Sweden National Report

GLOSS GE XVIII 2025

GLOSS Group of Expert 18th Meeting
11-14 March 2025
Panama / VTC

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SWEDISH MARITIME ADMINISTRATION

Co-financed by the European Union
Connecting Europe Facility

Swedish Sea Level Network

- Real-time data in RH 2000/BSCD2000 from 60 stations
- 1-minute values with 1 cm accuracy
- Real-time and delayed mode quality control

Class I	Upgrade with battery backup	27 stations (23 SMHI, 3 SMA, 1 CTH)
Class II	Upgrade without battery backup	27 stations (23 SMA, 3 GBG, 1 SKB)
Class III	Unchanged, temporary	6 stations (6 SMA)

Present water level information are shown in Wind- and Water Information (ViVa)

SWEDISH MARITIME ADMINISTRATION

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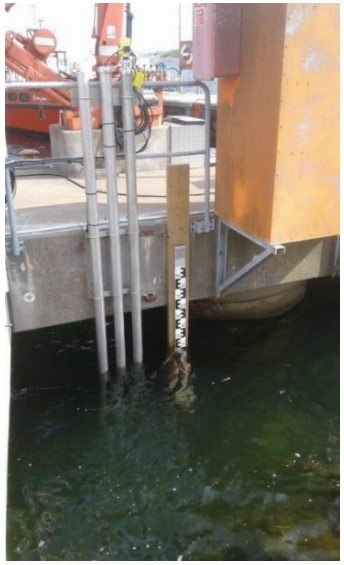
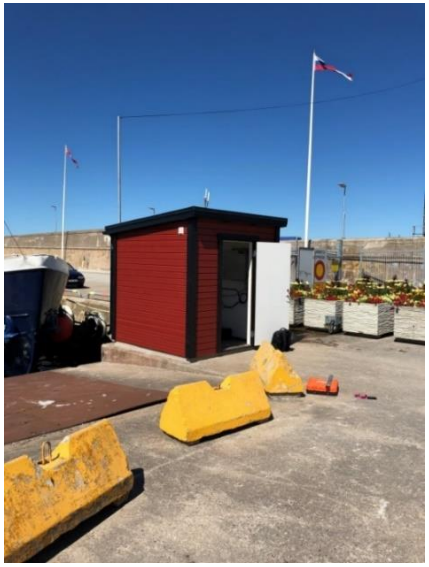
Connecting Europe Facility

Upgrade of the Swedish Sea Level network 2017-2019

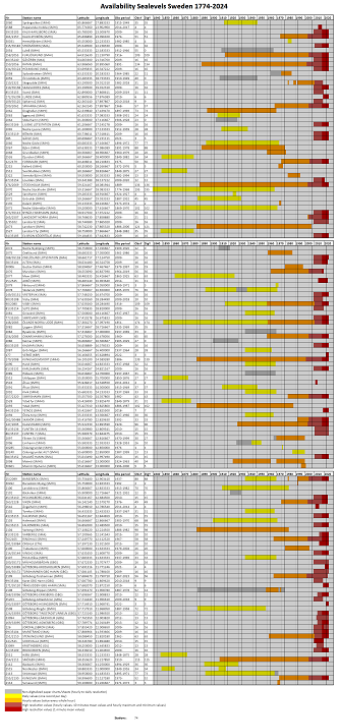
- One common and harmonised Swedish Sea Level network
- Upgrade and modernize 53 stations in the new network, two new sensors at all stations
- Sea level data of better accuracy, continuous time series
- Open and faster access to quality controlled real-time and archive data
- All stations connected to the land survey datum (RH 2000/BSCD2000)
- Partly financed by the EU-project FAMOS Odin. Leads to that the objectives of the FAMOS Odin is achieved: safer and more cost effective shipping routes


SWEDISH MARITIME ADMINISTRATION

Swedish Sea Level observations 1774-2025

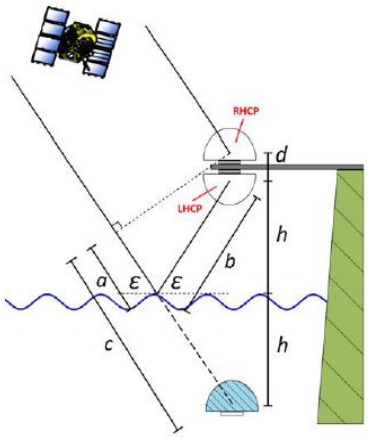
- First observations started in Stockholm 1774
- 141 sea level stations/records, 60 stations are active (2025)
- 5067 years of observations, 4699 years of data are digitalized (93%)
- 2305 years from continued stations, 100% digitalized
  - High-Resolution data (1-15 minutes)
  - Hourly values
  - Daily values



Onsala mareograph

In 2015, a new mareograph was installed at Råö on the Onsala peninsula, just south of Göteborg. This has been done in close cooperation between SMHI and Chalmers in Göteborg. The station will be located close to a continuous GPS station (A-type), which is operated by Chalmers/SWEPOS. Close to the mareograph, there is also a GNSS-reflectometer measuring sea level, installed in 2010. The station is delivering high-resolution (1-minute) values of sea level. A very precise levelling of the station has been performed and the station is very well connected to the Swedish land survey datum RH 2000 or BSCD2000, as for the rest of the locations. The mareograph has been a part of the Swedish Sea Level network since 2015.

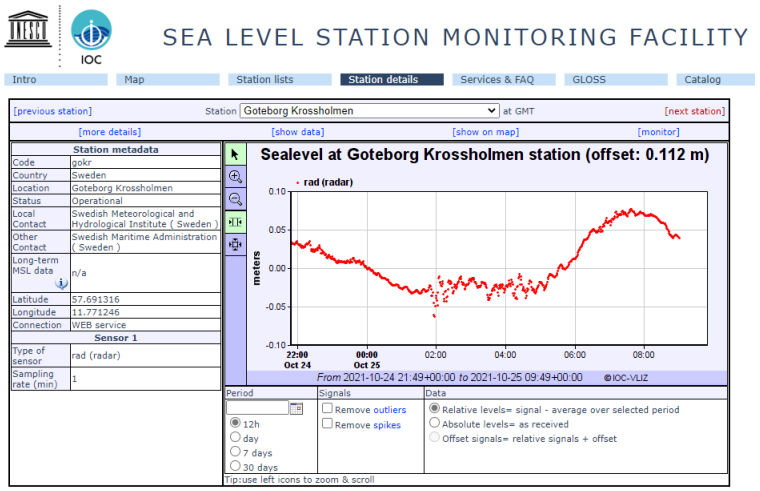
The Onsala mareograph, installed in 2015.



An upward- and downward looking GNSS-reflectometer.

Göteborg-Krossholmen mareograph

In 2021, a new mareograph was installed at Krossholmen in Göteborg. The station is now delivering high-resolution (1-minute) values of sea level. A very precise levelling of the station has been performed and the station is very well connected to the Swedish land survey datum RH 2000 and BSCD2000 as for the rest of the locations. The mareograph is now a part of the Swedish Sea Level network since May 2021 and will replace Göteborg-Torshamnen as the Swedish contribution to the GLOSS Core Network. Soon also a Continuous GPS station will be installed nearby, which will be operated by SWEPOS.



The Göteborg-Krossholmen mareograph, installed in 2021.

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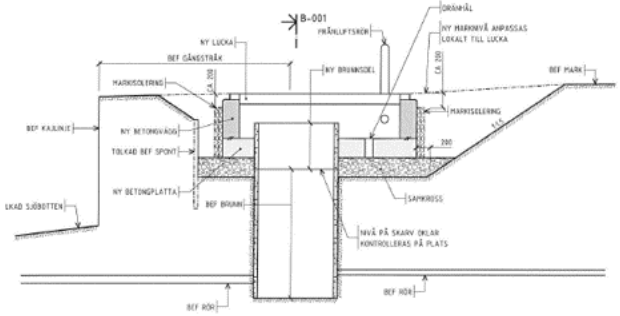
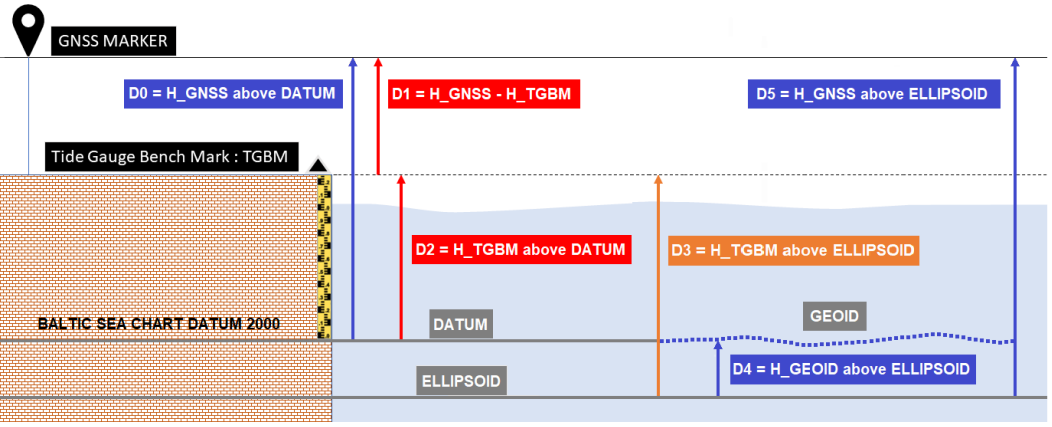
Stockholm-Skeppsholmen mareograph

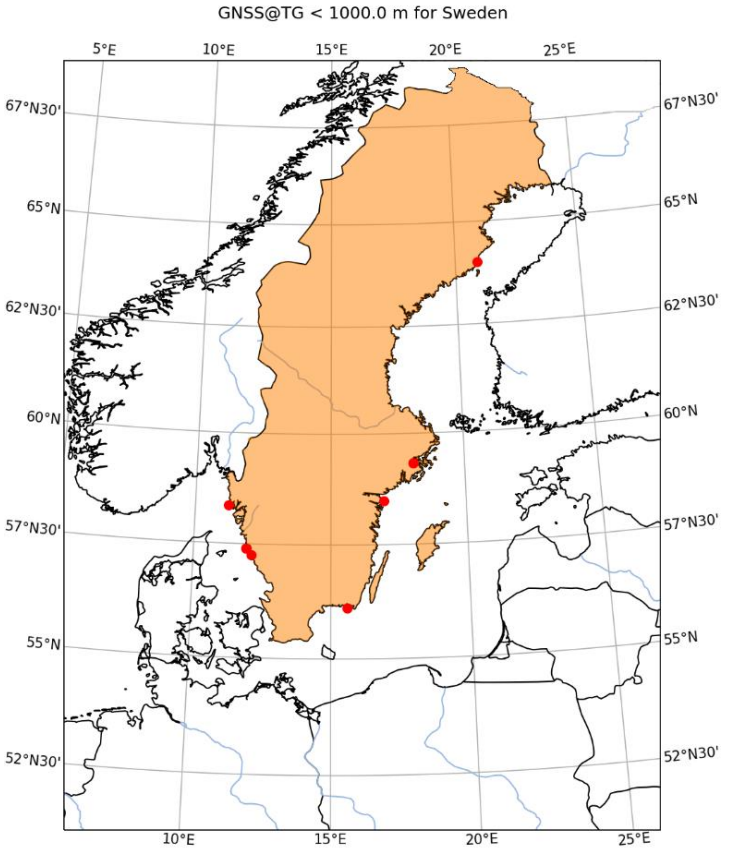
In 1889 the Nautical-Meteorological Bureau, a predecessor of SMHI, established a continuously recording sea level station (mareograph) in the bedrock on the island Skeppsholmen, located close to the sluice. This mareograph has since then recorded the Stockholm sea level. The sea level series in Stockholm constitutes the longest sea level record in the world. In 2019, a new measuring chamber and two radar gauges were installed near the old mareograph, which is the new technology for measuring sea level at the site.



Co-location of sea level stations and GNSS in Sweden

RESPONSIBLE AGENCY		TIDE GAUGE COORDINA		CO-LOCATED INSTRUMENTS	GNSS COORDINATES (SWEI					CO-LOCATED CRITERIA	LEVELING INFORMATION		
RESPONSIBLE FOR GNSS	RESPONSIBLE FOR TG	LON	LAT	TIDE_GAUGE	GNSS_SONEL	GNSS_SWEPOS	LON	LAT	INSTALLED	GNSS->TG HORIZONTAL DISTANCE (m)	TGBM_ID	DATUM DEFINITION	D0 = H_GNSS above DATUM (m) = D1+D2 ≈ D5-D4_GNSS
SWEPOS-LMV	SMHI	20.895060	63.986060	RATAN	RAT0	RATA.0	20.89556580	63.98558831	2006-06-09	77	58	h	BSCD2000/RH2000	10.252
SWEPOS-LMV	SMHI	18.081690	59.324200	STOCKHOLM	0MOS	MOSE.0	18.07420578	59.31842324	2013-07-11	1051	373	a (LMV 108*2*6503)	BSCD2000/RH2000	68.215
SWEPOS-LMV	SMHI	16.963640	58.483140	ARKO	0ARK	ARKO.1	16.96265021	58.48327049	2019-08-26	111	158	101	BSCD2000/RH2000	10.671
SWEPOS-LMV	SMHI	15.589280	56.105200	KUNGSHOLMSFORT	KUN0	KUNG.0	15.58903022	56.10423868	2004-12-31	110	108	a (LMV 035*2*3704)	BSCD2000/RH2000	2.485
SWEPOS-LMV	Chalmers	11.911500	57.397130	ONSALA	ONSA	ONSA.0	11.92551310	57.39529604	1993-07-01	1570	533	827a	BSCD2000/RH2000	9.167
SWEPOS-LMV	Chalmers	11.911500	57.397130	ONSALA	ONS1	ONSA.1	11.92453692	57.39533058	2012-01-28	1462	496	827a	BSCD2000/RH2000	8.052
SWEPOS-LMV	SMA	11.608770	57.631650	VINGA2	VING0	VING.0	11.60486580	57.63234270	2020-08-18	441	250	254 Vinga	BSCD2000/RH2000	19.793
SWEPOS-LMV	SMA	11.608770	57.631650	VINGA2	VING0	VING.0	11.60486580	57.63234270	2020-08-18	441	250	Stålbult 104	BSCD2000/RH2000	19.793
SWEPOS-LMV	SMHI	11.217850	58.353620	SMOGEN	SMO0	SMOG.0	11.21792382	58.35346156	2002-08-26	19	18	g	BSCD2000/RH2000	9.104





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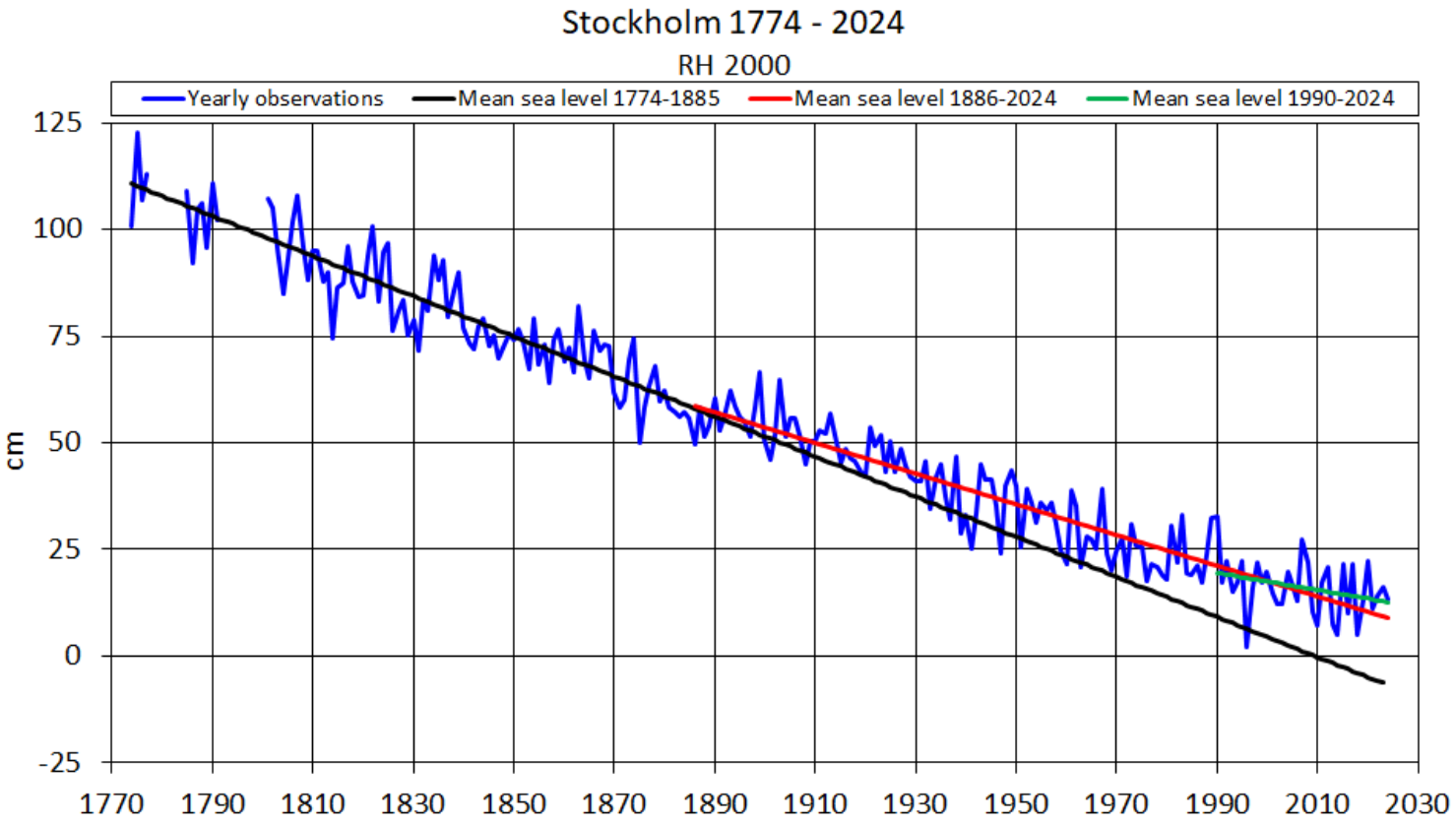
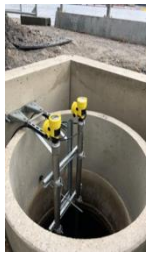
Stockholm
”World’s longest sealevel record”





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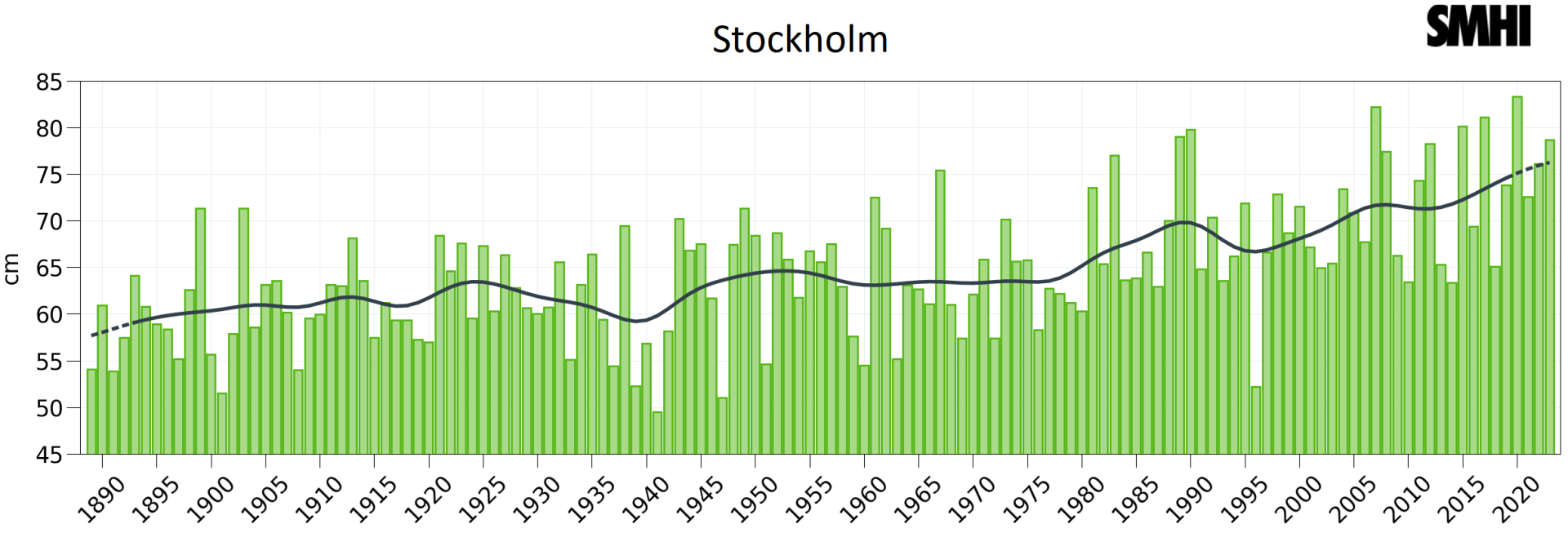
Sea level rise



Observed sea level change in Stockholm since 1889

Sea level corrected for the land-uplift (glacial isostatic adjustment)

The black line shows the gauss-filtered (smoothed) average

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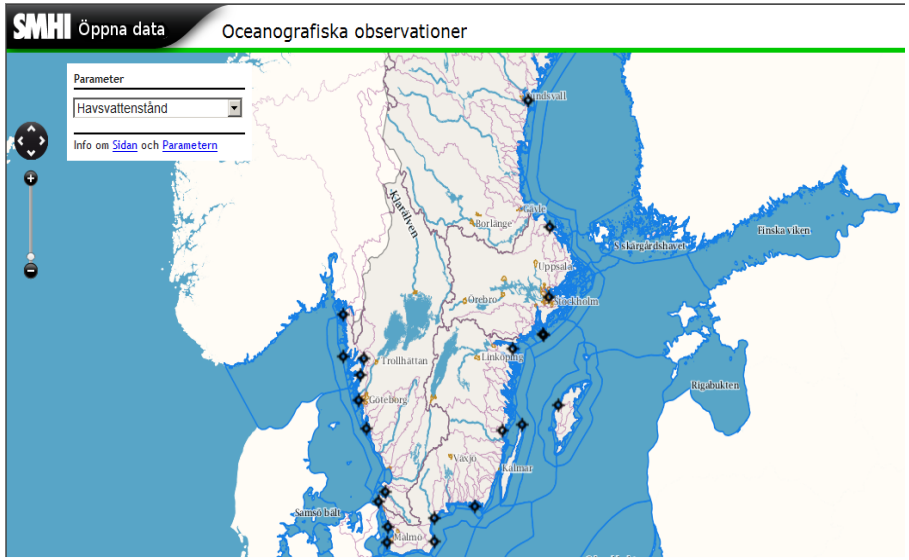
International data exchange

Programme	Data host	Frequency	Resolution	Media	Notes
PSMSL	BODC	Yearly	Month	Mail	All stations (28 SMHI, 32 SMA)
SLSMF	VLIZ	Hourly	Minute	FTP	All stations (28 SMHI, 25 SMA)
BOOS/NOOS	SMHI	Hourly	Hour	FTP	All stations (28 SMHI, 32 SMA)
CMEMS	IFREMER	Daily	Hour	FTP	All stations (28 SMHI, 32 SMA)
EMODNET	SMHI	Daily	Hour	FTP	All stations (28 SMHI, 32 SMA)
SEADATANET	SMHI	Yearly	Hour	FTP	SMHI stations (28 SMHI)
VIVA	SMA	Every minute	Minute	Web	All stations (28 SMHI, 32 SMA)
www.smhi.se	SMHI	Hourly	Hour	Web	All stations (28 SMHI, 32 SMA)
www.boos.org	DMI	Hourly	Hour	Web	SMHI stations (28 SMHI)



All oceanographic data are open and freely available:

Open Data Service

Sealevel related to the national height system RH 2000/BSCD2000

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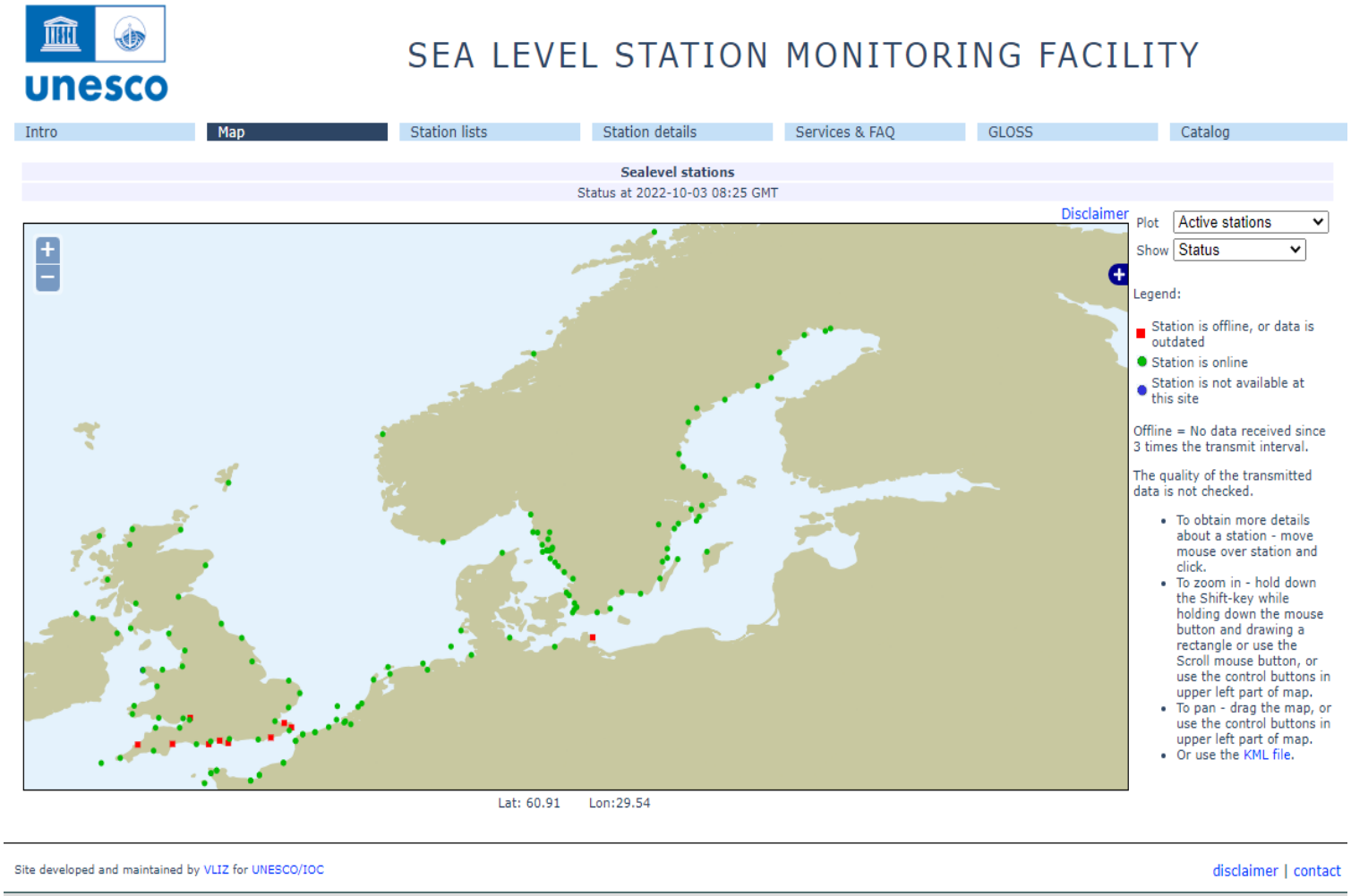
50 Swedish Sea Level stations added to the IOC Sea Level Station Monitoring Facility



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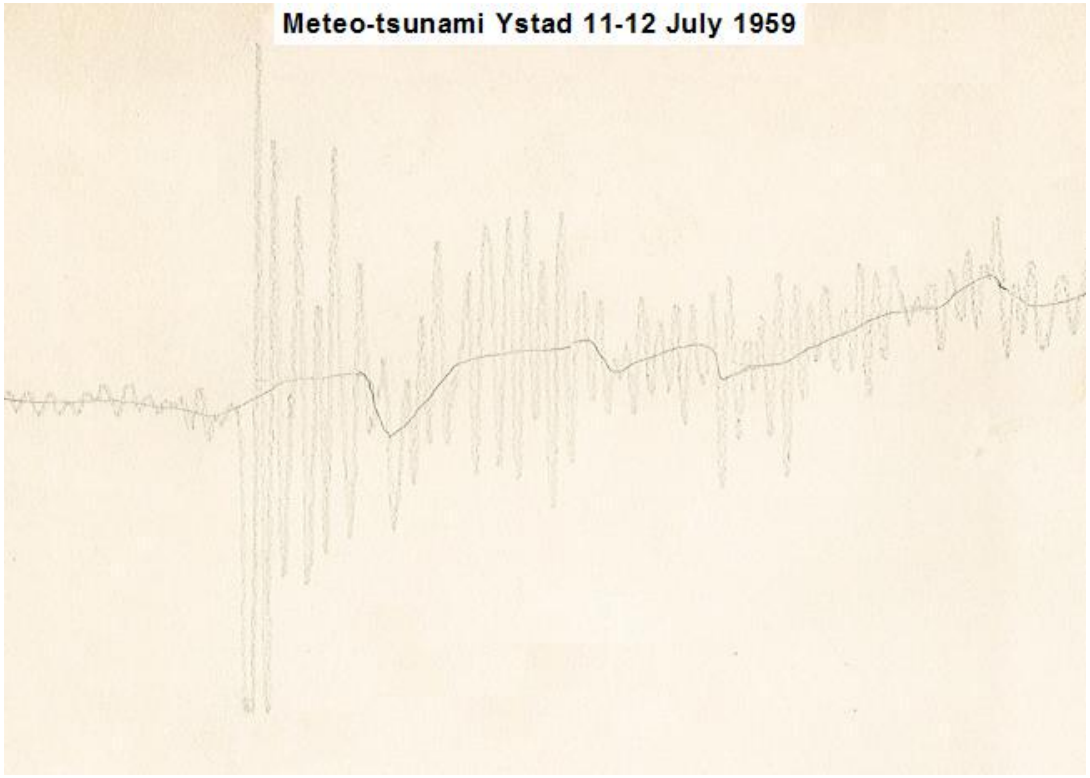
Phenomena in Swedish Sea Level observations

”Sea jump” (Meteo-tsunami) Ystad 11-12 July 1959



Disturbance lasted about: 6 hours
Largest difference between high and low: 132 cm
Time between two highs or lows (period): 10 minutes

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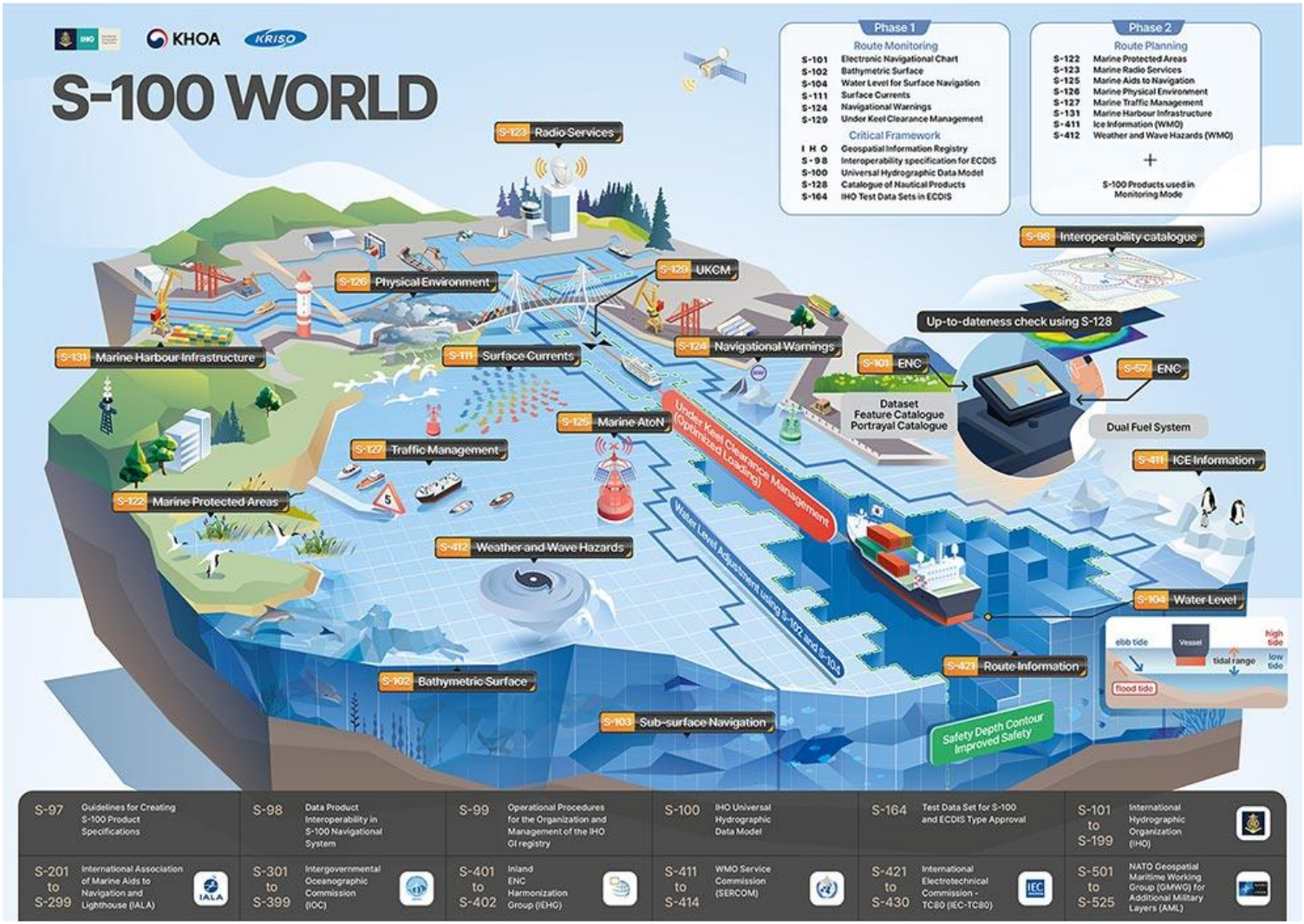
Future Maritime Services S-100



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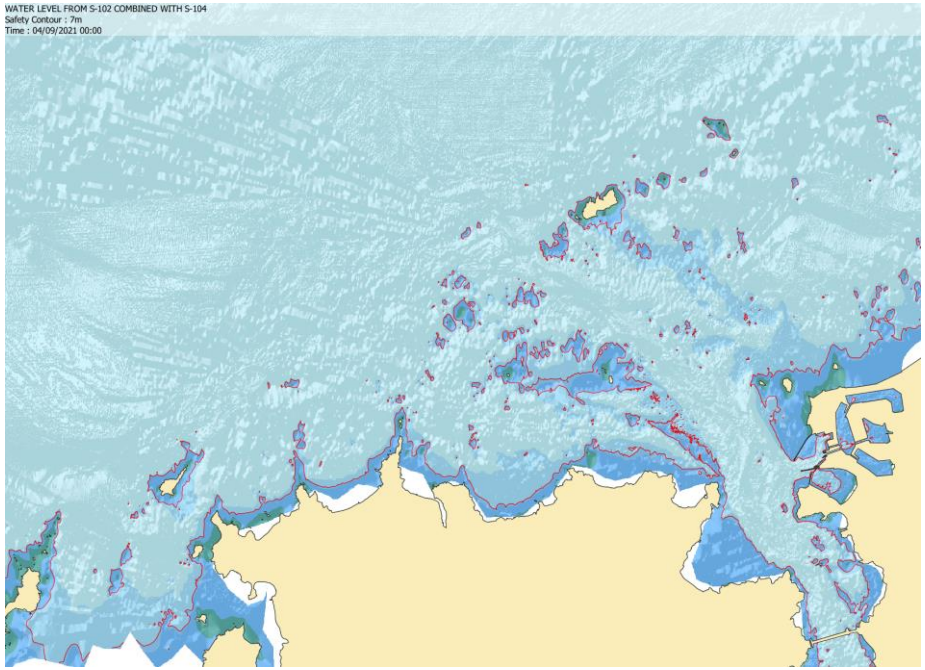
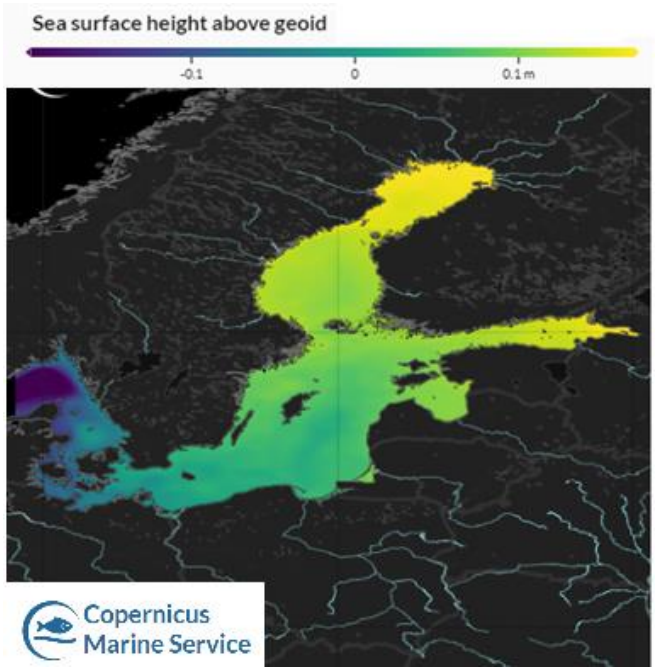
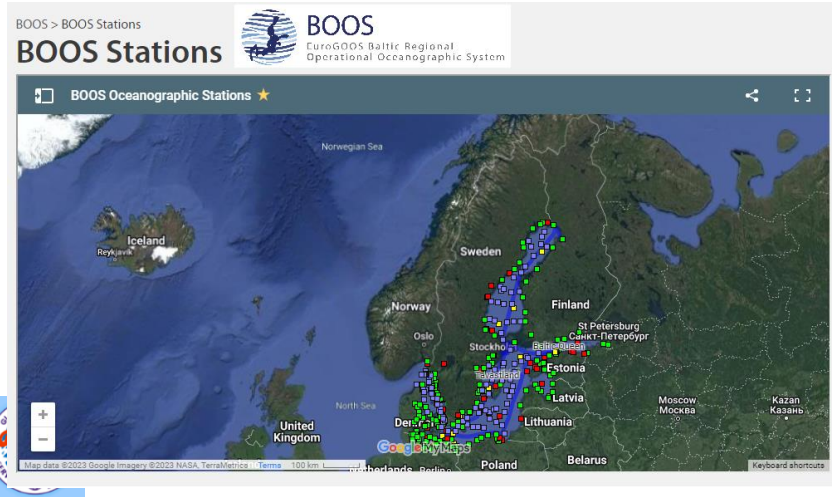
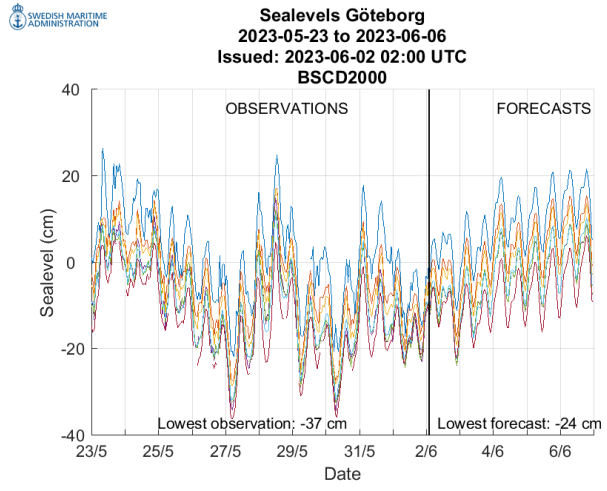
S-104 Water Level









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Future navigation

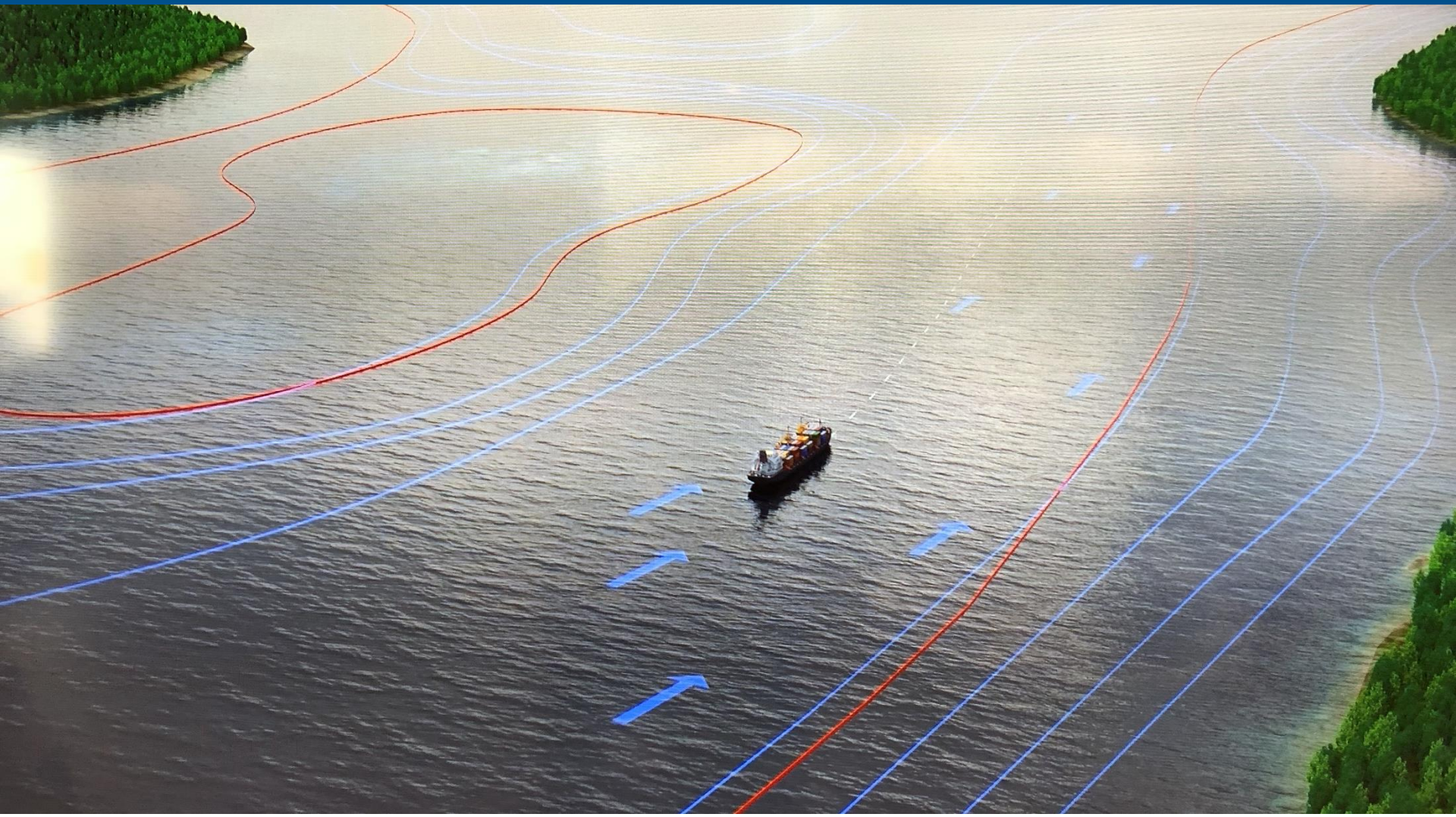

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Chart Datum, Water level and Currents Working Group (CDWCWG)

Chart Datum, Water level and Currents Working Group (CDWCWG)

"To implement a common reference system, S-104 and S-111 in the Baltic Sea"

Photo: Chart Datum, Water level and Currents Working Group 1st meeting, 26-27 March 2024, Helsinki, Finland

https://www.bshc.pro/working-groups/cdwcwg

Members of CDWCWG:

Denmark	Mr Nikolaj Møller
Denmark	Mr Kristian Villadsen Kristmar
Estonia	Mrs Gabriela Kotsulim
Finland	Mr Jyrki Mononen
Finland	Mrs Anni Jokiniemi
Germany	Dr Patrick Westfeld
Latvia	Mr Bruno Špēls
Lithuania	Mr Mindaugas Zakarauskas
Poland	Mr Witold Stasiak
Poland	Mrs Alicja Olszewska
Russia	Mr Leonid Shalnov
Russia	Dr Sergey V. Reshetniak
Sweden	Mr Thomas Hammarklint (Chair)
Sweden	Mr Henrik Tengbert

Observers and Experts:

Estonia	Prof. Artu Ellmann
Estonia	Dr Sander Varbla
Estonia	Dr Nicole Camille Delpeche-Ellmann
Finland	Mr Jarmo Mäkinen
Finland	Dr jani Särkkä
Finland	Dr Mirjam Bilker-Koivula
Finland	Dr Timo Saari
Germany	Dr Gunter Liebsch
Germany	Dr Joachim Schwabe
Latvia	Mr Armands Murans
Latvia	Mr Krists Dzenis
Lithuania	Mr Emilis Tertelis
Lithuania	Mr Romuald Obuchovski
Norway	Mr Aksel Voldsund
Poland	Mr Krzysztof Pyrchla
Poland	Mrs Małgorzata Pająk
Poland	Dr Monika Wilde-Piórko
Poland	Dr Malgorzata Szelachowska
Sweden	Dr Jonas Ågren
Sweden	Dr Per-Anders Olsson
Sweden	Mrs Johanna Linders

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Thanks!

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