KESKKONNAAGENTUUR

28th Baltic Sea ice meeting

September 13th -15th, 2023

Tallinn, Estonia

Final Report BSIM-28

Tallinn, Estonia 2023

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1. Introduction

The 28th Baltic Sea Ice Meeting was hosted by the Estonian Environment Agency (ESTEA) in Tallinn, Estonia. It was the fourth time the meeting was held in Tallinn. The meeting was opened on Wednesday 13th of September 2023 and closed on Friday the 15th of September 2023. A total of 25 participants joined the meeting: ice analysts and icebreaker management representatives from Estonia, Finland, Sweden, Poland, Germany and Lithuania.

1.1. Organisation of the meeting

Joonatan Kama – specialist responsible for ice reports and forecasts at ESTEA hydrology department, took over as a chair of the daily meeting events. Patrick Eriksson, FMI was chosen as secretary of the meeting.

2. Opening of the meeting

Head of ESTEA weather forecasting department Jüri Joonas opened the BSIM-28 meeting and welcomed all participants to Tallinn. Mr Joonas also gave an introduction of the ESTEA Weather Services.

Chair Joonatan Kama opened the meeting and started with an around the table presentation round for participants. Full list of all participants is provided in Appendix 1.

2.1. BSIM chair

Joonatan Kama was pleased to host the meeting with so many participants from most of the ice services in the Baltic Sea region. This is the fourth time BSIM has been hosted in Estonia, previously in 2005. The adopted agenda of the meeting is attached in Appendix 2.

2.2. Action items from BSIM-27

The actual list of the action items from BSIM-27 is presented in Appendix 3.

3. National reports

Each participating ice service gave a status report of its activities and recent developments. Slides of all national reports are attached in Appendices 4-10

3.1. Estonia

The national report was presented by Ilona Vahter, ESTEA. Presentation available in Appendix 4.

The ice service in Estonia is working within Estonian Environment Agency (ESTEA), who is responsible for providing weather and ice information in Estonian sea-waters. 4 people from

different departments are able to perform ice service duties and produce ice charts & ice reports in turn.

Ice service in ESTEA issues daily ice products like: marine bulletin, ice report, sea ice charts.

All ice products are distributed via e-mail to Baltic Sea ice services and other customers. Starting from spring of 2018 analysis of the ice situation is done using QGIS based ice chart drawing tool. From QGIS icechart drawing tool ice charts are exported directly to Geoserver and public ice chart web-application: http://jaakaart.envir.ee. Interactive icechart contains also remote sensing data and ice observations. Estonian ice chart is also available at ESTEA's weather service page: https://www.ilmateenistus.ee/meri/jaakaart/?lang=en. Both QGIS ice chart plugin and public ice chart web application were developed during recent ESTEA's ice project.

Main users of ice information are state institutions: Estonian Transport administration, Estonian Rescue Board, Police Border Guard Board. Another customers are public users, private companies, fishermen, people living on islands. Estonian Transport administration is responsible for icebreaking activities in Estonian sea-waters and send latest information of restrictions to navigation to Estonian Ice service, this information is added to our ice products.

The number of observation stations with ice observations has decreased to 4: Ristna, Ruhnu, Vilsandi, Kihnu. Ice observations are done only if ice is present. Ice observations are sent by e-mail(text or photo). No operational data from Ruhnu, all observations are sent only at the end of the ice season. No ice observations in Gulf of Finland or any of ports. About 10 public web-cameras on the coast are also used to check the ice conditions. Volunteer ice observation from ESTEA-s mobile weather app Ilm + used additionally from the season 2022/2023.

Satellite images used for the ice charting are Modis Terra and Aqua, MetOp, NOAA-20, Suomi-NPP, Sentinels-1,2, 3. Radarsat-2 imagery is being used actively since ice season 2022/23, to compensate the loss of data from Sentinel-1b. Sentinel data is processed operationally at EstHub (National satellite data centre, which gathers satellite data for Estonian area of interest). Sentinel-1 SAR data is available from EstHub after 5 hours of sensing time; this data together with other Sentinel data goes directly to QGIS ice chart drawing tool and ice chart web-application layers.

Another ice input data used for ice charting: ice information from other ice services, CMEMS satellite based products (DMI sea surface temperature, FMI/SMHI ice products), FMI ice forecasts.

Ice condition forecasts are done only on demand from customers and are based mostly on meteorological forecast. Clients are mostly interested in ice phase dates such as first ice, first freezing, ice period duration and the ice break-up. At the end of the season is usually done short overview of past ice winter.

With respect to sum of negative air temperatures (sum of coldness) four of past five ice seasons have been mild (sum of coldness was less than 270°C, which is threshold for mild winters) and no ice was present at all in our sea-areas during season of 2019/2020.

The last winter 2022/2023 was mild, the ice cover reached maximum extent on March 11th, when ice edge in Gulf of Finland run by line Kalbodagrund-island Vaindloo-island Väike Tütarsaar-Toila.

Winters with maximum ice cover edge staying eastward of longitude of Tallinn are considered mild, during average winter the maximum ice cover edge should reach longitude of Ristna. According to that, only winter of 2020/21 can be considered as almost average ice winter, on this winter maximum ice cover extent occurred February 17, when ice edge in Gulf of Finland run by line Dirhami-Marienhamn. During other ice seasons (2018/19, 2021/22, 2022/23) maximum ice cover edge hasn't reached longitude of Tallinn.

Icebreaker activities give also some overview on sevirity of winters: the longest icebreaking period was observed in area of Pärnu Bay, where icebreaker EVA-316 assisted vessels for 2,5-4 month(74-110 days). In Gulf of Finland ships were assisted by Botnica icebreaker for a short period during two winters: ice season 2022/23(18 days) and ice season 2020/21(44 days). No ice breaker assistance was needed to port of Tallinn for the 5 past ice winters.

Ice information issued during past ice seasons 2018-2023 by Estonian Ice service:

Ice season	**Ice reports**	**Ice charts**
2018/2019	106	71
2019/2020	-	-
2020/2021	124	60
2021/2022	136	94
2022/2023	118	84

The presentation generated discussion about the Citizen Science Portal used by Estonia.
Information from this portal can be utilized by the Estonian Coast Guard and in ice charting.

3.2. Finland

The national report was presented by Patrick Eriksson, FMI. Presentation available in Appendix 5.

Discussion followed about satellite image ordering and ice winter severity determination (question emerged from reference to statistical medians).

3.3. Sweden

The national report was presented by Oskar Åslund, SMHI. Presentation available in Appendix 6.

3.4. Poland

The national report was presented by Anna Kubicka, IMGW. Presentation available in Appendix 7.

3.5. Germany

The national report was presented by Jürgen Holfort, BSH. Presentation available in Appendix 8.

The Amtsblatt (ice report summary) will most likely be discontinued.

The content of the Ice Logistics Portal will be transferred to the PolarView pages.

3.6. Lithuania

The national report was presented by Giedrė Andruškienė and Janina Brastovickytė-Stankevič, LHMT Forecasting division, Klaipeda. Presentation available in Appendix 9.

LHMT is issuing an SST forecast for the Curonian Lagoon.

4. Sea Ice Database at BSH

Jürgen Holfort (BSH) presented the BSH IceDB database.

Presentation available in Appendix 10.

Information included:

- The Baltic Sea Ice Code
- Assistance restrictions
- Ice Chart metadata
- Ice Chart polygons, point and lines (in menu at Climate)

An interactive interface exists to view the content, but an API is planned to access the data.

From other ice services the database includes data from 2005/06.

4.1. Discussion

Would it be possible to include ice observations? For fixed stations, this inclusion would be easy. For citizen science, this would require its own database, allowing changing positions.

In the updated database, there is a parameter showing the history of the data (when changed and possibly also why it was changed).

4.2. Workshop

BSH is prepared to organize training for accessing the database. Each one who wants to join is encouraged to sign in, Jurgen approves access to the site and sends a follow-up with "lesson". BSH prepares this guidance material and possibly even organizes an online "workshop". [Action Item 1]

5. Presentation about FTIA Winter navigation's new organization with FMI + a short presentation about Baltice.org pages

The report was presented by Tuomas Taivi, FTIA.

Presentation available in Appendix 11.

The FTIA Maritime Unit coordinates the winter navigation along Finnish waterways.

Discussion arose about assistance operations in demanding conditions, like in brash and under pressure conditions, and how these are accentuated in assistance of vessels that are wider than the icebreakers. Also usage of coastal radars for ice identification was discussed.

About the winter navigation portal Baltice.org the following was mentioned:

- Will be updated soon
- Open to suggestions of what (ice information) to include into the portal. [Action Item 2]
- 1. Encouraged to go and check the current portal
- 2. Send suggestions of content mika.nyrhila@vayla.fi

6. New sea ice mapping developments in Estonia + QGIS demo

The developments were presented by Jekaterina Služenikina (ESTEA) and Rain Elken.

Presentation available in Appendix 12.

The Web map application is accessible at jaakaart.envir.ee.

6.1. Discussion

- Q: Is the source code to the ILM+ app accessible? A: Not at the moment but might be negotiable.
- Information of the map application's WMS layers can be found in the application itself as links.

7. General discussion

7.1. The Baltic Sea Ice Services BSIS

- Each service is asked to update the ice chart and ice information link(s) to Jürgen.[Action Item 3]
- Updating of corrected BSIC: General discussion on how this is done.
- The future of the BSIS page.

7.2. Ice observation guideline harmonization.

The meeting called for a way to practically fulfill this need. [Action Item 4]

Niko Tollman (FMI) coordinates the distribution.

7.3. Sharing platform

A Wiki-like site was requested, where BSIM could share material internally. The Google Groups tool was suggested. [Action Item 5]

7.4. Other

Other openly and briefly discussed topics were:

- IICWG
- Open-Source tools
- AI/ML solutions

8. Action items

Item	Subject	Action	Responsibility	Date	Status
1	BSH IceDB	Interested institutes or persons to request access.	Jürgen Holfort (BSH)	Any time	Ongoing
2	Baltice.org	Call for suggestions of what to include into the portal.	Mika Nyrhilä, Tuomas Taivi (FTIA)	Next meeting	Open
3	BSIS portal	Each service is asked to update the ice chart and ice information link(s) to Jürgen, if needed.	All ice services	Next meeting	Open
4	Ice observations	Joint effort to create a harmonized guideline for ice observations.	All ice services, Niko Tollman (FMI)	Next meeting	Open
5	BSIM “Wiki”	Choice and set-up of a portal where BSIM could share material internally.	All ice services	Next meeting	Open

9. Additional activities

During the meeting, some activities were of a more social nature.

9.1. Meeting dinner

On Wednesday, ESTEA kindly hosted a dinner at the Fotografiska restaurant in Telliskivi, with a splendid view over the city of Tallinn and with a warm and relaxed atmosphere.

9.2. Visit to Estonian Maritime Academy

On Thursday, the meeting participants were invited on a visit to the Estonian Maritime Academy. Professor Pentti Kujala presented the activities and premises of this academy with fine old traditions.

9.3. Visit to ESTEA weather forecasting department

On Friday, the ESTEA staff presented their forecasting centre. During this much appreciated visit, the hosts introduced their tools and procedures and a lot of fruitful discussions took place.

10. Next meeting

Jürgen Holfort from BSH tentatively promised that the next Baltic Sea Ice Meeting will be held in Germany in 2025.

Suggested topics to be considered:

- Automatic functions.
- Presentations, demonstrations how we work with different topics and details.
- How we utilize scientific results.

11. Closing of the meeting

The meeting was closed on Friday, September 15th. Chair Joonatan Kama thanked all the participants for attending the Baltic Sea Ice meeting in Tallinn.

Participants of the 28th BSIM: from top left Patrick Eriksson, Mika Nyrhilä, Anna Kubicka, Alicja Olszewska, Oskar Åslund, Jekaterina Služenikina, Ilona Vahter, Giedrė Andruškienė, Janina Brastovickytė-Stankevič, Elisa Lindgren, Anna Hagenblad, Joonatan Kama, Jouni Vainio, Niko Tollman, Helve Meitern

Appendix 1. Participants

Name	Country	Organisation
Aleksei Vaštšenko	Estonia	ESTEA
Anna Põrh	Estonia	ESTEA
Ele Pedassaar	Estonia	ESTEA
Helve Meitern	Estonia	ESTEA
Ilona Vahter	Estonia	ESTEA
Jekaterina Služenikina	Estonia	ESTEA
Joonatan Kama	Estonia	ESTEA
Jüri Joonas	Estonia	ESTEA
Mari Maltis	Estonia	ESTEA
Silve Grabbi-Kaiv	Estonia	ESTEA

Svetlana Puustusmaa	Estonia	ESTEA
Taimi Paljak	Estonia	ESTEA
Elisa Lindgren	Finland	FMI
Jouni Vainio	Finland	FMI
Niko Tollman	Finland	FMI
Patrick Eriksson	Finland	FMI
Mika Nyrhilä	Finland	FTIA
Tuomas Taivi	Finland	FTIA
Jürgen Holfort	Germany	BSH
Giedrė Andruškienė	Lithuania	LHMT
Janina Brastovickytė-Stankevič	Lithuania	LHMT
Alicja Olszewska	Poland	IMGW
Anna Kubicka	Poland	IMGW
Anna Hagenblad	Sweden	SMHI
Oskar Åslund	Sweden	SMHI

Appendix 2. Meeting agenda

Day 1: Wednesday, September 13

12:00 - 13:00	Arrival, registration, light lunch
13:00 - 13:15	Welcome to the BSIM 2023 meeting!
13:15 - 14:55	National presentations (25 min each) *13:15-13:40 Estonia* *13:40-14:05 Finland* *14:05-14:30 Latvia* *14:30-14:55 Sweden*
14:55 - 15:10	Coffee break
15:10 - 16:50	National presentations (25 min each) *15:10-15:35 Poland*

	15:35-16:00 Germany *16:00-16:25 Denmark* *16:25-16:50 Lithuania*
16:50-17:00	General discussion
17:00	End of meeting, day 1

18:30	Dinner hosted by ESTEA *Fotografiska restaurant/Telliskivi 60a-8, Tallinn*

Day 2: Thursday, September 14

09:00 - 10:15	New, openly available sea ice database from the BSH (Jürgen Holfort, BSH)
10:15 - 10:45	Coffee break
10:45 - 12:00	Presentation about FTIA Winter navigation's new organization with FMI + a short presentation about Baltice.org pages (Tuomas Taivi, FTIA)
12:00 - 13:00	Lunch
13:00 - 14:30	New sea ice mapping developments in Estonia (Ilona Vahter and Jekaterina Služenikina, ESTEA) + QGIS demo (Rain Elken)
14:30 - 17:00	Visit to Estonian Maritime Academy (Kopli 101)
17:00	End of meeting, day 2

Day 3: Friday, September 15

09:00 - 10:30	What are the future tasks or goals? Next meeting: place and time?
10:30 - 11:00	Coffee break
11:00 - 11:45	Visit to ESTEA weather forecasting department
11:45 - 12:00	End of meeting
12:00 - 13:00	Lunch and departure

Appendix 3. Action items BSIM-27

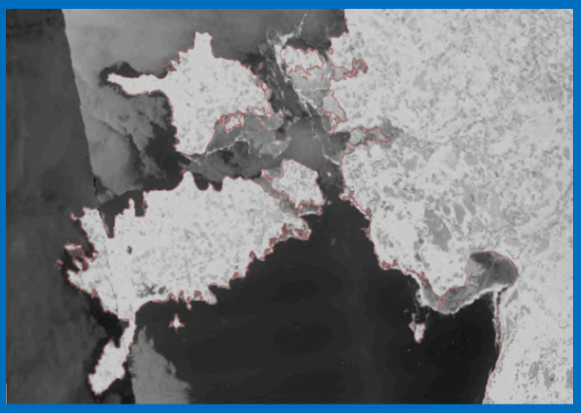
Item	Subject	Action	Responsibility	Date	
1	NAVTEX	Content. Short ice information, similar to the Artic, come up with a suggestion	Magnus Larsson SMHI Jürgen Holfort BSH	Next meeting	Closed
2	Indicator of Sea Ice condition	Comparison of Ice Volume and Max extent of ice cover. Share statistics after season and upload to the BSIS web page	Sandra Schwegmann BSH Patrick Eriksson FMI	Sep. 2019	Ongoing
3	Chart symbols	Jammed brash barrier symbol - make a suggestion about the type of symbol and lift to ETSI.	Jürgen Holfort BSH Patrick Eriksson FMI	Jan. 2019	Ongoing
4	Baltic sea ice code	Get observations from pilots and icebreakers	Emma Grönkvist SMA Tuomas Taivi FTA	Next meeting	Ongoing
5	Baltic sea ice code	Open the BSH database of the Baltic sea ice codes to the other services.	Jürgen Holfort BSH	Sep. 2019	Ongoing
6	Baltic sea ice code	Other ice services send ice codes to the BSH in electronic form (optional)	Other ice services	Next meeting	New
7	Observation application	FMI are developing a new application, Seawiki, will share info.	Antti Kangas FMI	Dec. 2016	Closed
8	Ice chart shape files	BSH open FTP server for other ice services to upload shape files	Jürgen Holfort BSH Other ice services	Sep. 2019	New
9	National ice season reports	Other ice services send their reports to BSH	Jürgen Holfort BSH Other Ice services	Sep. 2018/every season	New
10	Check list of action items	Check list of action items	Chair/co-chair	Sep. 2019/every year	New
11	BSIM-28	Estonia/Denmark contact with Andrejs (LEGMC) about hosting next meeting	Carsten Hansen (FCOO) Maile Meius EWS Andrejs Zubaničs LEGMC	Sep. 2018	Ongoing

Appendix 4. National report Estonia

REPUBLIC OF ESTONIA
ENVIRONMENT AGENCY

ENVIRONMENTALLY CONSCIOUS IN ANY WEATHER

National report, Estonia

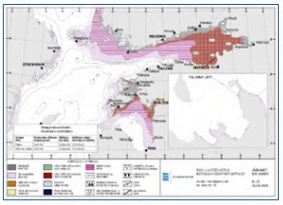


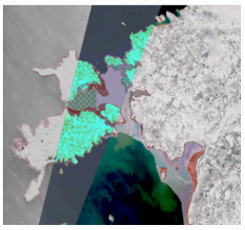
Jekaterina Služenikina & Ilona Vahter
Estonian Environment Agency (ESTEA)

13.09.2023

Ice service in Estonia

- Estonian Ice service is working within Estonian Environment Agency(ESTEA)
- Estonian Ice service produces next daily products: marine bulletin, ice report, ice charts.
- Ice chart & ice reports are distributed into the international network by 11:00 UTC
- Operational ice information is transmitted via e-mail, ESTEA homepage, public ice chart web-application.
- Ice forecasts are produced on demand from customers.
- Ice statistics: overview of ice season, containing dates of ice formation and ice break-up





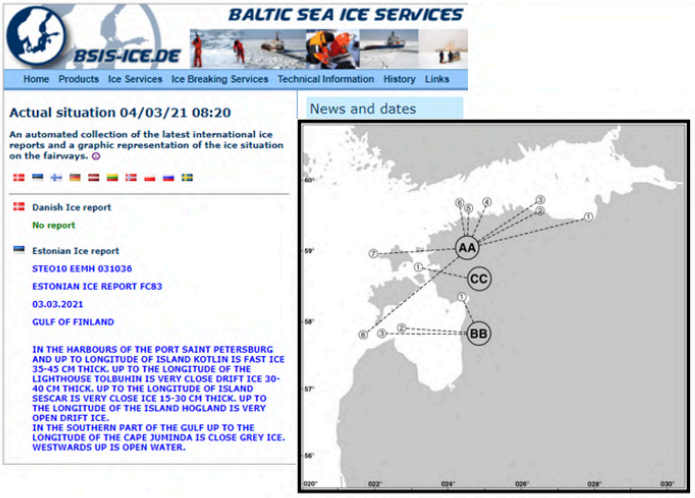
Estonian Ice report
STEO10 EEMH 031036
ESTONIAN ICE REPORT FC83
03.03.2021
GULF OF FINLAND

IN THE HARBOURS OF THE PORT SAINT PETERSBURG AND UP TO LONGITUDE OF ISLAND KOTLIN IS FAST ICE 35-45 CM THICK. UP TO THE LONGITUDE OF THE LIGHTHOUSE TOLBUHIN IS VERY CLOSE DRIFT ICE 30-40 CM THICK. UP TO THE LONGITUDE OF ISLAND SESCAR IS VERY CLOSE ICE 15-30 CM THICK. UP TO THE LONGITUDE OF THE ISLAND HOGLAND IS VERY OPEN DRIFT ICE.
IN THE SOUTHERN PART OF THE GULF UP TO THE LONGITUDE OF THE CAPE JUMINDA IS CLOSE GREY ICE. WESTWARDS UP IS OPEN WATER.

During ice season ice service duties are performed by 4 people from different departments:

- 2 weather forecasters
- 1 hydrologist
- 1 remote-sensing specialist

Ice report

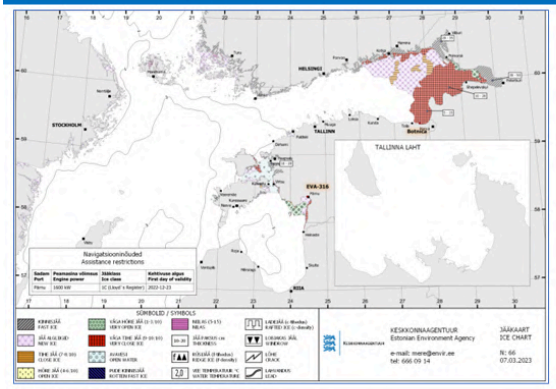


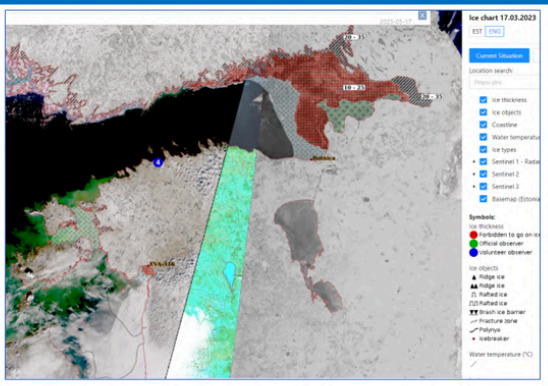
Ice reports for the fairways:
in Gulf of Finland:
-from Narva to Ristna and Irbe Strait
-Väinameri
Gulf of Riga:
-from Pärnu to Irbe Strait

Ice reports are distributed to:

-Baltic Sea Ice Services network
-Estonian Transport Administration
(vessel traffic management department)
-Police and Border Guard Board
-Estonian Rescue Board

Ice chart





Estonian coast ice chart is sent to:

- ESTEA Weather Service homepage (png image) https://www.ilmateenistus.ee/meri/jaakaart/
- Public ice chart web application http://jaakaart.envir.ee
- Baltic Sea ice services
- Other users

Users of ice information

Estonian Transport Administration

Police and Border Guard Board

Estonian Rescue Board

Safe winter navigation: effective planning of the ship's and icebreaker's route.

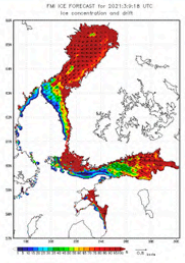
Life safety & rescue operations: restriction to go on ice, effective rescue operations.

Preventing the shipping accidents risk and oil pollution during winter.

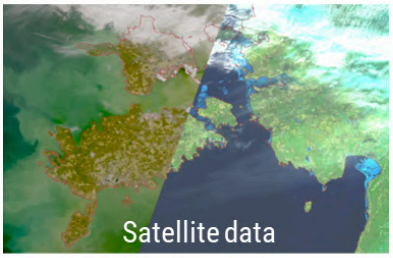
Ice information in use

Ice observations

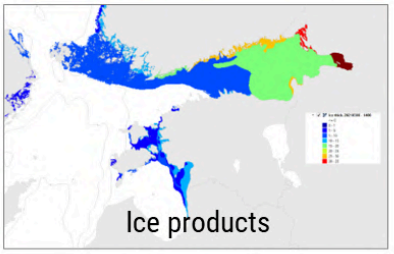
Ice forecasts



Mobile application **ILM+ :** volunteer ice observations

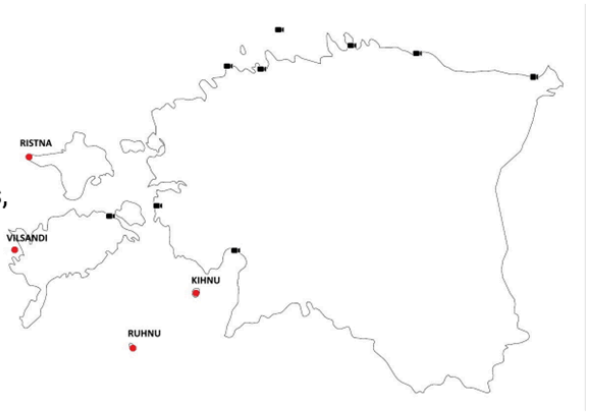


Webcams



Input data: Ice observations

- 4 observation stations, visual ice conditions observations done, when ice is present: **Ruhnu**, **Kihnu**, **Vilsandi**, **Ristna.** (6 stations in 2018).
- Observations are sent via e-mail, ice conditions description of ice or photo.
- No ice observations in Gulf of Finland or in any of ports, as Pärnu, Tallinn, Muuga, Kunda.
- Volunteer irregular ice observations from mobile application **Ilm+** (ice thickness & images)
- Occasional consultations with ship captains and ports.

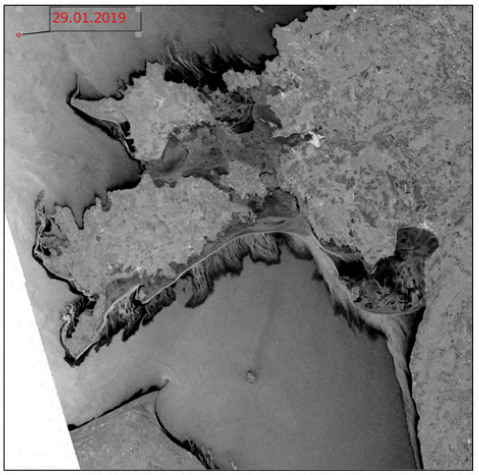


Web-cameras near the coast on different webpages(~10)

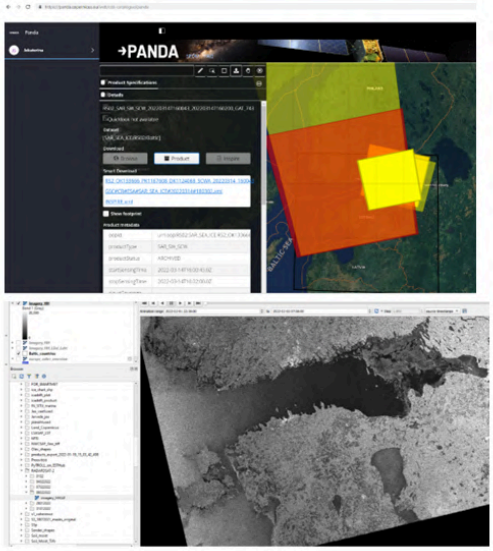
Input data: Radar instrument SAR

Sentinel-1 SAR (IW/EW)

- Operational processing on ESTHub platform in both sensing modes since 2019.
- Quick data processing: processed satellite data is available within 5 hours after sensing time.
- Provides very detailed ice information in spite of cloudiness & illumination by sun



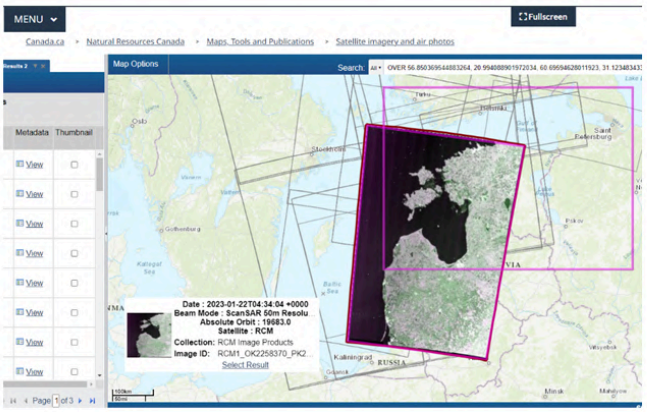
Input data: Radarsat 2



- Data used operationally since ice season 2022/23, when public user application was approved.
- Valuable source of information after the loss of Sentinel-1B data
- Manual file download from PANDA online catalogue: https://panda.copernicus.eu/
- Import distributed TIFF files directly to QGIS.
- A bit noisy images, but the coverage is excellent
- 61 images used in total during the last ice season

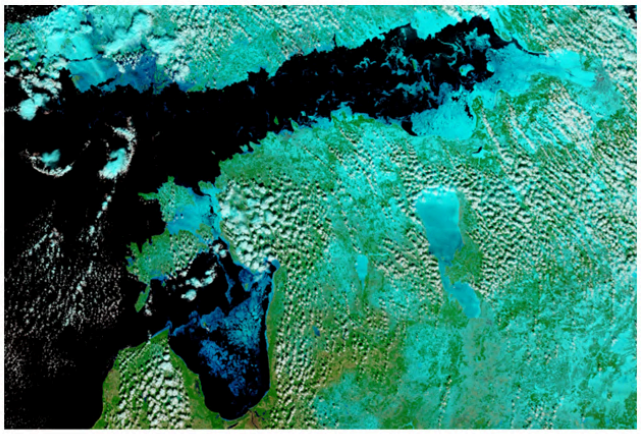
Input data: new RCM possibility

- RCM Application for Vetted User Account was approved in February 2023
- Supporting letter from ESA
- Internal Access to the RCM data has been open since May 2023
- Plans to use new RCM data during future ice season 2023/2024
- Some manual work need to be done to learn how to use new data

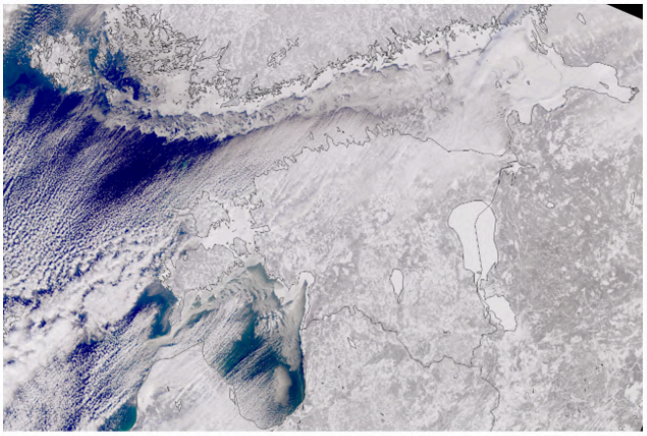


Input data: Optical instruments

MODIS Terra/Aqua



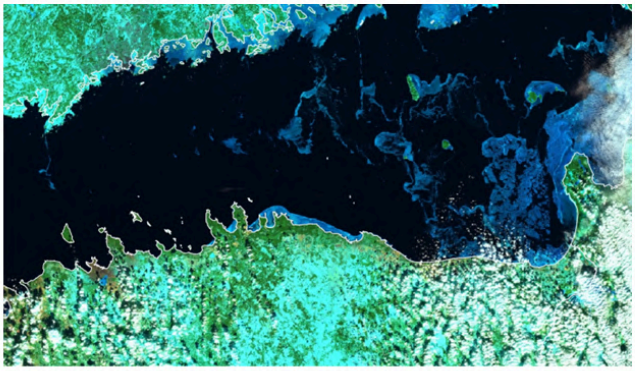
OLCI Sentinel-3A/3B



Operational data processing on ESTHub

Input data: Optical instruments – MSI

Sentinel-2 MSI



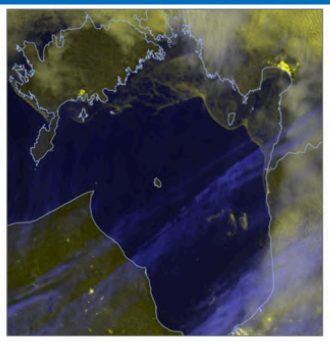
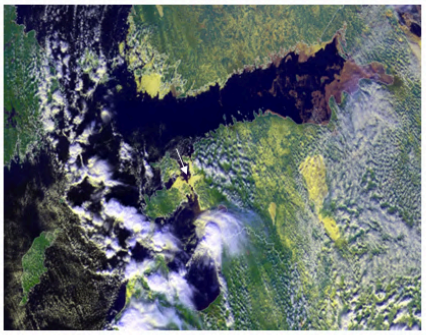
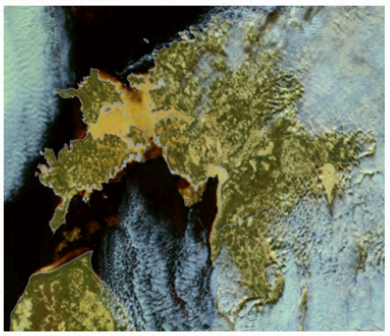
Operational processing on ESTHub

Public service of Estonian Land Board

Satiladu https://satiladu.maaamet.ee/

Ice information with the highest possible resolution in clear sky conditions

Input data: Optical instruments – VIIRS

- Started to use operationally VIIRS DNB & Overview, Snow-age RGB for ice charting purposes
- Quite helpful in clear sky conditions when SAR data is not available
- In-house processing, satellite data operationally distributed by **EUMETSAT**

Input data: other products

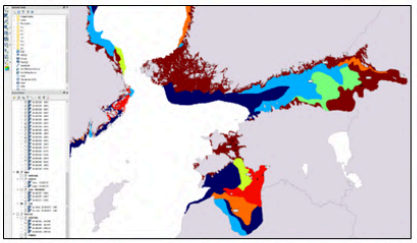
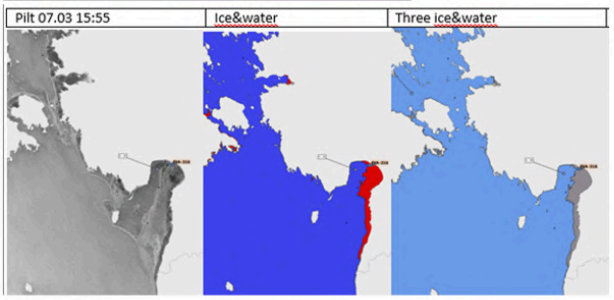
CMEMS satellite based products:

- FMI ice thickness and concentration products
- SAR ice thickness
- DMI Sea Surface Temperature Analysis

Satellite products developments by TalTech:

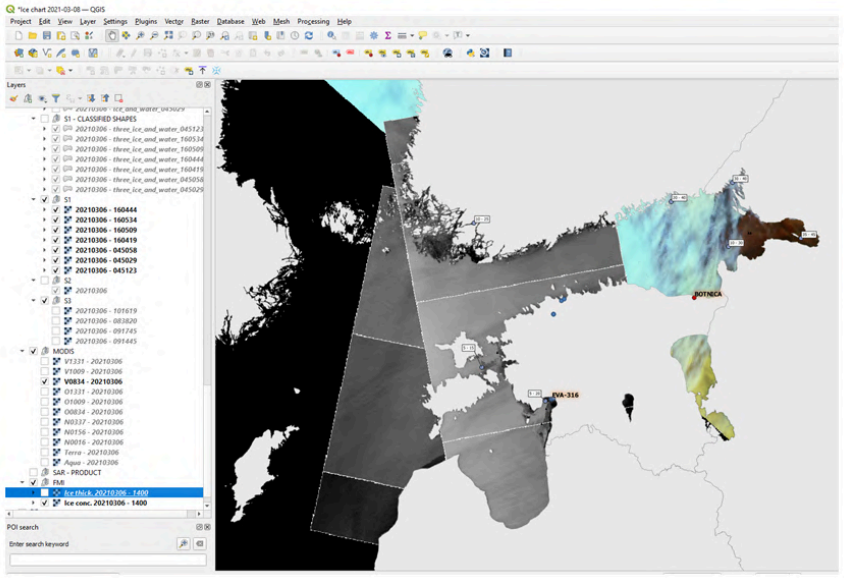
- Detecting sea-ice types, ice thickness(lakes), lake ice with machine-learning algorithm
- Algorithms are based on Sentinel-1 SAR data
- Rarely used operationally.

CMEMS products and some of TalTech ML products go to QGIS ice chart tool layers

QGIS based ice chart drawing tool

RAIN ELKEN FIE

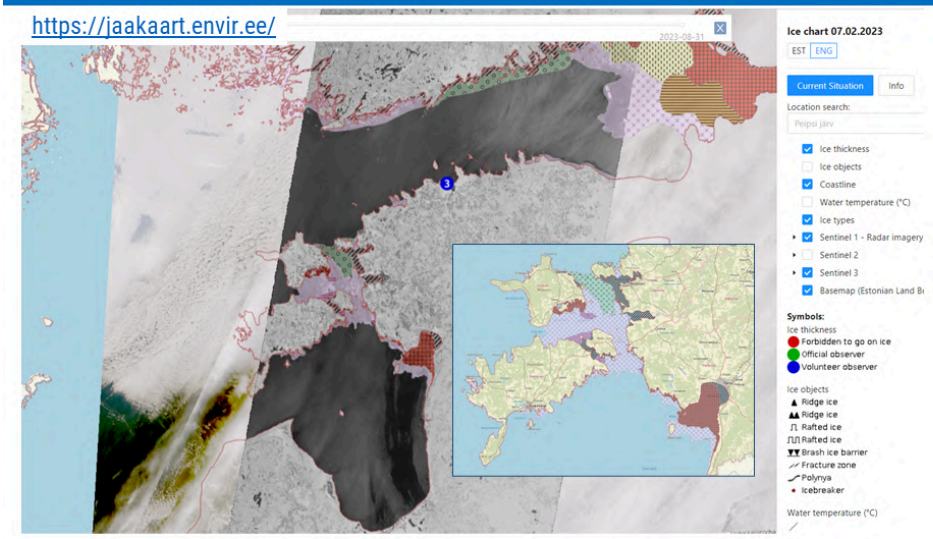


- Ice chart drawing tool in GIS environment
- Developed @ ESTEA & successfully integrated into operational process since 2018
- Different layers of input data(ice products, satelliite images, water temperature)
- Remote sensing data automatically uploads to the application for the **last 3 days**
- Ready ice chart can be exported to Geoserver and ice chart webpage application in one click.
- Possibility to calculate ice statistics for certain time period and sea area.

Public ice chart web-application

CGI

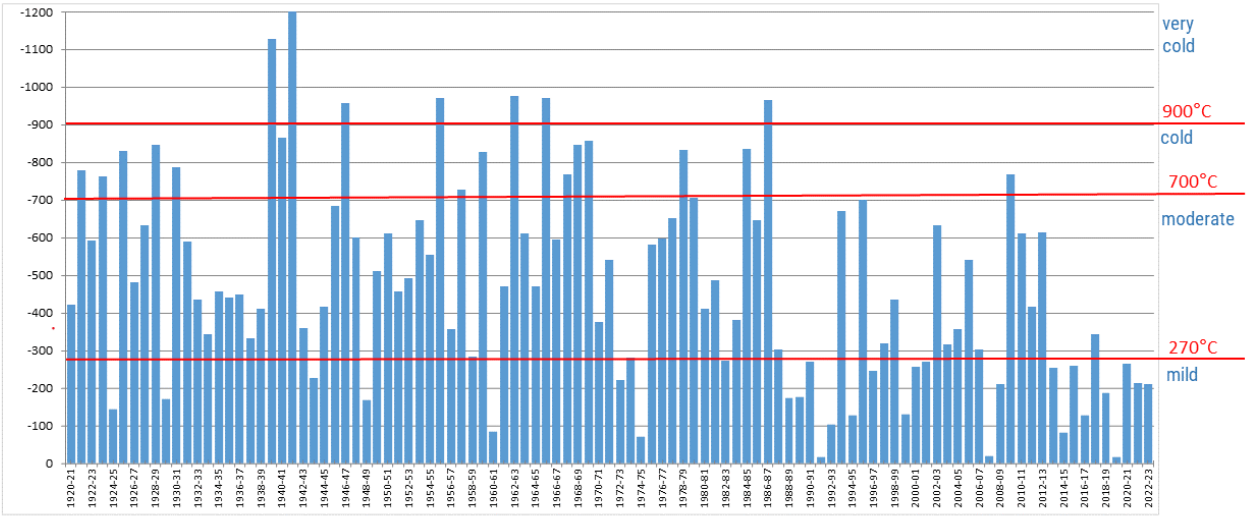
https://jaakaart.envir.ee/



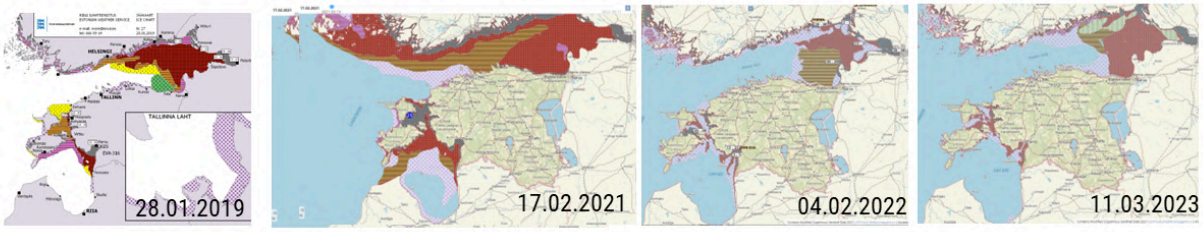
Multiple layers of ice-related data:
-satellite images
-water temperature data
-latest ice chart
-ice thickness observations

The order of layers can be changed, layers can be switched on/off

Totals of negative air temperatures 1920-2023(sum of coldness, Tallinn)



Ice seasons 2018-2023(maximum ice extent)



Ice season	First ice report	First daily ice chart	Maximum ice cover extent	Last ice chart/ icereport
2018/2019	13.12	17.12	28.01	29.03/01.04
2019/2020	-	-	-	-
2020/2021	11.12	11.01	17.02	07.04/13.04
2021/2022	02.12	02.12	04.02	14.04/16.04
2022/2023	05.12	02.12	11.03	31.03

Ice information 2018-2023

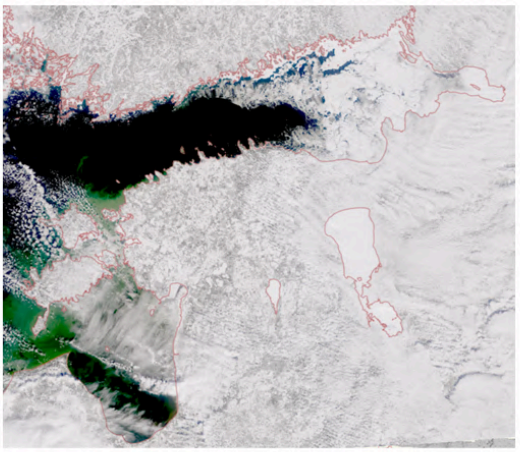
- 2018/2019: (mild winter): 106 ice reports, 71 icecharts
- 2019/2020: no ice
- 2020/2021 (average winter): 124 ice reports and 60 icecharts
- 2021/2022 (mild winter): 136 ice reports and 94 icecharts
- 2022/2023 (mild winter): 118 ice reports and 84 icecharts

Ice breaking statistics 2018-2023

Ice season	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
First icebreaker	12.01(Pärnu)	-	17.01(Pärnu) 09.02(Gulf of Finland)	10.12(Pärnu)	14.12(Pärnu) 03.03(Gulf of Finland),
Last icebreaker	26.03(Pärnu)	-	06.04(Pärnu), 23.03(Gulf of Finland)	30.03(Pärnu) no icebreakers in Gulf of Finland)	21.03(Pärnu) 29.03(Gulf of Finland),
Ice breaking period(days)	74(Pärnu)	-	79(Pärnu), 44(Gulf of Finland)	110(Pärnu)	97(Pärnu) 18(Gulf of Finland)

Last ice season overview 2022/2023

- New ice formation started at the beginning of December, 1-2 weeks earlier than average.
- First ice chart issued on 2nd December, last on 31st March
- 84 ice charts and 118 icereports issued
- Ice period lasted almost 4 months.
- Maximum ice extent was reached on 11th March 2023, when ice edge run by line Kalbodagrund-island Vaindloo-island Väike Tütarsaar-Toila. Mild winter with respect to ice cover maximum extent
- Icebreaker assistance needed mostly in Pärnu Bay, icebreaker „EVA-316“ was on duty in Pärnu Bay from 15.12 till 21.03 (97 days)
- Icebreaker „Botnica“ assisted ships in Gulf of Finland to port of Sillamäe from 03.03 till 29.03 (18 days)
- No need of icebreaker assistance to port of Tallinn



Sentinel-3 image of Estonian coast from 12.03.2023

What have changed since last BSIM?(2018)

State of 2018 (Problems)	State of 2023 (Solutions)
SAR images were not available in near real-time (1-2 days old images)	Processed SAR data is available operationally (5 hours after sensing time). Data processing is done at national satelliite data center ESTHub.
Only few manual observations(6 stations)	4 observation stations (-2), irregular volunteer observations from ESTEA's mobile app Ilm+, use of ice thickness observations from Rescue Service.
Ice charting tool was Adobe Illustrator / from March of 2018 first steps with QGIS ice chart plugin	New ice charting system has been developed: QGIS ice chart drawing tool, containing many layers of different satellite data and other ice information. Public icechart web-application.

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Thank you!

Appendix 5. National report Finland

28th Baltic Sea ice meeting - September 13th -15th, 2023 - Tallinn, Estonia

National Report

Finnish Meteorological Institute
ICE SERVICE

Staff at The FMI Oceanographic Services






Patrick Eriksson	**Aleksi Arola**	**Anni Jokiniemi**	**Elisa Lindgren**	**Niko Tollman**	**Jouni Vainio**
Head of Group, Ice Expert	Ice Analyst	Oceanographer	Oceanographer	Meteorologist	Senior Ice Expert

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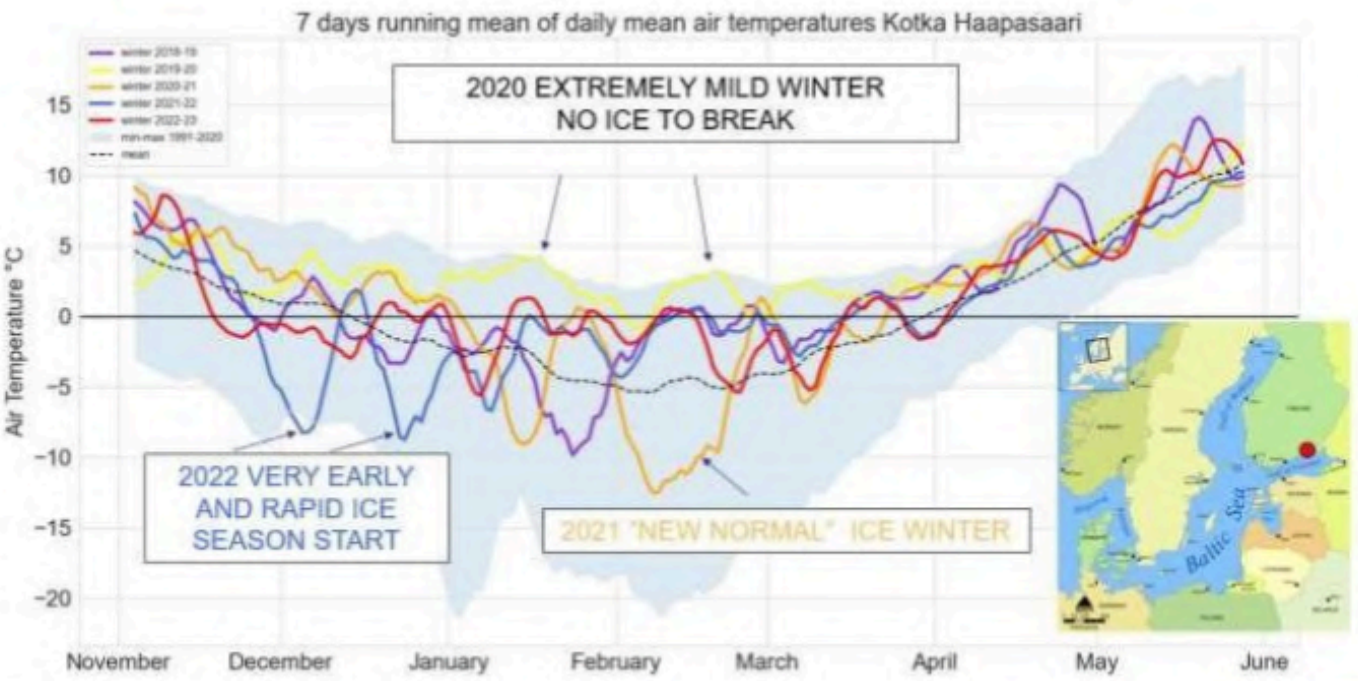
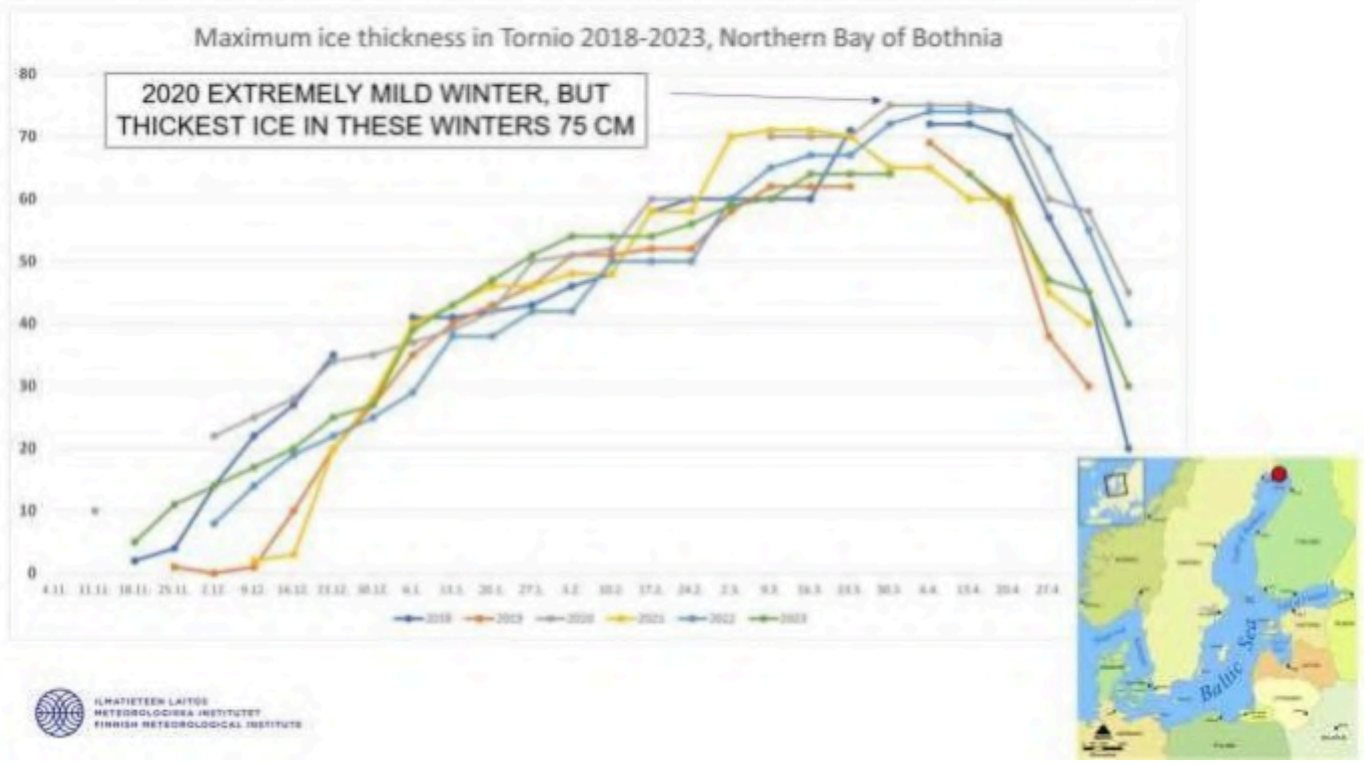
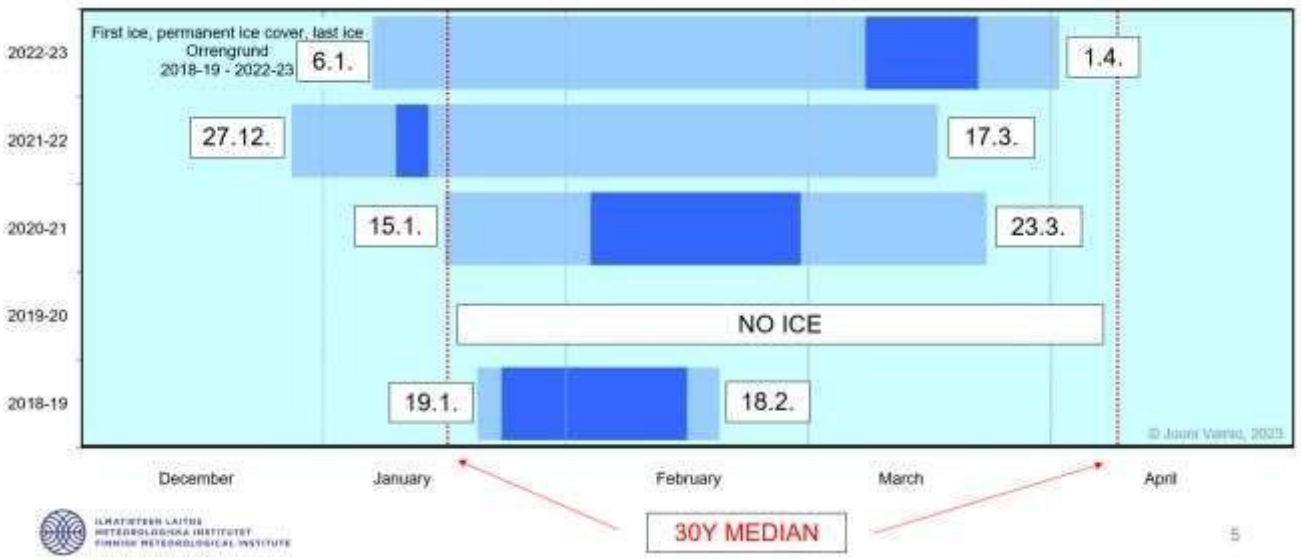
ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

A few interesting indicators from the winters 2018/19 – 2022/23

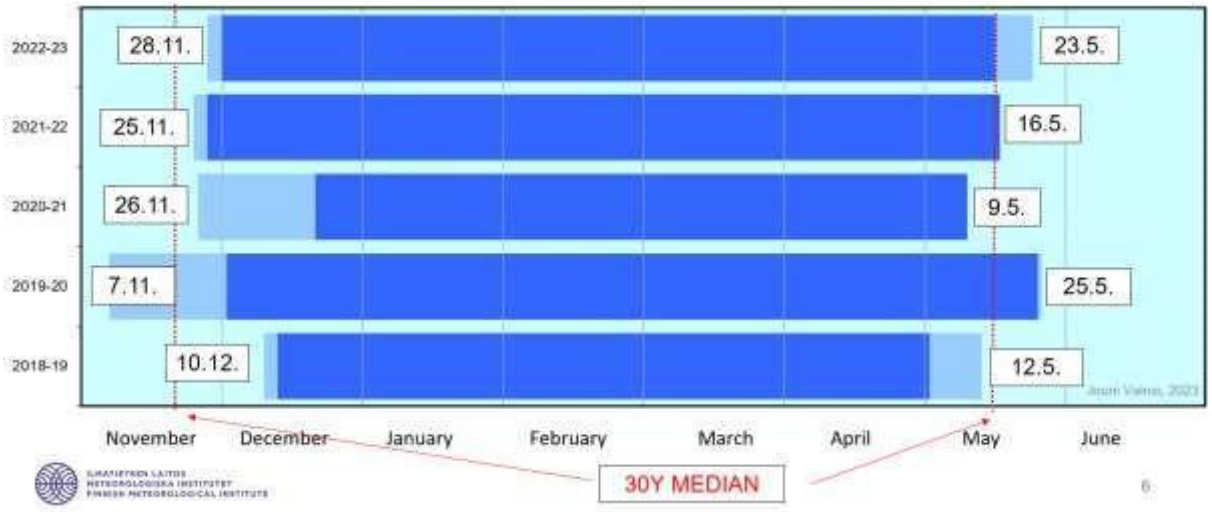




Ice season dates in Kotka, Eastern Gulf of Finland



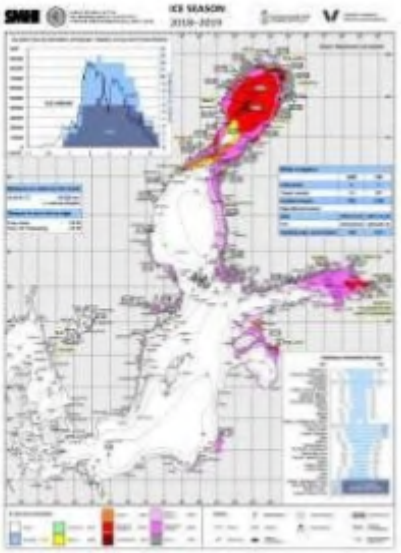
Ice season dates in Kemi, Northern Bay of Bothnia



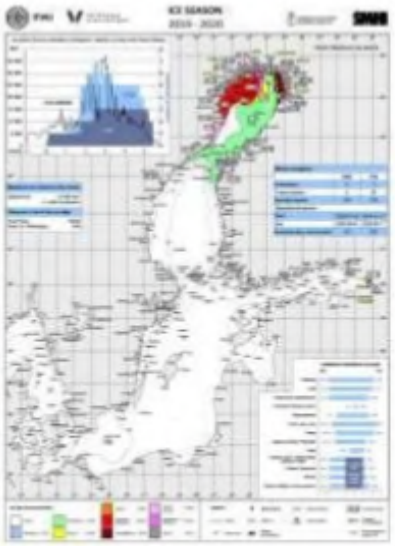
Ice Season summary charts

(Each winter's heading is a link to the ice season summary on the FMI pages (the two first ones in Finnish only).)

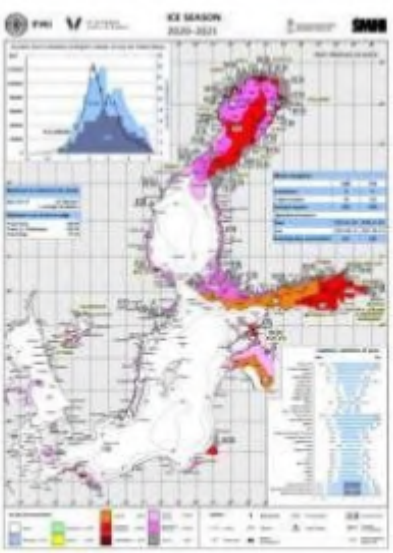
Ice Season 2018/19



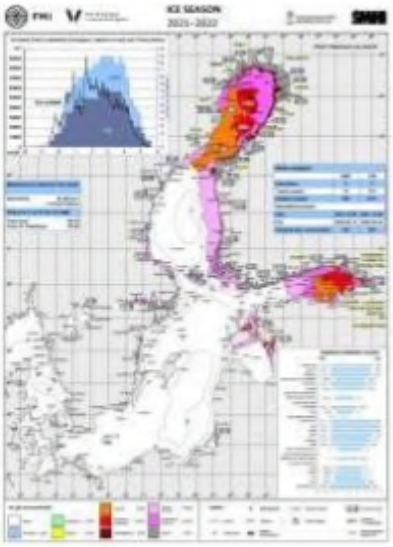
Ice Season 2019/2020



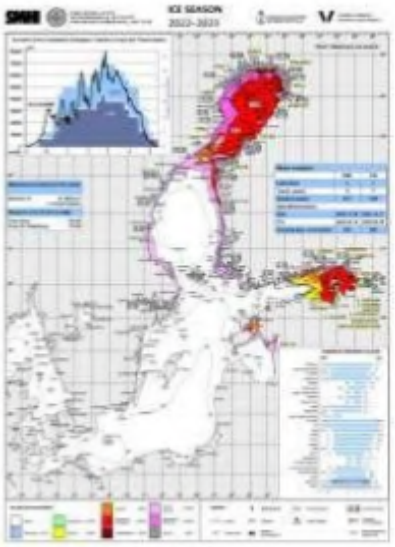
Ice Season 2020/2021



Ice Season 2021/2022



Ice Season 2022/2023



Appendix 6. National report Sweden

SMHI

Oskar

Anna

ICE SERVICE SWEDEN

Contact: ice@smhi.se

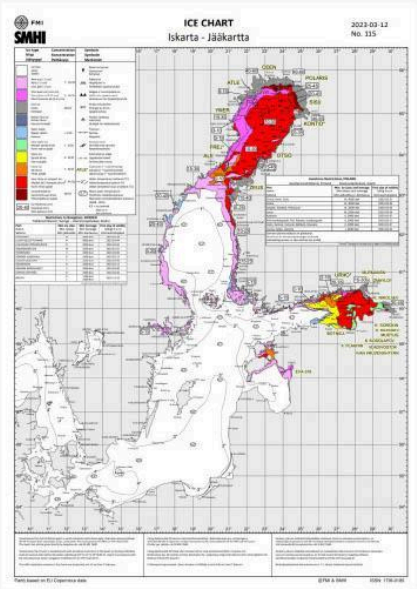
Jörgen

Magnus

Main product

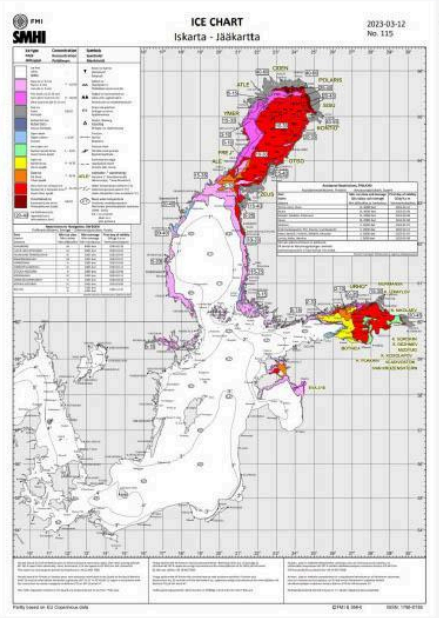
SMHI

- Produce in turns with the Finnish ice service (FMI)
  - Produced daily
- Chart the entire Baltic Sea (and more)
  - Ice & Sea Surface Temperature
- Serves as a basis for navigation assistance restrictions (FTIA, SMA)
- Archive from 1957



Side product

- Based on the ice conditions visible in the ice chart we produce:
  - A written ice report
  - Baltic Sea Ice Code (Swe ports)
- Digital database containing ice conditions from 1979 onward

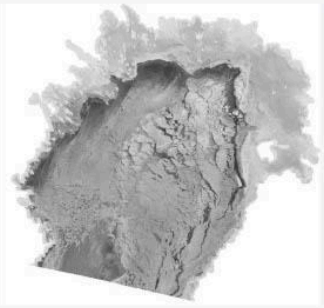


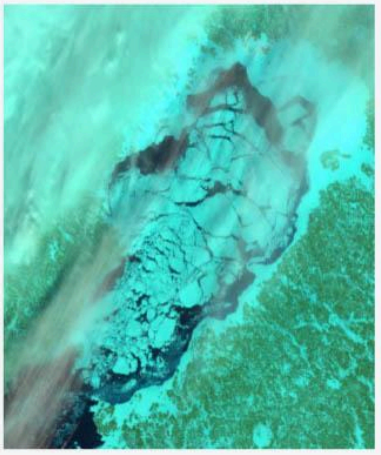
SMHI

Currently...

SMHI

- Currently charting using ArcGIS, a system developed in collaboration with FMI
  - A replacement is under development
- Manual analysis of satellite data
  - SAR
  - Optical images





Currently...

SMHI

- Currently charting using ArcGIS, a system developed in collaboration with FMI
  - A replacement is under development
- Manual analysis of satellite data
  - SAR
  - Optical images
- In situ data
  - Reports from ice breakers
  - From private individuals

Progress and activities during the intersessional period

SMHI

- Development of new system for chart production
  - Based on QGIS instead of ArcGIS, will hopefully be ready during this season
- New web-based tool for text production
  - Ice reports and restrictions for maritime traffic

Strategic focus/priorities for the service

SMHI

- Currently moving towards open source tools
- More robust/secure production
- Less forecasts – more focus on ice chart product
- Working with ice data assimilation for our ocean models (RnD and operational activities)

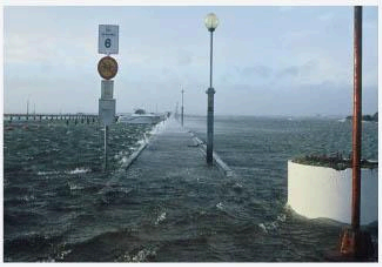
Other duties

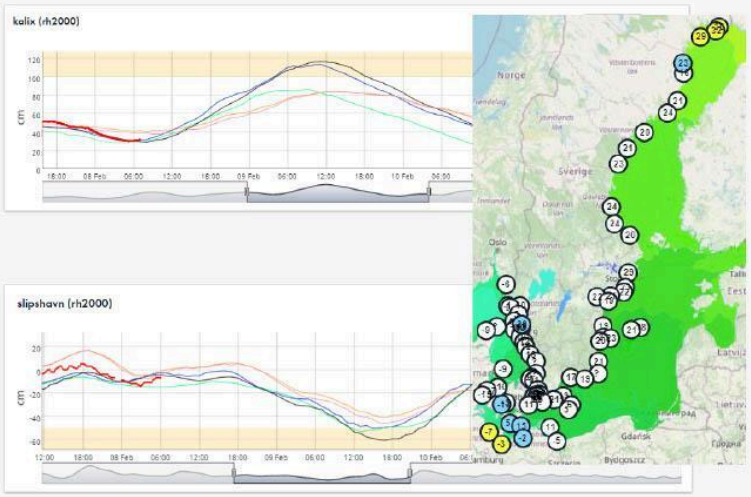
SMHI

- Consultance, analysis, surveys, statistics used in:
  - Planning of wind parks
  - Port construction/rebuilding
- Any question about current ice situation
  - Media
  - Public
  - Articles
  - Social media

Other other duties

SMHI





Appendix 7. National report Poland

Polish National Ice Service – Report

Anna Kubicka, Alicja Olszewska

anna.kubicka@imgw.pl, alicja.olszewska@imgw.pl

Tasks:

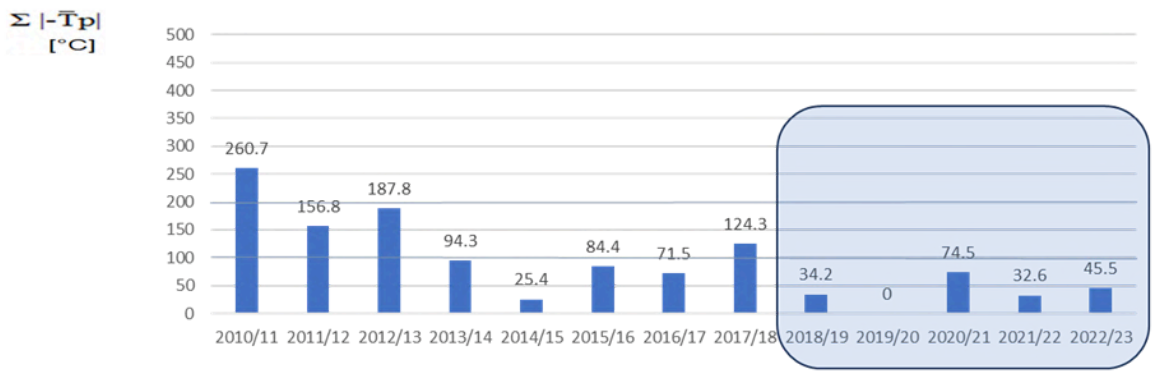
1. Sea Ice monitoring
2. Sea Ice observations
3. Data verification
4. Data distribution
5. Ice conditions analysis

Products:

1. Ice Bulletin
2. Polish Ice Report
3. Baltic Sea Ice Chart
4. Polish Coast Ice Chart
5. Ice Season Summary

Winter season 2018/2019-2022/2023 – summary

On the graph are shown totals of negative daily mean temperatures, the sum of coldness, on the Polish Coast from the year 2010 until now, there is noticeable negative trend.



In the last couple of years winters were mild and very mild. In season 2019/2020 even extremely mild. Days with observed ice varied with maximum in 2020/21 where there were 47 days with ice. During season 2019/2020 there was no ice observed.

Coldest months, at the beginning of shown period, were mainly in January and February, but in the last two winter seasons it was December.

Ice seasons started mostly in December and the end of the seasons varied. The longest season in this period was the last one, which ended in March, although there were less days with ice than in season 2020/2021.

Ice Season	Severity	Days with ice	Coldest month	First Ice/Last Ice
2018/2019	very mild	33	January	1.12./13.02.
2019/2020	very mild	0	No negative temperatures	No ice
2020/2021	mild	47	January, February	16.01/03.03.
2021/2022	very mild	16	December	28.12/18.01.
2022/2023	mild	24	December	09.12./09.03.

Over open waters of Polish Coast there was no ice, only in season 2020/21 there was a short period were ice appeared over shallow waters of Pomorska Bay, which is in west part of our coast. It was mainly open ice and open water.

Every year we had ice on Polish inner waters: The Szczecin Lagoon, the Vistula Lagoon and the Bay of Puck with the exception in season 2019/20 when there was no ice at all. In the area of Vistula Lagoon this happened for the first time since the beginning of observations in 1946.

Last winter season: 2022/2023

Last winter season ice appeared in the inner waters but no ice was observed in the open sea.

Mean monthly temperatures were mostly positive and above the monthly average of period 1961-1990. Winter was classified as warm. Only December, especially in northern Poland was classified as cold.

Monthly mean air temperatures in winter 2022/23 and deviation from the means 1961-1990

Month	Hel		Kołobrzeg	
	Monthly average 2022/23	Deviation	Monthly average 2022/23	Deviation
XI	6,2	1,4	5,8	1,1
XII	1,6	0,3	0,8	-0,2
I	3,6	4,4	3,9	4,7
II	2,6	3,2	2,8	3,0
III	3,6	1,9	4,6	2,1

Ice occurred in the first half of December and shortly later disappeared around 23rd of December. Over Vistula Lagoon there were single days with small amount of ice in February and March.

Area	First ice	Last Ice
The Vistula Lagoon	9.12.	09.03.
The Puck Bay	11.12.	23.12.
The Szczecin Lagoon	15.12.	23.12.

In season 2022/23 IMGW-PIB developed and released the following products informing about the ice situation on the Polish Baltic coast:

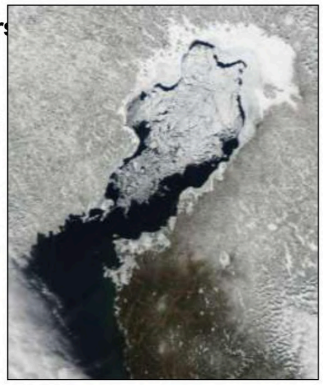
- 0 Polish Ice Report
- 25 General Baltic Sea Ice charts (once a week)
- 0 Polish Baltic Coast Ice charts
- 51 Ice Bulletins (twice a week).

Appendix 8. National report Germany

Ice service and Baltic sea level service at the German federal maritime agency (BSH)

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

7 Staff members
J. Holfort
W. Aldenhoff
I. Perlet-Markus
B. Weidig
M. Kirchhoff
K. Dobrzynski
D. Melchert



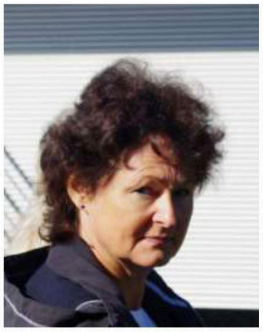
ice@bsh.de
Wvd.rostock@bsh.de
Antarktis@bsh.de

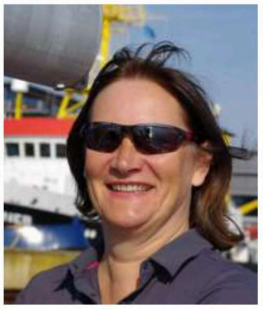
1

Ice service and Baltic sea level service at the German federal maritime agency (BSH)

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

7 Mitarbeiter
J. Holfort
W. Aldenhoff
I. Perlet-Markus
B. Weidig
M. Kirchhoff
K. Dobrzynski
D. Melchert





2

Where are we located within the marine science department

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

M 1 3100	M 2 3200	M 3 3300	M 4	M 5 3500
Forecasting Services Dr. Jennifer Brauch	Ocean Physics and Climate Dr. Kerstin Jochumsen	Marine Chemistry Laboratory – Shipping and Enviroment Dr. Berit Brockmeyer	National Noise Registry and Physical Moni-toring of Marine Installations Dr. Manfred Zeiler	Science Management and Communication Dr. Stefan Schmolke
M 11 3110 Tidal Information, Water Level Forecast and Storm Surge Warning Services North Sea Karina Stockmann	M 21 3210 Marine Climate Dr. Tim Kruschke	M 31 3310 Chemical Oceanography Annika Grage	M 41 National Noise Registry N.N.	
M 12* 782* Ice Service and Water Level Forecast Service for the Baltic Sea Dr. Jürgen Holfort	M 22 3220 Oceanographic Assessments Dr. Dagmar Kieke	M 32 3325 Marine Radioactivity – IMIS Federal Coordinating Office N.N	M 42 Physical Monitoring of Marine Installations Thomas Jahnke	
M 13 3133 Operational Modeling Thorger Brüning	M 23 3230 Mobile and stationary Measurements Kai Herklotz	M 33 3330 Marine Sediments Dr. Torben Kirchgeorg		
M 14 3100 Remote Sensing and Copernicus N.N.	M 24 3240 Marine Technics Thomas Diercks	M 34 3340 Environmentally Hazardous Substances Dr. Simone Hasenbein		

Next the full BSH view =>

Organisation chart of the Federal Maritime and Hydrographic Agency (BSH)

March 1, 2023

P — President

Helge Heegewaldt

Vice-President: Rainer Fröhlich

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Chief Privacy Officer Jürgen Ballnus	Information Security Officer Gerds Roesberg	Contact Person for the Prevention of Corruption Jürgen Ballnus	Security Officer Christoph Merkel	Sabotage Protection Officer Christoph Merkel	Hamburg: Rainer Fröhlich Rostock: Thomas Dehling

M Marine Sciences	N* Nautical Hydrography	O Management of the Sea	S Maritime Shipping	Z Central Services
N.N.	 Thomas Dehling	 Dr. Nico Nolte	 Jörg Kaufmann	 Rainer Fröhlich
M 1 Forecasting Services Dr. Jennifer Brauch	N 1* Marine Geodesy, Hydrographic Surveying and Wreck Search Cindy Niemeyer	O 1 Spatial Planning Dr. Kai Trümpler	S 1 Law of the Flag, Certification of Mariners, Subsidies for Maritime Shipping Stefanie Kärtner	Z 1 Legal Matters, Procurement, Compliance Marion Hinrichs
M 2 Ocean Physics and Climate Dr. Kerstin Jochumsen	N 2* Nautical Information Service Jens Schröder-Fürstenberg	O 2 Preliminary Investigation of Sites Karin Schröder	S 2 Tonnage Measurement, Individual Surveys and Monitoring, "DeuMarDa", Market Surveillance Kai-Jens Schulz-Reifer	Z 2 Budget, Human Resource and Personnel Management, Personnel Development Christiane Wilken
M 3 Marine Chemistry Laboratory – Shipping and Environment Dr. Berit Brockmeyer	N 3 Ships and Equipment Kai-Oliver Twest	O 3 Offshore Projects Janine Sänger-Graef	S 3 Navigation and Communication Systems Doreen Thoma	Z 4 Strategy, Organization Wulf Evers
M 4 National Noise Registry and Physical Monitoring of Marine Installations Dr. Manfred Zeiler	N 4* Graphic Technology Stefan Schaumlöffel	O 4 Environmental Assessments and Monitoring N.N.	S 4 Environmental Protection in Maritime Traffic, Maritime Security, other Legal Matters of the Department Carolin Abromeit	Z 5 Inner Services Birgith Kliemke
M 5 Science Management and Communication Dr. Stefan Schmolke				

MDZ
Maritime Data Center BSH Jörg Gerdes**
MDZ 1 Control Jörg Gerdes (temporarily)
MDZ 2 Design Natalia Shevchenko
MDZ 3 Provision Torsten Menne

* Office Rostock
** Temporality charged with the conduct of affairs

General Staff Council
Heike Schlesinger

Staff Council Hamburg
Carsten Brügmann

Staff Council Rostock
Helge Gamm

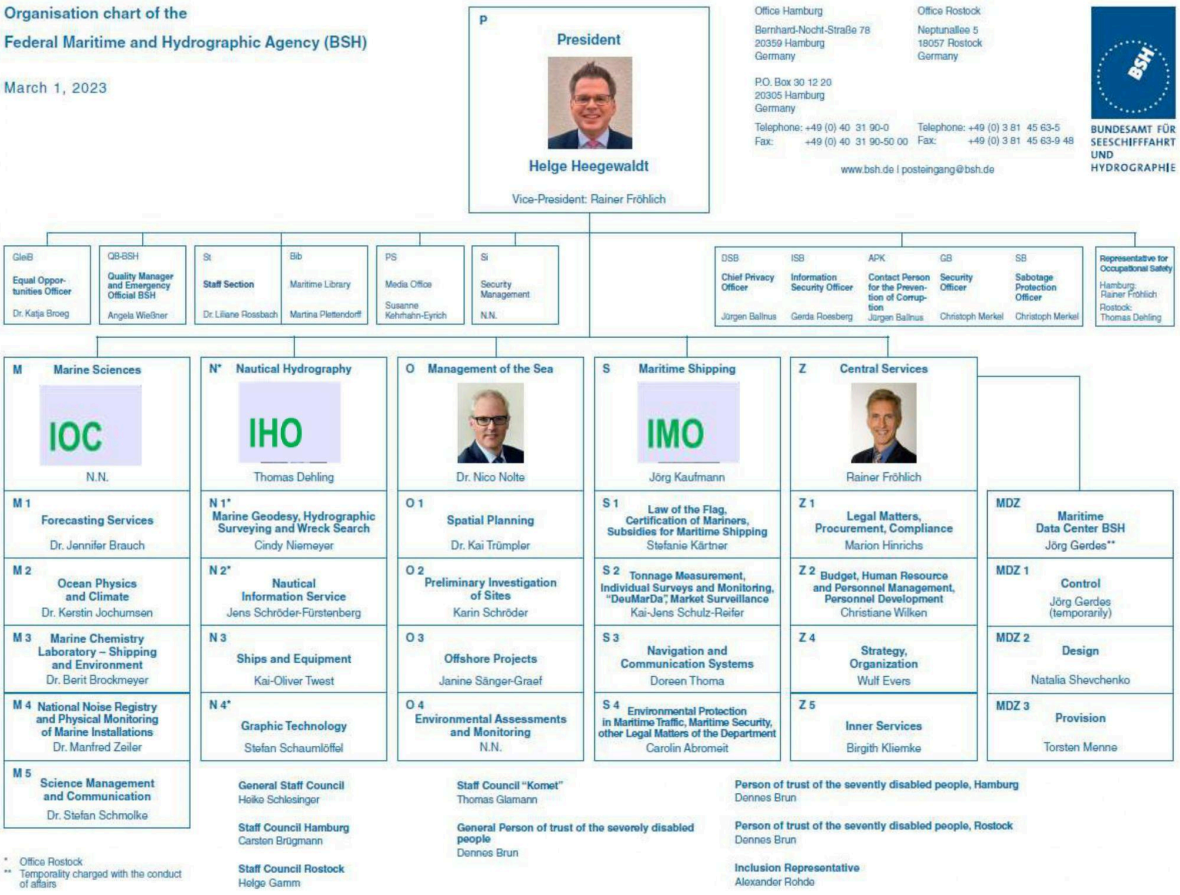
Staff Council "Komet"
Thomas Glamann

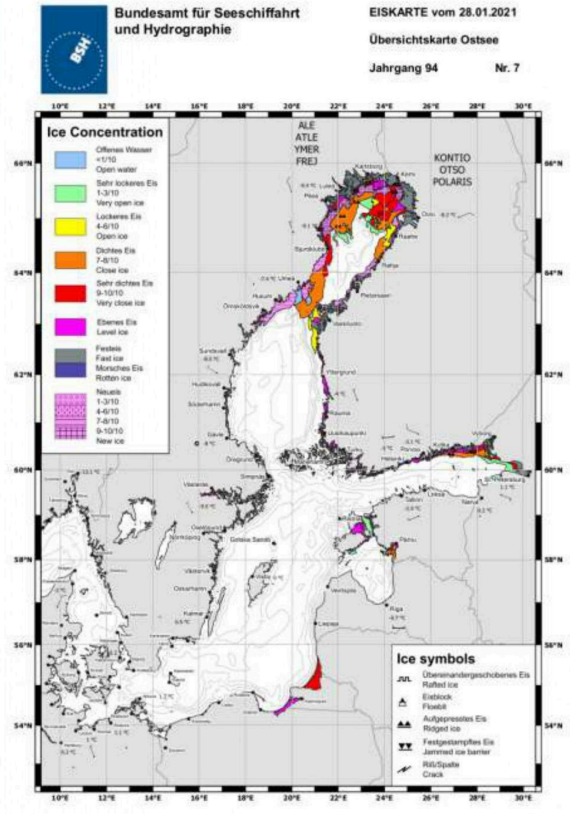
General Person of trust of the severely disabled people
Dennes Brun

Person of trust of the seventy disabled people, Hamburg
Dennes Brun

Person of trust of the seventy disabled people, Rostock
Dennes Brun

Inclusion Representative
Alexander Rohde





Ice service

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Task

- Sea ice advice worldwide for German shipping.
- Regular ice products

  Different reports (e.G. Wochenbericht, Amtsblatt, German Ice Report) and ice charts.

  With heavier ice at german coasts working 7 days a week.
- Analysis / Climatologies

  Season reports, 2 atlases
- Antarctic permits

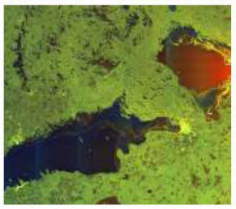
Baltic sea ice concentration 28.01.2021
done using QGIS

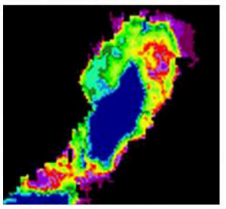
6

Ice service

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Since 1897 ice observers report ice condition along the German coast.
We work with many satellite data (optical, passive and active microwave)



Cooperation with DLR for direct satellite data delivery (M12/M14), but also web interfaces.

Main satellite systems:

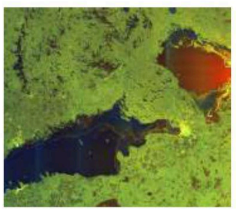
- Sentinel-1
- Sentinel-3
- RCM (over a vetted user account)
- MODIS
- AMSR
- METEOSAT (also over Ninjo)

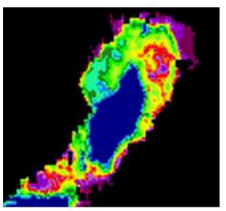
7

Ice service

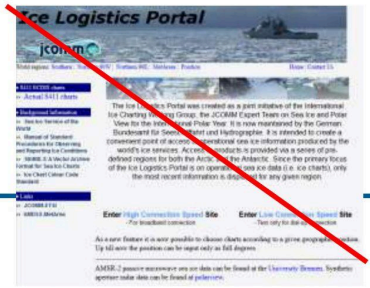
BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

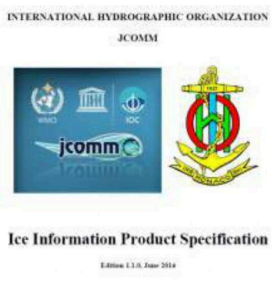
Since 1897 ice observers report ice condition along the German coast.
We work with many satellite data (optical, passive and active microwave)



Strong international Cooperation (IICWG, BSIM, IOC/WMO, IHO, IMO, Arctic council, ATCM ..). We are hosting the website of the Baltic Sea Ice Services (and the ice logistics portal). We work on the IHO-WMO S-411 specification for ice in ECDIS.

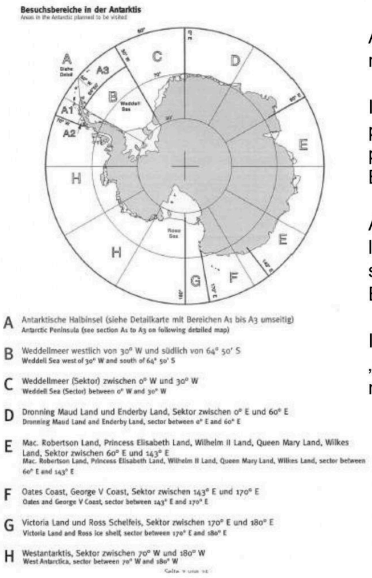




8

Permits for Antarctica

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE



A Antarktische Halbinsel (siehe Detailkarte mit Bereichen A1 bis A3 umseitig)
Antarctic Peninsula (see section A1 to A3 on following detailed map)

B Weddellmeer westlich von 30° W und südlich von 64° 50' S
Weddell Sea west of 30° W and south of 64° 50' S

C Weddellmeer (Sektor) zwischen 0° W und 30° W
Weddell Sea (Sector) between 0° W and 30° W

D Dronning Maud Land und Enderby Land, Sektor zwischen 0° E und 60° E
Dronning Maud Land and Enderby Land, sector between 0° E and 60° E

E Mac. Robertson Land, Princess Elisabeth Land, Wilhelm II Land, Queen Mary Land, Wilkes Land, Sektor zwischen 60° E und 143° E
Mac. Robertson Land, Princess Elisabeth Land, Wilhelm II Land, Queen Mary Land, Wilkes Land, sector between 60° E and 143° E

F Oates Coast, George V Coast, Sektor zwischen 143° E und 170° E
Oates and George V Coast, sector between 143° E and 170° E

G Victoria Land und Ross Schelfeis, Sektor zwischen 170° E und 180° E
Victoria Land and Ross ice shelf, sector between 170° E and 180° E

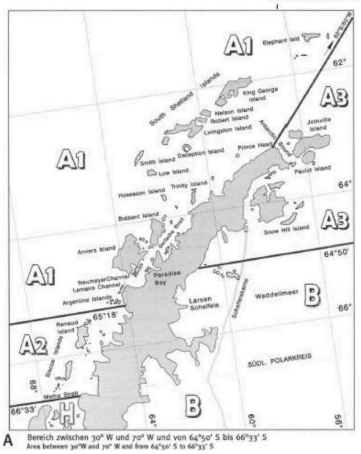
H Westantarktis, Sektor zwischen 70° W und 180° W
West Antarctica, sector between 70° W and 180° W

All persons entering Antarctica need a permit.

In Germany the environmental protection agency (UBA) gives this permits, but if a ship is involved the BSH must be involved.

At the BSH the ice service is the lead responsible (involving also the shipping department).
Email: antarktis@bsh.de

If there are incidents on or involving „German“ ships the BSH has to be notified immediately.



A Bereich zwischen 30° W und 70° W und von 64°50' S bis 66°33' S
Area between 30°W and 70° W and from 64°50' S to 66°33' S

A1 Bereich westlich der Halbinsel zwischen 65°18' S und westlich der Linie von Prince Head bis 60° S/50° W (d.h. einschließlich Elephant Island und Clarence Island)
Area west of the peninsula between 65°18' S and west of the line from Prince Head to 60° S/50° W (i.e. including Elephant Island and Clarence Island)

A2 Bereich westlich der Halbinsel bis 70° W und zwischen 65°18' S und 66°33' S
Area west of the peninsula to 70° W and between 65°18' S and 66°33' S

A3 Bereich östlich der Linie von Prince Head bis 60° S/50° W, westlich von 30° W und nördlich von 64°50' S (d.h. einschließlich Snow Hill Island und South Orkney Islands)
Area east of the line from Prince Head to 60° S/50° W, west of 30° W and north of 64°50' S (i.e. including Snow Hill Island and South Orkney Islands)

Ongoing and future work

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Better user interface to the sea ice database, involvement of other ice services

Improvements using automatic satellite classification for ice chart production (together with DLR and M14)

S411 new version and update sea ice objects catalog

Update climatological atlases from 1960-2010 to 1960-2020

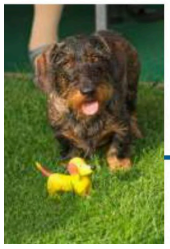
Together with the modelling section improve the sea ice modelling and include data assimilation (so in the far future we have prognosis charts)

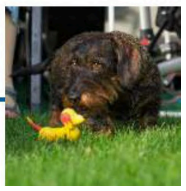
And the continuous work of smaller and larger improvements, finding and teaching new ice observers, trying to include more sea ice parameters, ……

Main working tools (using Windows and Linux): python, qgis

Thanks

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE





Appendix 9. National report Lithuania

Lietuvos hidrometeorologijos tarnyba

Baltic Sea Ice observations in Lithuania

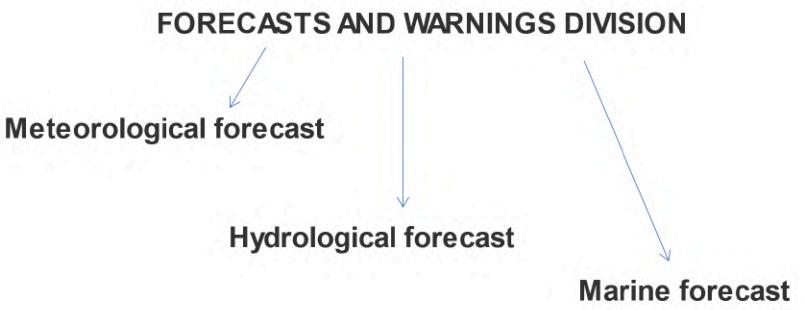
Giedrė Andruškienė
Senior Specialist of Forecasts and Warnings Division

Janina BrastovickytėStankevič
Chief Specialist of Forecasts and Warnings Division

2023-09-13

Lithuanian Hydrometeorological Service

Lietuvos hidrometeorologijos tarnyba



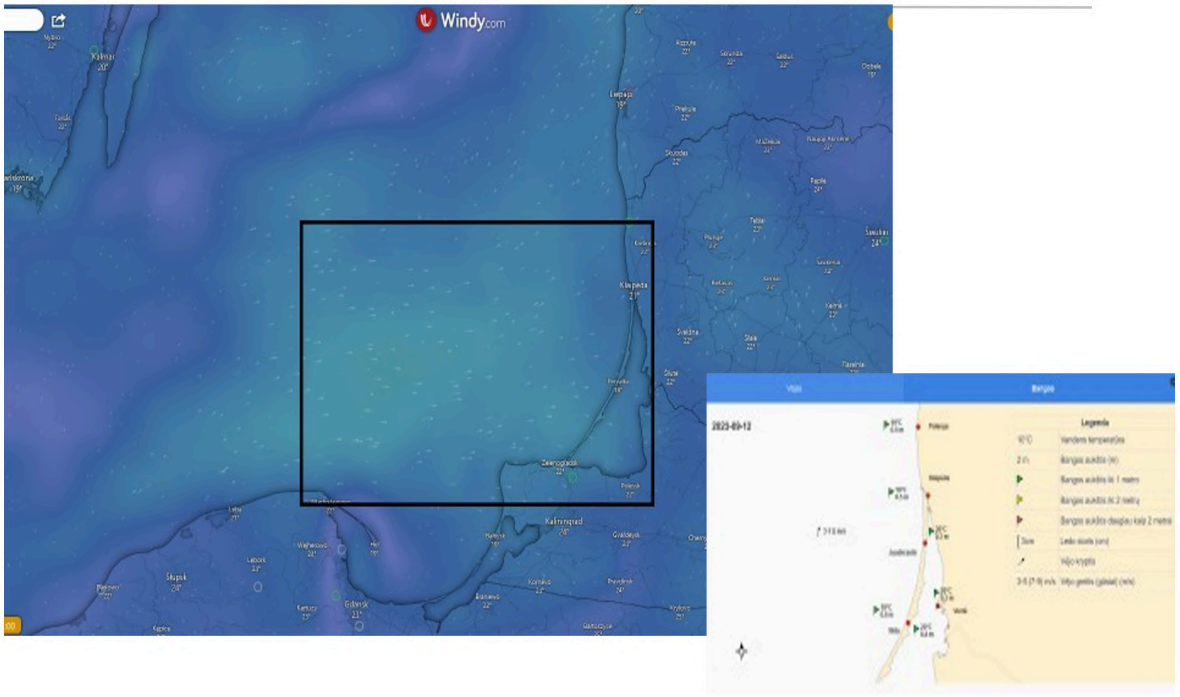
Marine forecasts

Lietuvos hidrometeorologijos tarnyba

- Water temperature in Southeastern Baltic and Curonian lagoon
- Water waves in Southearn Baltic and Curonian lagoon
- Water level in Klaipėdos harbour
- Warnings
- In winter Baltic sea ice and Curonian lagoon ice conditions

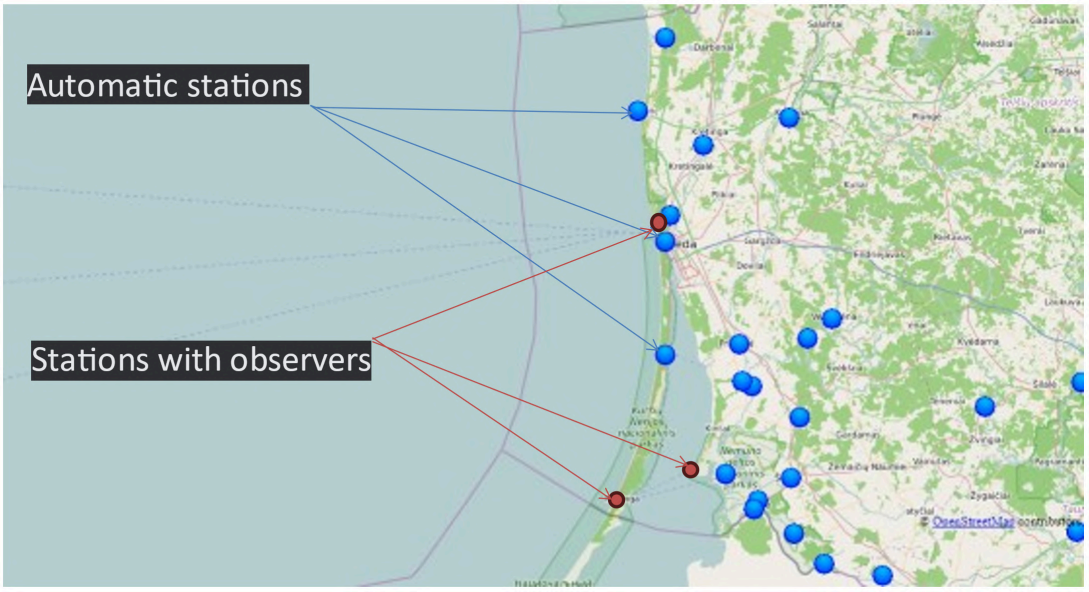
Observed territory

Lietuvos hidrometeorologijos tarnyba



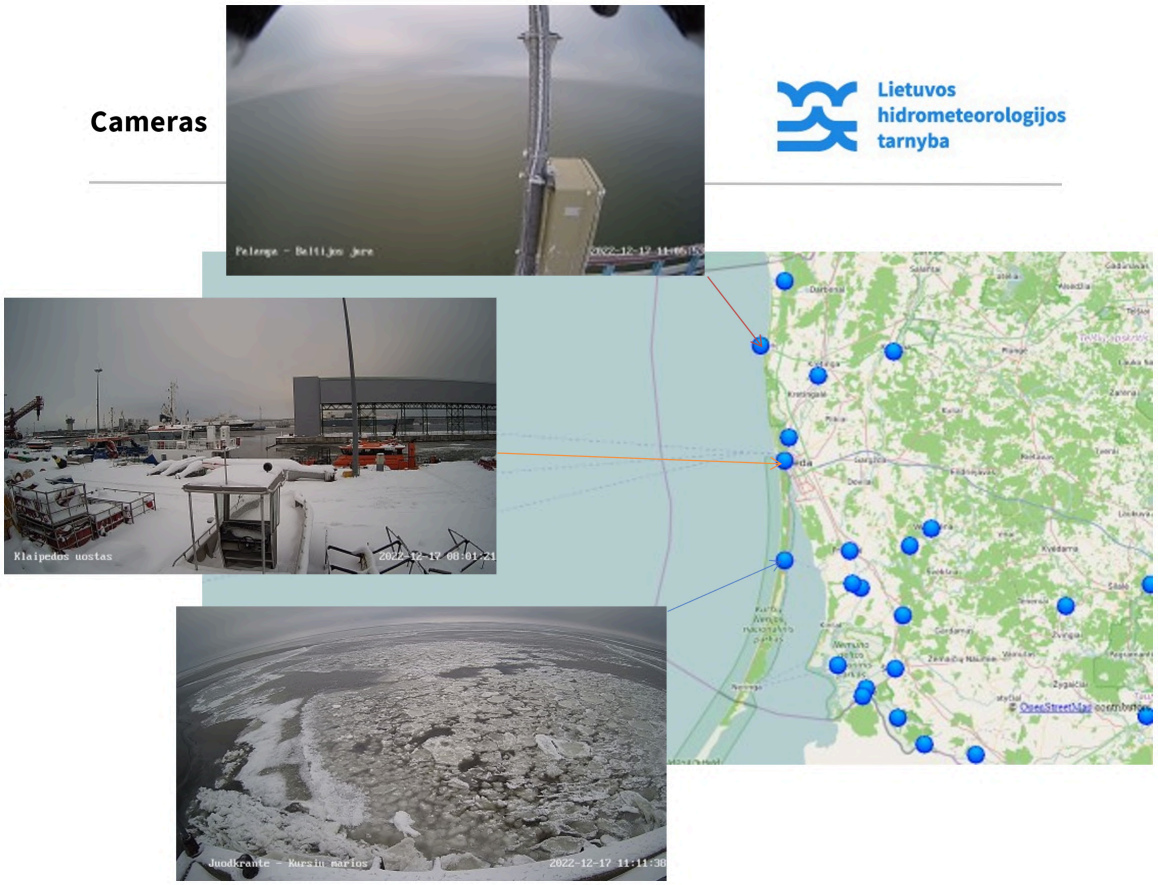
Observations

Lietuvos hidrometeorologijos tarnyba



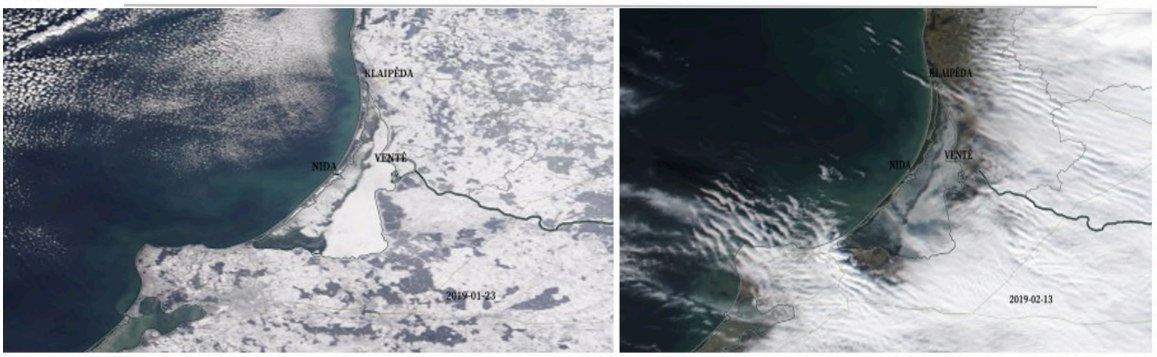
Cameras

Lietuvos hidrometeorologijos tarnyba



Marine Ice: observations and forecasts

Lietuvos hidrometeorologijos tarnyba



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Ice stories???

Lietuvos hidrometeorologijos tarnyba

Gal kada buvo ledas Baltijoje? Nes neradau nieko pas save :o

Thank You!

Baltic sea near Šventoji

Appendix 10. Sea Ice Database at BSH (Jürgen Holfort, BSH)

Sea ice database

Dr. Jürgen Holfort
German ice service
ice@bsh.de

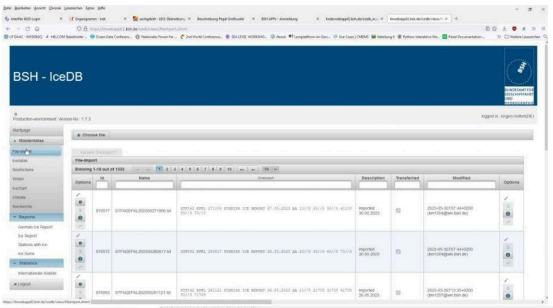
BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

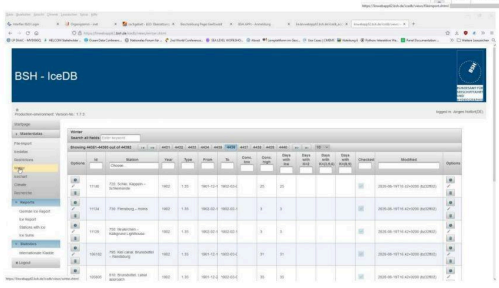
The sea ice database at the BSH

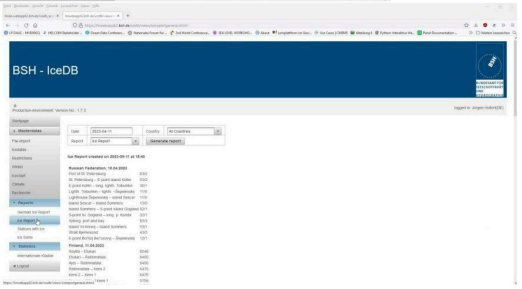
BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Hopefully a nice tool for historical and actual sea ice data in the Baltic.

Open data with read access for the public and read/write access for the ice services.







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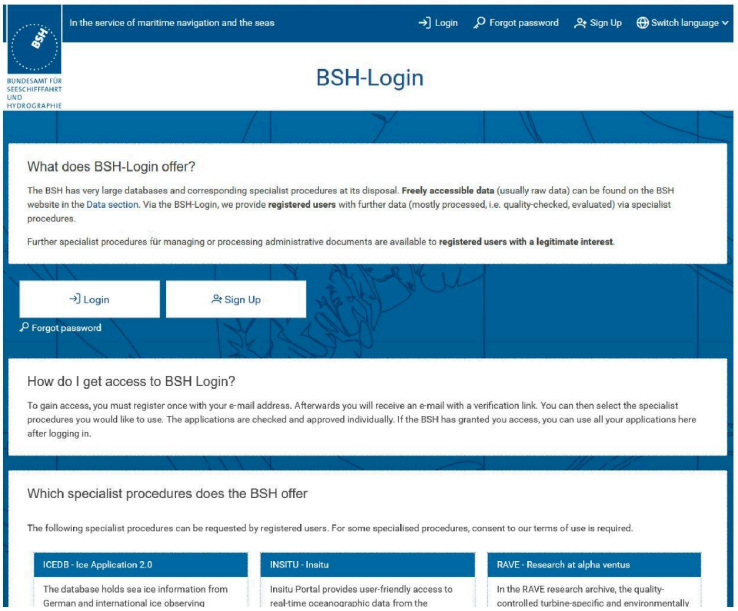

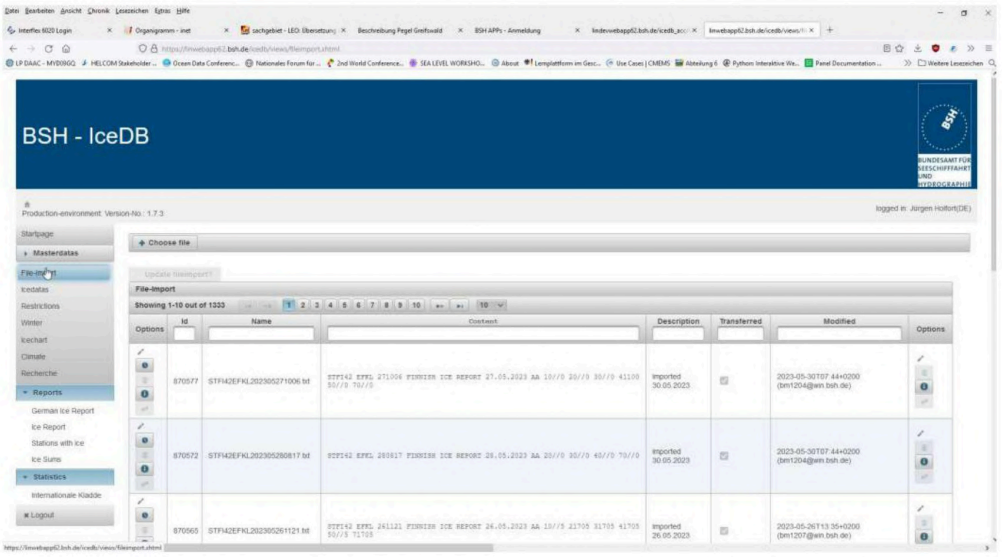

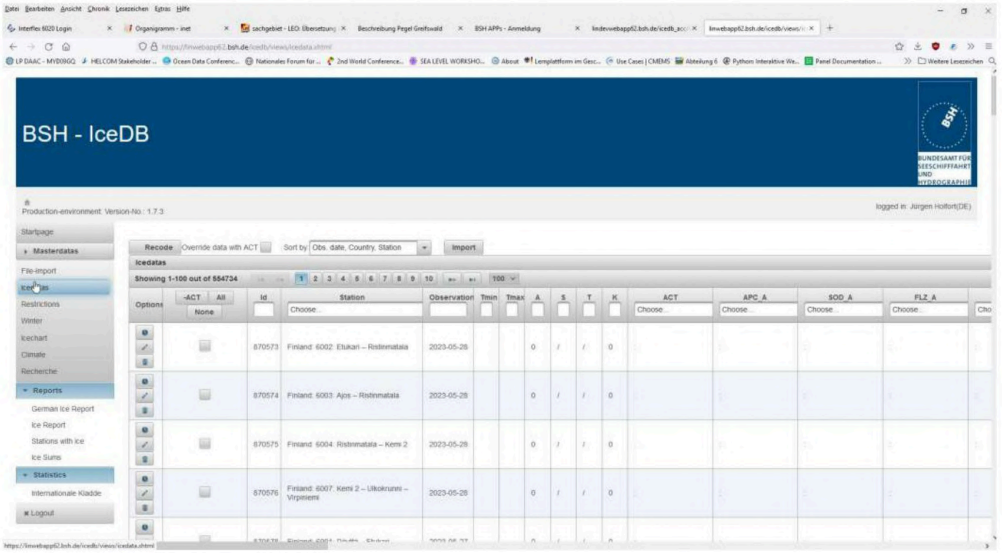
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Masterdatas
File-import
Icedatas
Restrictions
Winter
Icechart
Climate
Recherche
Reports
German Ice Report
Ice Report
Stations with Ice
Ice Sums
Statistics
Internationale Kladde
Logout
Recode
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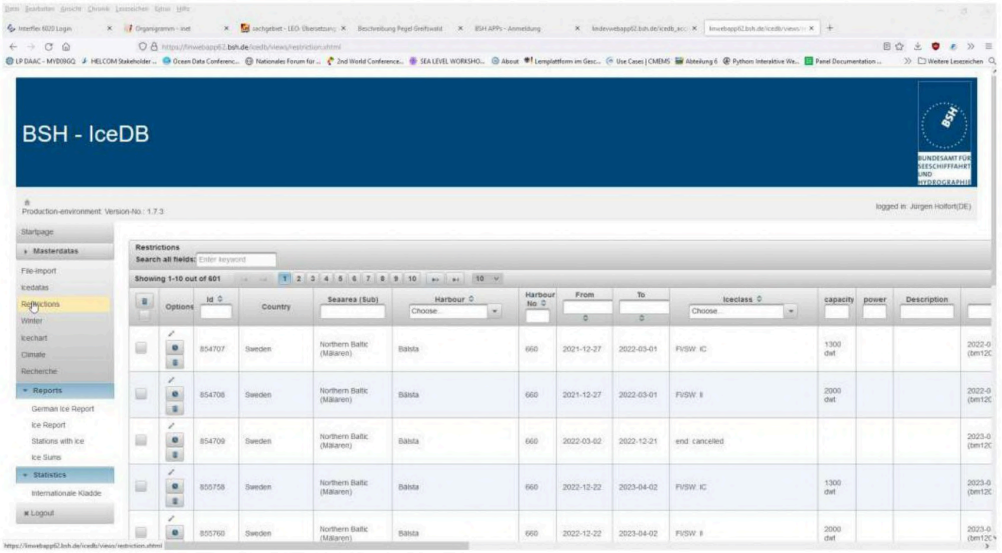
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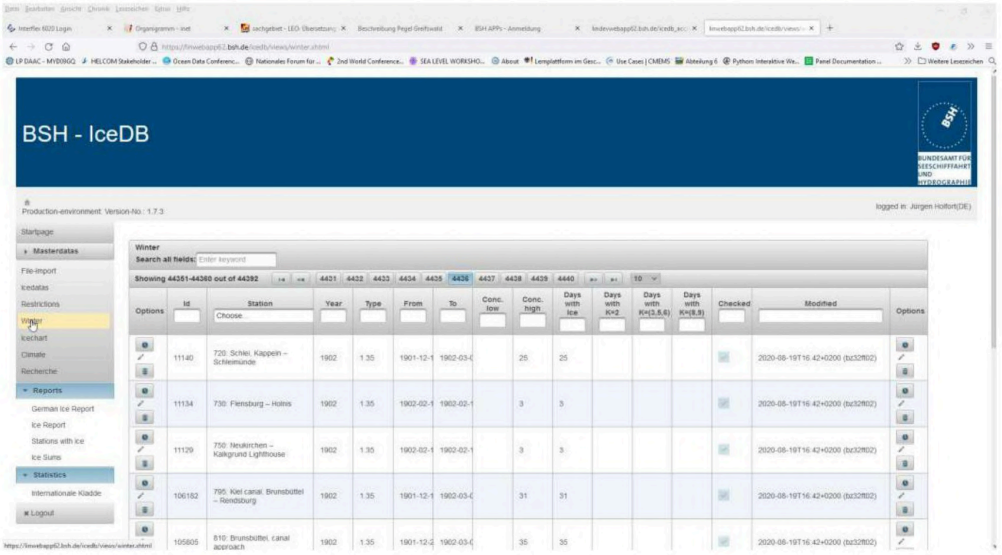
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To
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Conc. high
Days with Ice
Days with K>2
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Days with K>(8,9)
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1902
1.35
25
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750: Neukirchen – Kalkgrund Lighthouse
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810: Brunsbüttel, canal approach
35
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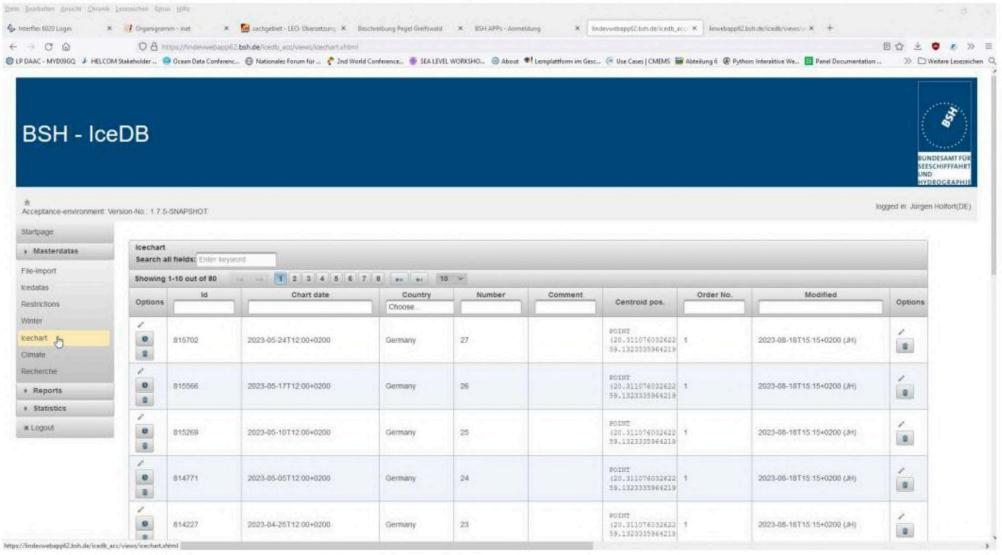
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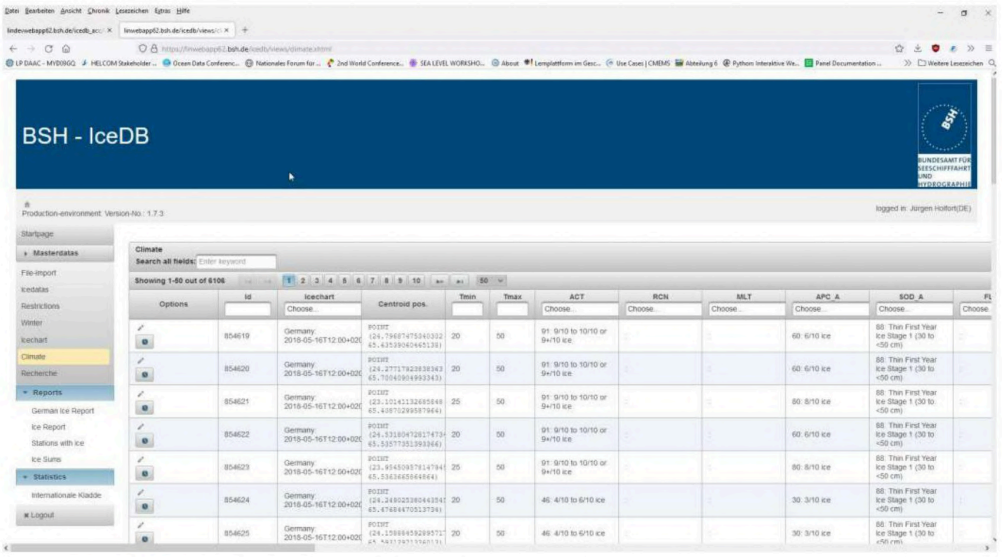
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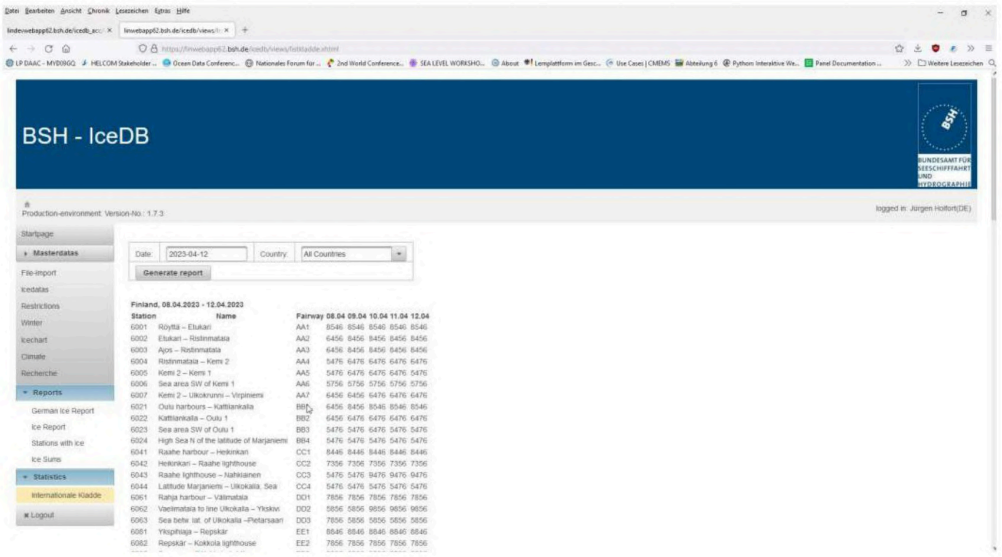
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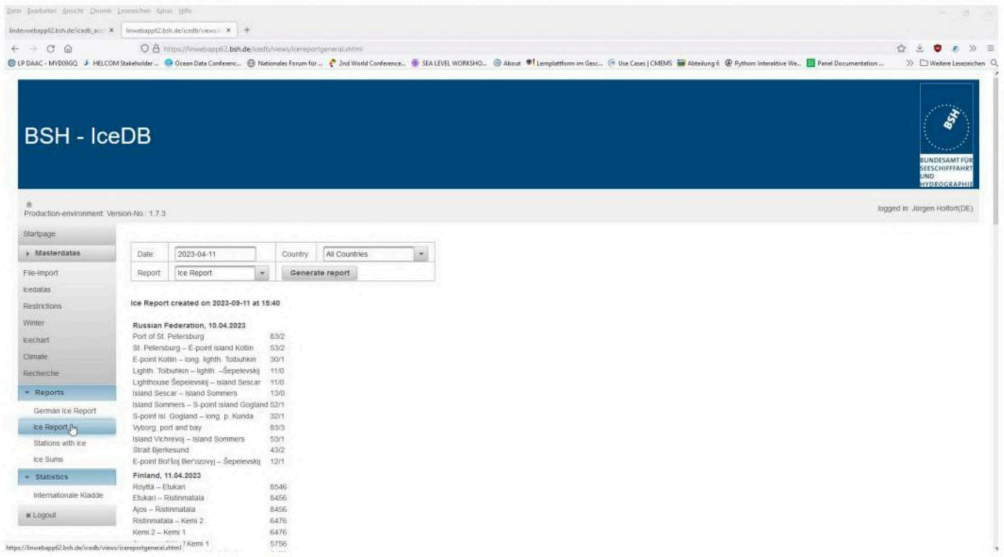
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Climate
Recherche
Reports
German Ice Report
Ice Report
Stations with Ice
Ice Sums
Statistics
Internationale Kladde
Logout
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Country: All Countries
Report: Ice Report
Generate report
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Russian Federation, 10.04.2023
Port of St. Petersburg 63/2
St. Petersburg – E-point island Kotlin 53/2
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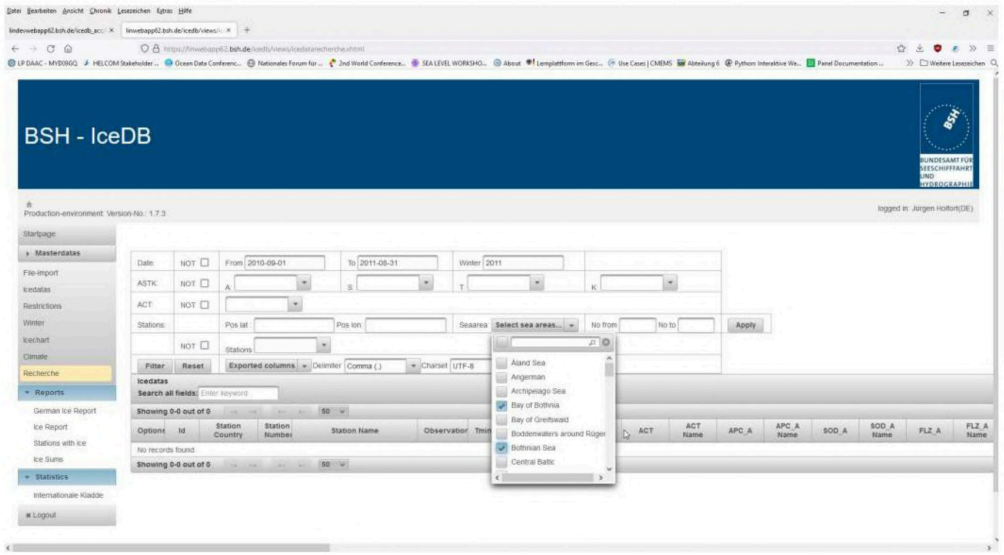
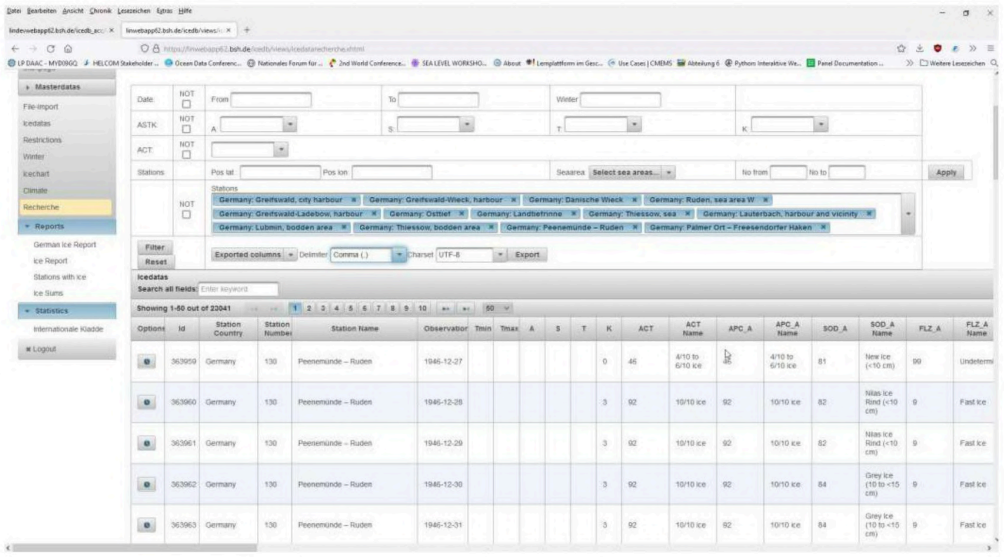
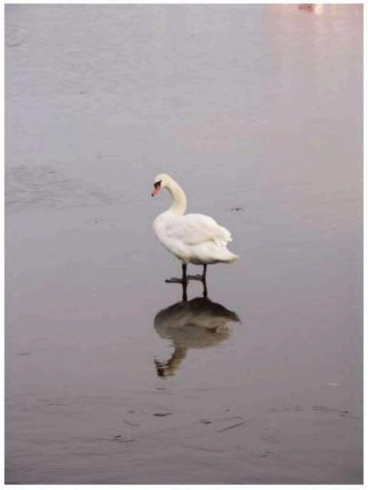
Lighth. Tolbuhkin – lighth. –Sepelevskij 11/0
Lighthouse Šepelevskij – island Sescar 11/0
Island Sescar – island Sommers 13/0
Island Sommers – S-point island Gogland 52/1
S-point isl. Gogland – long. p. Kianda 32/1
Vyborg port and bay 83/3
Island Vichrevoj – Island Sommers 53/1
Strait Bjerkesund 43/2
E-point Bol'šoj Ber'ozovyj – Šepelevskij 12/1
Finland, 11.04.2023
Roylta – Etukari 8546
Etukari – Ristinmatala 8456
Ajos – Ristinmatala 8456
Ristinmatala – Kemi 2 6476
Kemi 2 – Kemi 1 6476
Kemi 1 5756


BSH - IceDB
Production-environment Version-No.: 1.7.3
logged in: Jürgen Holfort(DE)
Startpage
Masterdatas
File-import
Icedatas
Restrictions
Winter
Icechart
Climate
Recherche
Reports
German Ice Report
Ice Report
Stations with Ice
Ice Sums
Statistics
Internationale Kladde
Logout
Date: NOT From 2010-09-01 To 2011-08-31 Winter 2011
ASTK: NOT A S T K
ACT: NOT
Stations: Pos lat Pos lon Seaarea Select sea areas... No from No to Apply
NOT Stations
Filter Reset Exported columns Delimiter Comma (,) Charset UTF-8
Icedatas
Search all fields: Enter keyword
Showing 0-0 out of 0
Options Id Station Country Station Number Station Name Observation Time ACT ACT Name APC_A APC_A Name SOD_A SOD_A Name FLZ_A FLZ_A Name
No records found
Showing 0-0 out of 0
Åland Sea
Angerman
Archipelago Sea
Bay of Bothnia
Bay of Greifswald
Boddenwaters around Rügen
Bothnian Sea
Central Baltic



Many Thanks to all listeners and hopefully future users.



Appendix 11. Presentation about FTIA Winter navigation's new organization with FMI + a short presentation about Baltice.org pages (Tuomas Taivi, FTIA)

28th Baltic Sea Ice Meeting

Finnish Transport Infrastructure Agency

Tuomas Taivi
Mika Nyrhilä
14.9.2023

Julkinen

Väylävirasto
Trafikledsverket

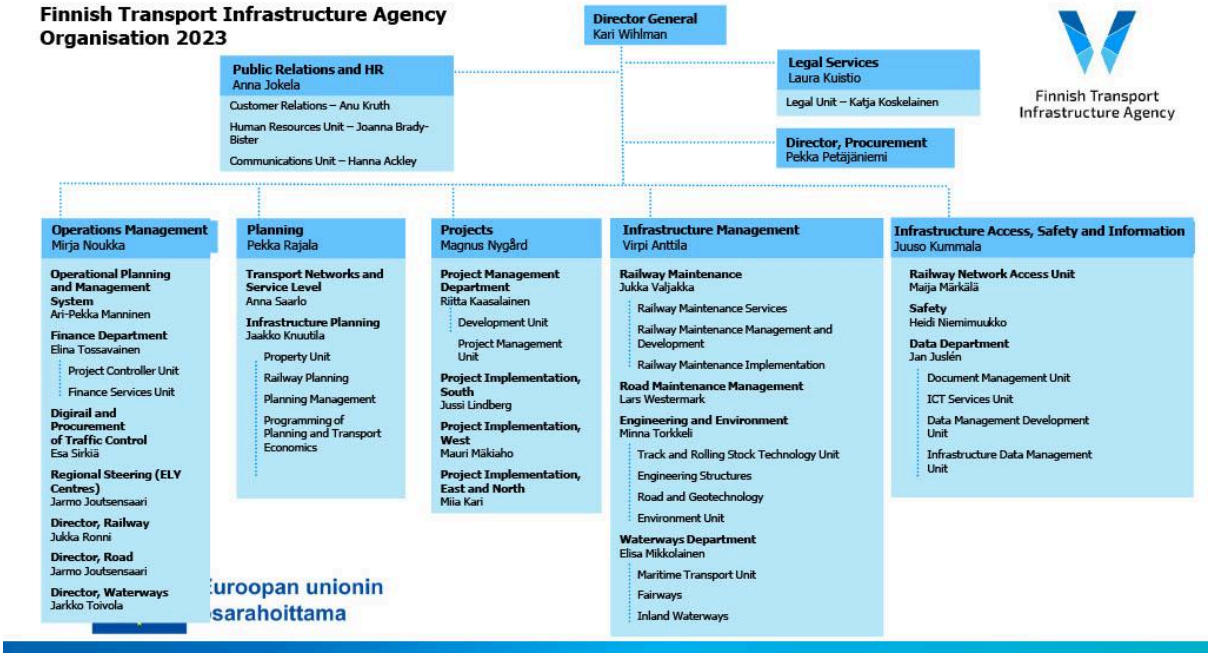
Euroopan unionin osarahoittama

What does the Finnish Transport Infrastructure Agency (FTIA) do?

- We focus on designing, developing, and maintaining road, rail, and maritime transport routes, **being responsible for and arranging winter navigation,** as well as on coordinating transport and land use.
- We strive to ensure that transport networks meet the needs of our citizens and businesses alike – promoting Finland's competitive edge.
- **FTIA**, in cooperation with the ELY Centers, operates as the primary partner of regional councils, municipalities, urban regions, and other operators in the planning of transport systems.
- FTIA is also responsible for organising traffic management services, a service agreement with Fintraffic is in place.
- FTIA operates responsibly by limiting environmental damage.
- FTIA is an expert procurement organisation.

2

Waterways in numbers



Maritime Unit

Finnish Transport Infrastructure Agency

- Head of Unit
  - Helena Orädd
- Maritime specialists
  - Tuomas Taivi
    - Coastal waters
  - Mika Nyrhilä
    - Lake Saimaa, and assiting with coastal waters
  - Lauri Kuuliala
    - Ice classes, wind mill coordinator

Euroopan unionin osarahoittama

5

Finnish Transport Infrastructure Agency

- Responsible for ensuring year-round maritime traffic to and from Finnish ports
- Strategic and operational icebreaking management co-operation with Sweden and Estonia
- Assistance restrictions, based on Finnish Swedish Ice Class Rules

6

Winter navigation system

- Ice classes for merchant ships
  - Finnish Swedish Ice Class Rules (FSICR)
- Icebreakers (FI+SE) for assisting merchant ships
- The balance between these two set the service level for the industry

7

Future opportunities…

- Research
  - Offshore wind power and ice field interaction
- Icebreaker assistance need
  - Merchant vessel fleet changes
- Icebreaker fleet age and composition
- Increase in traffic
- Climate change

8


OFFSHORE WIND
Will come, is needed
.....but consequences to winternavigation shall be recognized and mitigated in due time


Winternavigation in Northern Baltic
The Finnish Transport Infrastructure Agency (FTIA) is the responsible authority for safe and fluent winter navigation
All Finnish ports freeze during normal winters. Same applies to Estonian and Northern Swedish ports. Thousand of assistances, only few icebreakers.
Even icebreakers have to search for the easiest ice to pass through the dynamically mowing icefields.
Icebreaking is crucial for Finnish trade, industries and stakeholders, roughly 90% of our foreign trade is transported by ships.
Finnish Transport Infrastructure Agency
10

Winter Ports in Finland

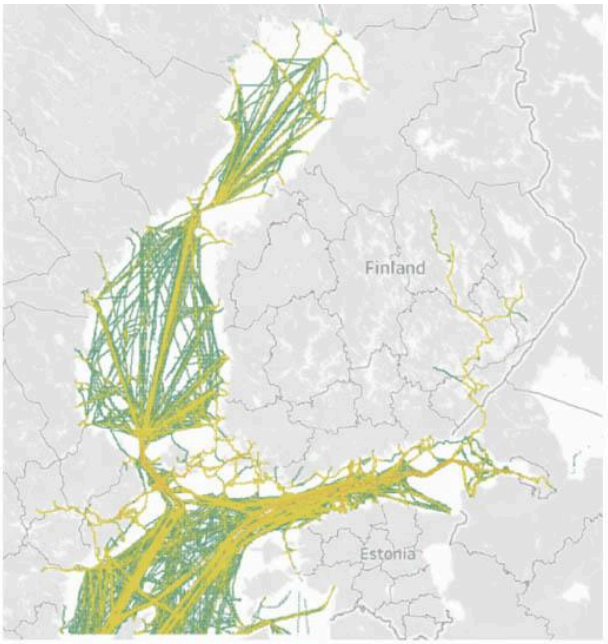
- 30 Ports in the Coastal area
- All ports are kept open during the winter
- Assistance restrictions are set for ensuring the safety of the traffic

- 10 Ports in the Lake Saimaa area
- Traffic inside the Lake Saimaa is kept flowing as long as possible

11

Animation of merchant vessel tracks during a hard winter 2010-2011

Merchant vessel tracks during an easy winter 2021-2022



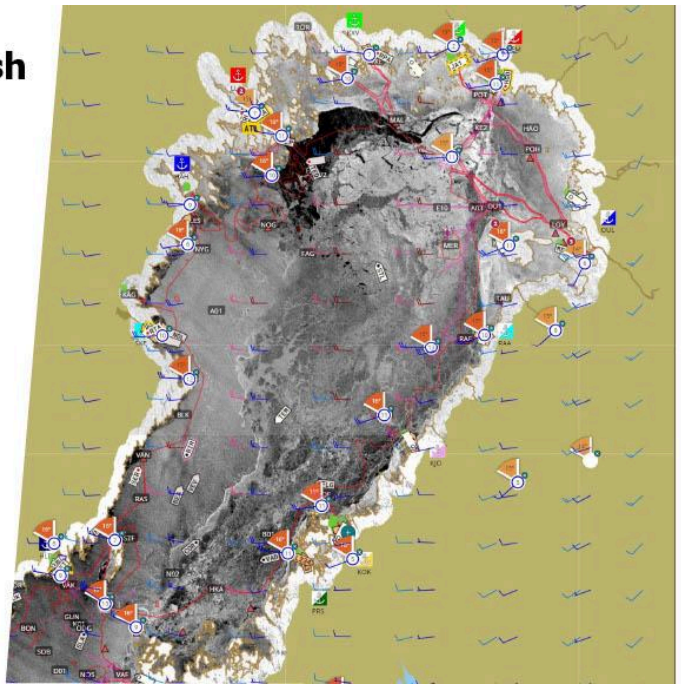
13

IBNet Finnish – Swedish winter navigation information system

- Satellite images
- Weather data
  - Forecasts and observations
- Vessel traffic
  - AIS
  - Port calls
  - Vessel data
  - Reporting
  - Dirways (ice waypoints)
  - Pilotage information
  - Sea Traffic Management (STM)
- Public icebreaking information
  www.baltice.org

Co-financed by the European Union
Connecting Europe Facility

14



Baltic Icebreaking Management, BIM

BALTIC ICEBREAKING MANAGEMENT

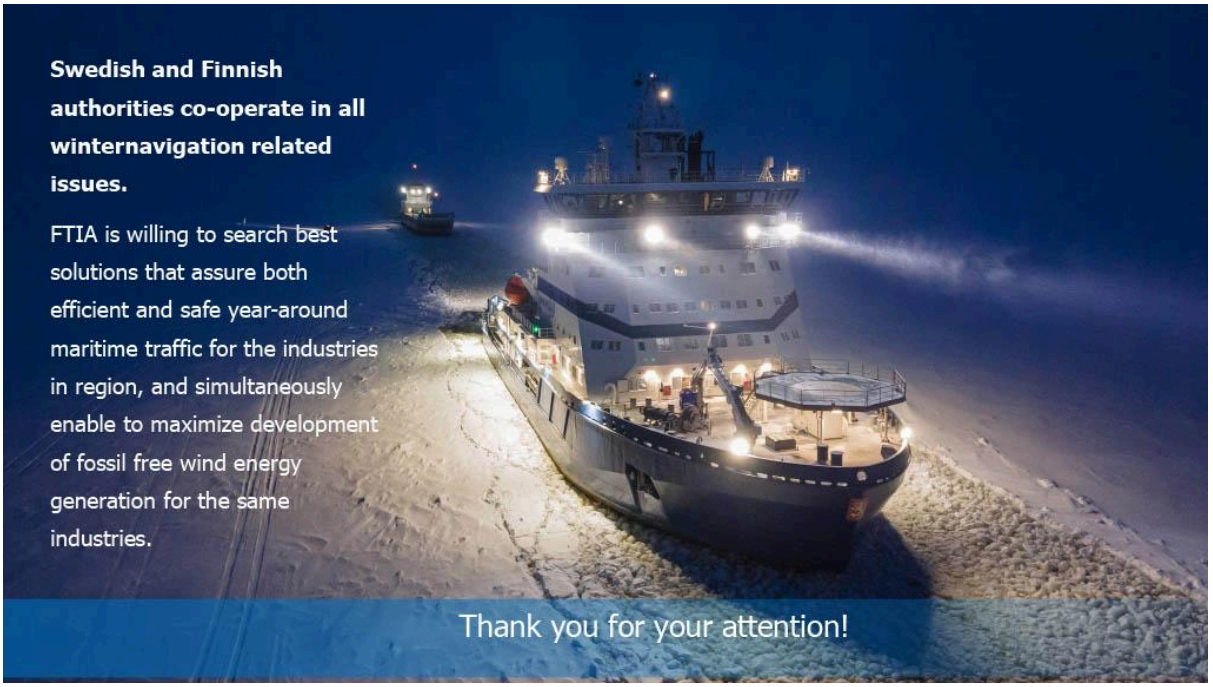
- Baltic Icebreaking Management, BIM, is an organization with members from all the Baltic Sea states. BIM is a result of the annual meetings of the Baltic states icebreaking authorities which have assembled for more than 25 years.
- The overall objective of BIM is to ensure a well-functioning, year-round maritime transport system in the Baltic Sea through enhancing the strategic and operational cooperation between the Baltic Sea countries in the area of winter navigation assistance.
- The member countries of BIM are Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Norway, Poland, Russia and Sweden.
- In practice BIM has postponed all the meetings and have not issued any annual reports because of the still ongoing geopolitical crisis.
- Still BIM is operational and renewing of the Baltice.org web pages is ongoing.

15

https://Baltice.org

- Primary information source for the maritime operators in the Baltic during the Winter months
- Provides
  - Ice charts
  - Icebreakers assistance plans
  - Assistance restrictions
  - Preliminary information about the changes of the assistance restrictions
  - Some history data of the past Winters
  - Possibility to order information about the assistance restrictions or selected vessels via e-mail

16



Väylävirasto
Trafikledsverket

Appendix 12. New sea ice mapping developments in Estonia (Ilona Vahter and Jekaterina Služenikina, ESTEA) + QGIS demo (Rain Elken)

REPUBLIC OF ESTONIA
ENVIRONMENT AGENCY
ENVIRONMENTALLY CONSCIOUS IN ANY WEATHER

New sea ice mapping developments in Estonia

Jekaterina Služenikina & Ilona Vahter
Estonian Environment Agency

14.09.2023

Project „Improvements in the ice charting information system“

Partners TAL TECH CGI **RAIN ELKEN** KeMIT 11111011101

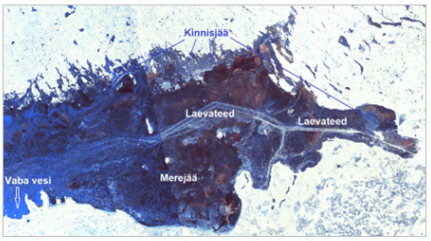
Duration 09.2019-09.2021

General aims

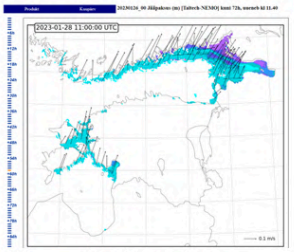
- To create new solutions for collection, processing and distribution of various sources of ice information, especially based on remote sensing data.
- Help to reduce the country's costs for icebreaking and ensure ice safety for the public by the new ice monitoring system.

Ice information was collected from different sources and took significant time to collect…

Regular ice observations

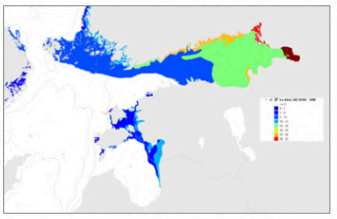


Satellite data



Ice forecasts

Webcams



CMEMS ice products

Planned activities in the project

- ✓ Create operational processing of high resolution satellite data that is useful for sea ice analysis.
- ✓ Develop remote sensing data-based machine learning ice products that will help ice charting process.
- ✓ Improve QGIS ice mapping application and its functionality.
- ✓ Create a new public interactive web application with different ice information.

Sentinel data processing on ESTHub

ESTHub gathers Sentinel and Landsat 8 data for the Estonian area of interest and provides a fast download service. ESTHub downloads data through the Sentinel Collaborative Data Hub (ColHub) the access to which is restricted towards Collaborative Ground Segments. The Land Board has access to ColHub pursuant to the Agreement with the European Space Agency, which was signed by Enterprise Estonia in 2016. Most of the users download data through Open Access Hub, but ESTHub offers a much faster download speed.

For Sentinel 1 and 2, but also for Landsat 8, ESTHub offers data about 200 km beyond state borders (Figure 1), for Sentinel 3 the area of interest covers the Baltic Sea and its surrounding area (Figure 2).

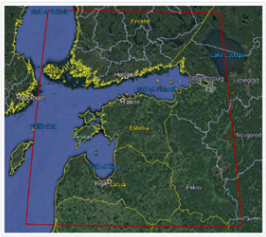
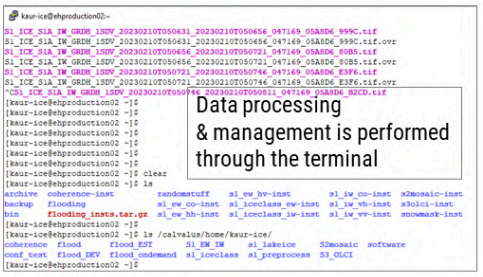


Figure 1. Sentinel 1, 2 ja Landsat 8 coverage

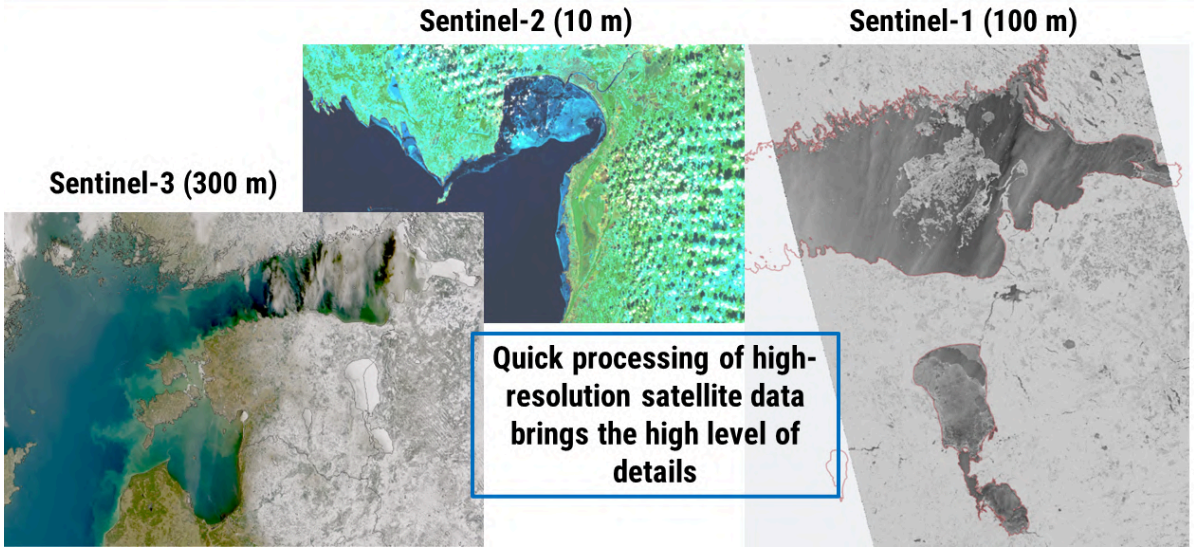
Figure 2. Sentinel 3 data coverage

https://geoportaal.maaamet.ee/eng/Spatial-Data/National-Satellite-Data-Centre-ESTHub-p654.html

- ESTHub offers hosted data processing service to governmental institutions.
- Project scripts were integrated to ESTHub platform.
- ESTEA was the first operational user thanks to the project and cooperation with TalTech.

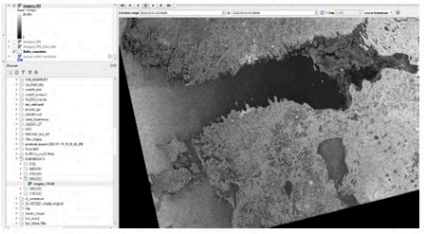


Sentinel-1,-2,-3 examples

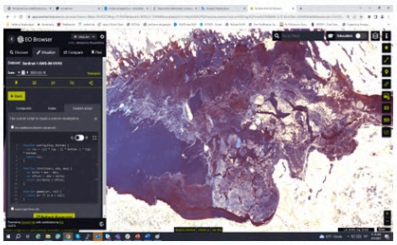


Enlarged usage of another remote sensing data

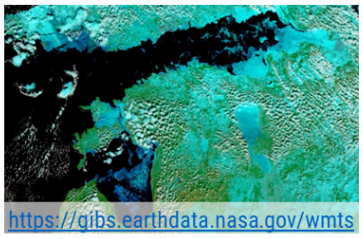
RADARSAT https://panda.copernicus.eu/



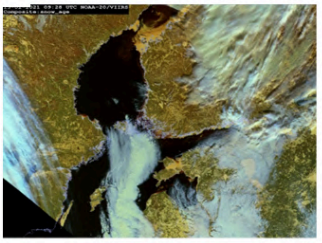
Sentinel-1 https://apps.sentinel-hub.com/



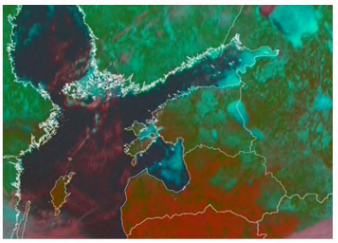
MODIS



VIIRS & AVHRR

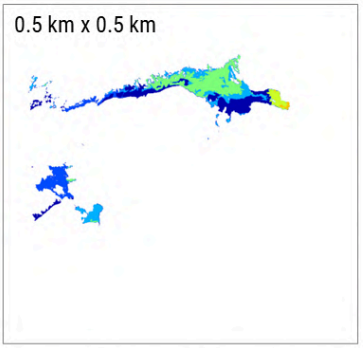


SEVIRI

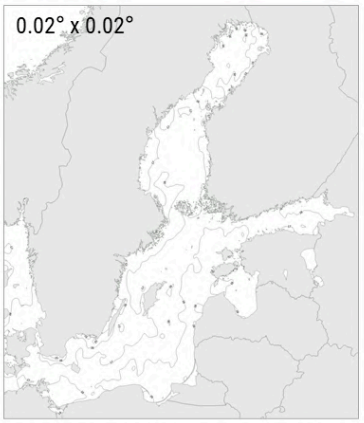


Use of CMEMS satellite-based products

FMI/SMHI Sea Ice Concentration & Thickness Charts Daily download at 14 UTC



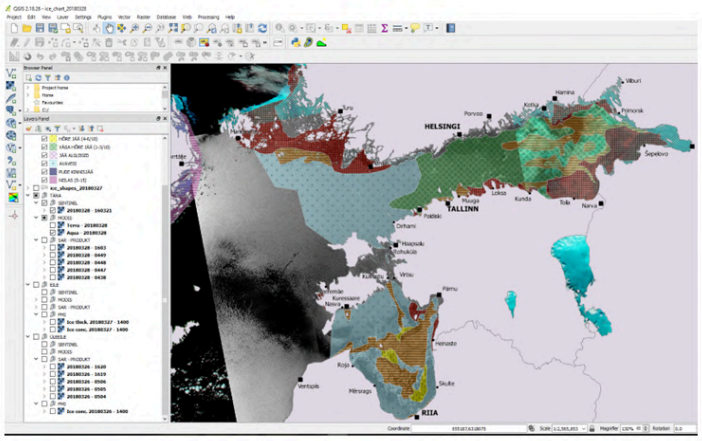
SAR Sea Ice Thickness Download automatically as data arrives



DMI Sea Surface Temperature Analysis Daily download at 06 UTC

QGIS ice chart drawing tool

RAIN ELKEN



Remote sensing data & other products automatically uploaded (available data from last 3 days).

Additonal base layers available.

Enables to compose more accurate & detailed ice charts and reports.

Composed ice chart direct export to the new web application.

Ice statistics tool for calculating ice cover area (for defined period and aquatory).

Satellite-based products developments

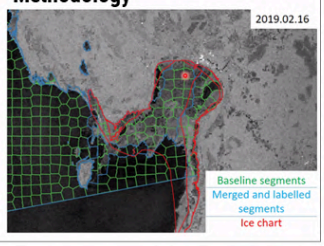
TAL TECH

Excisting ice charts & annotation creation

- Ice charts available since 2014
- Digital files since March 2018
  - Vector files (ESRI shape)
- SAR match-ups
  - IW in 23 cases 2018.03 – 2019.02
  - EW in 27 cases 2018.03 – 2019.02
- Manual annotation creation
  - Image segmentation
  - Merge according to ice chart
  - Adding labels

Credit: Sander Rikka

Methodology

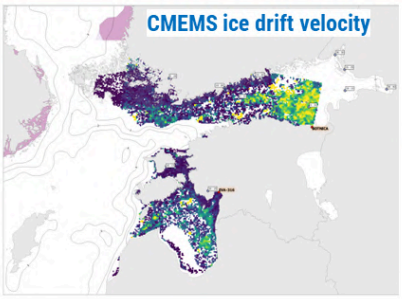


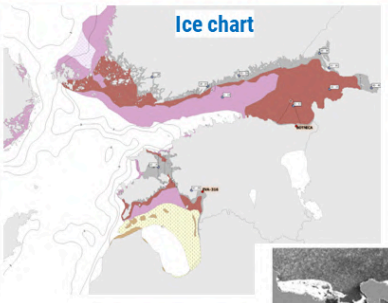
Developed machine learning products

Water and ice
Water + fast ice, strong ice, weak ice
Ice objects: ridged ice, polynya
Lake ice & ice thickness
Coherence (12-day changes)

- Ice products intended to simplify ice charting process in semi-authomatic way & improve the accuracy.
- Reliability of the products depends mainly on availability of observational data (ground truth).

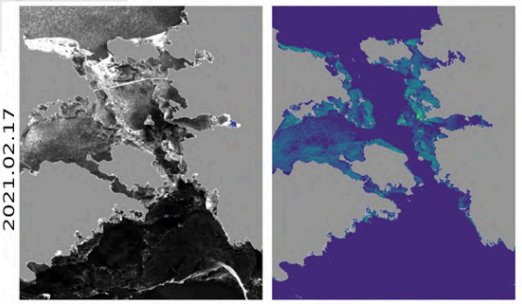
CMEMS ice drift visualization & coherence product

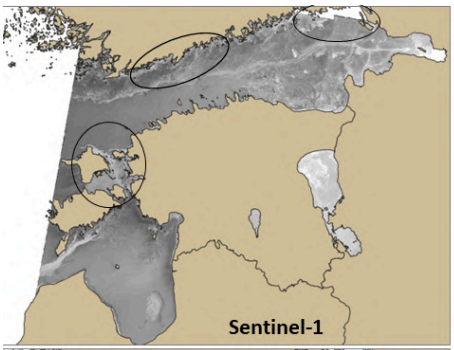


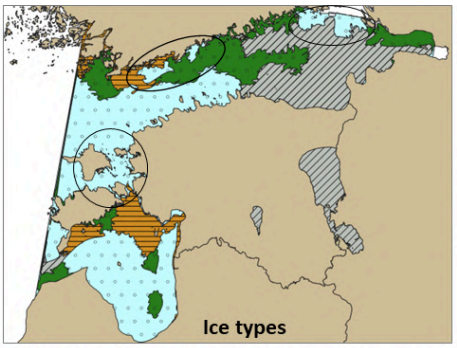


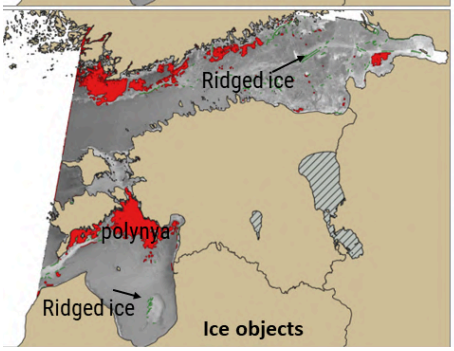
Both products can be used in operational work, not much experience yet

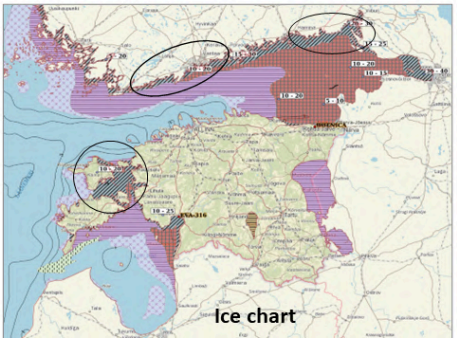
Coherence product (12-day changes)
Identification area of fast ice









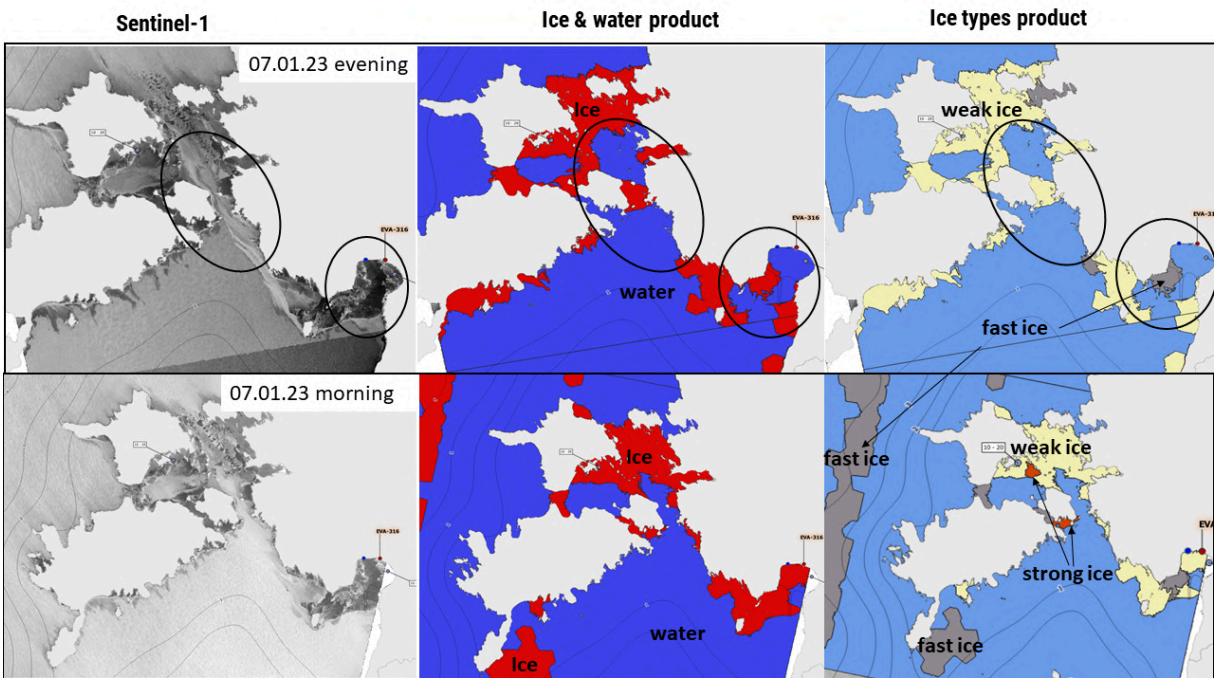


Machine learning ice products example

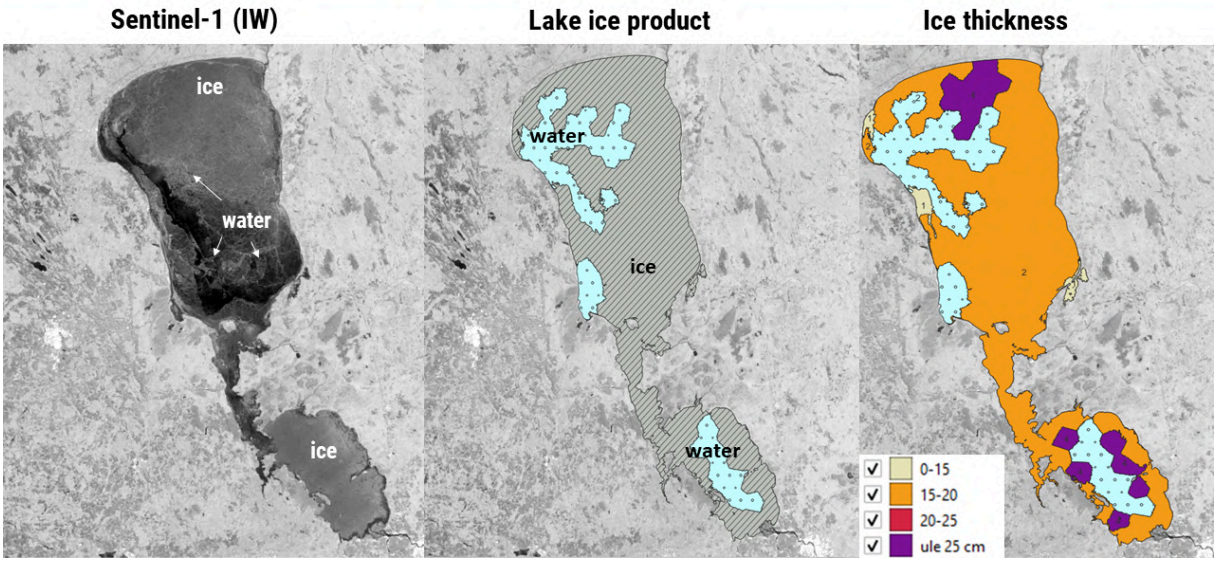
Successful polygons can be copied to the ice map and corrected if necessary

Helps to speed up the process of creating an ice map

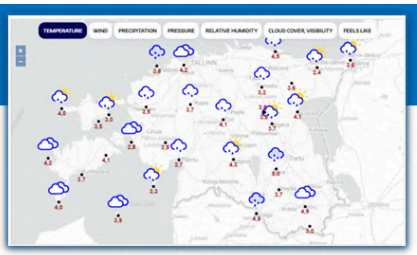
Needs manual inspection and filling the gaps of missing data



Detection of ice on Lake Peipus

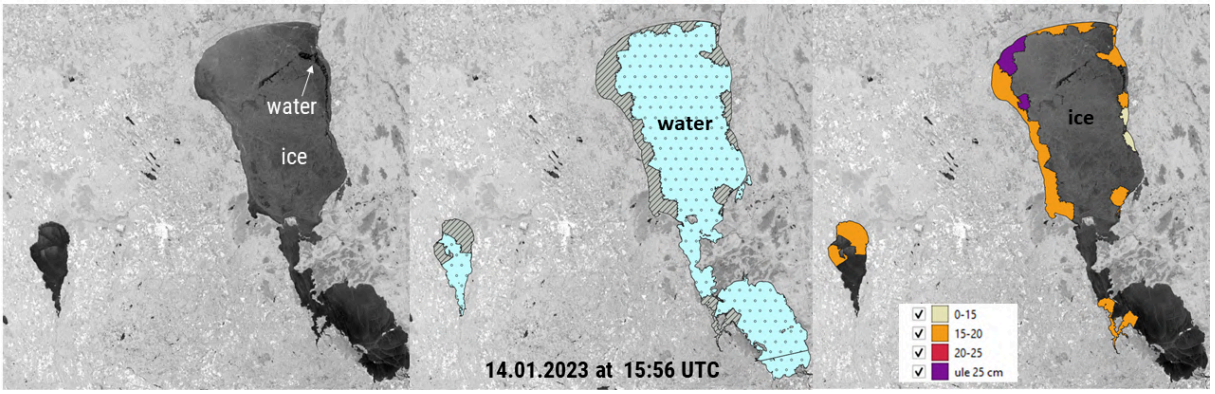


Detection of ice on Lake Peipus



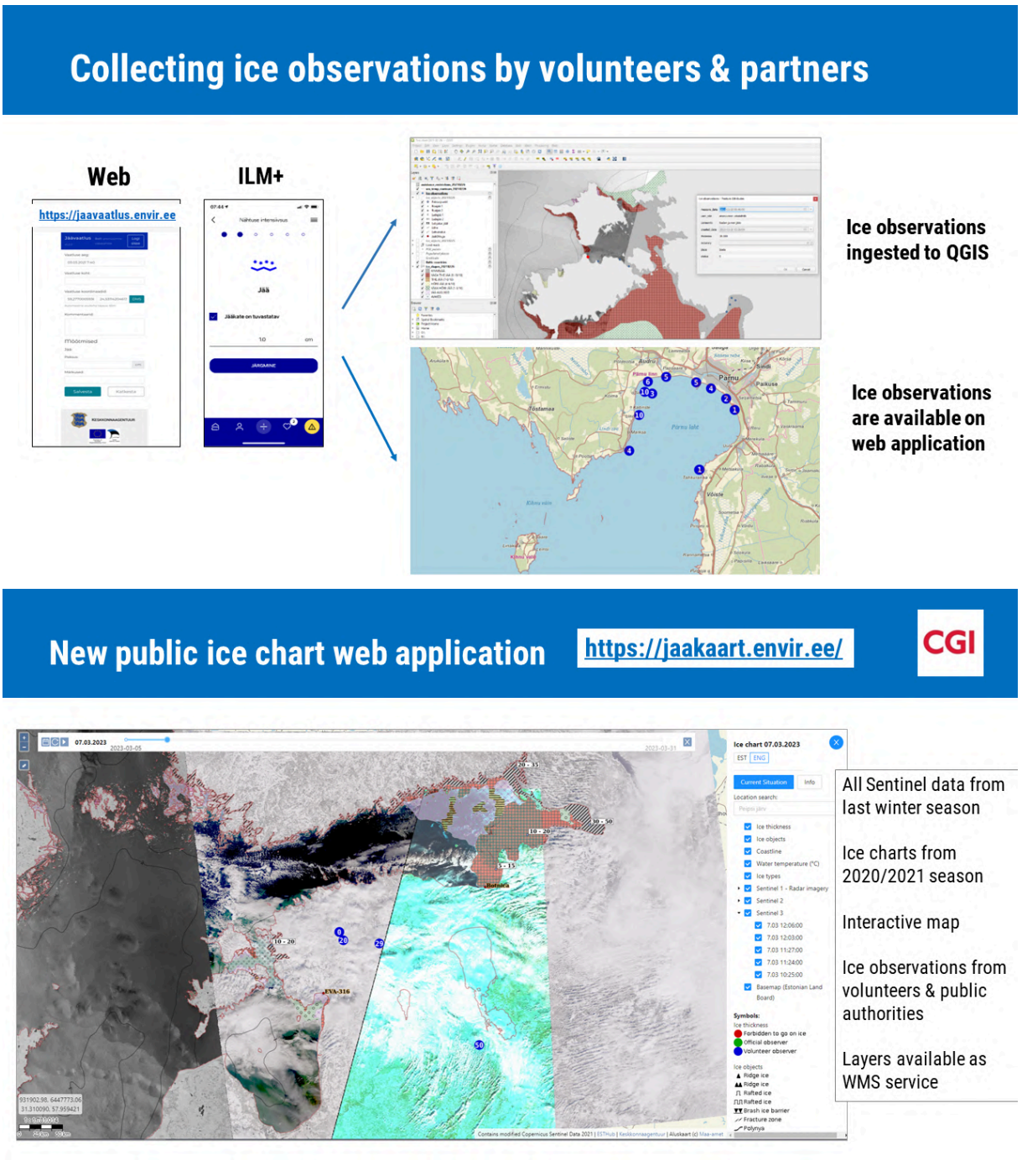
Melting conditions

Sentinel-1 (IW) **Lake ice product** **Ice thickness estimation**



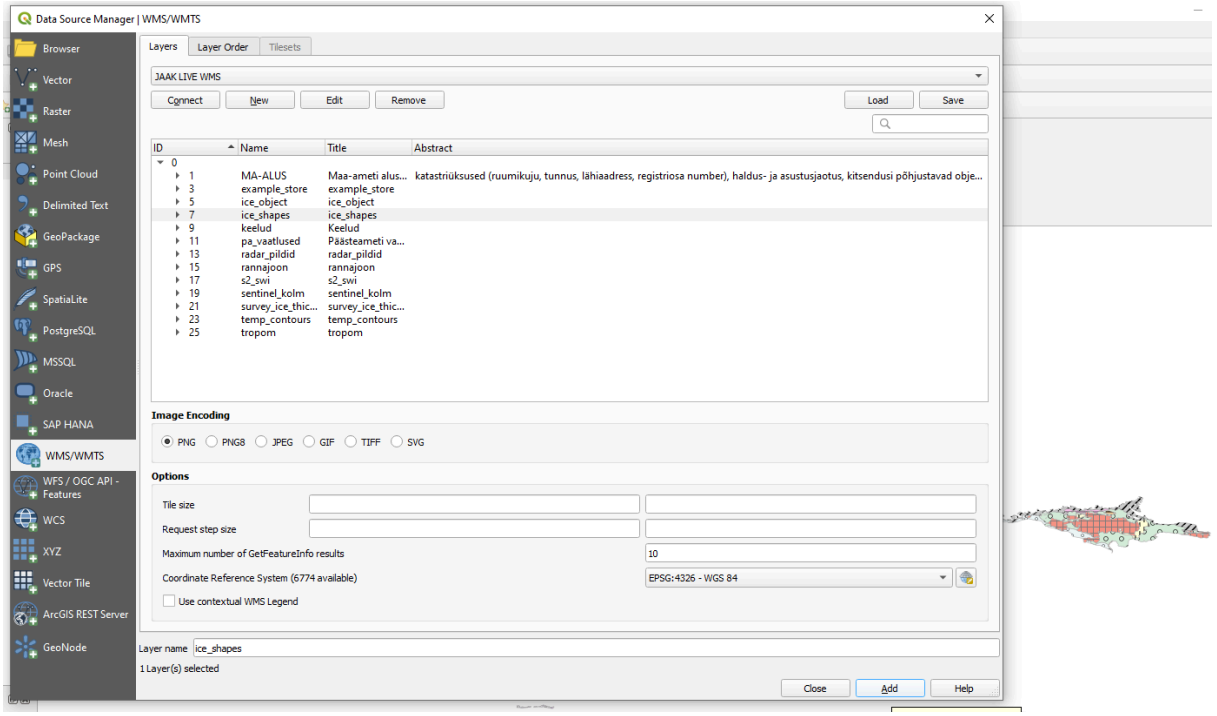
Challenges of products developments

- Product development took place within a limited time.
- Integration of algorithms to ESTHub was a great challenge due to compexity of the platform. Needed frequent help from ESTHub developers (*Brockmann Consult)*.
- Limited number of machine learning data: few ice observations, most ice maps were not georeferenced, .shp format only for the last 2 ice seasons.
- The algorithms were developed on past two winters data. During the project period, there was no proper winter to test the results.
- The accuracy of developed products were finally revealed later in operational use.

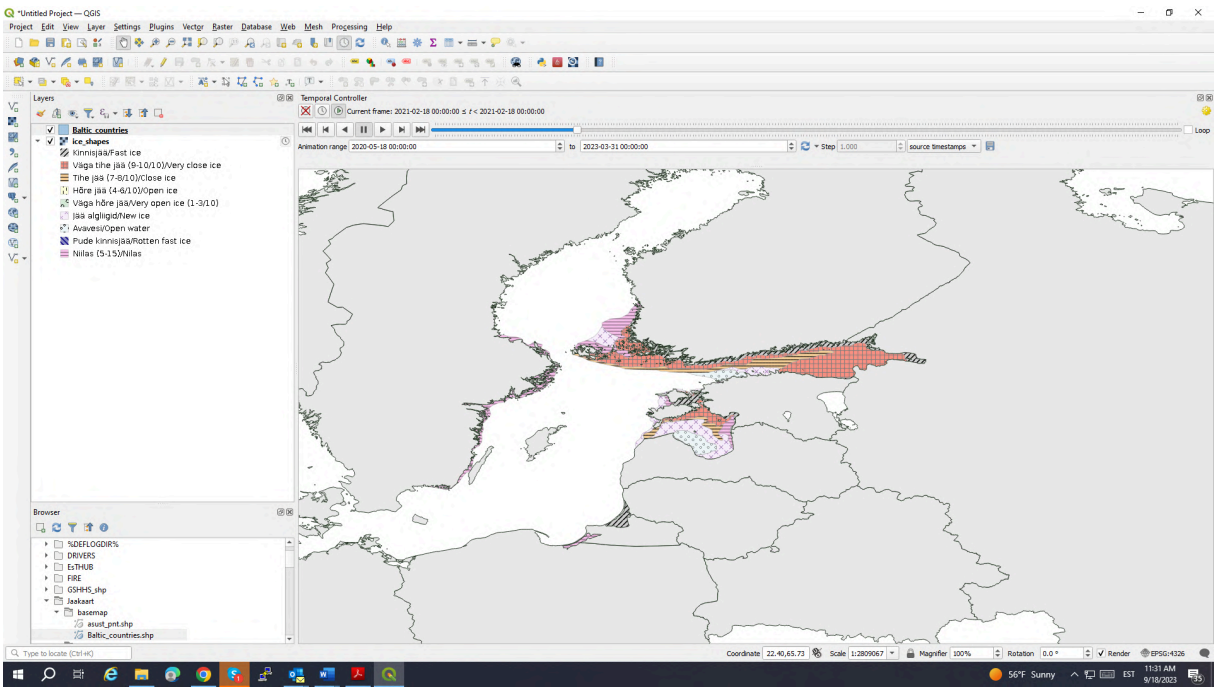


WMS service address is https://jaakaart.envir.ee/geoserver/JAAK/wms?request=GetCapabilitie.

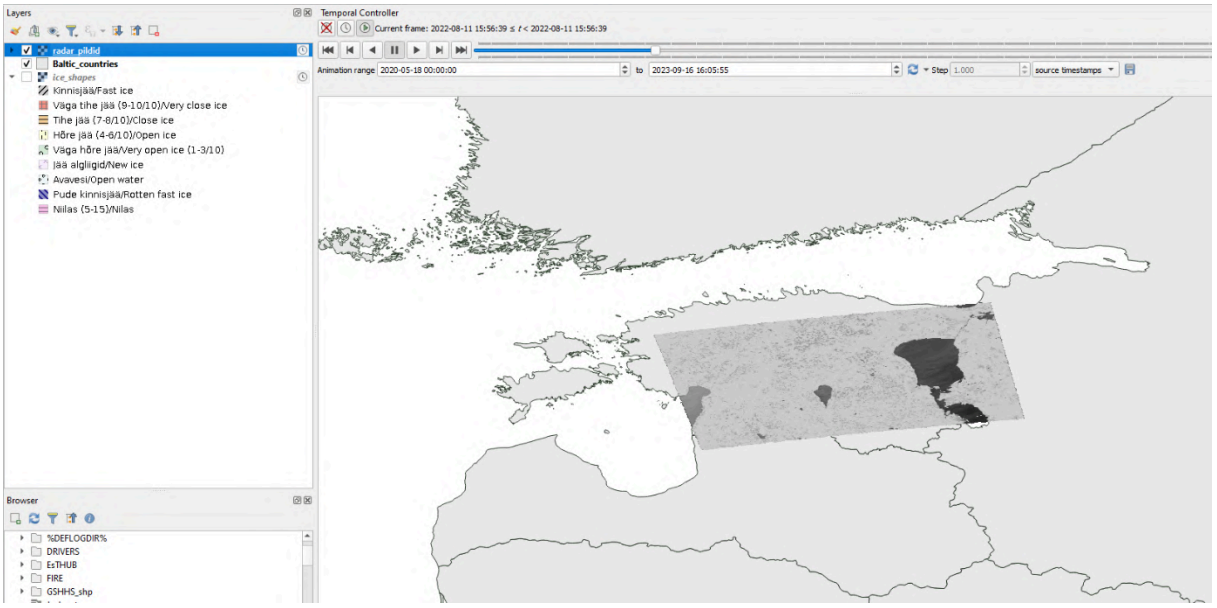
NB! Service works only in WGS 84 projection, there is the list on available layers, some of them are in english, some in estonian. Available ice shapes & ice charts, satellite imagery, ice observations etc.



Users can scroll the layers date by date and look them in GIS tool.

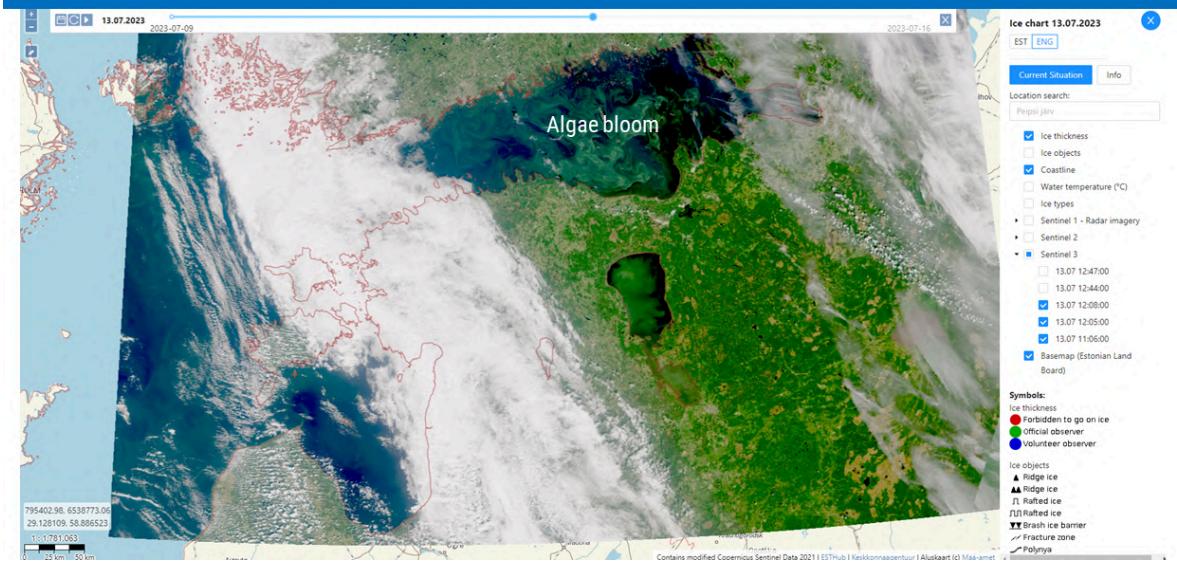


ESTEA ice shapes, WMS example.



Sentinel-1 SAR imagery, WMS example.

Web application can be used in summer time for algae bloom monitoring by Sentinel-3 OLCI data



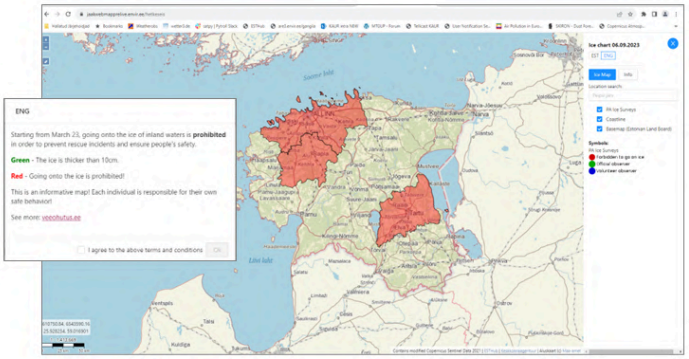
Cooperation with Rescue Board

Unique usage of ILM+ application planned since 2023/2024 - collection and sharing ice measurements to public.

Ice observation will contain option to add image.

Publish official ice restrictions on https://jaakaart.envir.ee/hetkeseis

Plan to collect and show all actual ice measurements on one layer.



CONCLUSIONS

- The project outputs improved the process of collection, analysis and distribution of ice information.
- The ESTHub enables to process the large amount of high resolution satellite data operationally.
- Machine learning products need additional improvements to increase their use in operational work.
- It was a great opportunity to improve ice service quality on national level & share detailed ice conditions information with public.

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QGIS ice chart demo

BSIM meeting 14.09.2023

Rain Elken
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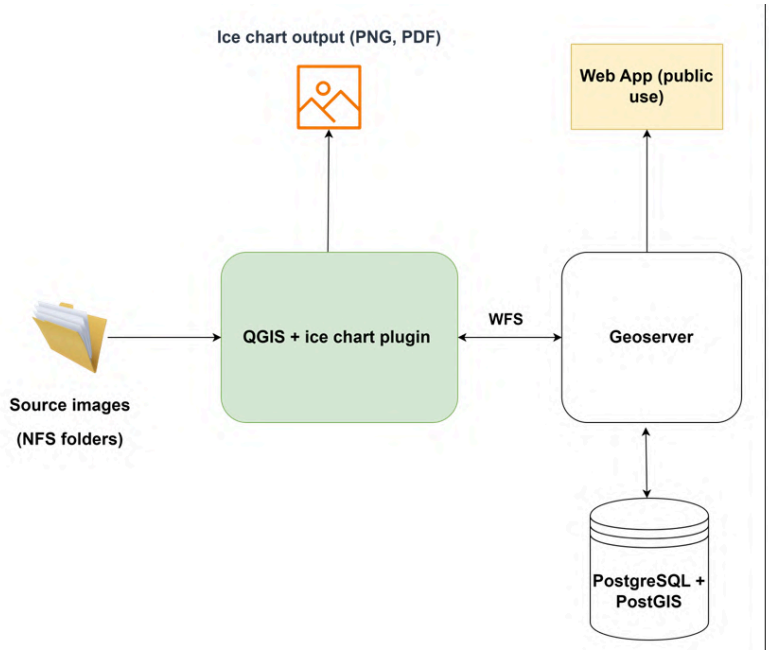

- Source images:
  - Previously created ice features
  - Sentinel 1,2,3
  - MODIS (The Moderate Resolution Imaging Spectroradiometer)
  - SAR (Synthetic Aperture Radar) thickness
  - FMI (Finnish Meteorological Institute) ice thickness, concentration
  - SST (Sea Surface Temperature)
  - Pre-classified ice polygons with ice type

Repository of QGIS ice chart plugin is available https://koodivaramu.eesti.ee/kemit/j-kaart

Appendix 13. BSIM mailing list.

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