



NOAA CoastWatch Great Lakes Ice Products

Andrea Vander Woude¹
Songzhi Liu²

October 21, 2024





CoastWatch Great Lakes Node

coastwatch.glerl.noaa.gov/

- Established in 1990
- Embedded in NOAA Great Lakes Environmental Research Laboratory (GLERL), Ann Arbor MI
- Service area is the Great Lakes region

Andrea Vander Woude (NOAA)
Node Manager

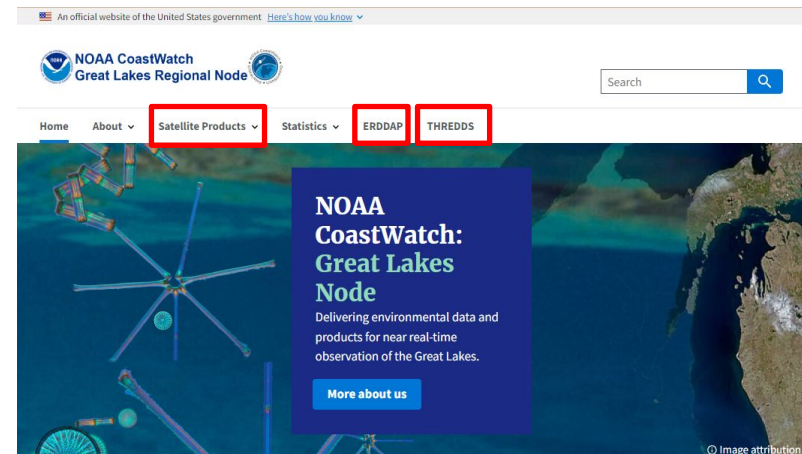
Songzhi Liu (CIGLR)
Operations Manager



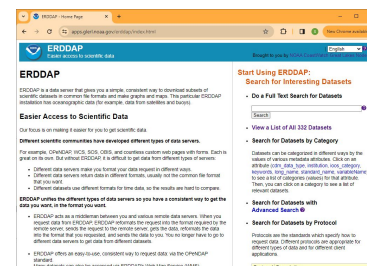


Great Lakes Datasets

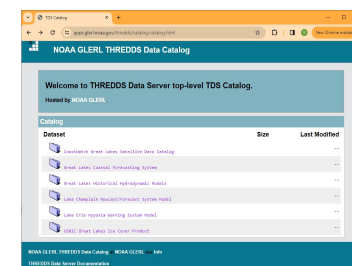
- Water Surface Temperature (SST)
- Water Quality: CPAs, Water Clarity Index
- True Color
- SAR : Winds, NRCS Imagery, ICECON
- Ice Cover: Ice Concentration, Ice Thickness
- Statistics: Long Term SST, Long Term Ice Concentration



coastwatch.glerl.noaa.gov/



ERDDAP



THREDDS

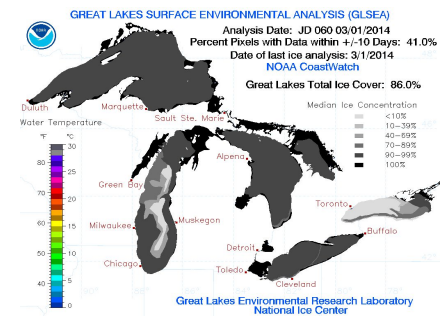
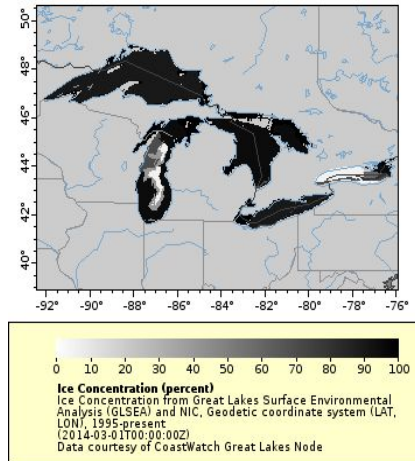
Ice Season: from November to May

Eg. 2024 ice season: from Nov 2023 to May 2024

Ice Concentration

- Analysis of several data sources including synthetic aperture radar (SAR)

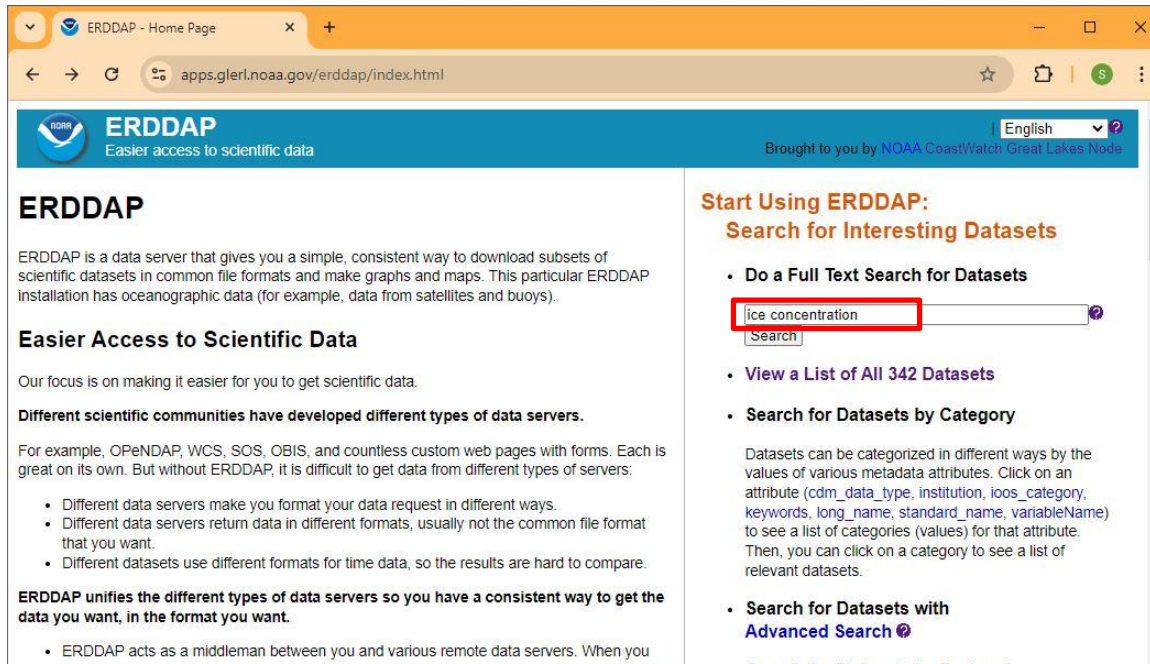
- Coverage: 1995 – present
- Spatial resolution: 1.1km/pixel
- File format: netCDF
- Access: HTTPS, ERDDAP, THREDDS





Ice Concentration Data Access

https://apps.glerl.noaa.gov/erddap/griddap/GL_Ice_Concentration_GCS.graph



ERDDAP
Easier access to scientific data

Brought to you by NOAA CoastWatch Great Lakes Node

ERDDAP

ERDDAP is a data server that gives you a simple, consistent way to download subsets of scientific datasets in common file formats and make graphs and maps. This particular ERDDAP installation has oceanographic data (for example, data from satellites and buoys).

Easier Access to Scientific Data

Our focus is on making it easier for you to get scientific data.

Different scientific communities have developed different types of data servers.

For example, OPeNDAP, WCS, SOS, OBIS, and countless custom web pages with forms. Each is great on its own. But without ERDDAP, it is difficult to get data from different types of servers:

- Different data servers make you format your data request in different ways.
- Different data servers return data in different formats, usually not the common file format that you want.
- Different datasets use different formats for time data, so the results are hard to compare.

ERDDAP unifies the different types of data servers so you have a consistent way to get the data you want, in the format you want.

- ERDDAP acts as a middleman between you and various remote data servers. When you request data from a remote server, ERDDAP formats the request to the format that the remote server understands and returns the data in the format that you want.
- ERDDAP offers a standard.

Start Using ERDDAP:
Search for Interesting Datasets

- Do a Full Text Search for Datasets
- View a List of All 342 Datasets
- Search for Datasets by Category
- Search for Datasets with Advanced Search

Search for Datasets by Category

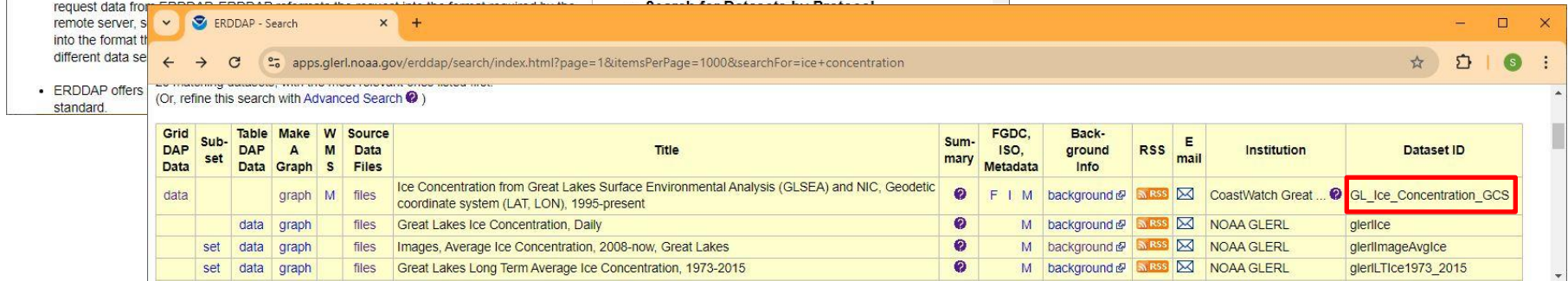
Datasets can be categorized in different ways by the values of various metadata attributes. Click on an attribute (cdm_data_type, institution, ioos_category, keywords, long_name, standard_name, variableName) to see a list of categories (values) for that attribute. Then, you can click on a category to see a list of relevant datasets.

Search:

ice concentration

Dataset name:

GL_Ice_Concentration_GCS



ERDDAP - Search

apps.glerl.noaa.gov/erddap/search/index.html?page=1&itemsPerPage=1000&searchFor=ice+concentration

(Or, refine this search with [Advanced Search](#))

Grid DAP Data	Sub-set	Table DAP Data	Make A Graph	W M S	Source Data Files	Title	Summary	FGDC, ISO, Metadata	Back-ground Info	RSS	E mail	Institution	Dataset ID
data			graph	M	files	Ice Concentration from Great Lakes Surface Environmental Analysis (GLSEA) and NIC, Geodetic coordinate system (LAT, LON), 1995-present		F I M	background	RSS		CoastWatch Great ...	GL_Ice_Concentration_GCS
		data	graph		files	Great Lakes Ice Concentration, Daily		M	background	RSS		NOAA GLERL	glerlice
	set	data	graph		files	Images, Average Ice Concentration, 2008-now, Great Lakes		M	background	RSS		NOAA GLERL	glerlImageAvgIce
	set	data	graph		files	Great Lakes Long Term Average Ice Concentration, 1973-2015		M	background	RSS		NOAA GLERL	glerlLTIce1973_2015



Ice Concentration Data Access

https://apps.glerl.noaa.gov/erddap/griddap/GL_Ice_Concentration_GCS.graph

The screenshot shows the ERDDAP web interface for the dataset "Ice Concentration from Great Lakes Surface Environmental Analysis (GLSEA) and NIC, Geodetic coordinate system (LAT, LON), 1995-present". The interface includes a navigation bar with the NOAA logo and the text "ERDDAP Easier access to scientific data". The main content area is titled "ERDDAP > griddap > Make A Graph".

Dataset Title: Ice Concentration from Great Lakes Surface Environmental Analysis (GLSEA) and NIC, Geodetic coordinate system (LAT, LON), 1995-present

Institution: CoastWatch Great Lakes Node (Dataset ID: GL_Ice_Concentration_GCS)

Information: Summary | License | FGDC | ISO 19115 | Metadata | Background | Data Access Form | Files

Graph Type: surface

X Axis: longitude

Y Axis: latitude

Color: ice_concentration

Dimensions: time (UTC) Start: 2019-03-01T12:00:00Z Stop: specify just 1 value →

Latitude (degrees_north): 38.8749871947297 to 50.6059751976539

Longitude (degrees_east): -92.4199507342304 to -75.8816402880531

Graph Settings: Color Bar, Continuity, Scale, Minimum, Maximum, N Sections, Draw land mask, Y Axis Minimum, Maximum, Ascending

Redraw the Graph (Please be patient. It may take a while to get the data.)

Optional: Then set the File Type: .htmlTable (File Type information)

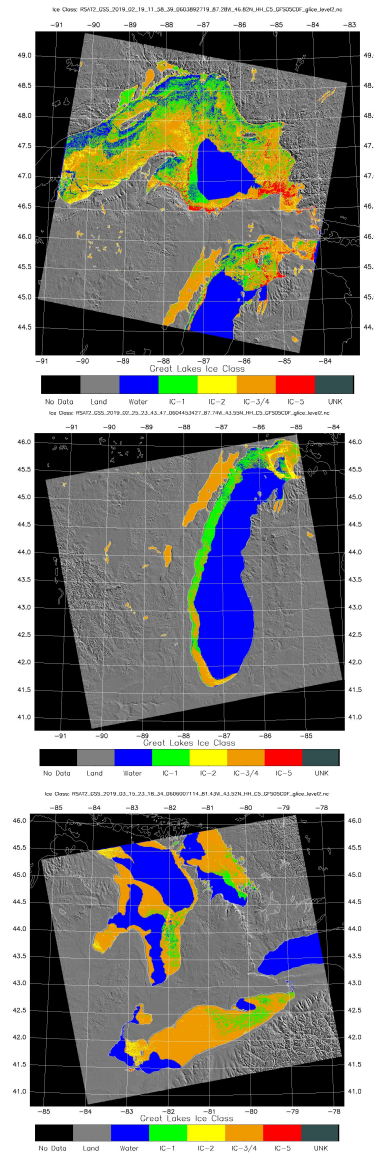
Map: A map of the Great Lakes region showing ice concentration. The map is titled "Click on the map to specify a new center point." and includes a zoom control: Zoom: Data | Out 8x | Out 2x | Out | In | In 2x | In 8x. The map shows a grayscale representation of ice concentration over the Great Lakes, with a color bar below it ranging from 0 to 100 percent. The color bar is labeled "Ice Concentration (percent)" and includes the text "Ice Concentration from Great Lakes Surface Environmental Analysis (GLSEA) and NIC, Geodetic coordinate system (LAT, LON), 1995-present (2019-03-01T12:00:00Z) Data courtesy of CoastWatch Great Lakes Node".



Ice Classification (ICECON)

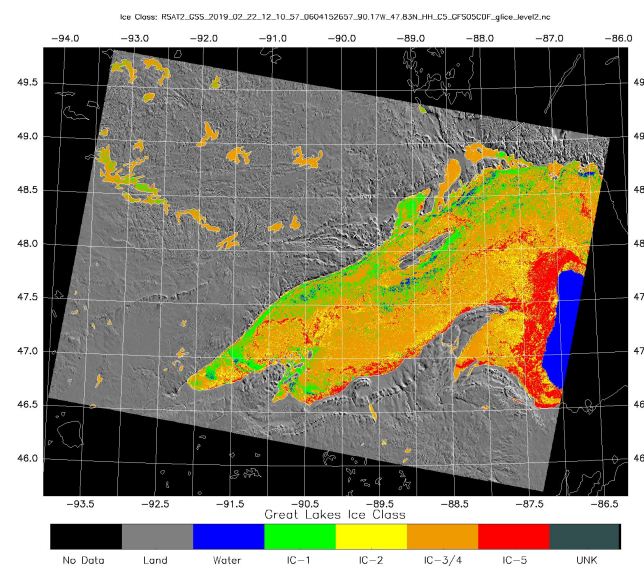
- ICECON is an ice map.
- The colors in ice map represent ice type, ice thickness ranges, and ICECON severity index (impact on vessels).
- Derived from RADARSAT2 and Sentinel 1A/1B.

- L2 level data
- Spatial resolution 0.15 km/pixel
- Coverage 2018 – present
- Offered png, geoTiff, kmz, netCDF file format
- Access by HTTP, THREDDS, ERDDAP



Ice Classification Color and Code

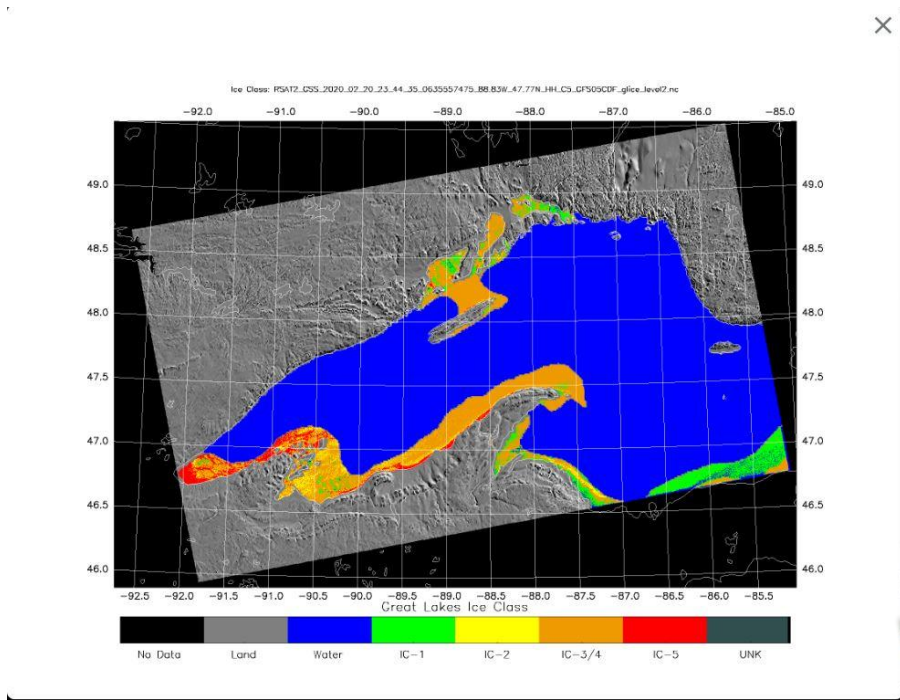
ICECON Categories	Description Example Ice Types	Thickness	Color	Code
0	Calm Water (or below noise floor)	0"	Blue	1
1	New Lake Ice	<2"	Green	21
2	Pancake Ice	2" - 6"	Yellow	12
3	Consolidated Flows	6" ->12"	Orange	27
4	Lake Ice w/patchy Orange crusted snow Snow/SnowIce/LakeIce	up to 28"		
5	Brash	>28" up to 9-11m	Red	14
	Land		Grey	1





Ice Classification Data Access

<https://coastwatch.glerl.noaa.gov/satellite-data-products/ice-cover-classification/>



NOAA CoastWatch Great Lakes Regional Node

Home About **Satellite Products** Statistics ERDDAP THREDDS

Ice Cover Classification

ICECON Ice Classification: 3050

Time: 05 - February

View Save Files

2/21/2020
Time: 06:14 PM
File size: 383973 bytes
View Save Files

2/21/2020
Time: 06:55 AM
File size: 335633 bytes
View Save Files

2/21/2020
Time: 06:54 AM
File size: 409427 bytes
View Save Files

2/20/2020
Time: 06:44 PM
File size: 336154 bytes
View Save Files

2/20/2020
Time: 06:43 PM
File size: 414575 bytes
View Save Files

2/20/2020
Time: 06:42 PM
File size: 159857 bytes
View Save Files

ERDDAP - GL_Ice_Classification

apps.glerl.noaa.gov/erddap/tabledap/GL_Ice_Classification.html?table=%2Cname%2CfileType%2Ctime%2C...

English

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https://apps.glerl.noaa.gov/erddap/files/GL_Ice_Classification/2020/02/RSAT2_GSS_2020_02_20_23_44_35_0635557475_88.83W_47.77N_HH_C5_GFS05CDF_glice_classes.kmz

https://apps.glerl.noaa.gov/erddap/files/GL_Ice_Classification/2020/02/RSAT2_GSS_2020_02_20_23_44_35_0635557475_88.83W_47.77N_HH_C5_GFS05CDF_glice_classes.png

https://apps.glerl.noaa.gov/erddap/files/GL_Ice_Classification/2020/02/RSAT2_GSS_2020_02_20_23_44_35_0635557475_88.83W_47.77N_HH_C5_GFS05CDF_glice_classes.tif

https://apps.glerl.noaa.gov/erddap/files/GL_Ice_Classification/2020/02/RSAT2_GSS_2020_02_20_23_44_35_0635557475_88.83W_47.77N_HH_C5_GFS05CDF_glice_level2.nc

ERDDAP Version 2.23
Disclaimers | Privacy Policy | Contact



Ice Classification Data Access

ERDDAP - <https://apps.glerl.noaa.gov/erddap/index.html>

ERDDAP - Search

Do a Full Text Search for Datasets:
ice classification

1 matching dataset. (Or, refine this search with Advanced Search)

Grid DAP Data	Sub-set	Table DAP Data	Make A Graph	W Data Files	Source Data Files	Title	Summary	FGDC, ISO, Metadata	Back-ground info	RSS	E mail	Institution	Dataset ID
set	data	gr	gr	files	files	Great Lakes Ice Classification, ICECON, (2018-present)		M	background#	rss		CoastWatch Great Lakes Node	GL_Ice_Classification

The information in the table above is also available in other file formats (.csv, .htmlTable, .jtk, .json, .jsonCSV1, .jsonCSV, .jsonKVP, .mat, .nc, .ncsv, .tsv, .xhtml) via a RESTful web service.

ERDDAP, Version 2.23
Disclaimers | Privacy Policy | Contact

- Search **ice classification**
- Click **files**
- Click **year (2024)**
- Click **month**
- Click selected file

ERDDAP > Files > GL_Ice_Classification

ERDDAP's "files" system lets you browse a virtual file system and download source data files. ("files" documentation, including "how can I work with these files?")

Dataset Title: **Great Lakes Ice Classification, ICECON, (2018-present)**

Name	Last modified	Size	Description
Parent Directory	-	-	-
2018/	-	-	-
2019/	-	-	-
2020/	-	-	-
2021/	-	-	-
2022/	-	-	-
2023/	-	-	-
2024/	-	-	-

ERDDAP, Version 2.23
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ERDDAP > Files > GL_Ice_Classification > 2024/

ERDDAP's "files" system lets you browse a virtual file system and download source data files. ("files" documentation, including "how can I work with these files?")

Dataset Title: **Great Lakes Ice Classification, ICECON, (2018-present)**

Name	Last modified	Size	Description
Parent Directory	-	-	-
01/	-	-	-
02/	-	-	-
03/	-	-	-
04/	-	-	-

ERDDAP, Version 2.23
Disclaimers | Privacy Policy | Contact

ERDDAP > Files > GL_Ice_Classification > 2024/04/

ERDDAP's "files" system lets you browse a virtual file system and download source data files. ("files" documentation, including "how can I work with these files?")

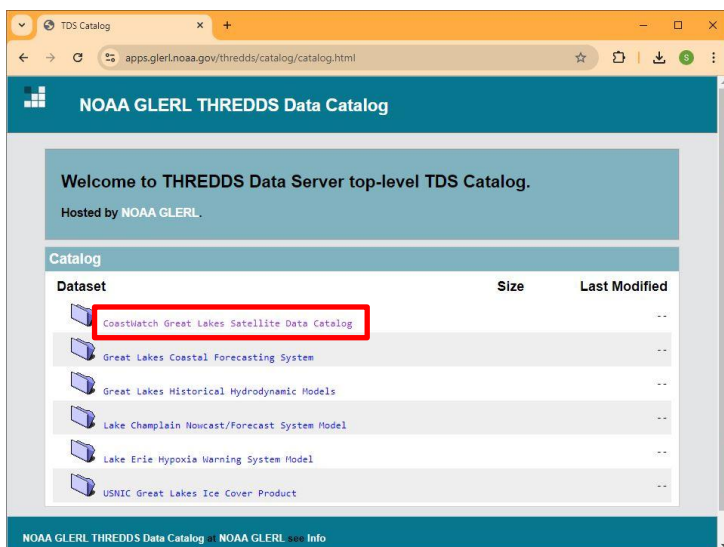
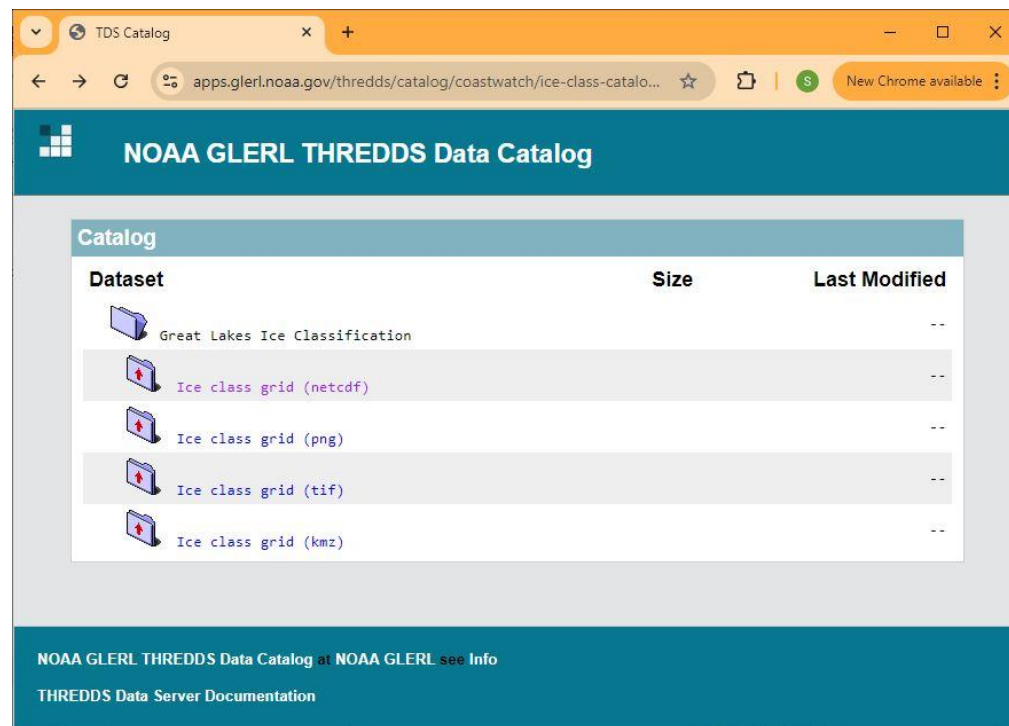
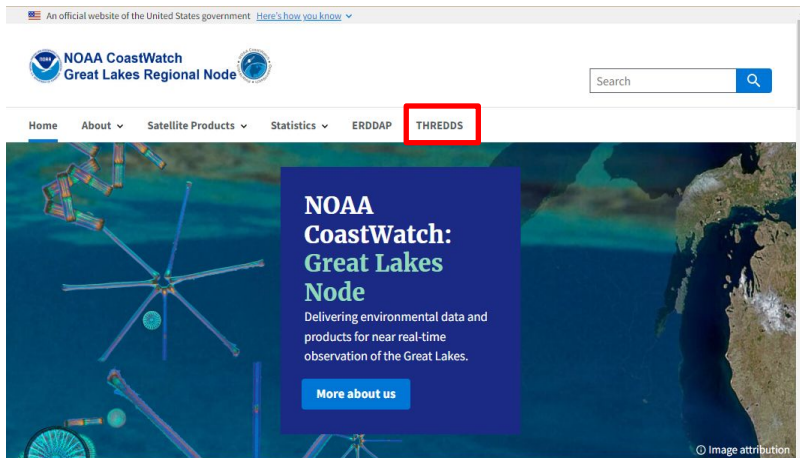
Dataset Title: **Great Lakes Ice Classification, ICECON, (2018-present)**

Name	Last modified	Size	Description
Parent Directory	-	-	-
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RCM3_SHUB_2024_04_14_12_08_12_0766411692_089_40W_47.74N_HH_C5_GFS05CDF_glice_level2.nc	21-May-2024 14:45	208139960	
S1A_ESA_2024_04_01_23_25_53_0765329153_083_12W_45.62N_VV_C5_GFS05CDF_glice_classes kmz	03-Apr-2024 19:35	497237	
S1A_ESA_2024_04_01_23_25_53_0765329153_083_12W_45.62N_VV_C5_GFS05CDF_glice_classes.png	03-Apr-2024 19:35	135752	
S1A_ESA_2024_04_01_23_25_53_0765329153_083_12W_45.62N_VV_C5_GFS05CDF_glice_classes.tif	03-Apr-2024 19:35	442660	
S1A_ESA_2024_04_01_23_25_53_0765329153_083_12W_45.62N_VV_C5_GFS05CDF_glice_level2.nc	03-Apr-2024 19:35	77348412	
S1A_ESA_2024_04_11_23_43_09_0766194189_088_00W_48.60N_VV_C5_GFS05CDF_glice_classes kmz	21-May-2024 14:35	518098	
S1A_ESA_2024_04_11_23_43_09_0766194189_088_00W_48.60N_VV_C5_GFS05CDF_glice_classes.png	21-May-2024 14:35	148660	
S1A_ESA_2024_04_11_23_43_09_0766194189_088_00W_48.60N_VV_C5_GFS05CDF_glice_classes.tif	21-May-2024 14:35	435150	



Ice Classification Data Access

THREDDA - <https://apps.glerl.noaa.gov/erddap/index.html>





Ice Classification File Naming Convention

RCM3_SHUB_2024_02_03_12_16_21_0760277781_091.50W_47.37N_HH_C5_GFS05CDF_glice_level2.nc

S1A_ESA_2024_02_01_23_24_37_0760145077_082.02W_41.12N_VV_C5_GFS05CDF_glice_level2.nc

- RCM3** - Platform Name (RCM1, RCM2, RCM3)
- SHUB** - is at the Canadian Space Agency (all RCM data are SHUB)
- 2024_02_03_12_16_21** - year, month, day, hours, minutes, seconds of acquisition_time
- 0760277781** - Julian seconds of acquisition_time
- 091.50W_47.37N** - center of the image.
- HH** - Polarization
- C5** - C is Band, 5 represents the GMF used to derived the surface wind speeds which is used as input for the product.
- GFS05CDF** - 0.5 deg GFS winds were used as the source of the wind directions for the SAR winds.
- glice** - Great Lakes ice
- level2** - level 2 data

- S1A** - Platform name (SENTINEL-1A, 1B)
- ESA** - European Space Agency
- VV** - Polarization



Great Lakes Ice Statistics

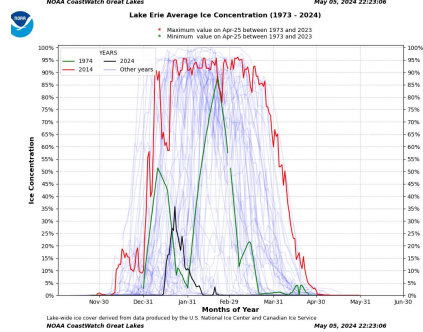
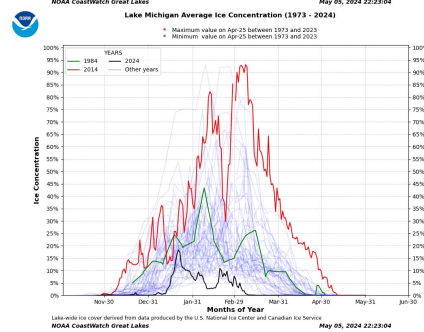
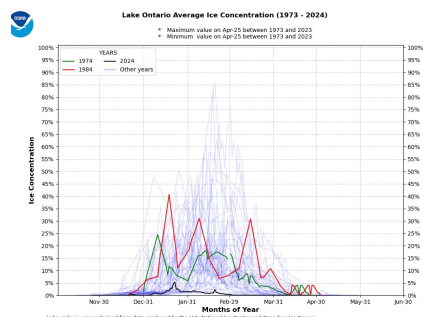
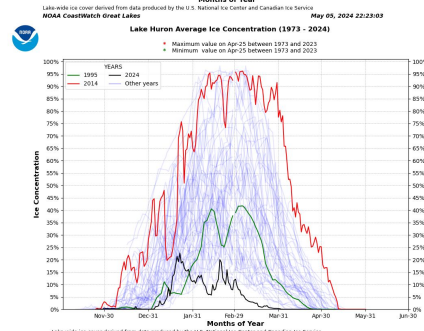
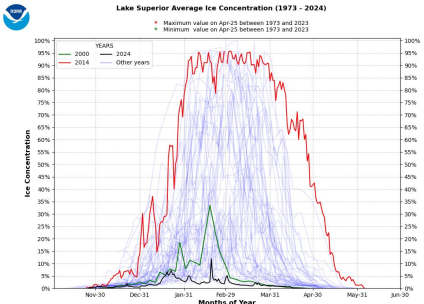
<https://coastwatch.glerl.noaa.gov/statistics/great-lakes-ice-concentration/>

- Average ice concentration (1995-present)
- Long-term Ice concentration compare to current year Ice concentration

The screenshot shows the NOAA CoastWatch Great Lakes Regional Node website. The 'Statistics' menu item is highlighted in the navigation bar. Below it, the 'Great Lakes Ice Concentration' section is highlighted. The page displays a grid of buttons for 'Great Lakes Average Ice Concentration Data' for various years: 2008-2009, 2009-2010, 2010-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018, 2018-2019, 2019-2020, 2020-2021, 2021-2022, 2022-2023, and 2023-2024. Below this, there is a section for 'Great Lakes Average Ice Concentration Graphs' with buttons for Superior, Michigan, Huron, Ontario, and Erie.



Average Ice Concentration Data and Graphs



apps.glerl.noaa.gov/coastwatch x +

apps.glerl.noaa.gov/coastwat... ☆ | \$ New Chrome available

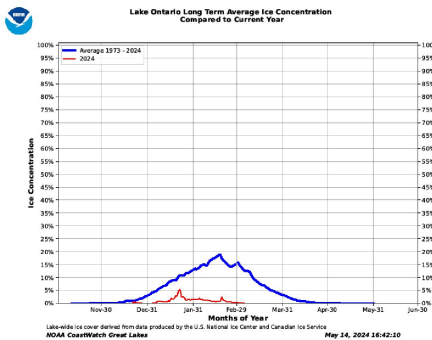
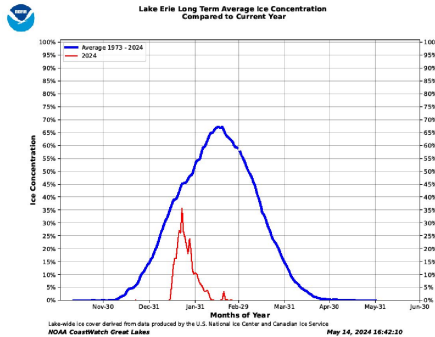
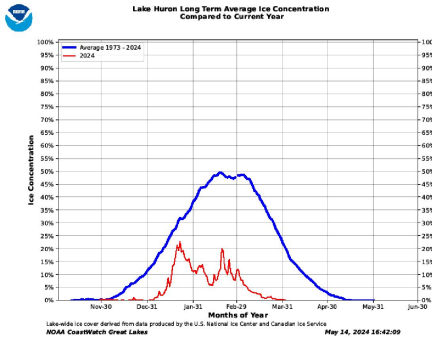
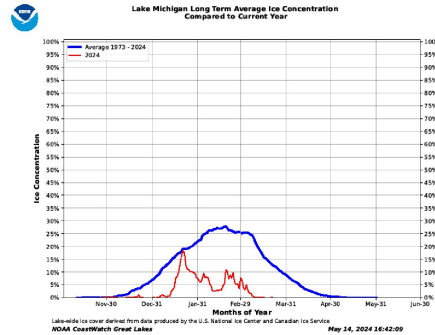
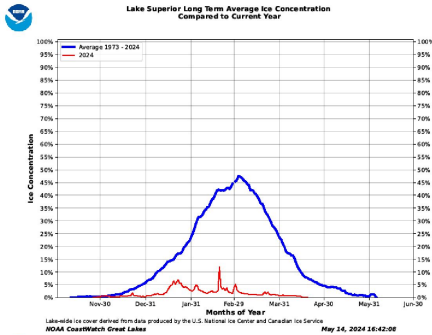
Great Lakes Average Ice Concentration

Ice Concentration (%)

Year Day	Sup.	Mich.	Huron	Erie	Ont.	St.Clr	GL Total
2023 329	0.06	0.00	0.03	0.00	0.00	0.00	0.03
2023 330	0.19	0.00	0.03	0.00	0.00	0.00	0.07
2023 331	0.11	0.00	0.02	0.00	0.00	0.00	0.05
2023 332	0.31	0.00	0.02	0.00	0.00	0.00	0.12
2023 333	0.41	0.19	0.03	0.00	0.00	0.07	0.20
2023 334	0.39	0.19	0.48	0.01	0.01	0.07	0.30
2023 335	0.70	0.19	0.29	0.01	0.01	0.31	0.37
2023 336	0.70	0.11	0.29	0.00	0.00	0.17	0.35
2023 337	0.69	0.17	0.29	0.00	0.00	0.07	0.36
2023 338	0.80	0.16	0.22	0.00	0.00	0.00	0.38
2023 339	0.55	0.13	0.31	0.00	0.00	0.00	0.30
2023 340	0.52	0.09	0.31	0.00	0.00	0.00	0.29
2023 341	0.48	0.04	0.30	0.00	0.00	0.00	0.26
2023 342	0.44	0.04	0.20	0.00	0.00	0.00	0.22
2023 343	0.37	0.02	0.09	0.00	0.00	0.00	0.16
2023 344	0.35	0.01	0.04	0.00	0.00	0.00	0.14
2023 345	0.35	0.01	0.04	0.00	0.00	0.00	0.14
2023 346	0.34	0.01	0.01	0.00	0.00	0.00	0.13
2023 347	0.35	0.01	0.01	0.00	0.00	0.00	0.13
2023 348	0.82	0.09	0.06	0.00	0.00	0.00	0.33
2023 349	0.64	0.07	0.06	0.00	0.00	0.00	0.26
2023 350	0.50	0.06	0.00	0.00	0.00	0.00	0.20
2023 351	0.50	0.08	0.00	0.00	0.00	0.00	0.20



Long-term Ice Concentration Compare to Current Year Ice Concentration



apps.glerl.noaa.gov/coastwatch

apps.glerl.noaa.gov/coastwat...

Great Lakes Average Ice Concentration

Ice Concentration (%)

Year	Day	Sup.	Mich.	Huron	Erie	Ont.	St.Clr	GL Total
2023	329	0.06	0.00	0.03	0.00	0.00	0.00	0.03
2023	330	0.19	0.00	0.03	0.00	0.00	0.00	0.07
2023	331	0.11	0.00	0.02	0.00	0.00	0.00	0.05
2023	332	0.31	0.00	0.02	0.00	0.00	0.00	0.12
2023	333	0.41	0.19	0.03	0.00	0.00	0.07	0.20
2023	334	0.39	0.19	0.48	0.01	0.01	0.07	0.30
2023	335	0.70	0.19	0.29	0.01	0.01	0.31	0.37
2023	336	0.70	0.11	0.29	0.00	0.00	0.17	0.35
2023	337	0.69	0.17	0.29	0.00	0.00	0.07	0.36
2023	338	0.80	0.16	0.22	0.00	0.00	0.00	0.38
2023	339	0.55	0.13	0.31	0.00	0.00	0.00	0.30
2023	340	0.52	0.09	0.31	0.00	0.00	0.00	0.29
2023	341	0.48	0.04	0.30	0.00	0.00	0.00	0.26
2023	342	0.44	0.04	0.20	0.00	0.00	0.00	0.22
2023	343	0.37	0.02	0.09	0.00	0.00	0.00	0.16
2023	344	0.35	0.01	0.04	0.00	0.00	0.00	0.14
2023	345	0.35	0.01	0.04	0.00	0.00	0.00	0.14
2023	346	0.34	0.01	0.01	0.00	0.00	0.00	0.13
2023	347	0.35	0.01	0.01	0.00	0.00	0.00	0.13
2023	348	0.82	0.09	0.06	0.00	0.00	0.00	0.33
2023	349	0.64	0.07	0.06	0.00	0.00	0.00	0.26
2023	350	0.50	0.06	0.00	0.00	0.00	0.00	0.20
2023	351	0.50	0.08	0.00	0.00	0.00	0.00	0.20



Questions