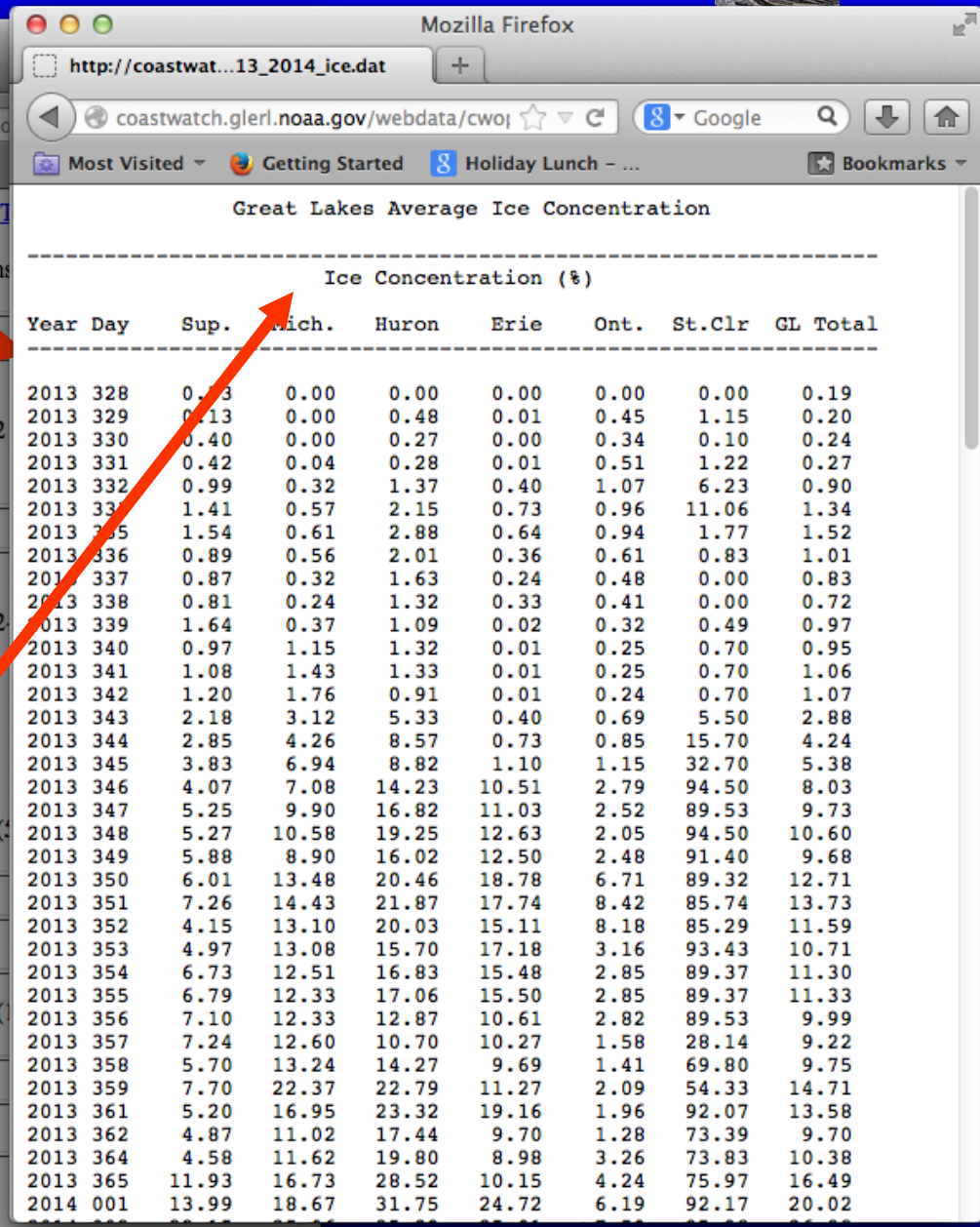
Note: Only stations containing data for selected day are plotted

See also All Stations not reporting today

Enter New DOY (001-366): 120 Submit Or Today (120)

Great Lakes Statistics





Great Lakes Average Ice Concentration

Ice Concentration (%)

Year	Day	Sup.	Mich.	Huron	Erie	Ont.	St.Clr	GL Total
2013	328	0.13	0.00	0.00	0.00	0.00	0.00	0.19
2013	329	0.13	0.00	0.48	0.01	0.45	1.15	0.20
2013	330	0.40	0.00	0.27	0.00	0.34	0.10	0.24
2013	331	0.42	0.04	0.28	0.01	0.51	1.22	0.27
2013	332	0.99	0.32	1.37	0.40	1.07	6.23	0.90
2013	333	1.41	0.57	2.15	0.73	0.96	11.06	1.34
2013	335	1.54	0.61	2.88	0.64	0.94	1.77	1.52
2013	336	0.89	0.56	2.01	0.36	0.61	0.83	1.01
2013	337	0.87	0.32	1.63	0.24	0.48	0.00	0.83
2013	338	0.81	0.24	1.32	0.33	0.41	0.00	0.72
2013	339	1.64	0.37	1.09	0.02	0.32	0.49	0.97
2013	340	0.97	1.15	1.32	0.01	0.25	0.70	0.95
2013	341	1.08	1.43	1.33	0.01	0.25	0.70	1.06
2013	342	1.20	1.76	0.91	0.01	0.24	0.70	1.07
2013	343	2.18	3.12	5.33	0.40	0.69	5.50	2.88
2013	344	2.85	4.26	8.57	0.73	0.85	15.70	4.24
2013	345	3.83	6.94	8.82	1.10	1.15	32.70	5.38
2013	346	4.07	7.08	14.23	10.51	2.79	94.50	8.03
2013	347	5.25	9.90	16.82	11.03	2.52	89.53	9.73
2013	348	5.27	10.58	19.25	12.63	2.05	94.50	10.60
2013	349	5.88	8.90	16.02	12.50	2.48	91.40	9.68
2013	350	6.01	13.48	20.46	18.78	6.71	89.32	12.71
2013	351	7.26	14.43	21.87	17.74	8.42	85.74	13.73
2013	352	4.15	13.10	20.03	15.11	8.18	85.29	11.59
2013	353	4.97	13.08	15.70	17.18	3.16	93.43	10.71
2013	354	6.73	12.51	16.83	15.48	2.85	89.37	11.30
2013	355	6.79	12.33	17.06	15.50	2.85	89.37	11.33
2013	356	7.10	12.33	12.87	10.61	2.82	89.53	9.99
2013	357	7.24	12.60	10.70	10.27	1.58	28.14	9.22
2013	358	5.70	13.24	14.27	9.69	1.41	69.80	9.75
2013	359	7.70	22.37	22.79	11.27	2.09	54.33	14.71
2013	361	5.20	16.95	23.32	19.16	1.96	92.07	13.58
2013	362	4.87	11.02	17.44	9.70	1.28	73.39	9.70
2013	364	4.58	11.62	19.80	8.98	3.26	73.83	10.38
2013	365	11.93	16.73	28.52	10.15	4.24	75.97	16.49
2014	001	13.99	18.67	31.75	24.72	6.19	92.17	20.02

GLSEA Average Surface Water Temperature Graph
6 Year Comparison

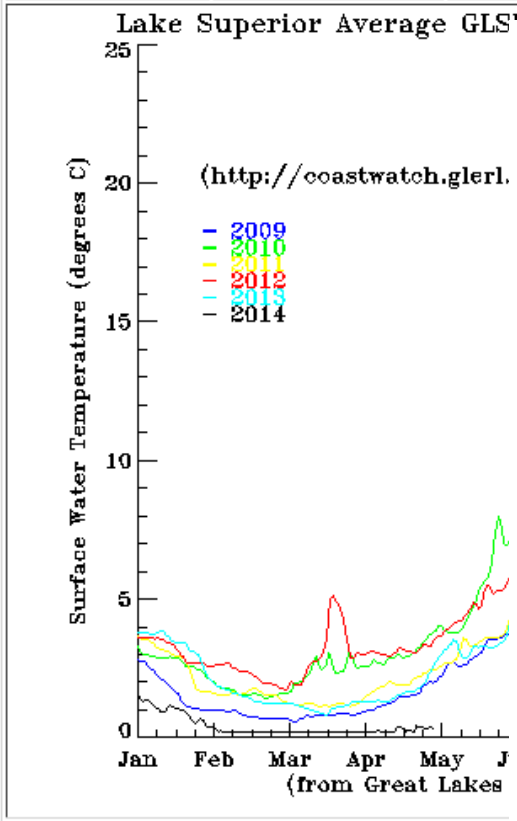
Great Lakes Average GLSEA Surface Water Temperature

Great Lakes Average GLSEA Sur...

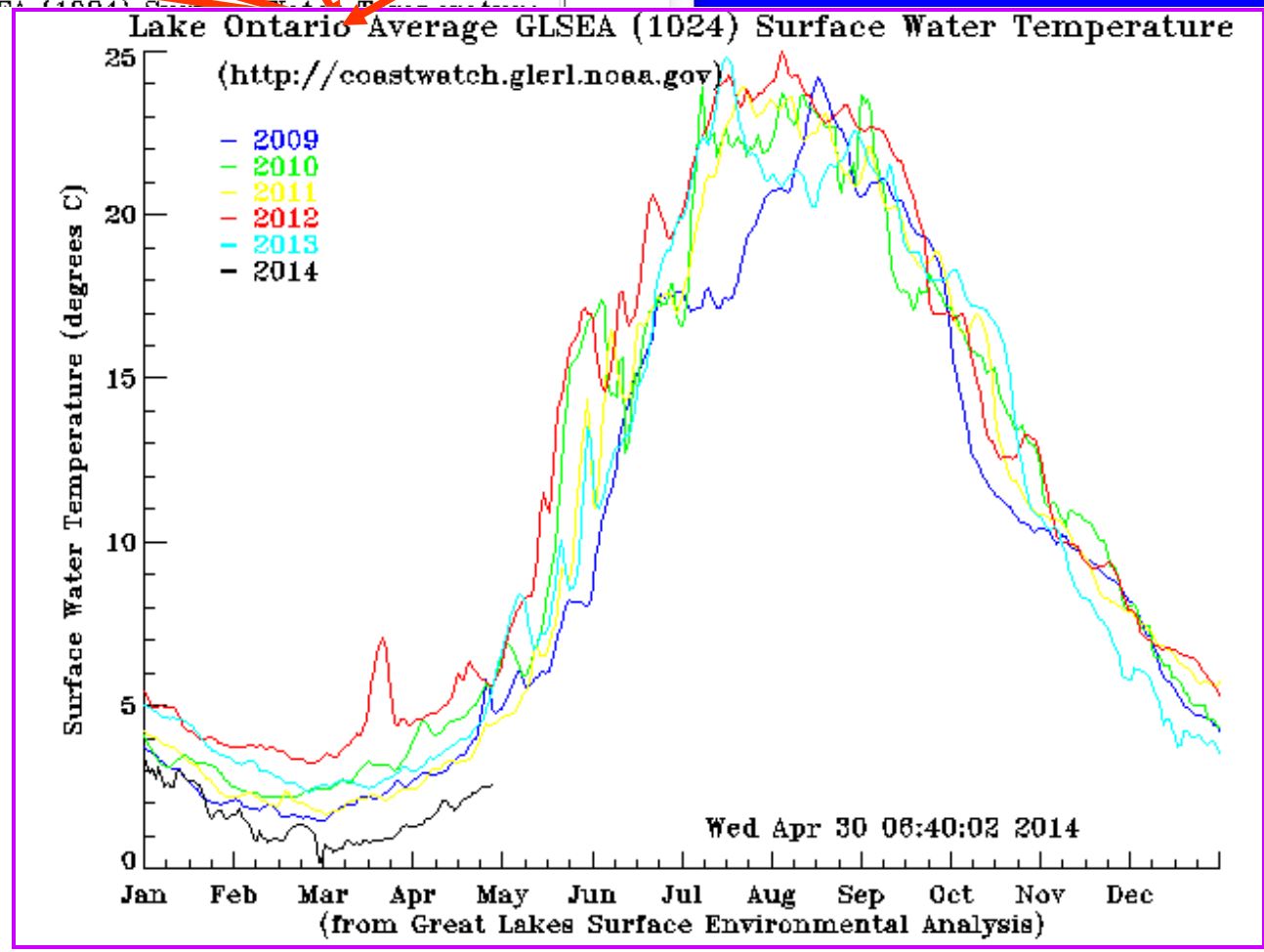
coastwatch.glerl.noaa.gov/webdata/cwops/html/statistic/avg-sst.ph

Most Visited | Getting Started | Holiday Lunch – ... | Bookmarks

Lake Sup.	Lake Mich.	Lake Huron	Lake Erie	Lake Ont.



1994	1995	
1999	2000	
2004	2005	
2009	2010	



GLSEA Long Term Average Surface Water Temperature Compared to Current Year

Lake Superior Average Great Lakes Surface Environmental Analysis (GLSEA)

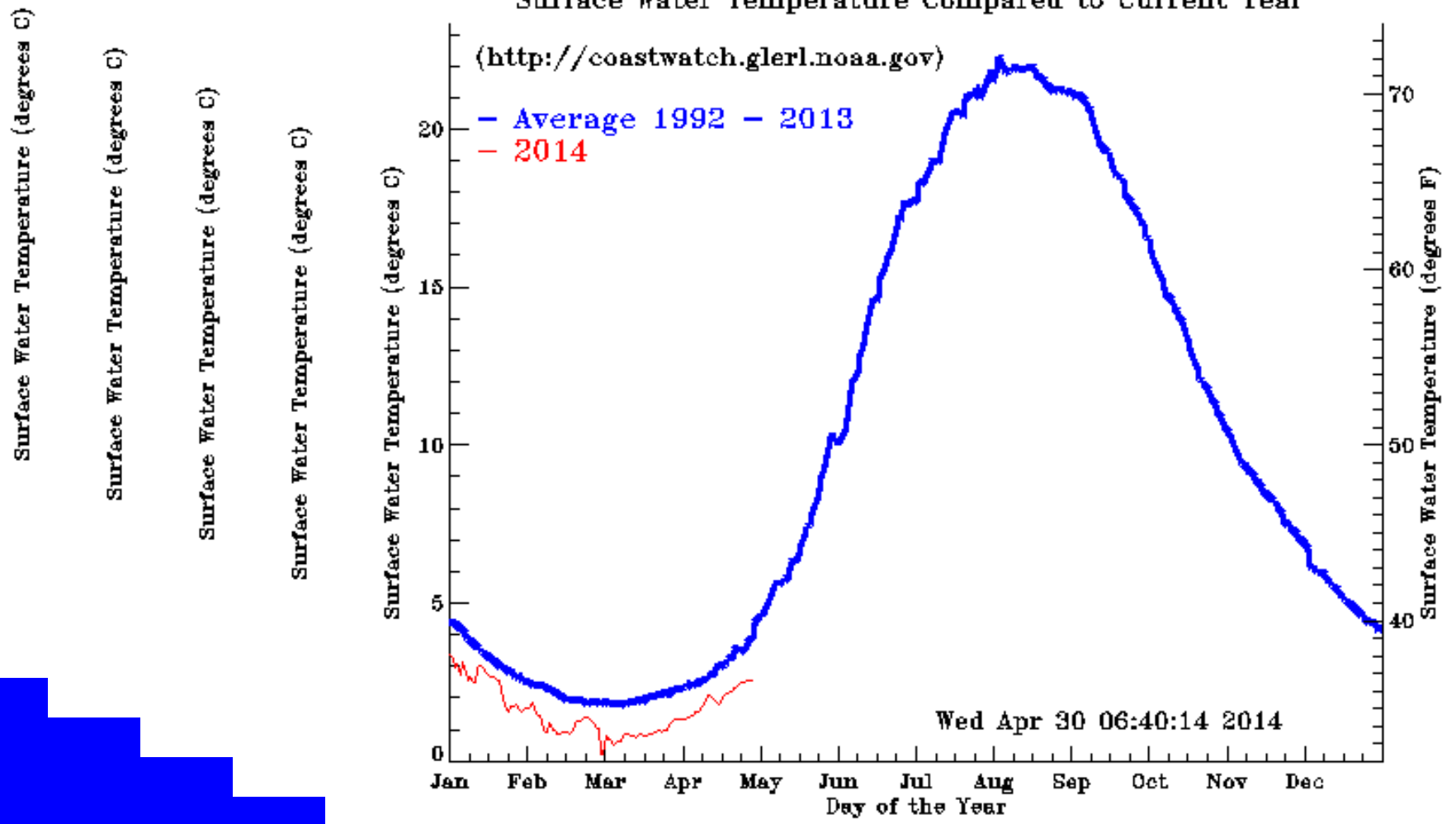
Lake Michigan Average Great Lakes Surface Environmental Analysis (GLSEA)

Lake Huron Average Great Lakes Surface Environmental Analysis (GLSEA)

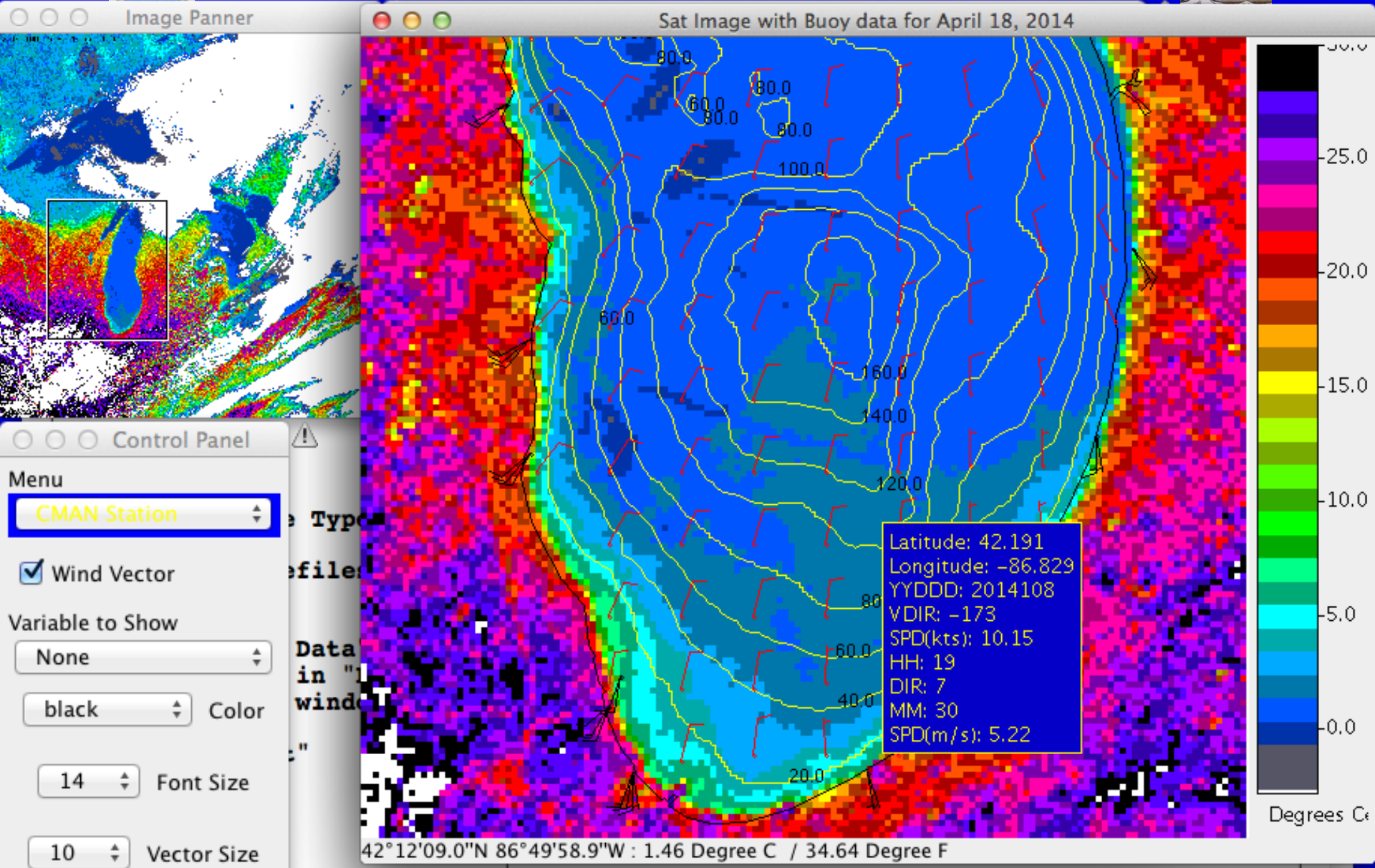
Lake Erie Average Great Lakes Surface Environmental Analysis (GLSEA)

Lake Ontario Average Great Lakes Surface Environmental Analysis (GLSEA)

Surface Water Temperature Compared to Current Year



Great Lakes CoastWatch Java GIS



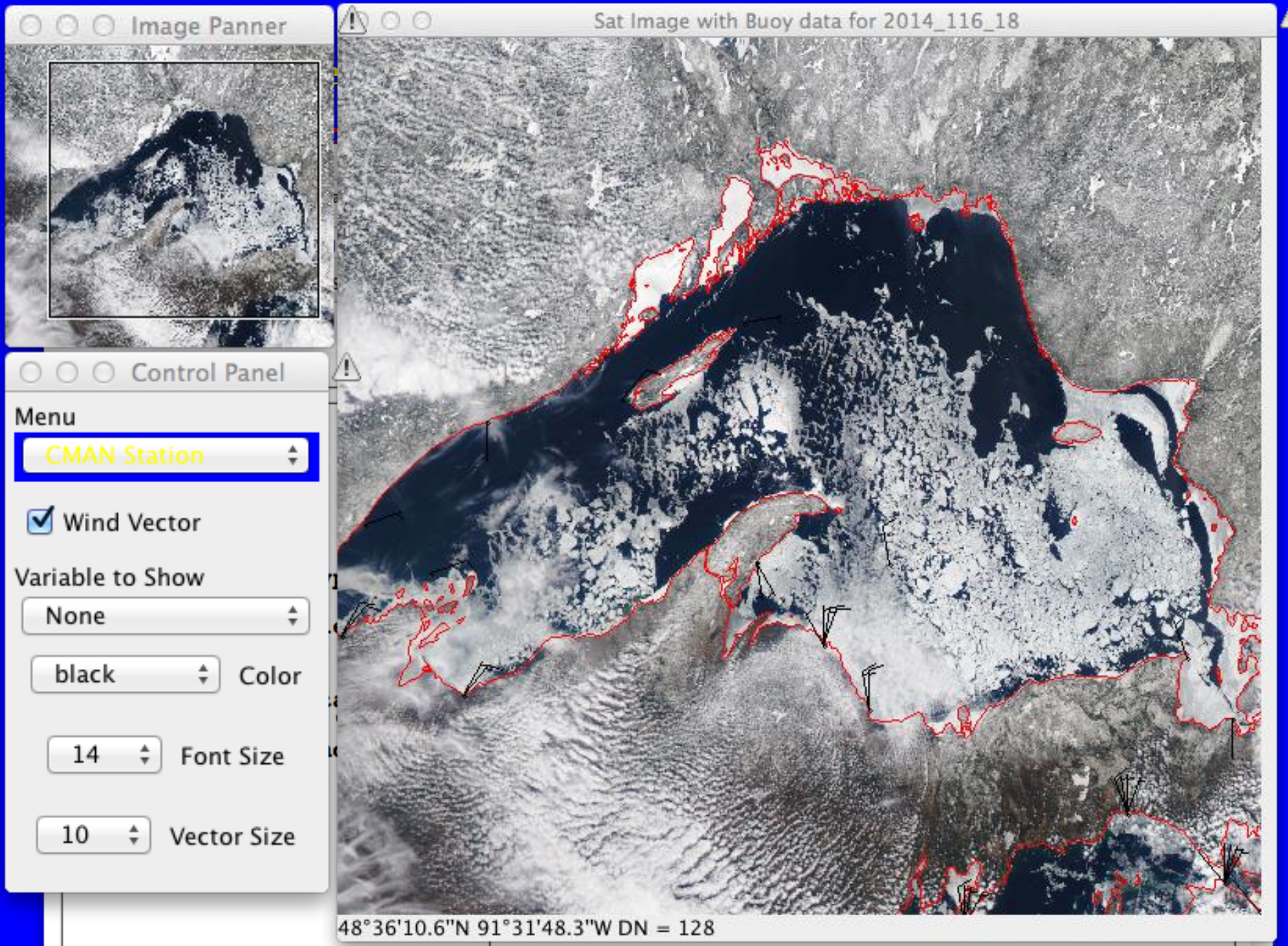


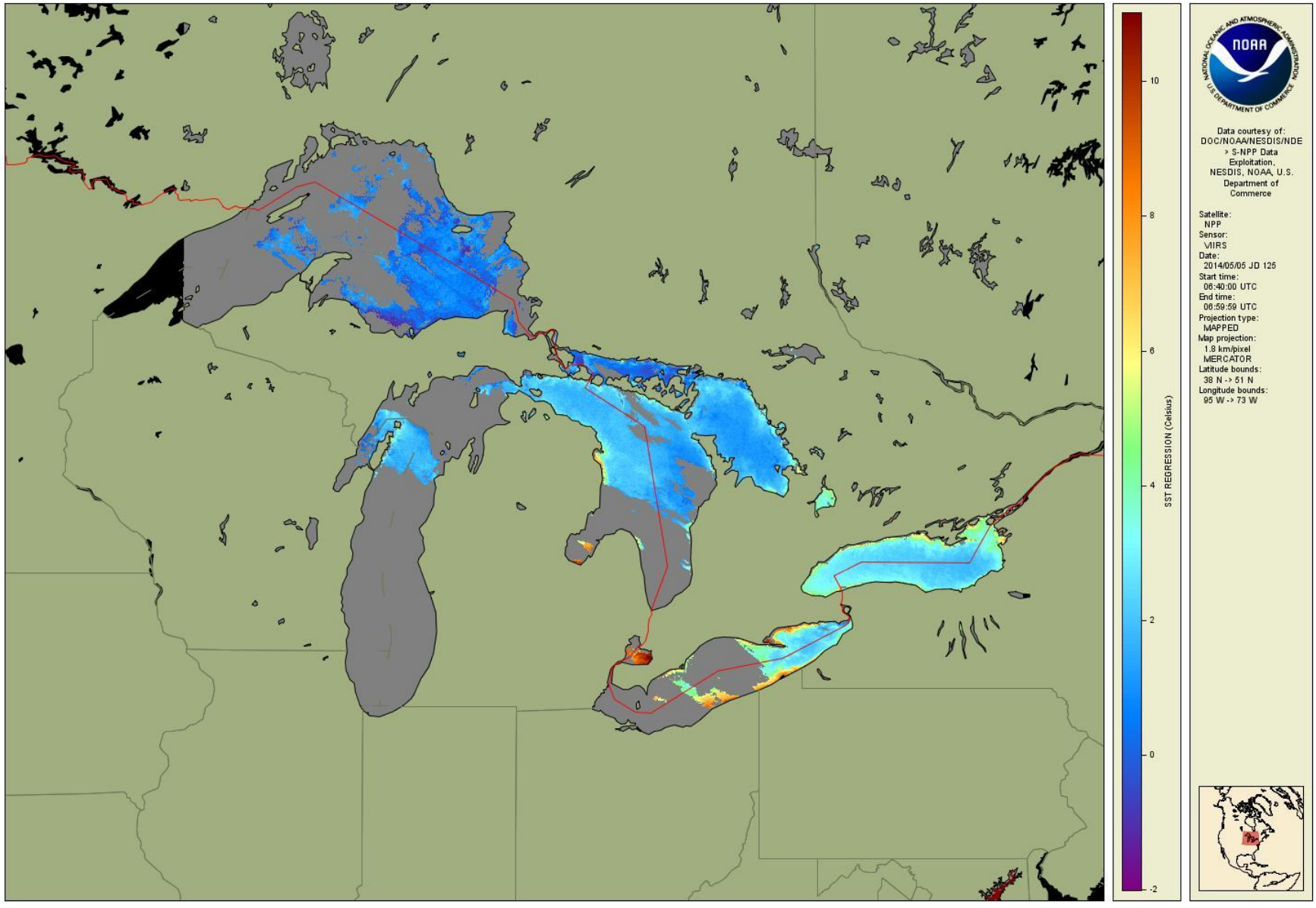
Image Panner
Sat Image with Buoy data for 2014_116_18
Control Panel
Menu
CMAN Station
Wind Vector
Variable to Show
None
black
Color
14
Font Size
10
Vector Size
48°36'10.6"N 91°31'48.3"W DN = 128

CoastWatch Great Lakes Products

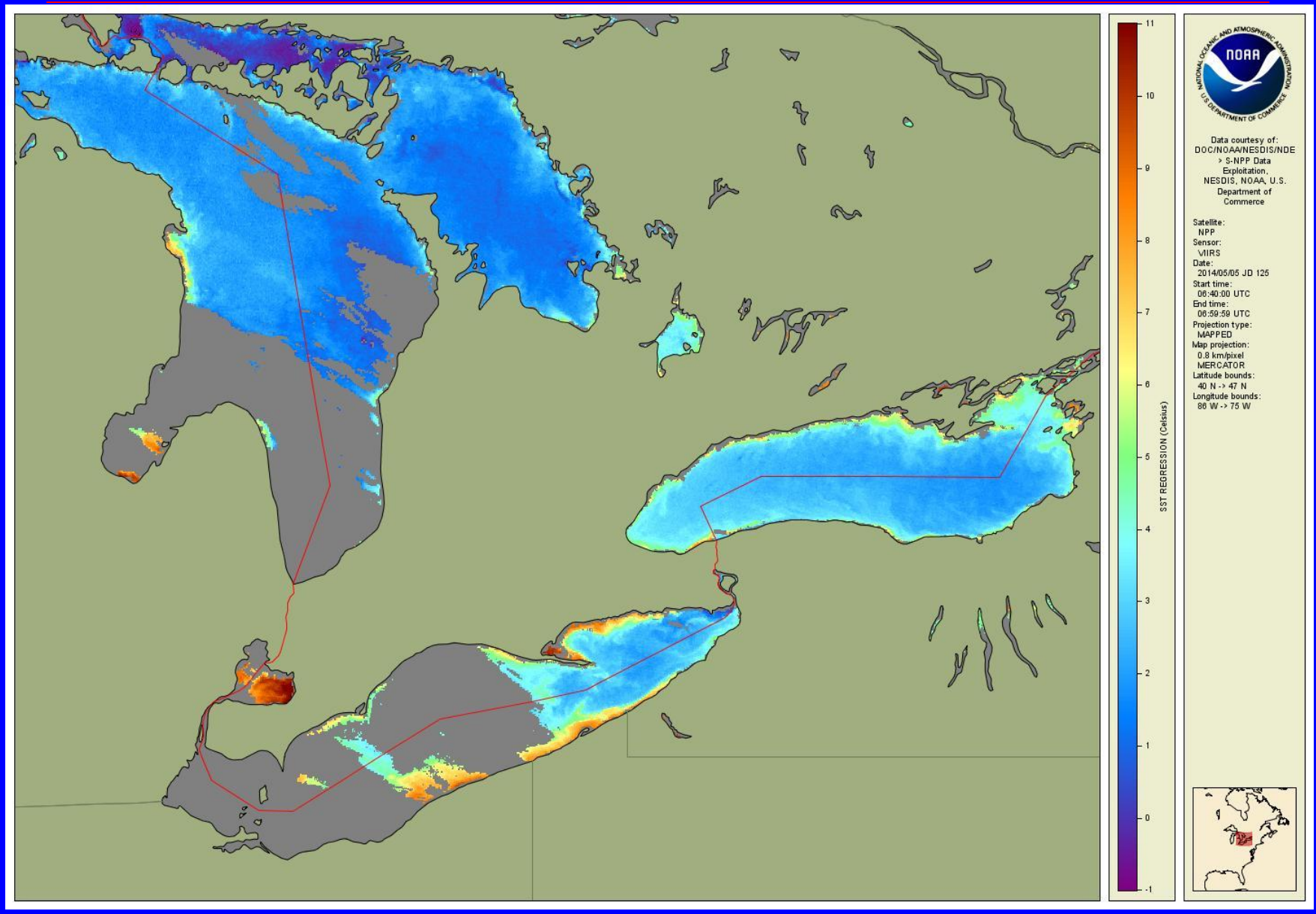
Future Products / Directions

- NPP VIIRS
- SAR Ice Type Classification
- SAR Wind Fields (Google)
- MODIS Chl, DOC, SM
- Primary Productivity
- Scatterometer Measured Winds/Ice
- Decision Support (GIS)
- Thredds /LAS or ERDAP Server

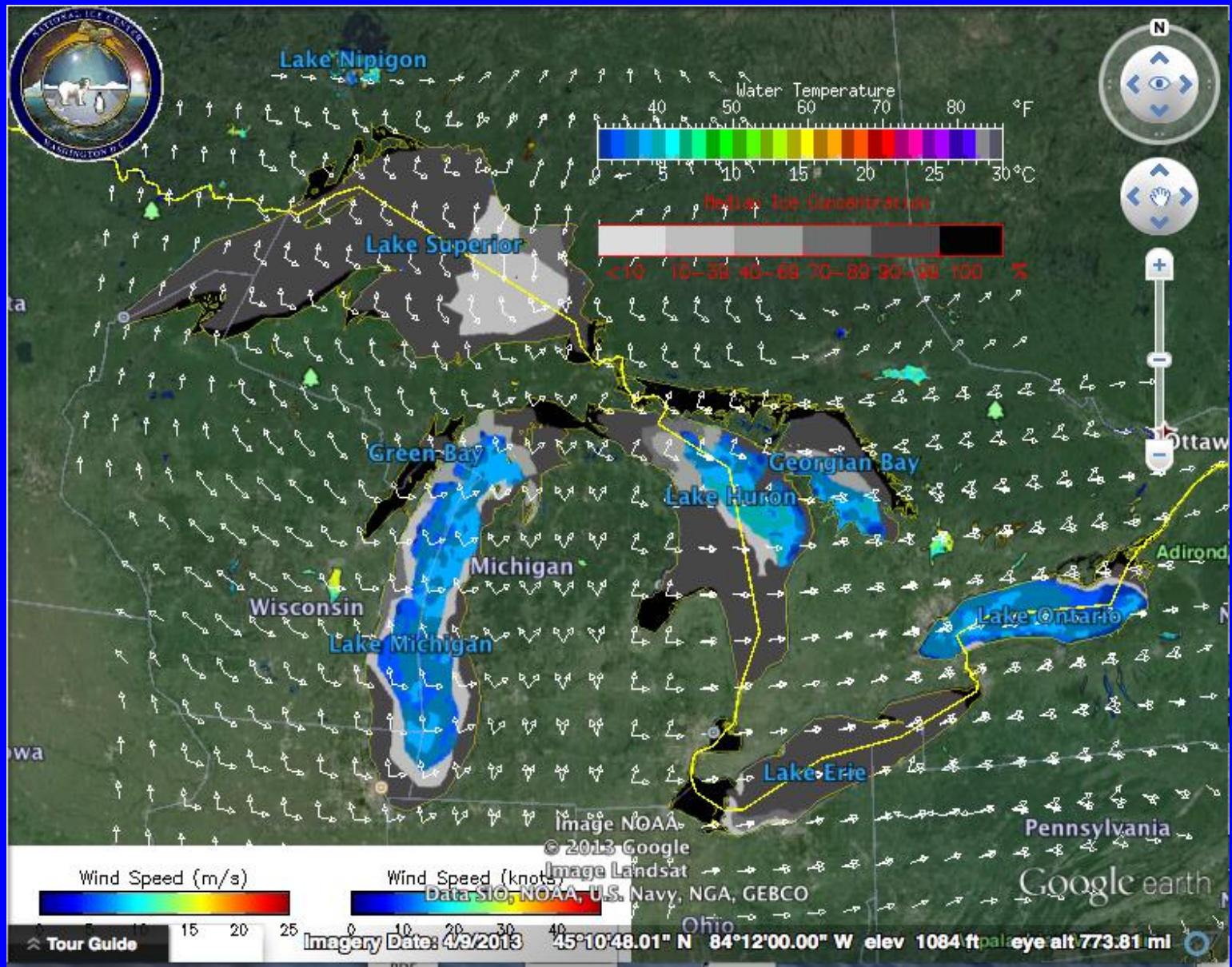
NPP VIIRS – 1.3 Km Resolution



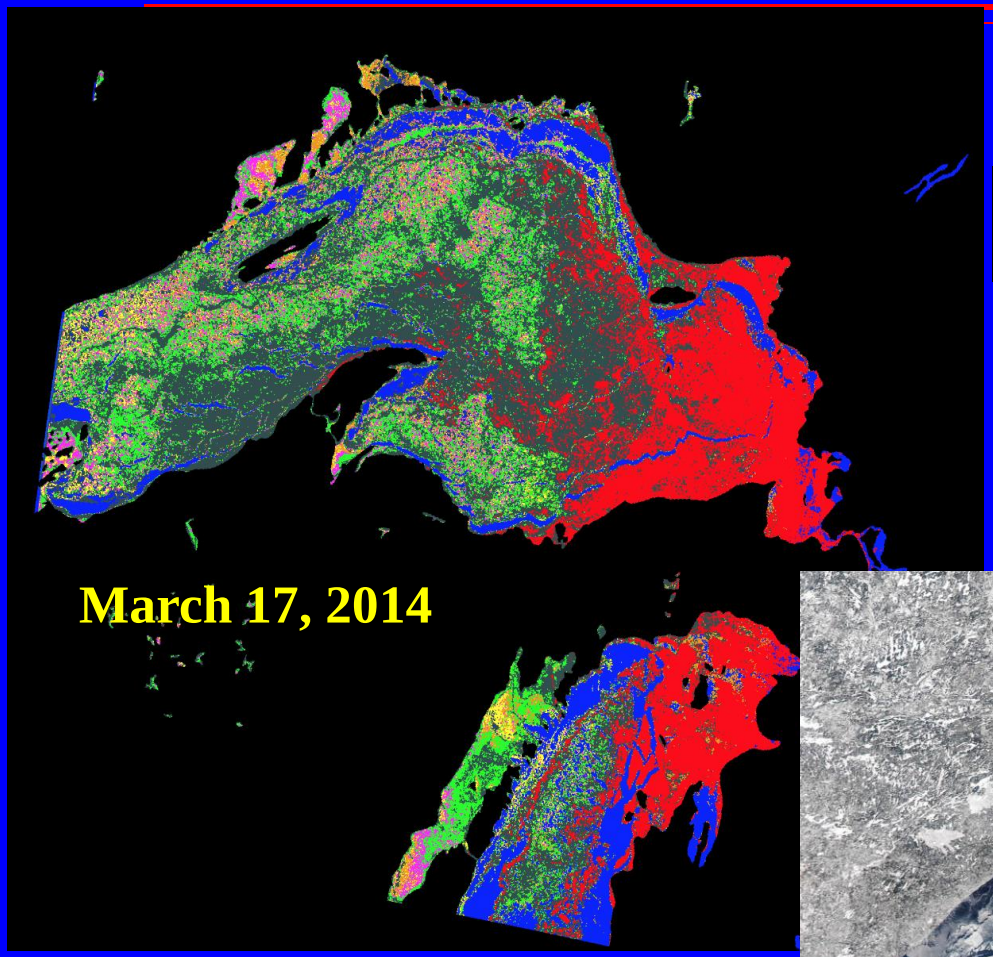
NPP VIIRS – 750 Meter Resolution



Google SAR Winds

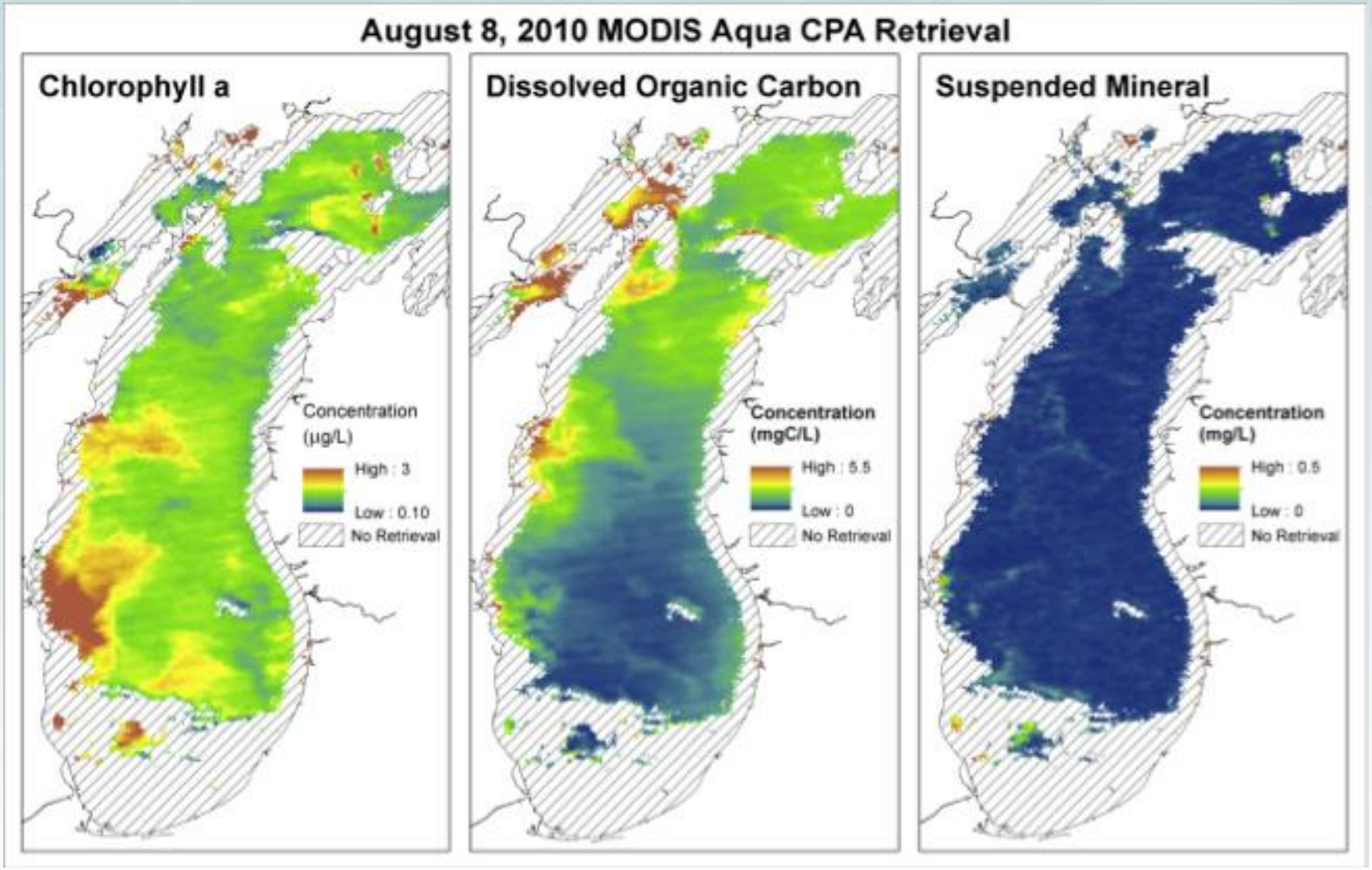


Lake Superior Ice Cover

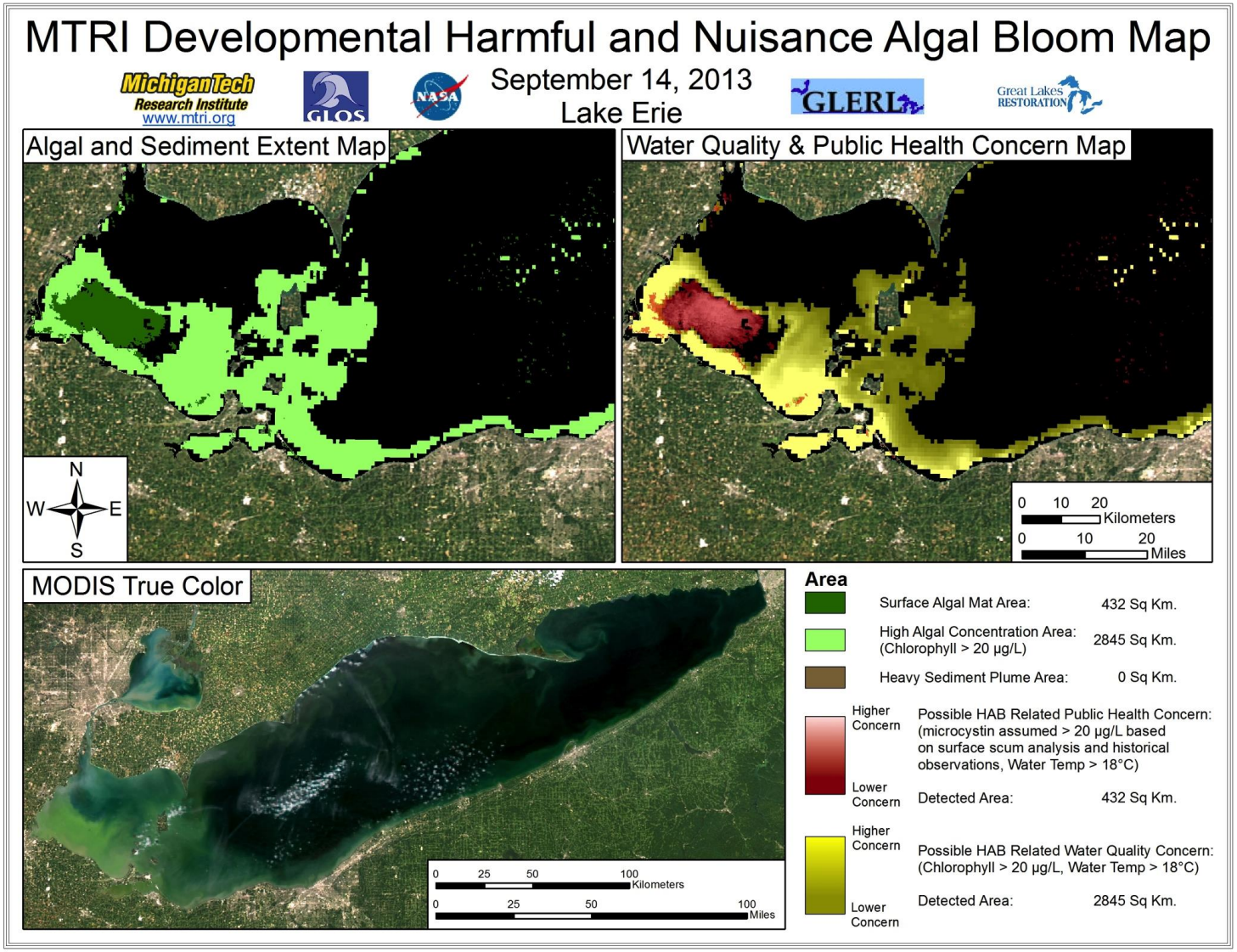


New lake ice
Lake ice with crusted snow
Consolidated ice floes
Brash ice
Stratified ice
Noise (<–20dB)
Pancake ice
Unclassified

Color Producing Agent Retrieval Algorithm
August 8, 2010

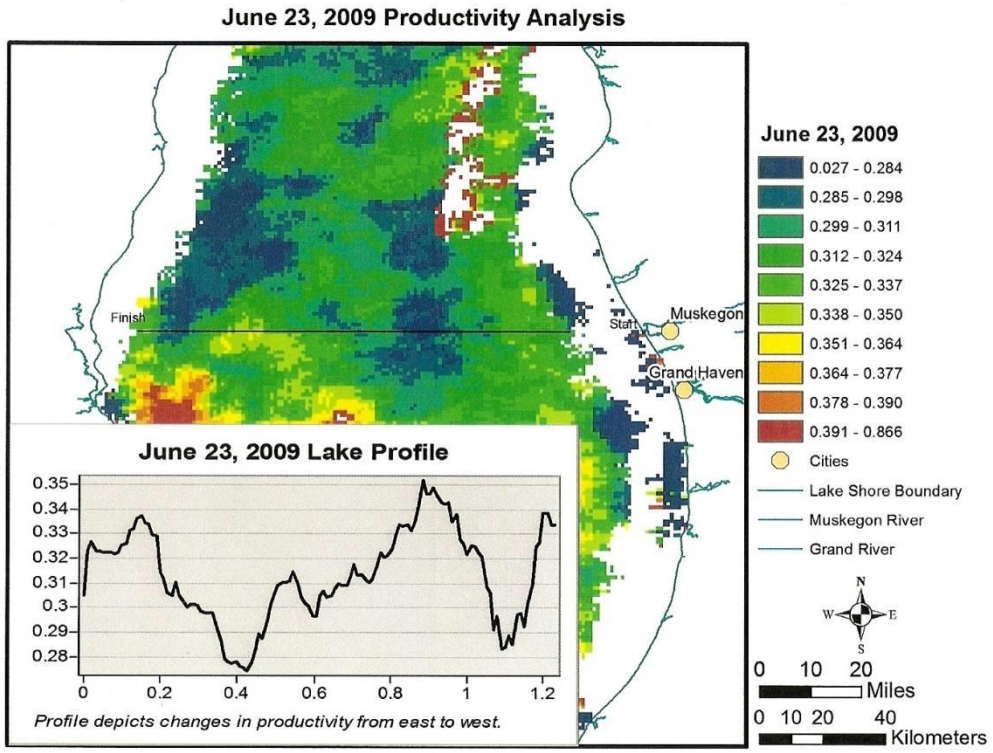


Future Products



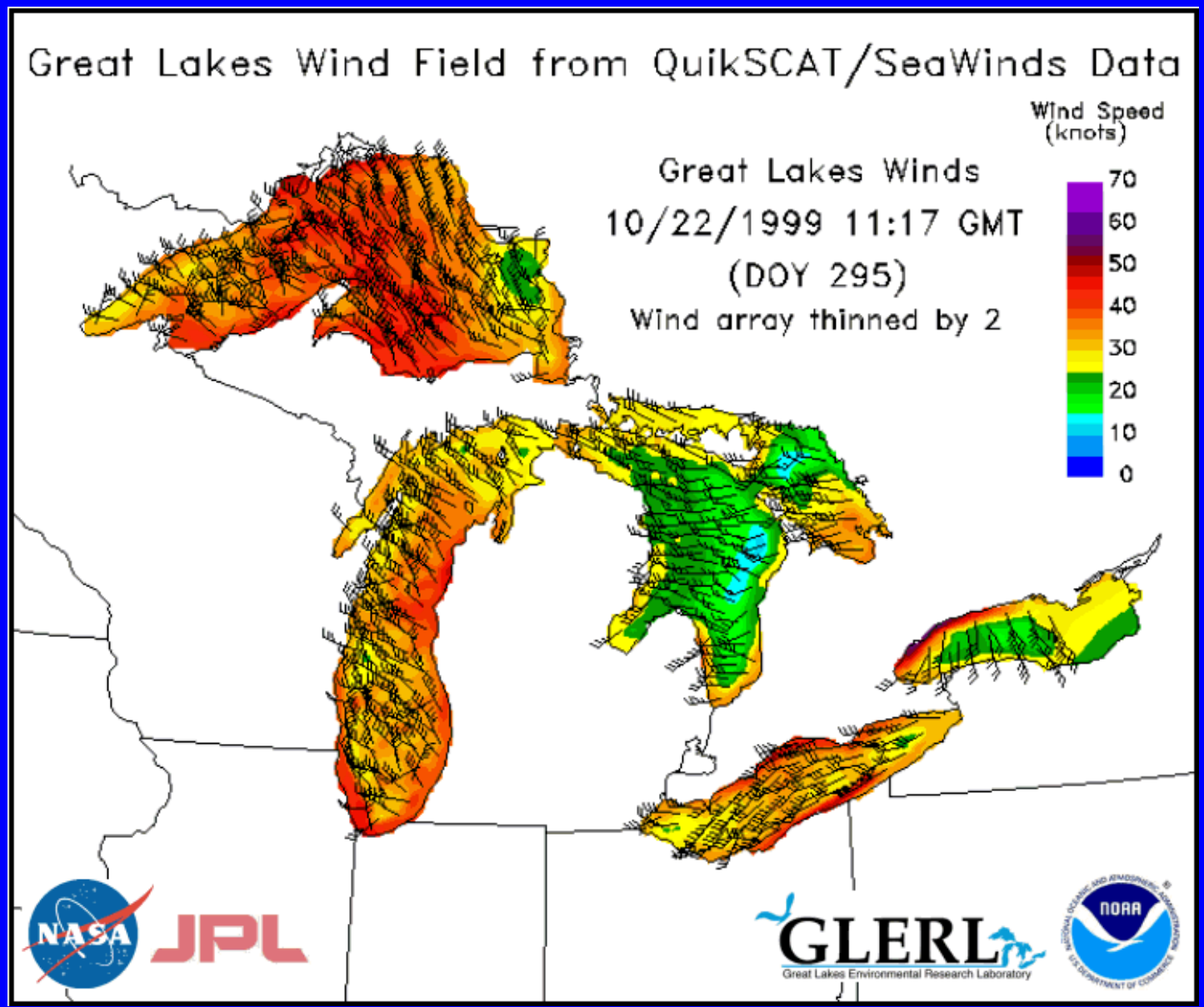
Future Products

Prototype
Primary Productivity



Future Products

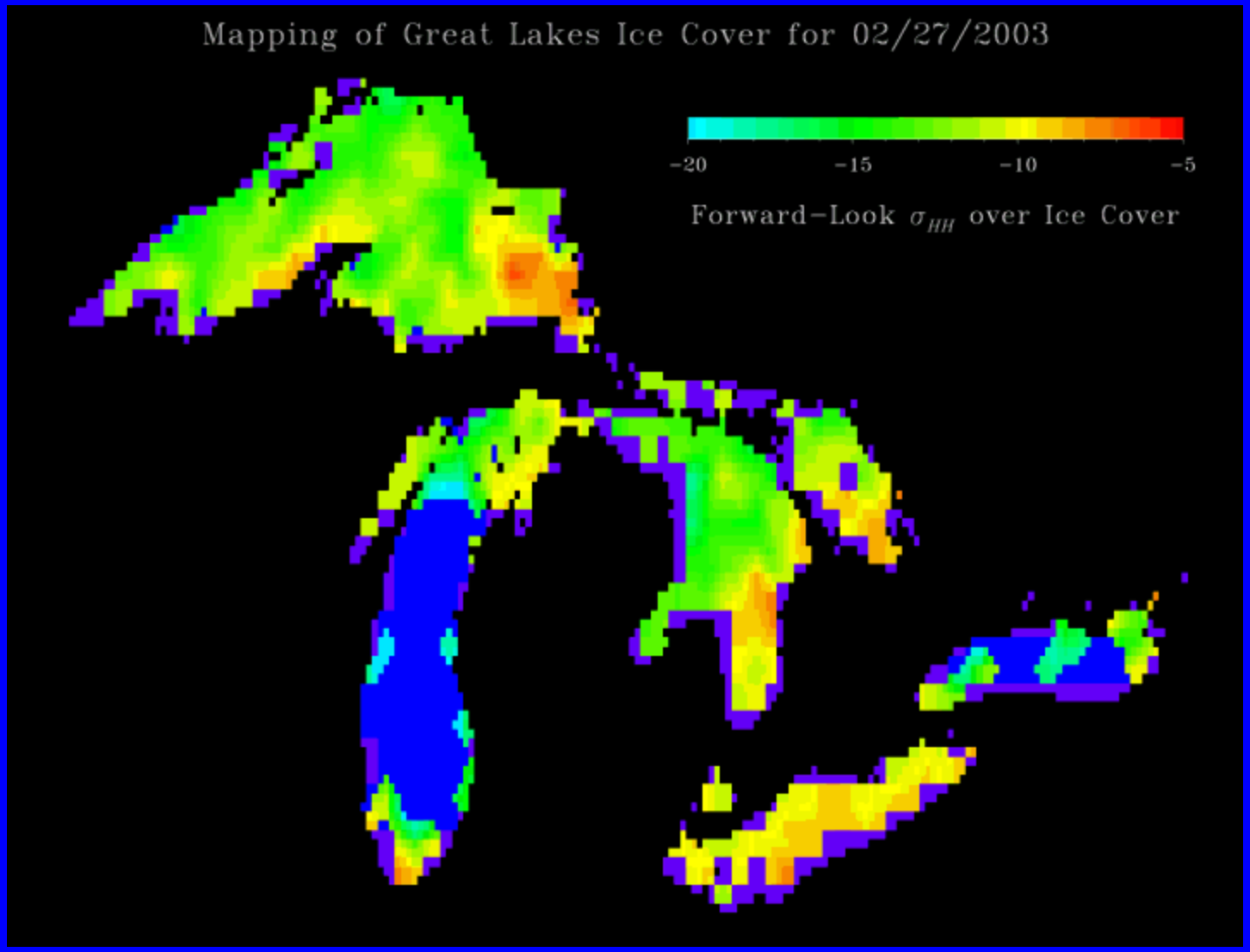
Prototype of Great Lakes wind-field product derived from QuikScat/SeaWinds Data



Future Products

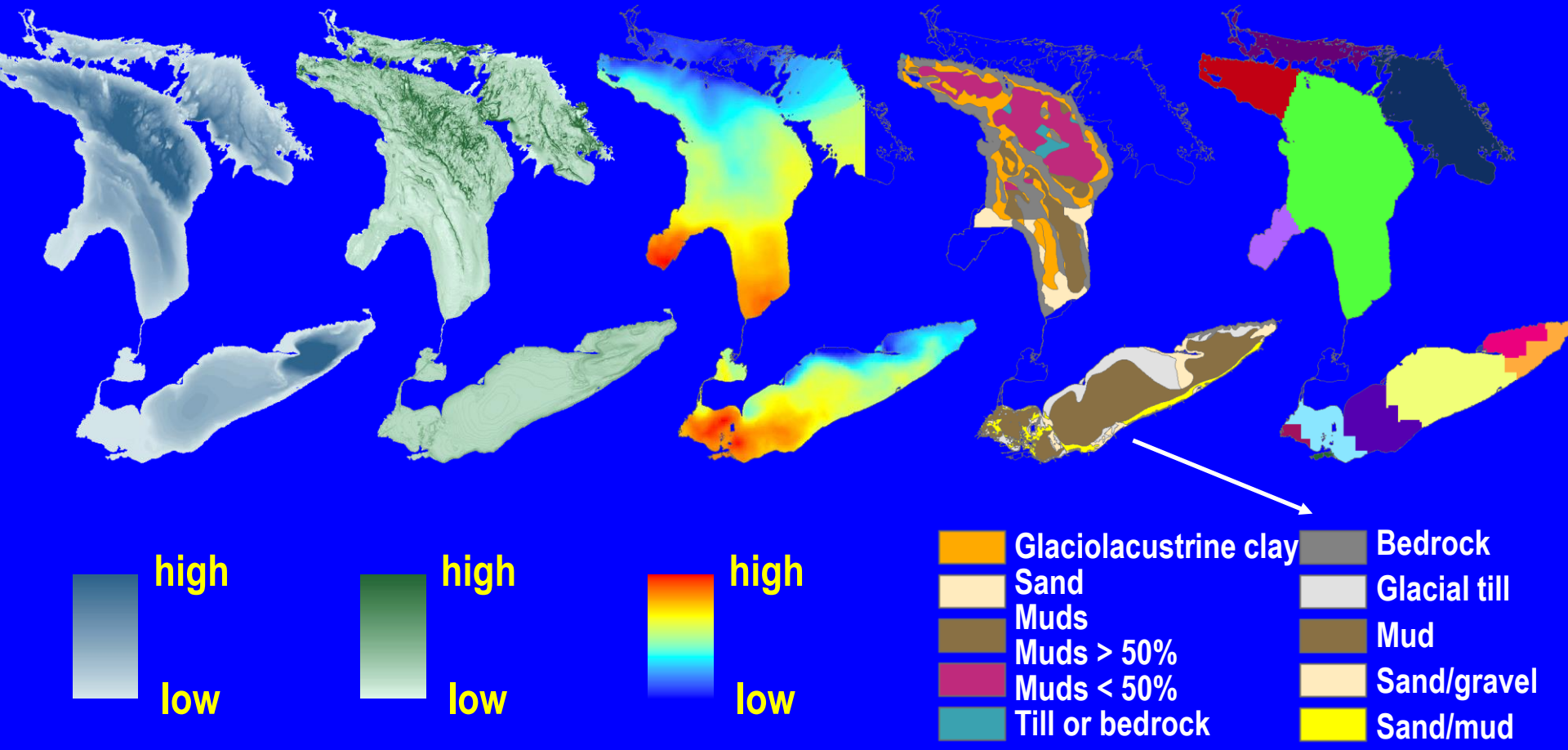
Prototype of Great Lakes Ice-cover product derived from QuikScat/SeaWinds Data

green-red = ice, blue = water, and violet = unclassified areas

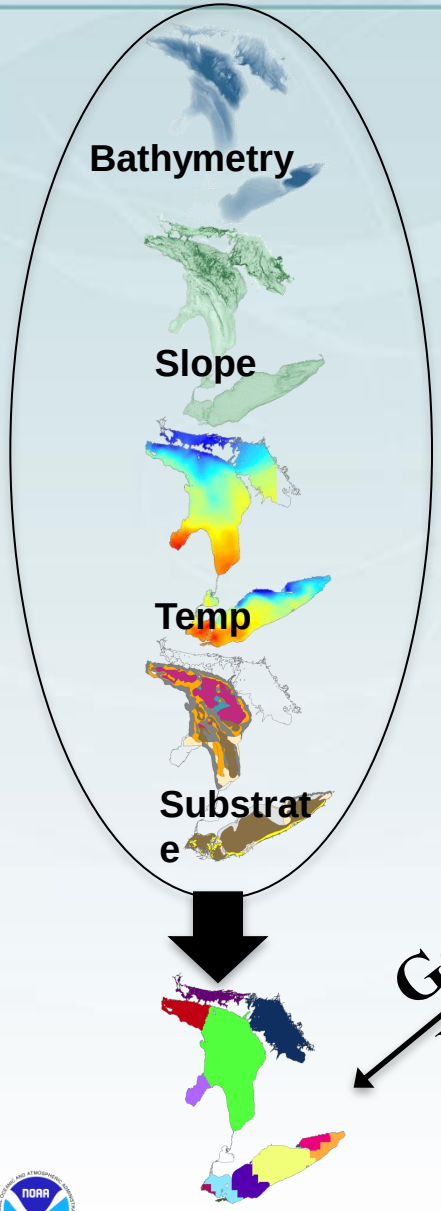


Decision Support System
Data Inputs

Bathymetry | Slope | Temperature | Substrate | Circulation



CoastWatch Great Lakes Decision Support Tool



Google Earth®

Decision Support

Great Lakes CoastWatch New Server

Dell PE-R710
Intel x5370

CoastWatch Great Lakes Node Web Address

http://coastwatch.glerl.noaa.gov