



**BALTIC SEA
HYDROGRAPHIC
COMMISSION**



IHO

Baltic Sea Chart Datum 2000

26th NSHC Tidal Working Group meeting
6 February 2024 Göteborg, Sweden

Thomas Hammarklint



Baltic Sea Hydrographic Commission (BSHC)



BALTIC SEA HYDROGRAPHIC COMMISSION



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The Baltic Sea Hydrographic Commission,

which is an integrant part of the International Hydrographic Organisation (IHO), promotes the technical co-operation in the domain of hydrographic surveying, marine cartography and nautical information among the neighboring countries of the Baltic Sea region.

The main objectives of the Commission are the coordination of the production of the Baltic Sea INT Charts, the coordination of hydrographic re-surveys, harmonization of chart datums, harmonization of Baltic Sea ENCs, and the exchange of information and the harmonization of practices with regard to various issues related to hydrography.

The most recent development is the [Baltic Sea Bathymetric Database](#) – accessible via this portal.

International Hydrographic Organization

The International Hydrographic Organization is an intergovernmental consultative and technical organization that was established in 1921 to support safety of navigation and the protection of the marine environment. The object of the Organization is to bring about:

- The coordination of the activities of national hydrographic offices
- The greatest possible uniformity in nautical charts and documents
- The adoption of reliable and efficient methods of carrying out and exploiting hydrographic surveys
- The development of the sciences in the field of hydrography and the techniques employed in descriptive oceanography

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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 Working Group 14th meeting, 28-29 March 2023, Göteborg, Sweden

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

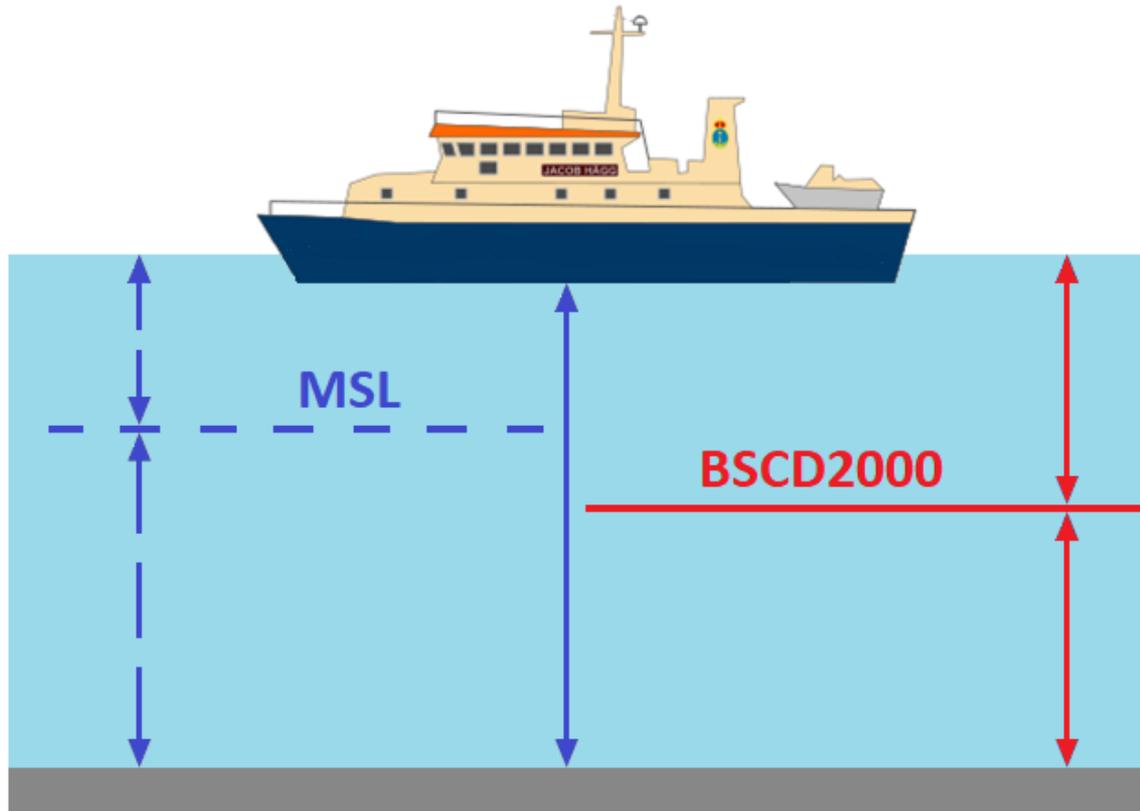
Members of CDWCWG:

Denmark	Mr Nikolaj Møller
Denmark	Mr Kristian Villadsen Kristmar
Estonia	Mrs Gabriela Kotsulim
Finland	Mr Jyrki Mononen
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 Lars Jakobsson
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	Mrs Anni Jokiniemi
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 Kristis Dzenis
Lithuania	Mr Emilis Tertelis
Lithuania	Mr Romuald Obuchovski
Norway	Mr Akxel Voldsund
Poland	Mr Krzysztof Pyrchla
Poland	Mrs Małgorzata Pająk
Poland	Dr Monika Wilde-Piórko
Poland	Dr Małgorzata Szelachowska
Sweden	Dr Jonas Ågren
Sweden	Dr Per-Anders Olsson
Sweden	Mrs Johanna Linders

New reference level



The water depth remains!

Baltic Sea Chart Datum 2000 (BSCD2000)

➤ **Definition:**

The datum refers to each Baltic country's realization of the European Vertical Reference System (EVRS) with land-uplift epoch 2000, which is connected to the Normaal Amsterdams Peil (NAP).

➤ **Justification:**

The Baltic Sea is an international shallow, non-tidal area in the northern part of Europe with dense traffic. IHO BSHC has approved the name and the adoption of the Baltic Sea Chart Datum 2000 ([specification](#)).

➤ **Height systems used as national realization of BSCD2000 (EVRS-based):**

Sweden RH2000	Denmark DVR90	Germany DHHN2016
Poland PL-EVRF2007-NH	Lithuania LAS07	Latvia LAS2000,5
Estonia EH2000	Finland N2000	Norway NN2000

➤ **Chart datum name to be shown in paper charts:**

Mean Sea Level (Baltic Sea Chart Datum 2000^{national realization name})

or

Mean Sea Level (Baltic Sea Chart Datum 2000)

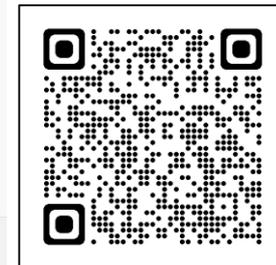


Baltic Sea Chart Datum 2000 in IHO Registry

BSCD2000 is now included in IHO Geospatial Information (GI) Registry, as chart datum number 44:

The screenshot shows the IHO Geospatial Information Registry Data Dictionary Register page. The page header includes the IHO logo and the text 'IHO Geospatial Information Registry'. The main content area displays the 'Data Dictionary Register' for 'Baltic Sea Chart Datum 2000'. The page features a navigation menu on the left with options like HOME, HELP&GUIDANCE, GI REGISTERS, PROPOSAL, TEST BED, Open Online Platform, and 2nd GI Registry(Old). The main content area shows a search bar with filters for Feature Type (366), Information Type (26), Attribute Type (667), Complex Type (92), Enumeration Value (2273), and Codelist Value (117). Below the search bar, there are dropdown menus for Domain (ALL), Status (Valid), Type (ALL), and Category (Name). The main content area displays the details for the 'Baltic Sea Chart Datum 2000' entry, including its Domain (IHO Hydro), Name (Baltic Sea Chart Datum 2000), CamelCase (balticSeaChartDatum2000), Item Identifier (1213), Definition (The datum refers to each Baltic country's realization of the European Vertical Reference System (EVRS) with land-uplift epoch 2000, which is connected to the Normaal Amsterdams Peil (NAP)), Data type (Enumerated value), Associated Attribute (Enumerated type), and Reference Source (Baltic Sea Hydrographic Commission). The page also includes a QR code on the right side and a copyright notice at the bottom: 'COPYRIGHT © IHO Geospatial Information Registry. ALL RIGHTS RESERVED. KHOA Acknowledgements'.

[Listed Value] Dictionary Details					
Domain	IHO Hydro				
Name	Baltic Sea Chart Datum 2000				
CamelCase	balticSeaChartDatum2000				
Item Identifier	1213 ?				
Definition	The datum refers to each Baltic country's realization of the European Vertical Reference System (EVRS) with land-uplift epoch 2000, which is connected to the Normaal Amsterdams Peil (NAP).				
Data type	Enumerated value				
Associated Attribute	<table border="1"><thead><tr><th>Attribute type</th><th>Name</th></tr></thead><tbody><tr><td>Enumerated type</td><td>Vertical Datum</td></tr></tbody></table>	Attribute type	Name	Enumerated type	Vertical Datum
Attribute type	Name				
Enumerated type	Vertical Datum				
Reference					
Reference Source	Baltic Sea Hydrographic Commission				



International Hydrographic Review Article

An article about the CDWCWG work and the implementation of the Baltic Sea Chart Datum 2000 has been published in the International Hydrographic Review (IHR) in May 2020: [THE BALTIC SEA CHART DATUM 2000 \(BSCD2000\) - Implementation of a common reference level in the Baltic Sea](#)

INTERNATIONAL HYDROGRAPHIC REVIEW MAY 2020

Articles

THE BALTIC SEA CHART DATUM 2000 (BSCD2000) Implementation of a common reference level in the Baltic Sea

By J. Schwabe¹, J. Ägren², G. Lebesch³, P. Westfeld⁴, T. Hammarik⁵, J. Mononen⁶ and G. B. Andersen⁶

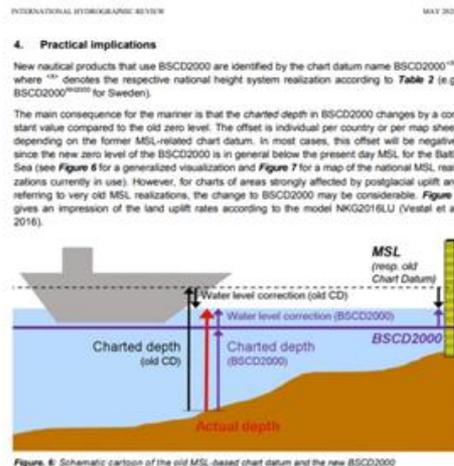
1. Federal Agency for Cartography and Geodesy (Germany)
2. University of Gävle (Sweden) and Lantmäteriet, the Swedish mapping, cadastral and land registration authority (Sweden)
3. Federal Maritime and Hydrographic Agency (Germany)
4. Swedish Maritime Administration (Sweden)
5. Finnish Transport Agency (Finland)
6. DTU Space (Denmark)

Abstract

The Baltic Sea Chart Datum 2000 (BSCD2000) is a geodetic reference system adopted for Baltic Sea hydrographic surveying, hydrographic engineering, nautical charts, navigational publications and water level information. It is based on the common geodetic standards for the height system (EVRS) and the spatial reference system (ETRS89) in Europe. In particular, the zero level of BSCD2000 is in accordance with the Normal Amsterdam Peil (NAP). BSCD2000 is about to be adopted as unified chart datum by all the countries around the Baltic Sea. It agrees with most national height realizations used on land. BSCD2000 will facilitate effective use of GNSS methods like GPS, GLONASS and Galileo for accurate navigation and hydrographic surveying in the future.

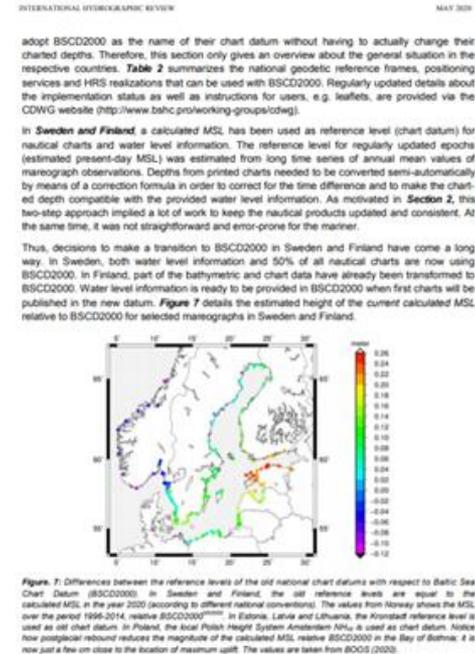
Résumé

Le Baltic Sea Chart Datum 2000 (BSCD2000) est un système de référence géodésique adopté pour les levés hydrographiques, l'ingénierie hydrographique, les cartes marines, les publications nautiques et les informations sur le niveau de l'eau de la mer Baltique. Il est basé sur les normes géodésiques communes au Système de Référence Européen (EVRS) et au Système de Référence Terrestre Européen (ETRS89). En particulier, le zéro hydrographique du BSCD2000 est conforme au Normal Amsterdam Peil (NAP). Le BSCD2000 est sur le point d'être adopté en tant que niveau de référence des cartes commun par l'ensemble des pays bordant la mer Baltique. Il correspond à la plupart des mesures de hauteur nationales utilisées à terre. Le BSCD2000 facilitera l'utilisation efficace des méthodes du GNSS comme le GPS, GLONASS et Galileo pour une navigation et des levés hydrographiques précis à l'avenir.



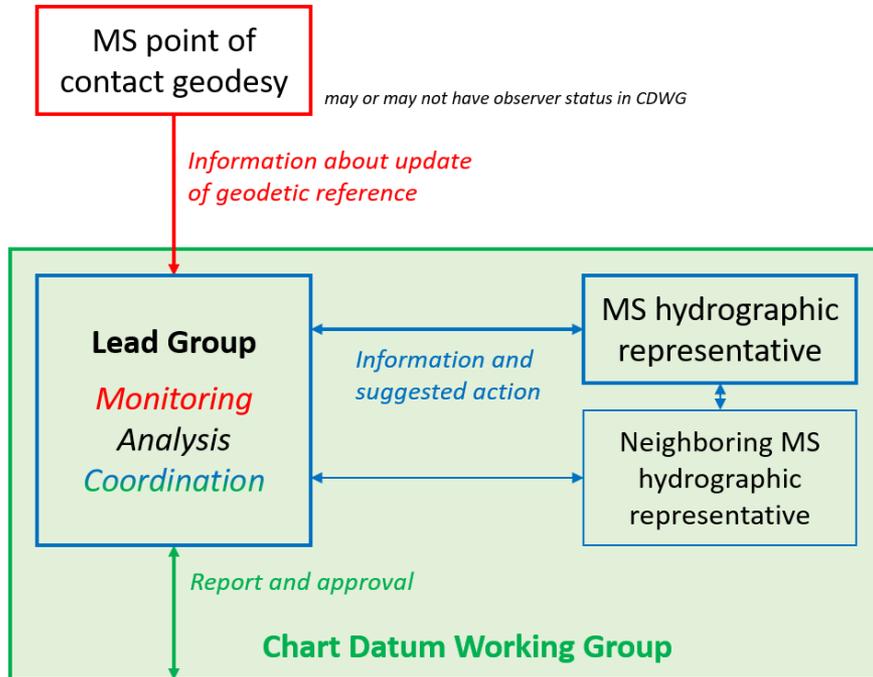
At the same time, real-time water level information (water level observations, corrections to the charted depths, forecasts, etc.) will also be changed accordingly to comply with the new chart datum. This also allows for a better and easier monitoring and prediction of the current and future sea states out at sea, since real-time oceanographic models can be simply interpolated (**Figure 8**), whereas switching between the sometimes far-distant mareographs and their local references may introduce a large error margin (**Figure 9**).

The transition from the numerous MSL-based chart datums of each country to BSCD2000 is a complex and stretched process from the first decisions to the final implementation in the chart products. In particular, paper charts need longest to be switched due to the long production cycles. Some countries, like Estonia, have already informed mariners about the changes to BSCD2000 and have published the first products. Others, like Denmark, are about to formally



Continuity Management of BSCD2000

Organizational scheme and workflow



BSCD2000 height transformation grid (geoid model)

Release note:

<https://doi.org/10.58440/ihr-29-2-n11>

Landing page:

<https://www.bshc.pro/iho-bscd2000>

Digital Object Identifier (DOI) with download

DOI: 10.58440/iho-bscd2000

URL: <https://doi.org/10.58440/iho-bscd2000>

The DOI has been configured as type 'database'. In perspective, we can assign any number of "datasets" to a "database". This means that each new BSCD2000 release can have its own entry.

We can also assign literature references (definition, specification, publications etc.) in the future.



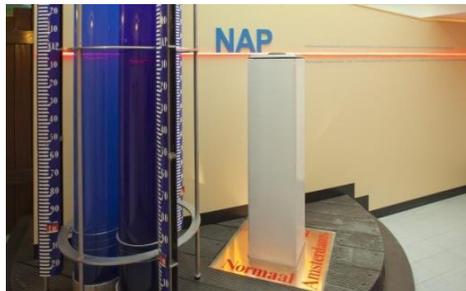
Swedish height systems



- **RH00 National height system 1900**
Official national height system until 1970
Zero-level defined by:
Normal height point in Stockholm from 1886
Placed +11,800 m above mean sea level in Stockholm 1900



- **RH70 National height system 1970**
Official national height system 1970-2005
Zero-level defined by:
Normaal Amsterdams Peil (NAP), a reference point in Varberg placed +4,234 m above NAP



- **RH 2000 National height system 2000**
"Baltic Sea Chart Datum 2000 (BSCD2000)"
Official national height system since 2005
Zero-level defined by:
NAP is the reference point in the European Vertical Reference System (EVRS)
Epoch year 2000

Swedish Chart Improvement project

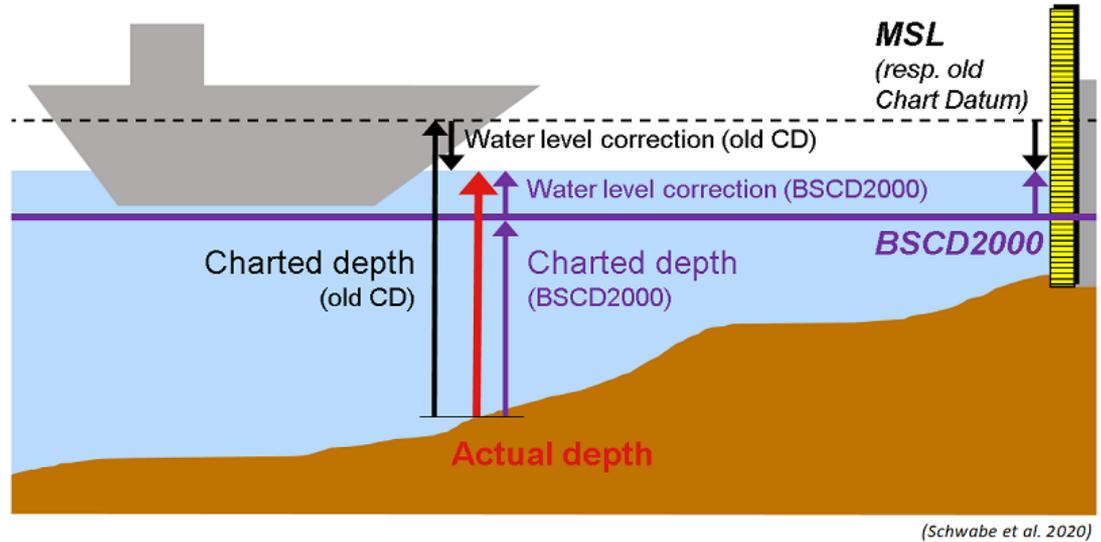
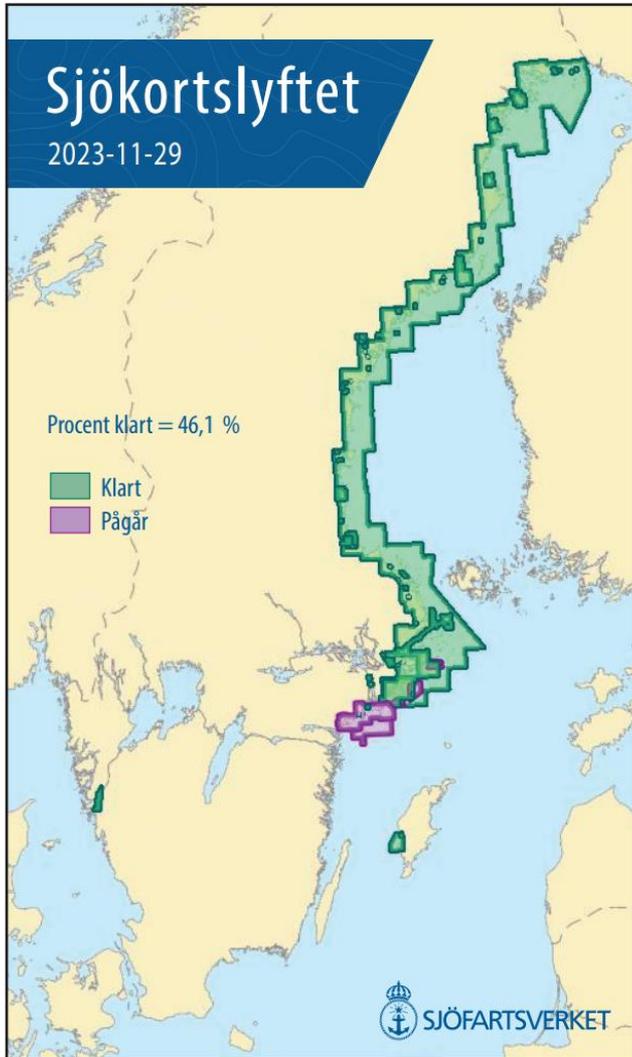


CHART DATUM: Mean Sea Level (Baltic Sea Chart Datum 2000^{RH2000})
REFERENSNIVÅ: Medelvattenyta (Baltic Sea Chart Datum 2000^{RH2000})
SYMBOLS and ABBREVIATIONS: see INT 1
BETECKNINGAR och FÖRKORTNINGAR: se KORT 1

Referensnivå

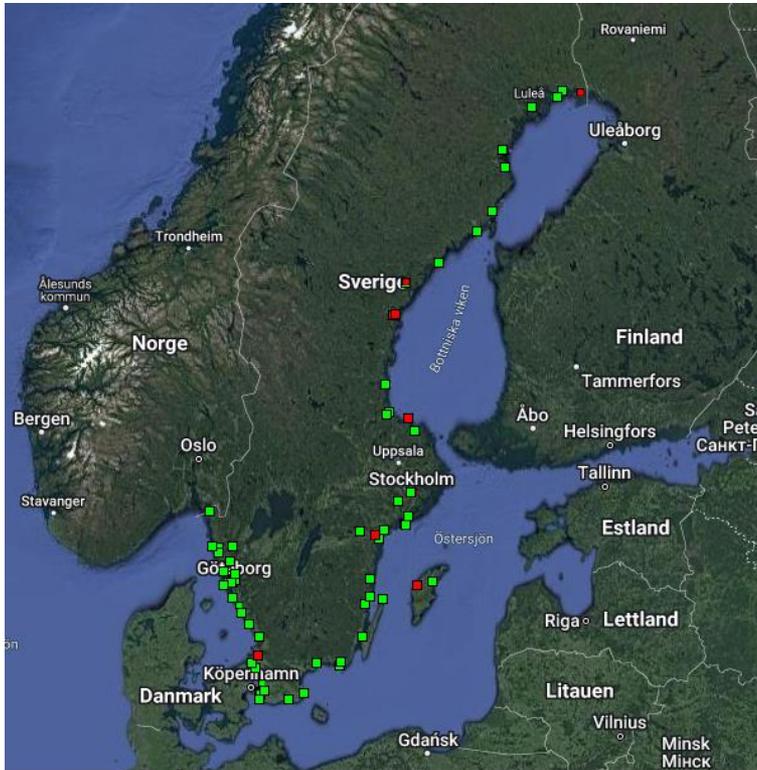


Status transition from MSL to BSCD2000 in nautical charts



Updated 2023-11-29

Swedish Sea Level Network



- Real-time data relative BSCD2000 from 60 stations
- 1-minute values with 1 cm accuracy
- Real-time and delayed mode quality control



Class I Upgrade with battery backup
 Class II Upgrade without battery backup
 Class III Unchanged, temporary

27 stations (23 SMHI, 3 SMA, 1 CTH)
 27 stations (23 SMA, 3 GBG, 1 SKB)
 6 stations (6 SMA)

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

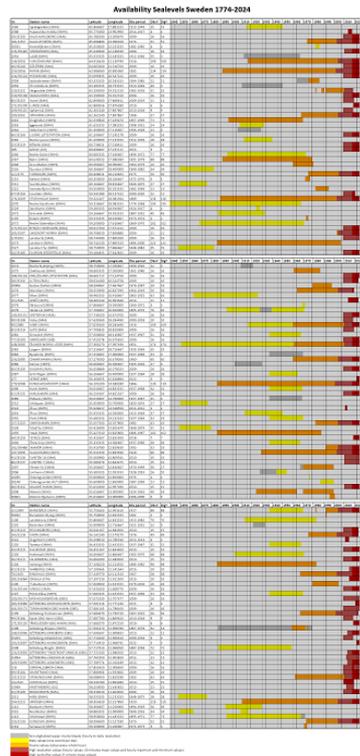
Upgrade of the Swedish Sea Level network 2017-2019

- 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



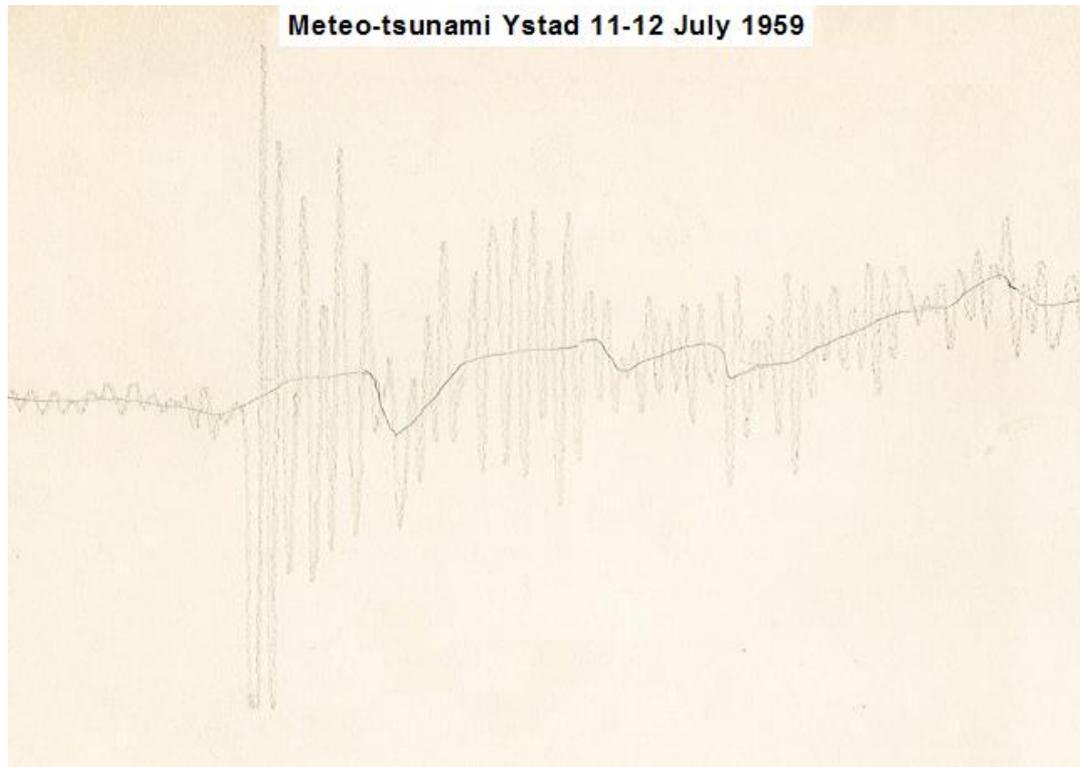
Swedish Sea Level observations 1774-2024

- First observations started in Stockholm 1774
 - 140 sea level stations/records, 60 stations are active (2024)
 - 4998 years of observations, 4630 years of data are digitalized (93%)
 - 2240 years from continued stations, 100% digitalized
- High-Resolution data (1-15 minutes)
- Hourly values
- Daily values



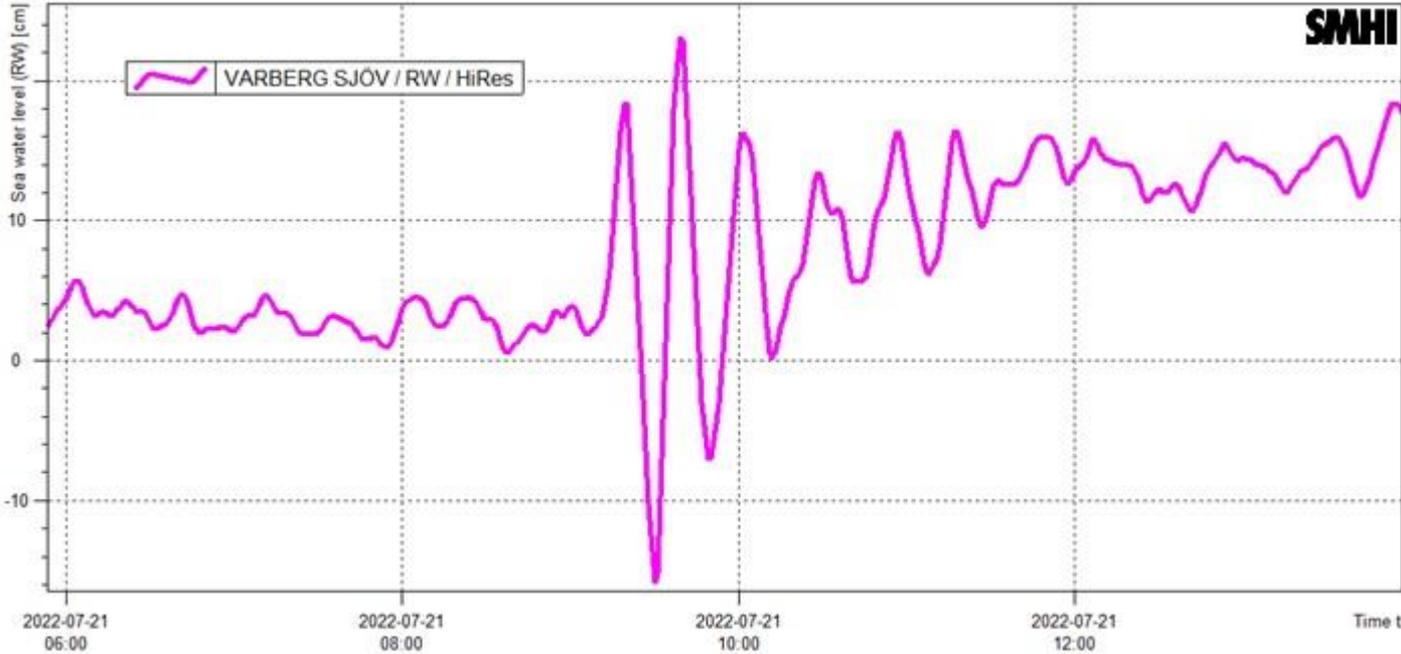
Phenomena in Swedish Sea Level data

Meteo-tsunami Ystad 11-12 July 1959

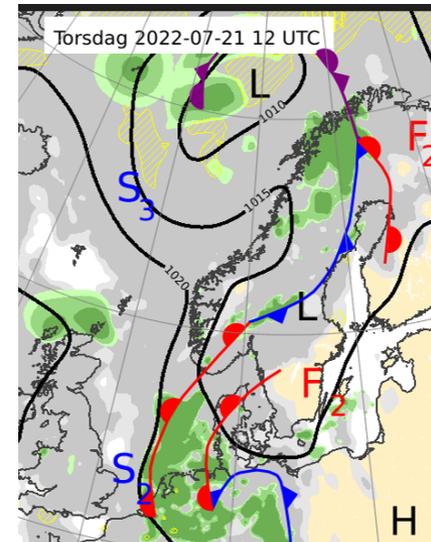
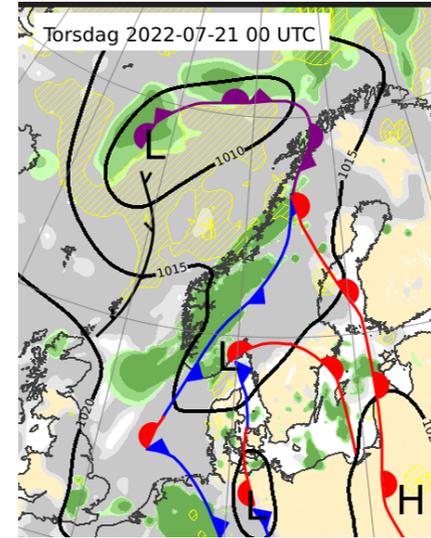
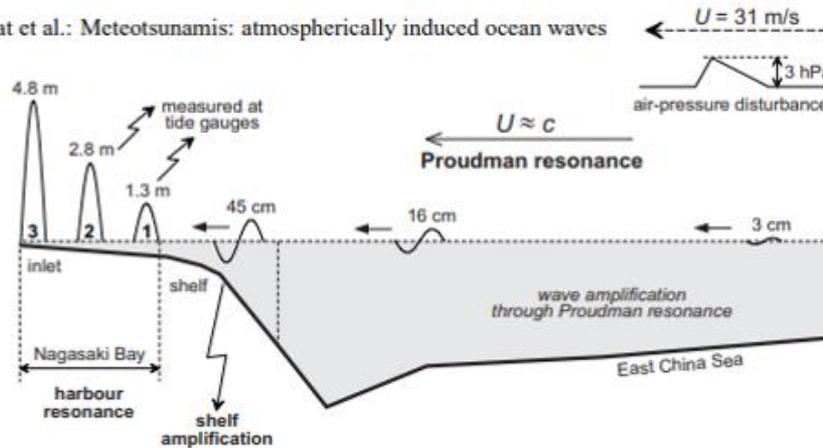


Disturbance lasted about: 6 hours
Largest difference between high and low: 132 cm
Time between two highs or lows (period): 10 minutes

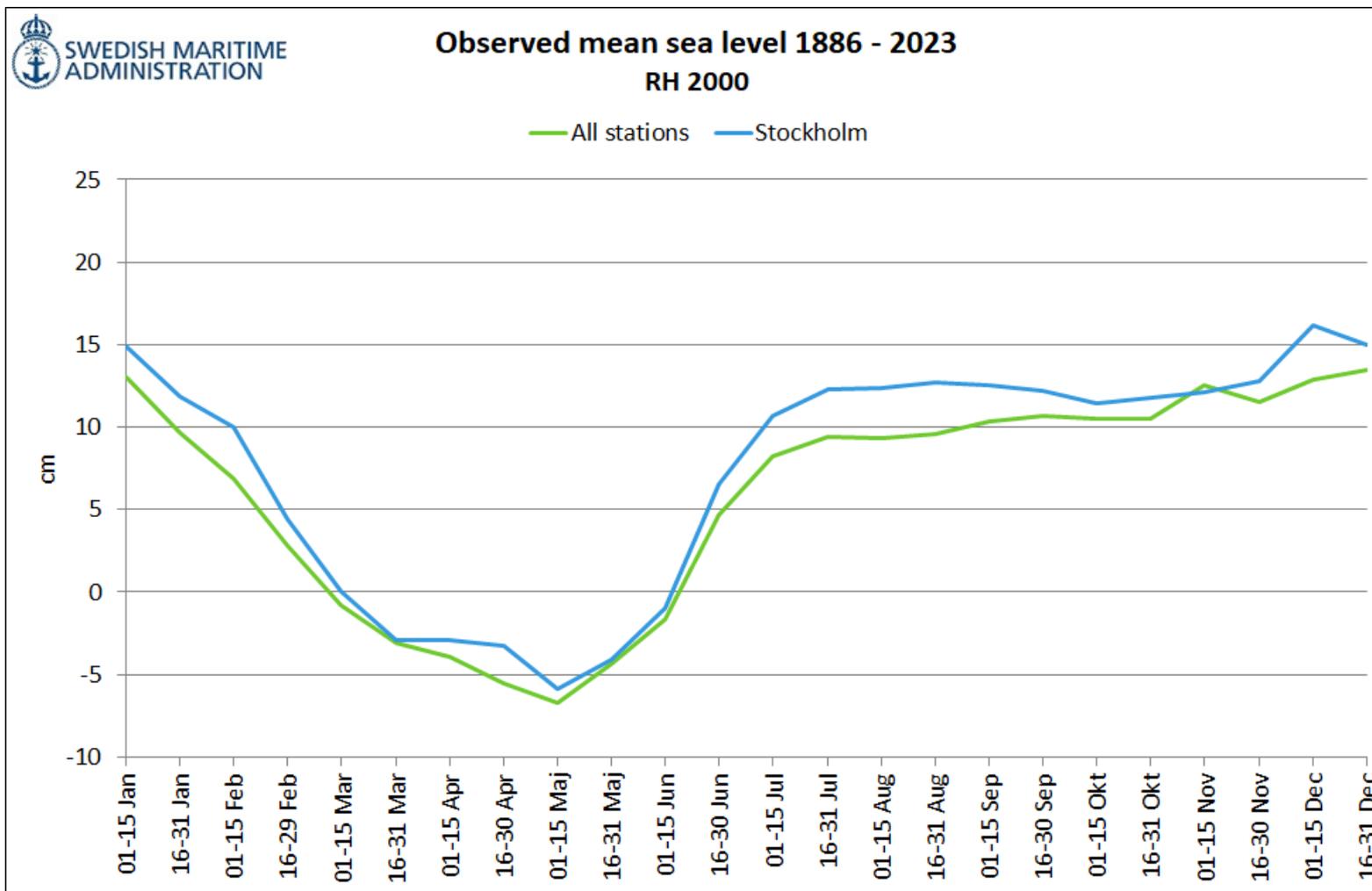
Meteo-tsunami Varberg 21st July 2022



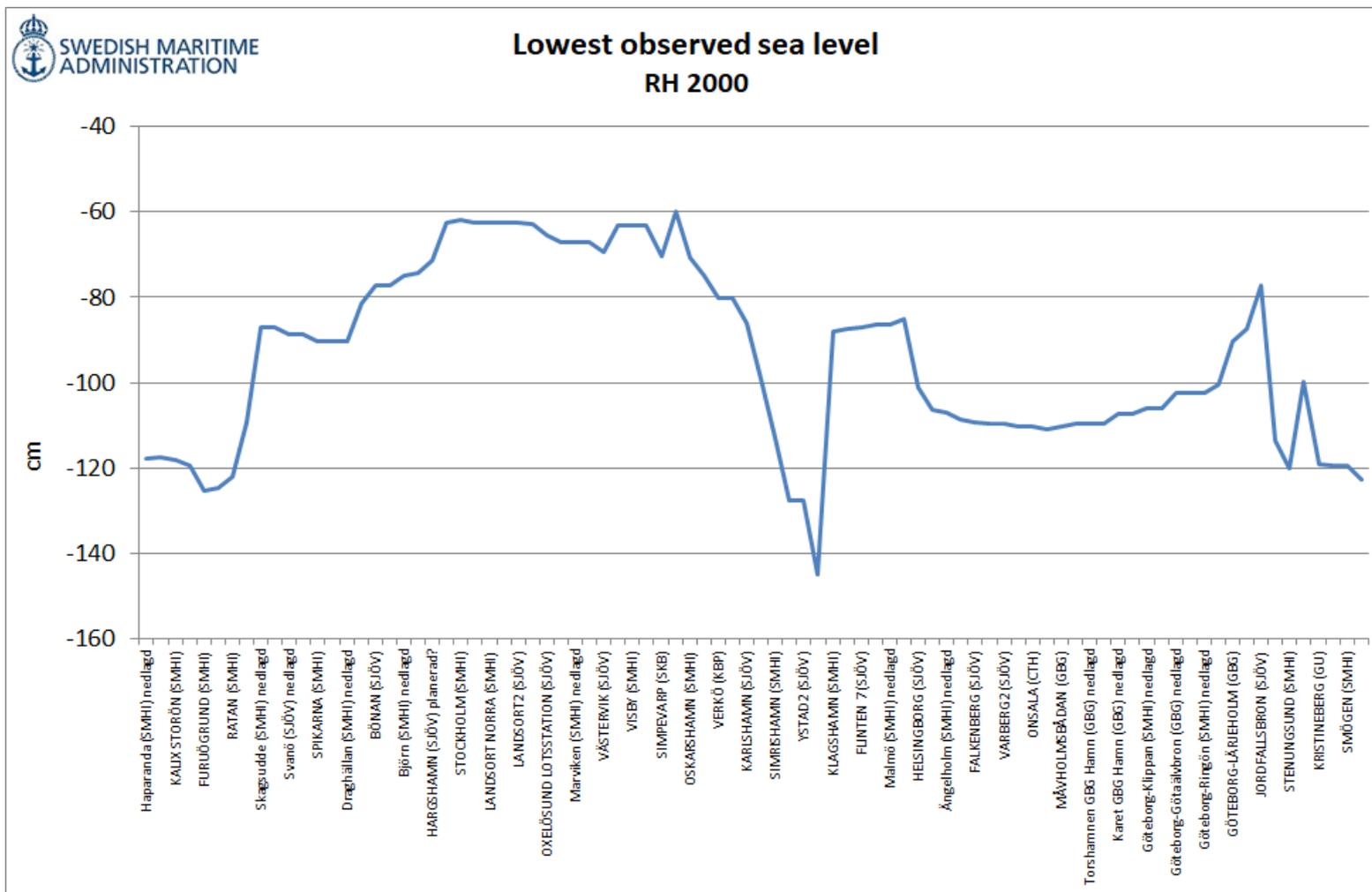
S. Monserrat et al.: Meteotsunamis: atmospherically induced ocean waves



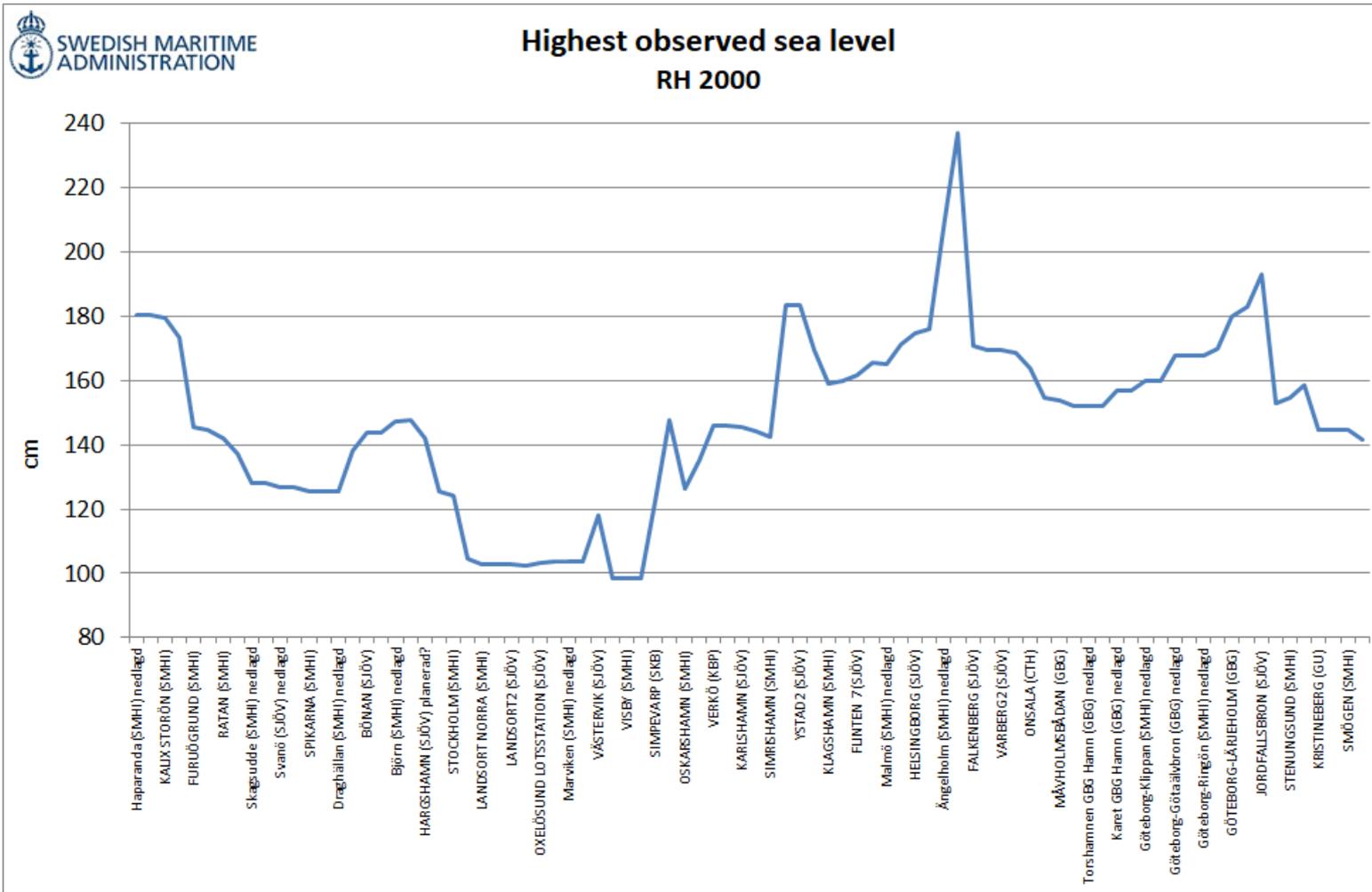
Observed mean sea level



Lowest observed sea level

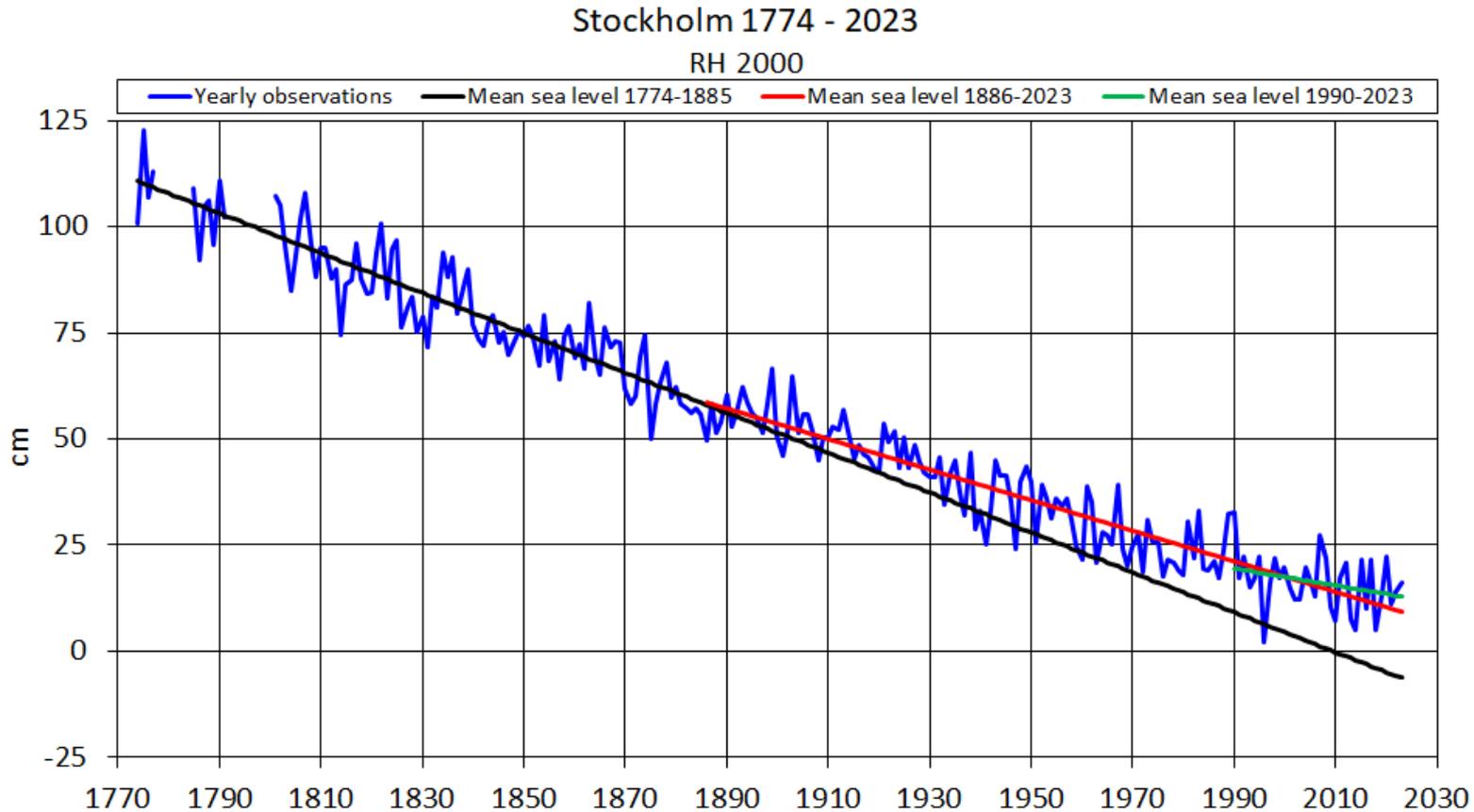


Highest observed sea level

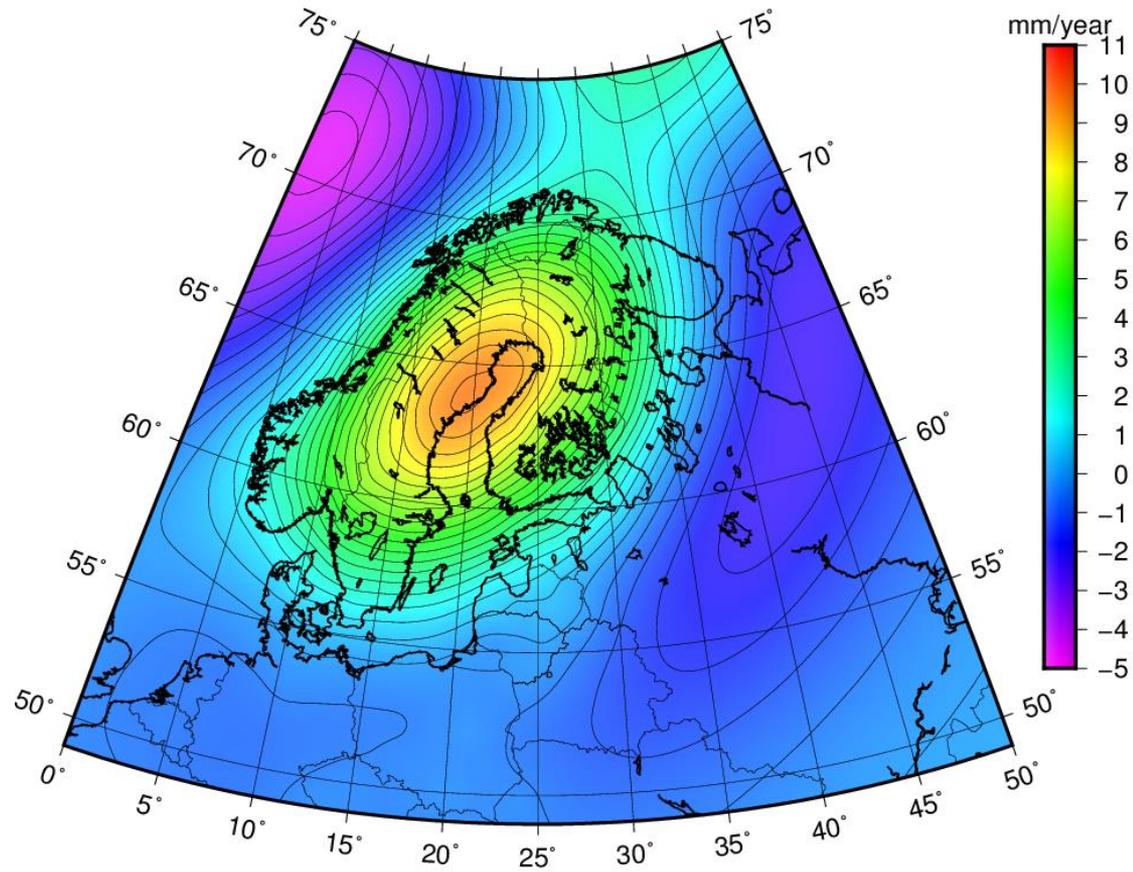


Stockholm

“World’s longest sea level record”



Land-uplift

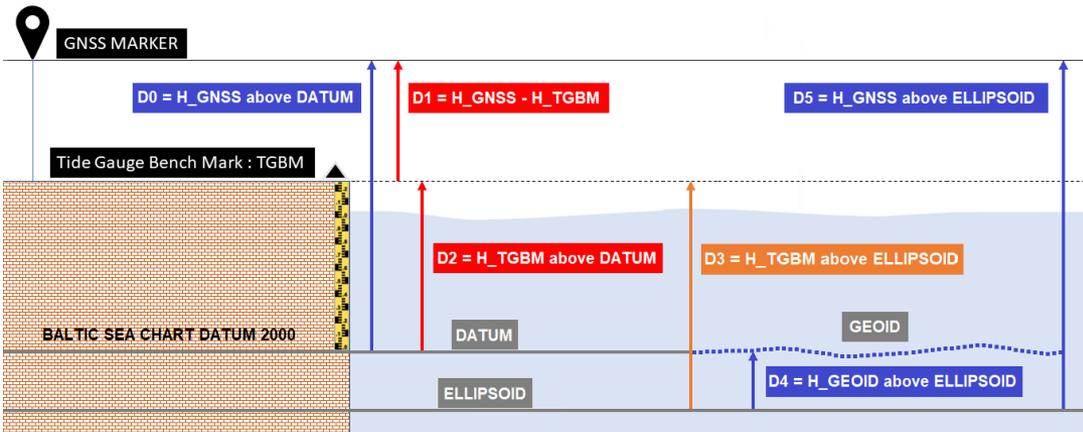


Levelled land-uplift (relative the geoid, NKG2016LU_lev) from the Nordic Geodetic Commission's (NKG) land-uplift model NKG2016LU

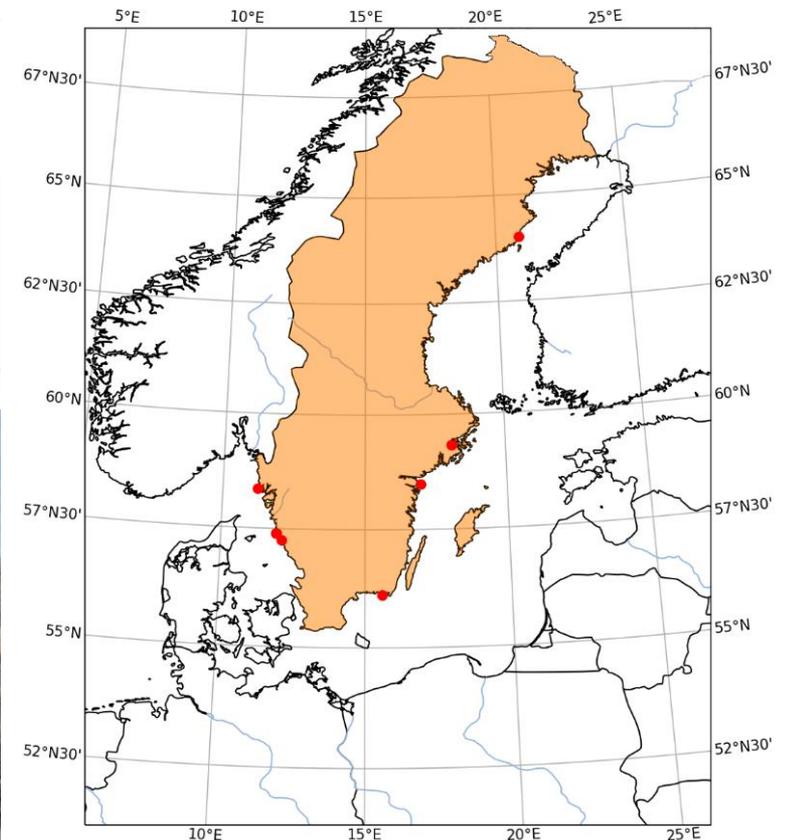


Co-location of sea level stations and GNSS

RESPONSIBLE AGENCY		TIDE GAUGE COORDINATE				CO-LOCATED INSTRUMENTS			GNSS COORDINATES		CO-LOCATED CRITERIA		LEVELING INFORMATION	
RESPONSIBLE FOR GNSS	RESPONSIBLE FOR TG	LONG	LAT	TIDE_GAUGE	GNSS_SONEL	GNSS_SWEPOS	LONG	LAT	INSTALLED	GNSS->TG HORIZONTAL DISTANCE (m)	TGBM_ID	DATUM DEFINITION		
SWEPOS-LMV	SMHI	20.895031	63.986056	RATAN	RATO	RATA.0	20.89556580	63.98558831	2006-06-09	58	h	BSCD2000/RH2000		
SWEPOS-LMV	SMHI	18.081944	59.324167	STOCKHOLM	OMOS	MOSE.0	18.07420578	59.31842324	2013-07-11	373	a (LMV 108*2*6503)	BSCD2000/RH2000		
SWEPOS-LMV	SMHI	16.960556	58.484167	ARKO	OARK	ARKO.1	16.96265021	58.48327049	2019-08-26	158	101	BSCD2000/RH2000		
SWEPOS-LMV	SMHI	15.589444	56.105278	KUNGS HOLMSFORS	KUNO	KUNG.0	15.58903022	56.10423868	2004-12-31	108	a (LMV 035*2*3704)	BSCD2000/RH2000		
SWEPOS-LMV	Chalmers	11.919167	57.391944	ONSA LA	ONSA	ONSA.0	11.92551310	57.39529604	1993-07-01	533	827a	BSCD2000/RH2000		
SWEPOS-LMV	Chalmers	11.919167	57.391944	ONSA LA	ONS1	ONSA.1	11.92453692	57.39533058	2012-01-28	496	827a	BSCD2000/RH2000		
SWEPOS-LMV	SMHI	11.217778	58.353611	SMOGEN	SMO0	SMOG.0	11.21792382	58.35346156	2002-08-26	18	g	BSCD2000/RH2000		

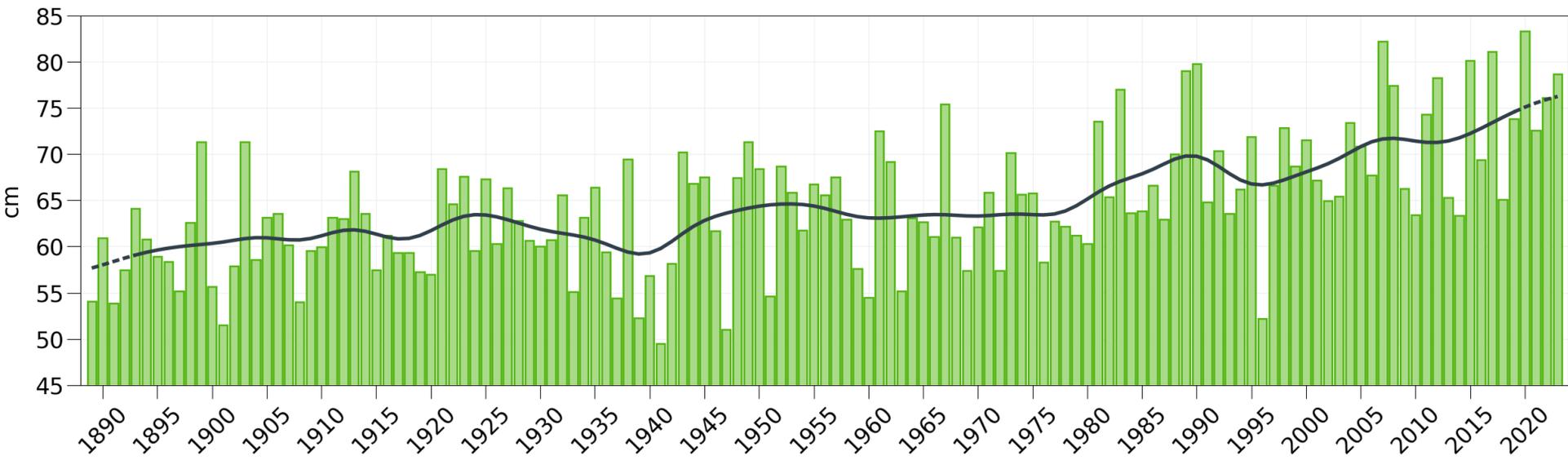


GNSS@TG < 1000.0 m for Sweden



Sea level rise

Stockholm



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



Future sea levels



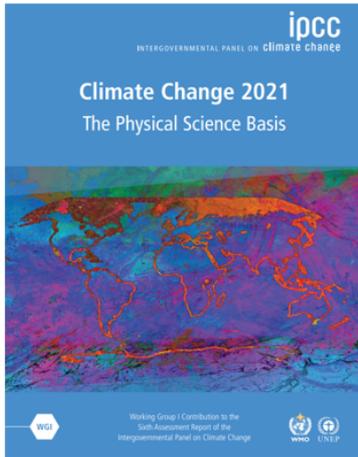
Thomas Hammarklint
Hydrographic Office

PM

Published 2019-11-30
Updated 2024-08-16

1 (10)

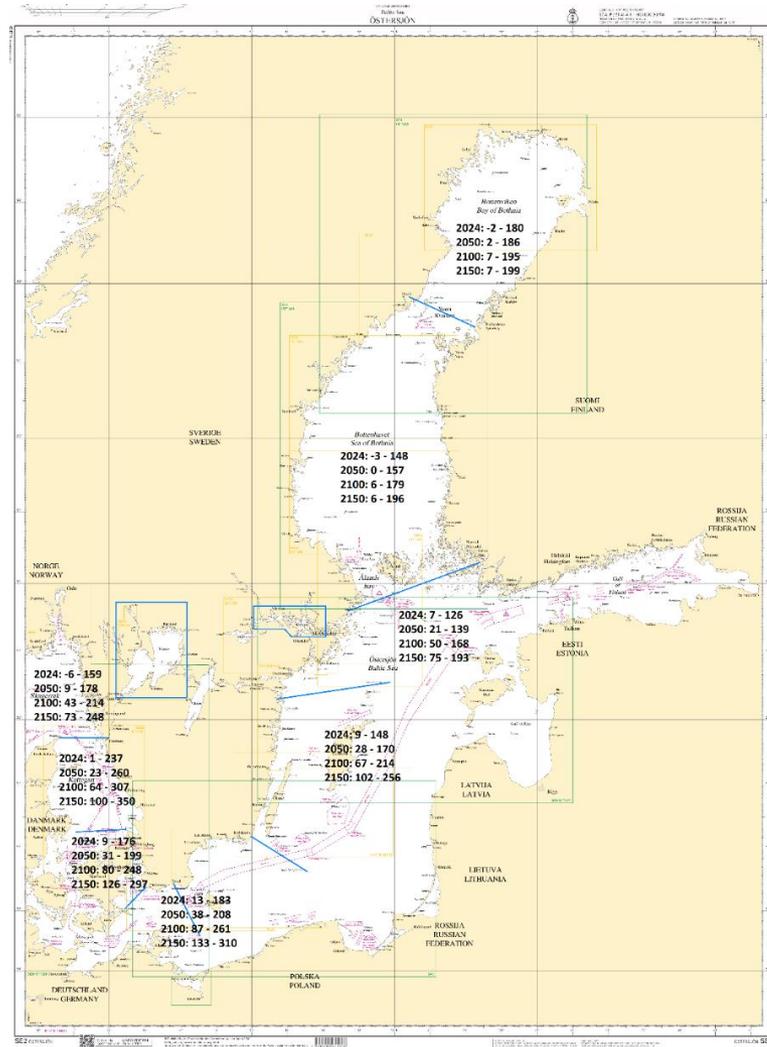
Future sea levels in Sweden



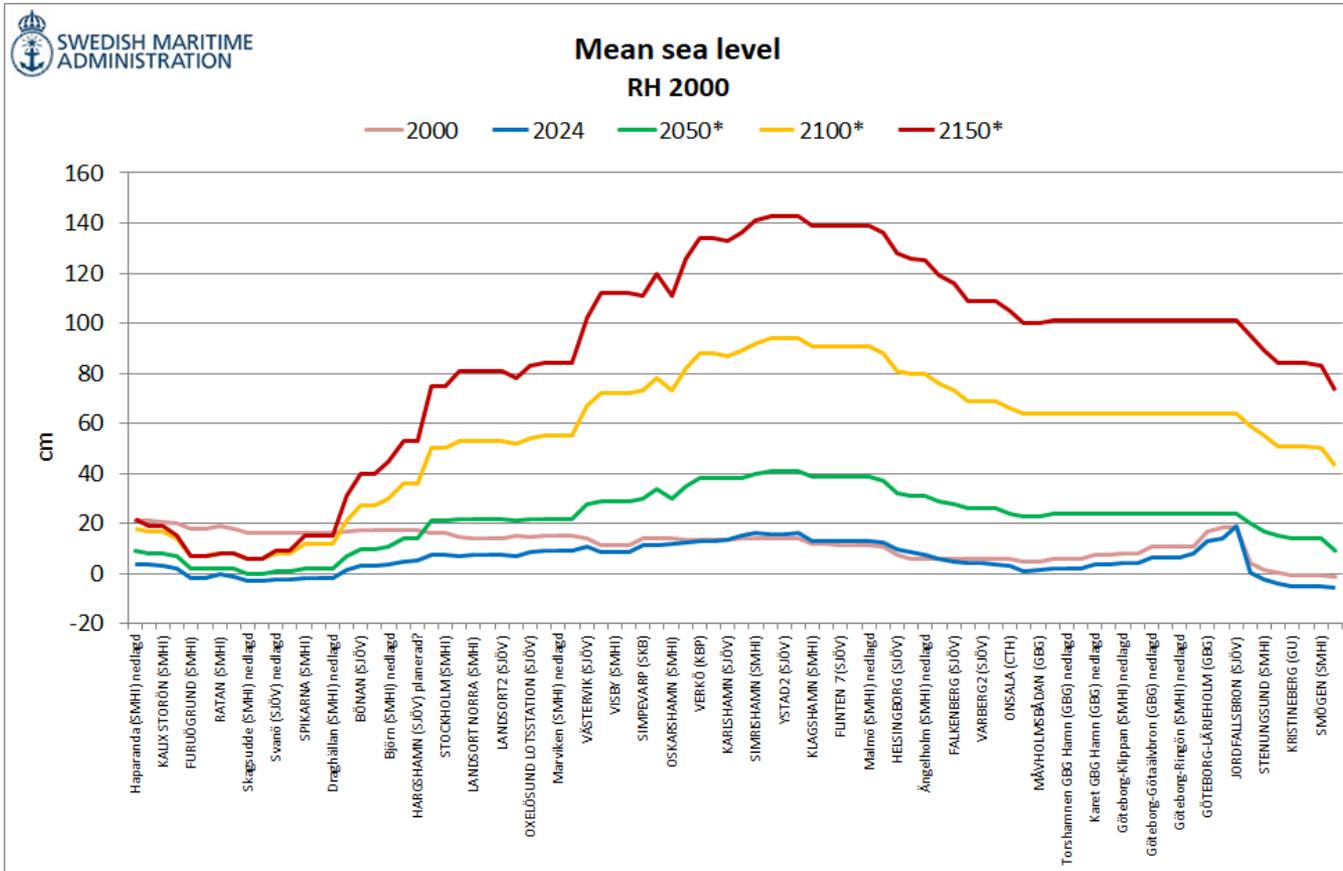
In 2021, the Intergovernmental Panel on Climate Change (IPCC) released the Sixth Assessment Report; AR6 Interim Report 1 - The Physical Science Basis [IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change] (AR6 WG1), where they present the latest calculations, including on future sea levels. SMHI has compiled data for probable projections for the years 2050, 2100 and 2150 municipality by municipality on its website (SMHI Future mean sea levels), which has been used in the calculations in this memorandum.

Summary

Calculations of mean sea levels and highest sea levels for the years 2024, 2050, 2100 and 2150 have been conducted for 86 Swedish stations (Figures 5, 6, 7 and Appendix Table 1). The results are based on analysis of historical observational data from 1886 through 2023 (SMHI Open Data Service, Availability Swedish sea levels) and extreme levels calculated at SMHI (SMHI Extreme levels) regional data on global sea level rise from the SSP5-8.5 projection (Figure 4, median values, likely scenario) in the Intergovernmental Panel on Climate Change (IPCC) projections presented in AR6 Interim Report 1 - The Scientific Basis (AR6 WG1) and total (aggregated) land uplift data compiled by SMHI (SMHI Future mean sea levels), which is based on the Nordic Commission for Geodesy (NGK) land uplift model (NGK2016LU). All results are reported in Sweden's national reference system for depths, heights and water levels; Land Survey Datum 2000 (RH 2000) or Baltic Sea Chart Datum 2000 (BSCD2000).

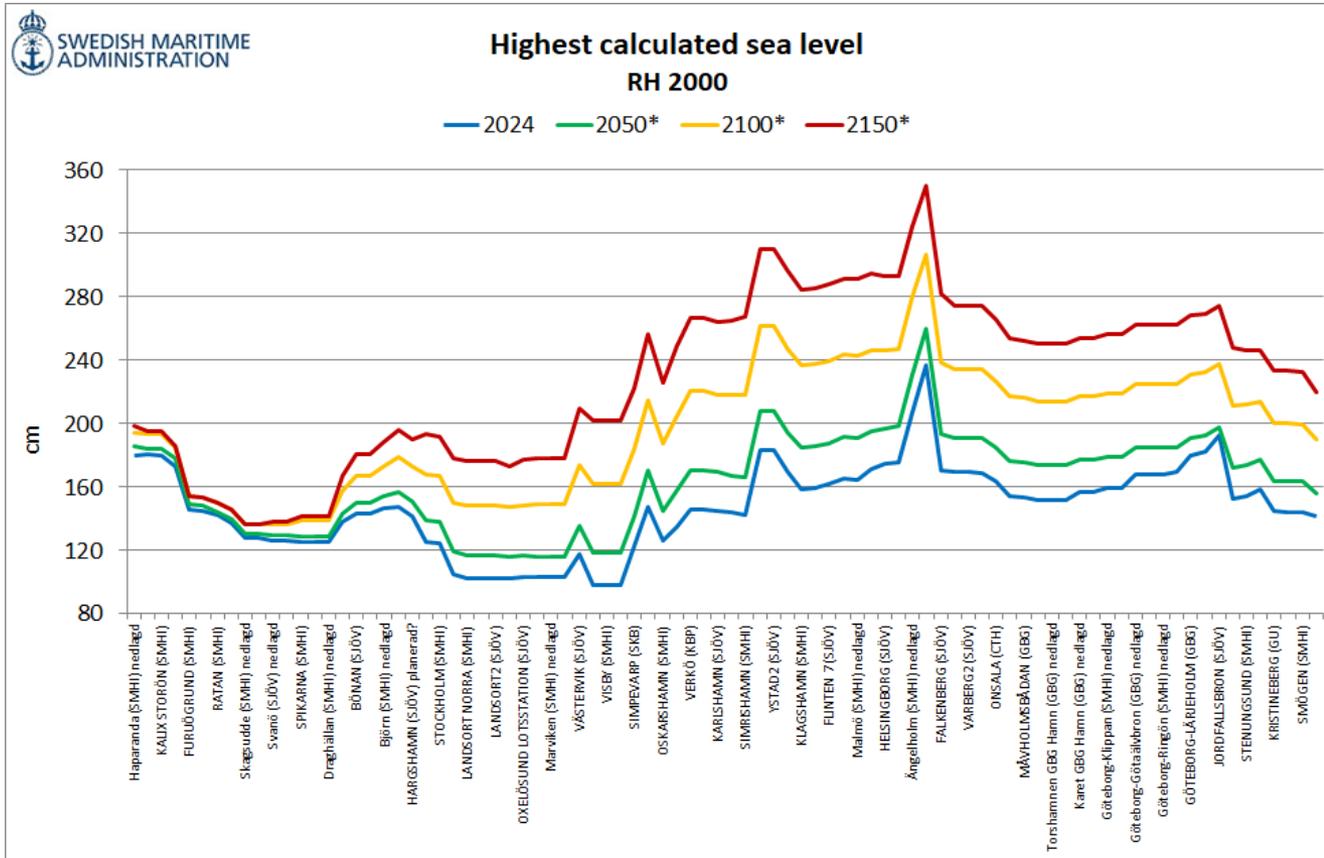


Mean sea level



Calculated mean sea level in RH 2000 (cm) for the years 2000, 2024, 2050*, 2100* and 2150* at 86 Swedish stations, * incl. sea level rise according to IPCC's projection SSP5-8.5 median values ([IPCC, AR6 WG1](#)) and total land uplift ([SMHI Future mean sea levels](#))

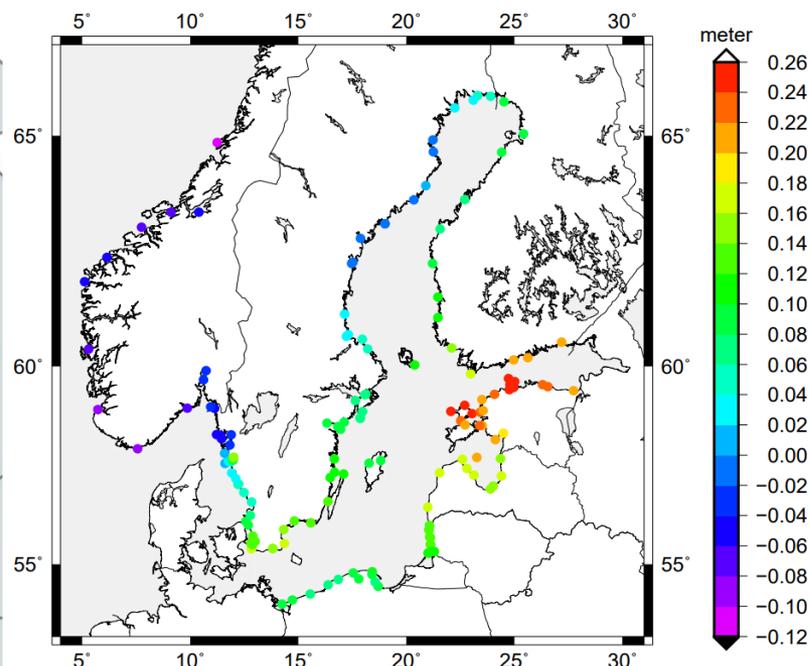
Highest calculated sea level



Highest calculated sea level in RH 2000 (cm) 2024, 2050*, 2100* and 2150*, at 86 Swedish stations * incl. sea level rise according to IPCC's projection SSP5-8.5 median values ([IPCC, AR6 WG1](#)) and total land uplift ([SMHI Future mean sea levels](#))

Reference levels in the Baltic Sea

Reference levels Baltic Sea
Water level information



BOOS SEALEVEL STATIONS 2021
Mean Sea Level (MSL) in different height systems
MSL based upon regression analysis since measurement start (Sweden)

2021-09-07

BSCD2000 = Baltic Sea Chart Datum 2000, heights referred to Amsterdam (NAP)
RH2000 = Swedish Height System 2000, heights referred to Amsterdam (NAP)
* = Correction of provided sea level data to BOOS to the Baltic Sea Chart Datum 2000 (BSCD2000)

COUNTRY	OWNER	NR	STATION NAME	LATITUDE	LONGITUDE	BSCD2000 rh2000	Apparent landuplift cm/year	Correction* BSCD2000 m
SWEDEN	SMHI	2388/33088	Haparanda discontinued	65.771667	23.902056	5.9	0.72	0.059
SWEDEN	SMA	59/35103	KALIX KARLÖBING	65.788889	23.303333	6.1	0.72	0.061
SWEDEN	SMHI	2157/33051	KALIX STORÖN	65.690444	23.096111	5.9	0.79	0.053
SWEDEN	SMA	115/35183	STRÖMÖREN	65.549722	22.238333	4.4	0.75	0.044
SWEDEN	SMHI	2055/33052	FURUÖGRUND	64.915833	21.230556	0.5	0.82	0.005
SWEDEN	SMA	40/35240	GÄSÖREN	64.678611	21.249167	0.8	0.82	0.008
SWEDEN	SMHI	2056/33053	KATAN	63.986111	20.895000	2.4	-0.80	0.024
SWEDEN	SMA	57/35124	HOLMSUND	63.695833	20.347222	1.4	0.80	0.014
SWEDEN	SMHI	2321/33054	Skagssjö discontinued	63.190556	19.025000	-0.4	0.80	-0.004
SWEDEN	SMA	110/35138	SKAGSLÖDDE2	63.190556	19.025000	-0.4	0.80	-0.004
SWEDEN	SMA	172/35209	LUNDE	62.880556	17.876389	0.1	0.77	0.001
SWEDEN	SMHI	2062/33074	Drughällan discontinued	62.333333	17.466667	0.7	0.74	0.007
SWEDEN	SMHI	2061/33055	SFARNNA	62.363333	17.531111	0.7	0.74	0.007
SWEDEN	SMA	66/35127	LJUSNE ÖRSKÄRSKAJEN	61.200444	17.145556	3.5	0.64	0.035
SWEDEN	SMA	33/35119	BÖNAN	60.738611	17.318611	5.0	0.58	0.050
SWEDEN	SMHI	2067/33075	GÄVLE	60.696444	17.239722	5.0	0.58	0.050
SWEDEN	SMHI	2067/33075	Igten discontinued	60.633333	17.966667	5.6	0.56	0.056
SWEDEN	SMHI	2179/33056	FORSMARK	60.408611	18.250833	6.3	0.53	0.063
SWEDEN	SMA	67/35154	LOUDDEN	59.341389	18.137222	8.4	0.38	0.084
SWEDEN	SMHI	2069/33057	STOCKHOLM	59.324167	18.083944	8.5	0.38	0.085
SWEDEN	SMA	173/35112	NYNÄS FJÄRHAMN	58.975000	17.972222	8.1	0.31	0.081
SWEDEN	SMHI	2507/33058	LANDSKRÖNNA	58.768889	17.858889	8.3	0.29	0.083
SWEDEN	SMHI	2073/33076	Landöret discontinued	58.750000	17.866667	8.3	0.29	0.083
SWEDEN	SMA	34/35185	E4 BRÖN SÖDERTÄLJE	59.384722	17.647778	8.2	0.33	0.082
SWEDEN	SMA	10/35118	ÖNELOUND VINTERALASEN	58.661667	17.124722	9.3	0.26	0.093
SWEDEN	SMA	58/35101	JUTEN	58.634167	16.324722	9.8	0.25	0.098
SWEDEN	SMHI	2076/33059	Marviken discontinued	58.553611	16.837222	9.8	0.25	0.098
SWEDEN	SMHI	2545/33085	ÄRÖ	58.484167	16.960556	9.8	0.25	0.098
SWEDEN	SMA	93/35151	VÄSTERVIK	57.748333	16.675278	11.0	0.16	0.110
SWEDEN	SMA	82/35114	SUTE	57.705833	16.810000	9.0	0.12	0.090
SWEDEN	SMHI	2080/33060	VISBY	57.639167	18.284444	9.0	0.12	0.090
SWEDEN	SKB	77/35200	SIMPEVARP	57.410278	16.675833	11.7	0.12	0.117
SWEDEN	SMHI	2083/33061	ÖLANDS NORRA UDDE	57.366111	17.097222	11.6	0.12	0.116
SWEDEN	SMHI	2085/33062	OSKARSHAMN	57.275000	16.478056	12.0	0.10	0.120
SWEDEN	SMA	60/35105	KALMAR	56.658889	16.378333	12.5	0.06	0.125
SWEDEN	SMHI	2088/33063	KUNGSÖLMSFÖRT	56.105278	15.528444	13.3	0.01	0.133
SWEDEN	SMA	61/35131	KARLSHAMN	56.154167	14.821389	13.8	-0.01	0.138
SWEDEN	SMHI	2543/33083	Åhus discontinued	55.928333	14.328611	15.1	-0.05	0.151
SWEDEN	SMHI	2320/33064	SMARSHAMN	55.557500	14.357778	16.0	-0.08	0.160
SWEDEN	SMHI	2093/33078	YARÉ discontinued	55.426444	13.825833	15.8	-0.07	0.158
SWEDEN	SMA	94/35159	YSTAD	55.422778	13.825556	15.8	-0.07	0.158

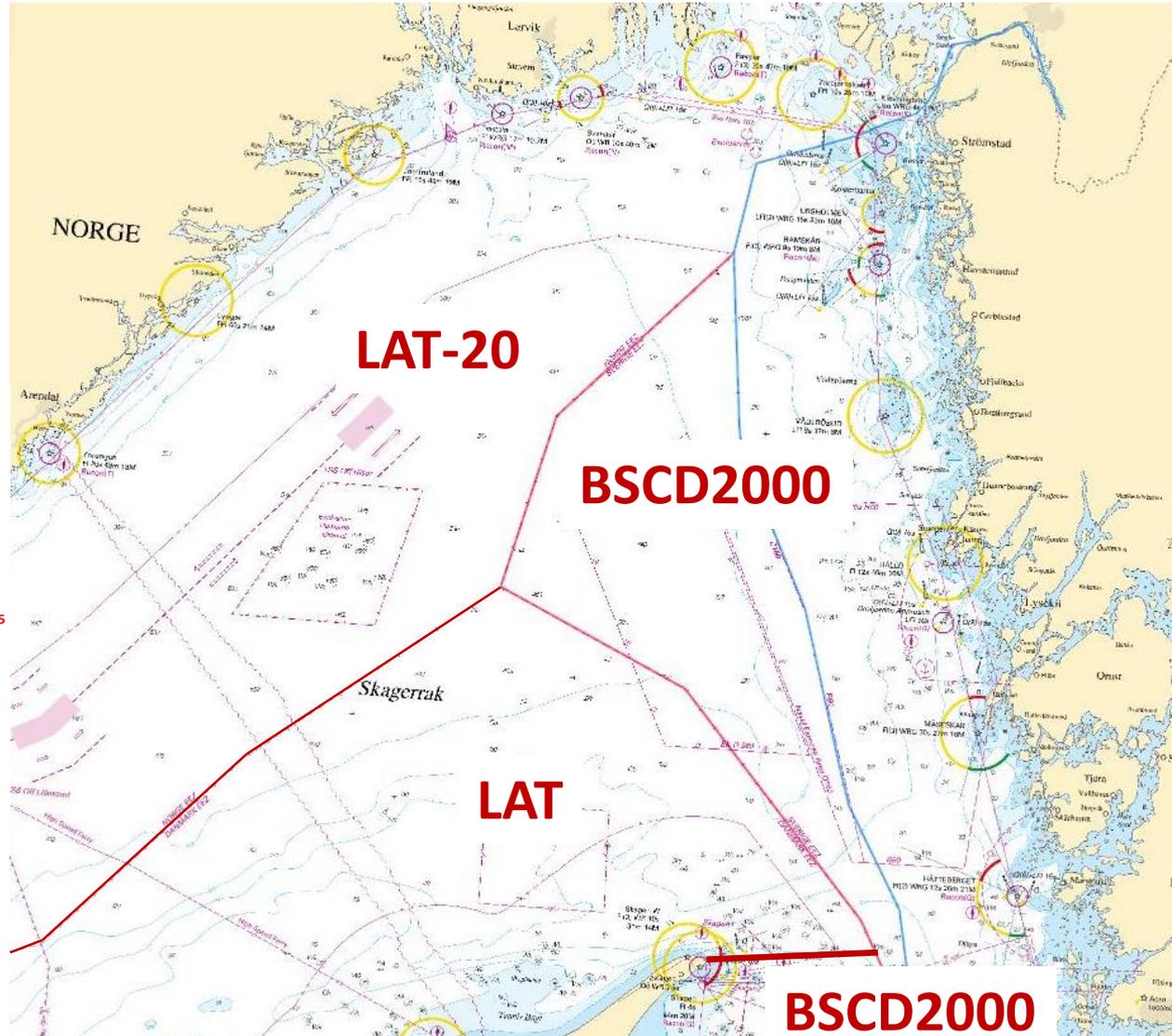
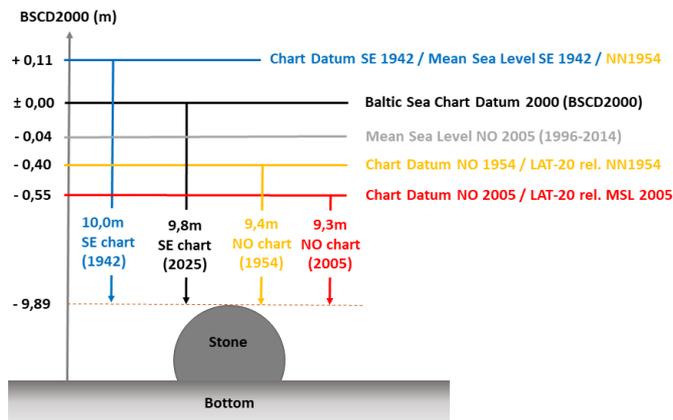
Reference levels used in the Baltic Sea, Marine Copernicus and EMODNET Data Portals and differences with respect to the Baltic Sea Chart Datum 2000 (BSCD2000). In Sweden and Finland, the old reference levels are equal to Mean Sea Level (MSL) transferred to year 2023 (according to different national conventions). The values from Norway shows the MSL for the period 1996-2014, relative BSCD2000. In Estonia, Latvia and Lithuania, the Kronstadt reference level is used as old chart datum. In Poland, the local Polish Height System Amsterdam NN₅₅ is used as chart datum. Notice how postglacial rebound reduces the magnitude of the MSL in the Bay of Bothnia. The values are shown in this [Table](#).



Reference levels in Skagerack

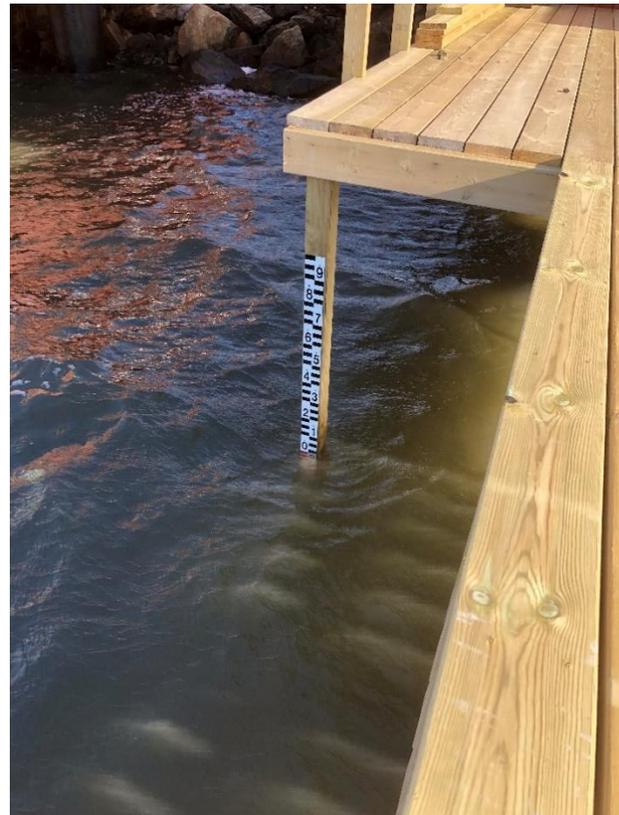
- Norwegian reference datum (LAT-20) ca 50-60 cm below BSCD2000
- Danish LAT ca 30 cm below BSCD2000

Chart datum Skagerack (Swedish-Norwegian border)



New reference level in Sweden

SMA and SMHI presents sea level data relative BSCD2000 since 3rd June 2019



SMHI oceanographic warning and forecasting service

- A transition to BSCD2000 (RH 2000) has been implemented at SMHI, where forecasts, warnings and current sea level are issued relative BSCD2000.
- A new impact-based and regional adapted warning system has also been introduced, which includes yellow, orange and red warning, where red is the most serious.

Högt vattenstånd   			
Varningsnivå	Gul	Orange	Röd
Område	cm i RH 2000		
Grupp 1 (Västra Götalands län, Hallands län, Skåne län)	90	130	180
Grupp 2 (Kalmar län, Östergötlands län, Gotlands län, Södermanlands län, Stockholms län)	80	110	-
Grupp 3 (Blekinge län, Uppsala län, Gävleborgs län, Västernorrlands län)	90	130	-
Grupp 4 (Västerbottens län, Norrbottens län)	100	150	-

Lågt vattenstånd 	
Varningsnivå	Gul
Område	cm i RH 2000
Skagerrak, Kattegatt, Södra Östersjön, Mellersta Östersjön, Norra Östersjön, Ålands hav	-80
Sydvästra Östersjön, Öresund, Bälten	-50
Södra Bottenhavet, Norra Bottenhavet, Norra Kvarnen, Bottenviken	-90

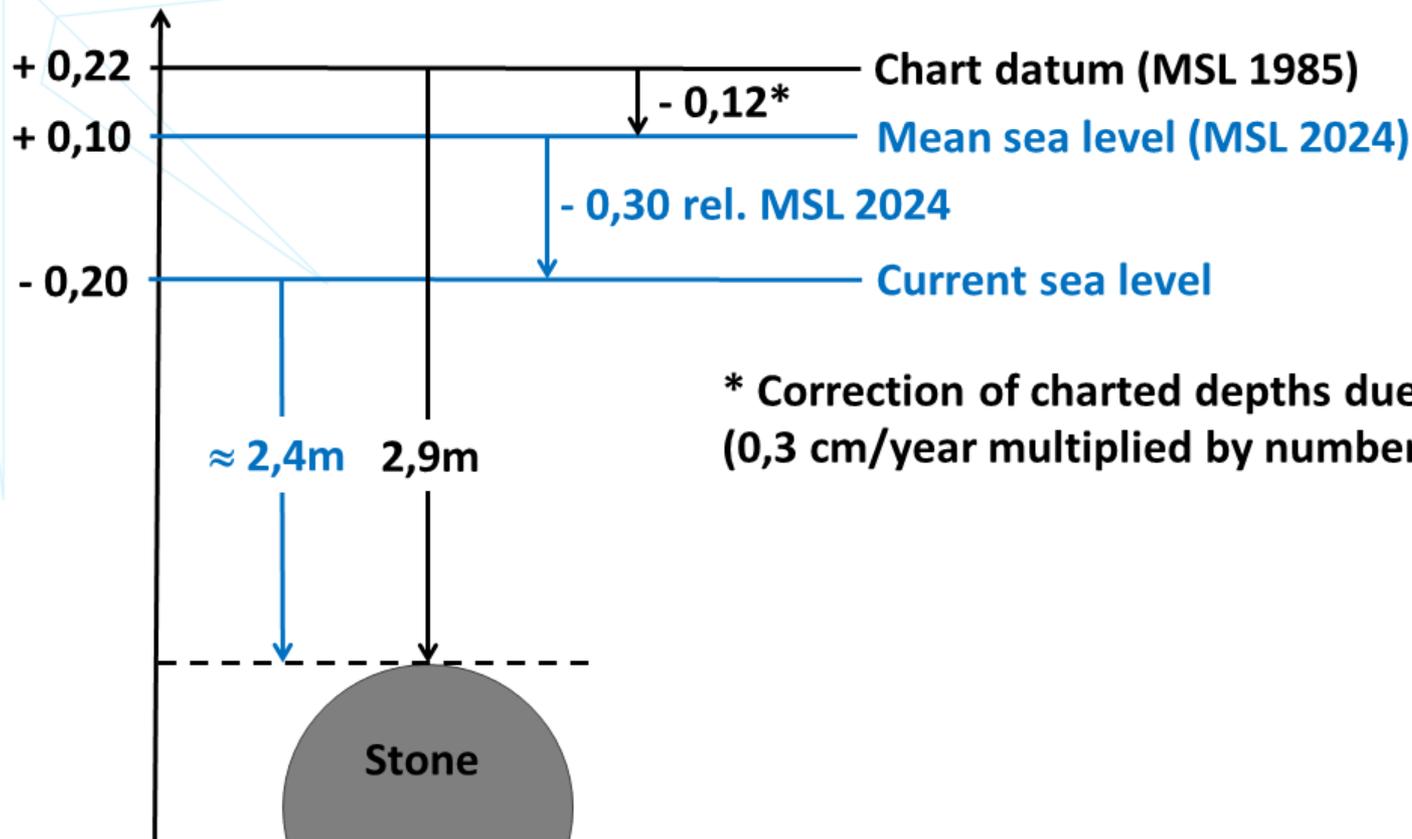


Nautical charts with chart datum MSL

CHART DATUM: Mean Sea Level (MSL) 1985
REFERENSNIVÅ: Medelvattenyta (MVY) 1985
LAND UPLIFT/LANDHÖJNING 0.3 cm annually / per år
SYMBOLS and ABBREVIATIONS: see INT 1
BETECKNINGAR och FÖRKORTNINGAR: se KORT 1

Nautical charts with chart datum MSL

BSCD2000 (m)



* Correction of charted depths due to land-uplift
(0,3 cm/year multiplied by number of years since 1985)

Bottom

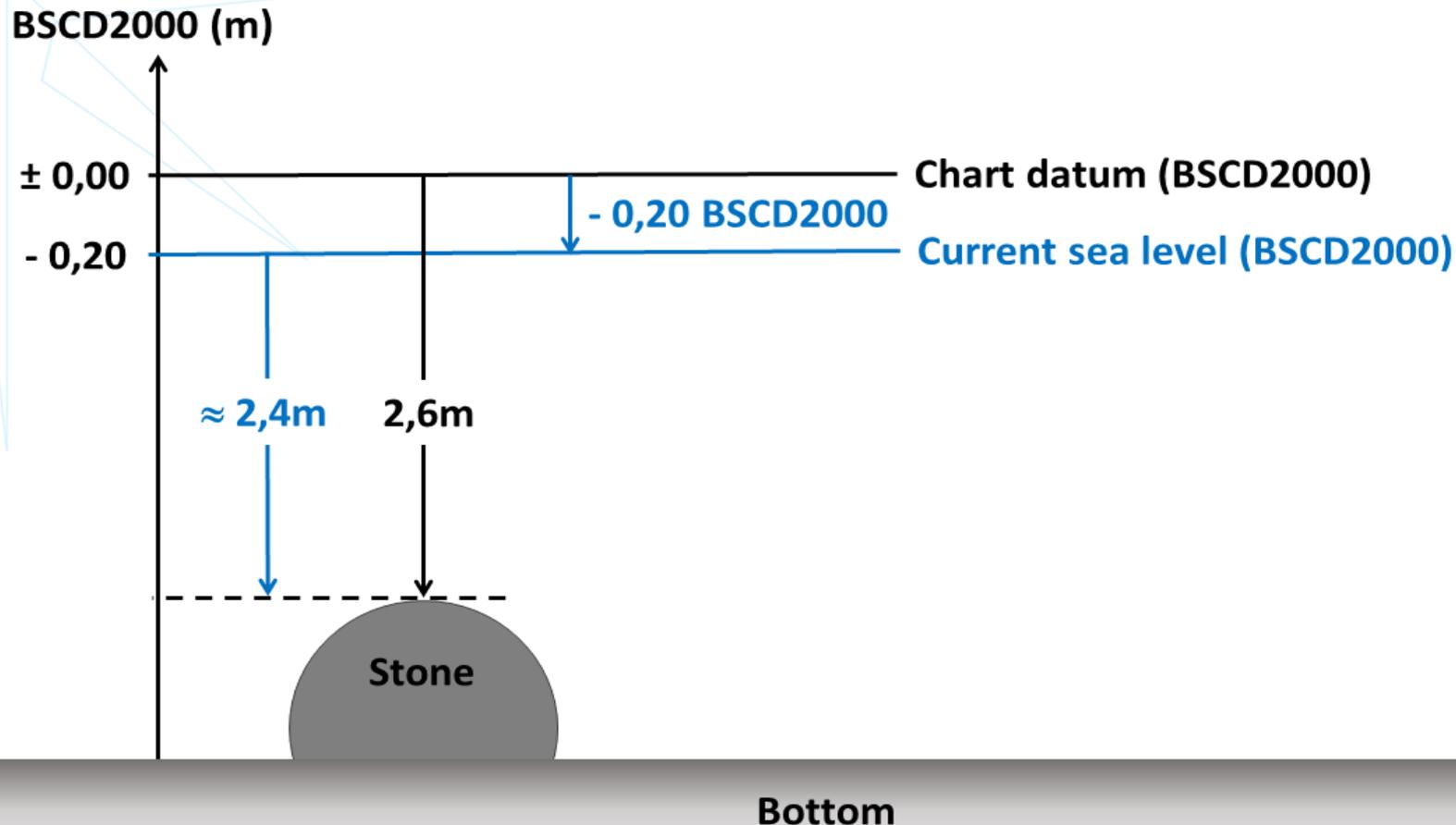


Nautical charts with chart datum BSCD2000

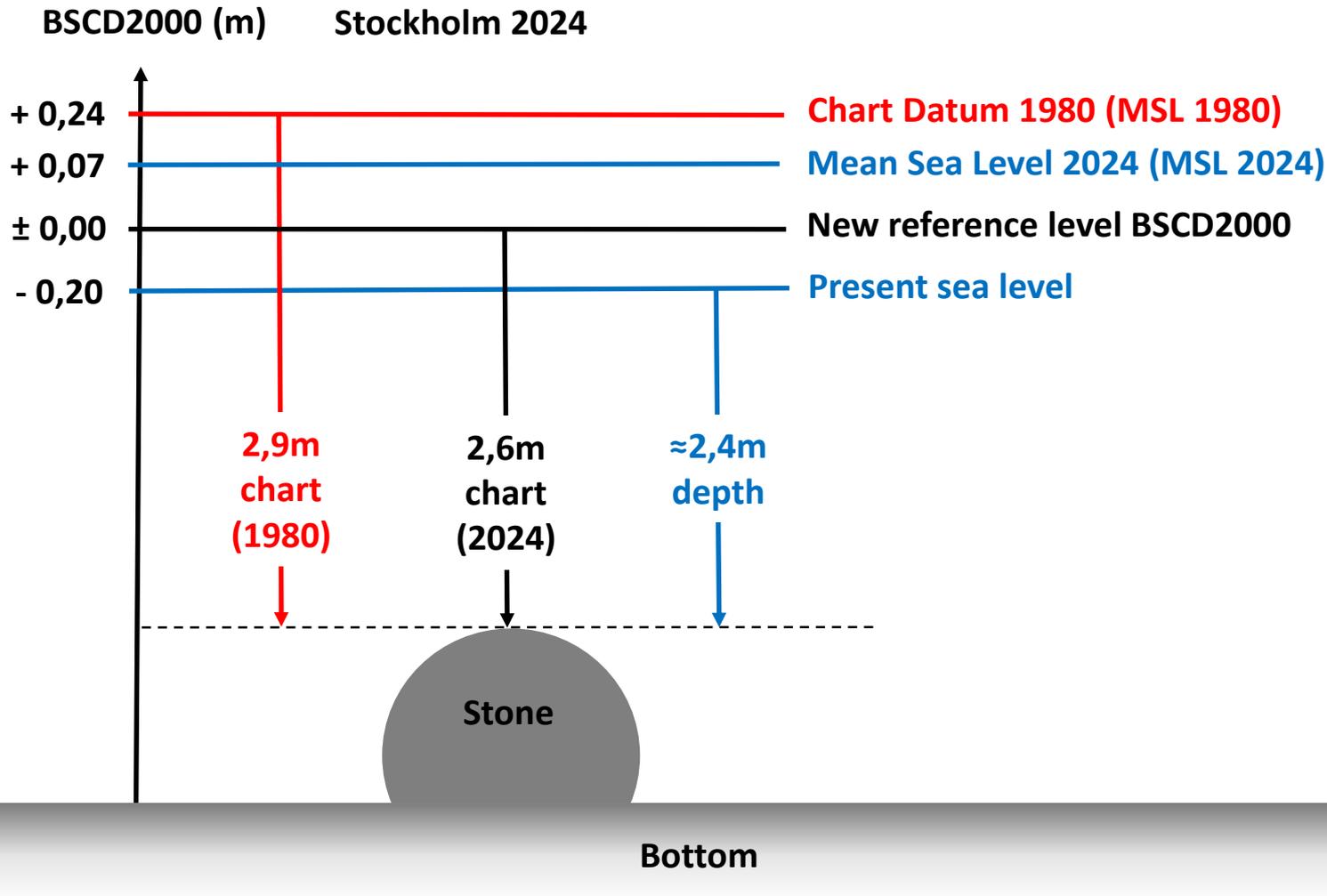
CHART DATUM: Mean Sea Level (Baltic Sea Chart Datum 2000^{MSL2000})
REFERENSIVÄ: Medelvattenyta (Baltic Sea Chart Datum 2000^{MSL2000})
SYMBOLS and ABBREVIATIONS: see INT 1
BETECKNINGAR och FÖRKORTNINGAR: se KORT 1



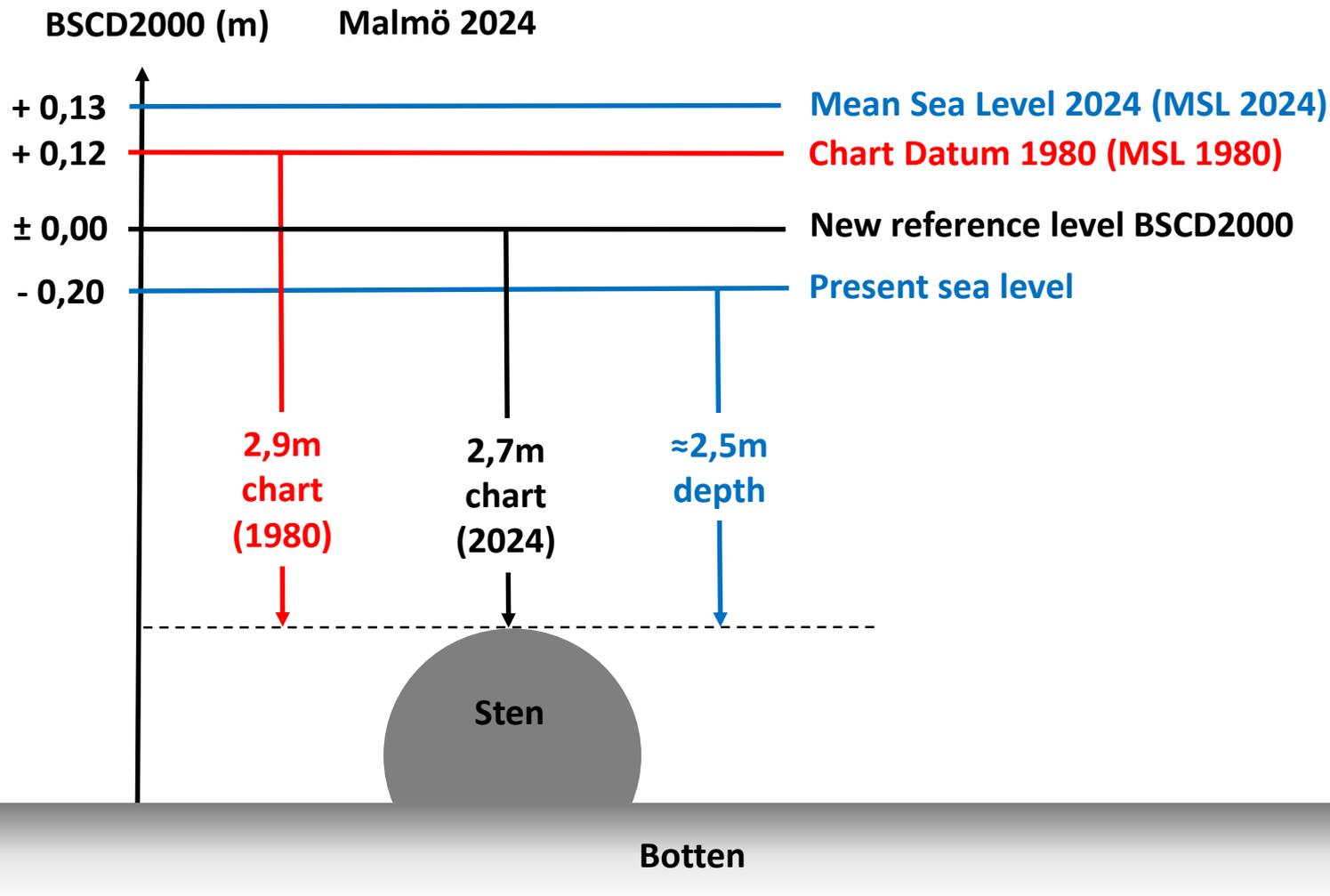
Nautical charts with chart datum BSCD2000



Transition to RH 2000/BSCD2000 in charts and sea level



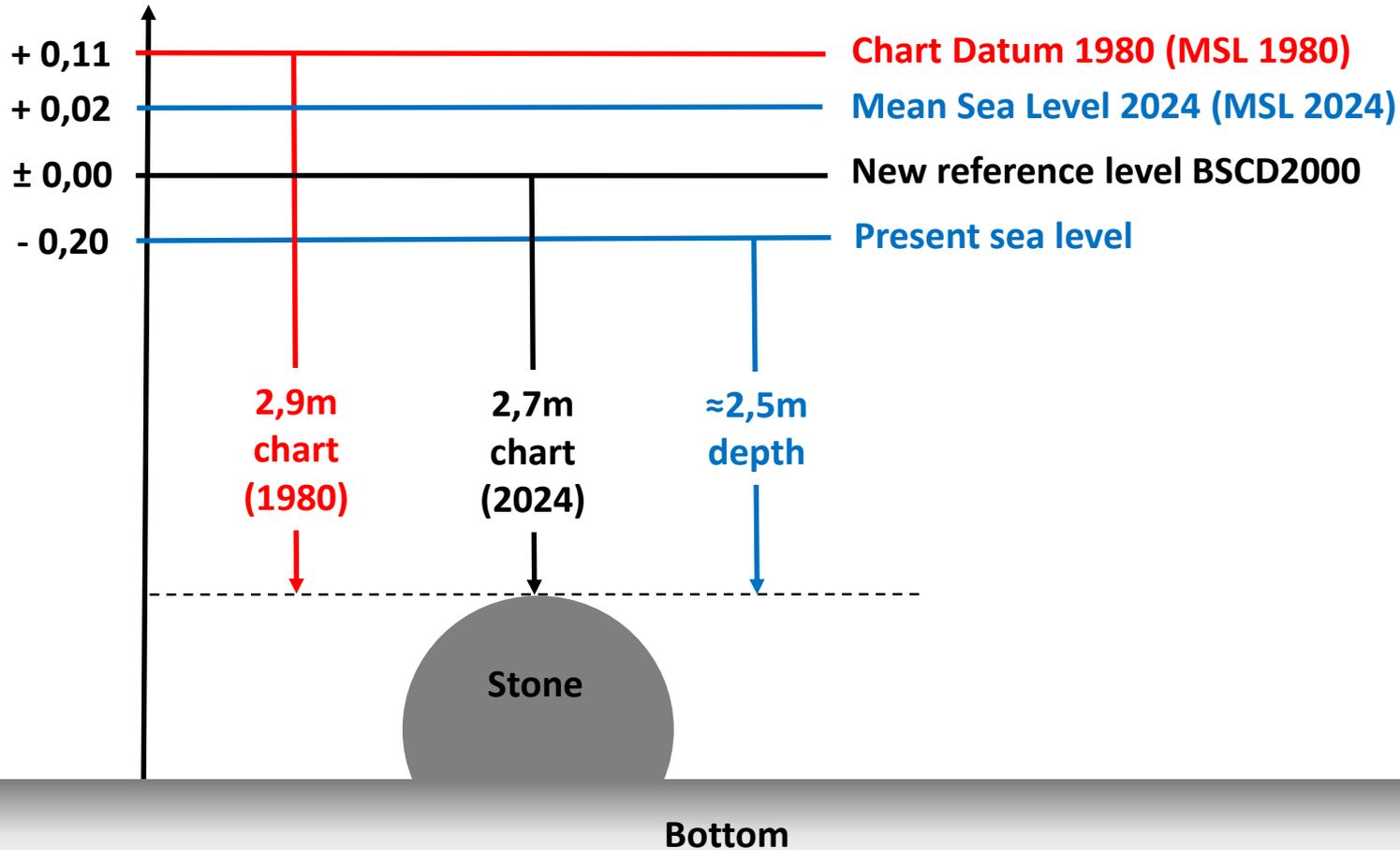
Transition to RH 2000/BSCD2000 in charts and sea level



Transition to RH 2000/BSCD2000 in charts and sea level

BSCD2000 (m)

Göteborg 2024



Notices to Mariners (NtM)

* 14040

**Sweden. not area bound. New reference system for sea level, nautical charts and warnings.
BSCD2000 / RH 2000.**

Expired notices: 2019:754/13917

See: 2018:716/13140

As of June 3, 2019, the Swedish national height system 'Rikets Höjdsystem 2000', or RH 2000 (international name 'Baltic Sea Chart Datum 2000', BSCD2000) will constitute the reference level for observations and forecasts of the water level in Swedish waters.

The zero level in RH 2000 is fixedly linked to land, and is not affected by land uplift, changes in sea level or geographical variations.

The change means that observations, forecasts, and warnings in the Swedish Maritime Administration's and Swedish Meteorological and Hydrological Institute's (SMHI) viewing services from 3 June 2019, or soon thereafter, refer to the new reference level and no longer to the 'mean sea level'.

The Swedish Maritime Administration is gradually adapting the charts to the new reference system. This is a time consuming process which will take several years to complete. During the transition period, it is important to know which reference level is used in the different charts. If the text 'Baltic Sea Chart Datum 2000', or 'BSCD2000' is printed in the chart, the update has been performed.

More information: www.sjofartsverket.se/RH2000 and www.smhi.se

www.sjofartsverket.se/RH2000 www.smhi.se

SMHI och Sjöfartsverket. Publ. 15 May 2019



New info sheets about the transition to BSCD2000 as the new reference level for sea level, nautical charts and warnings

Svensk



English



A uniform reference system from land to sea

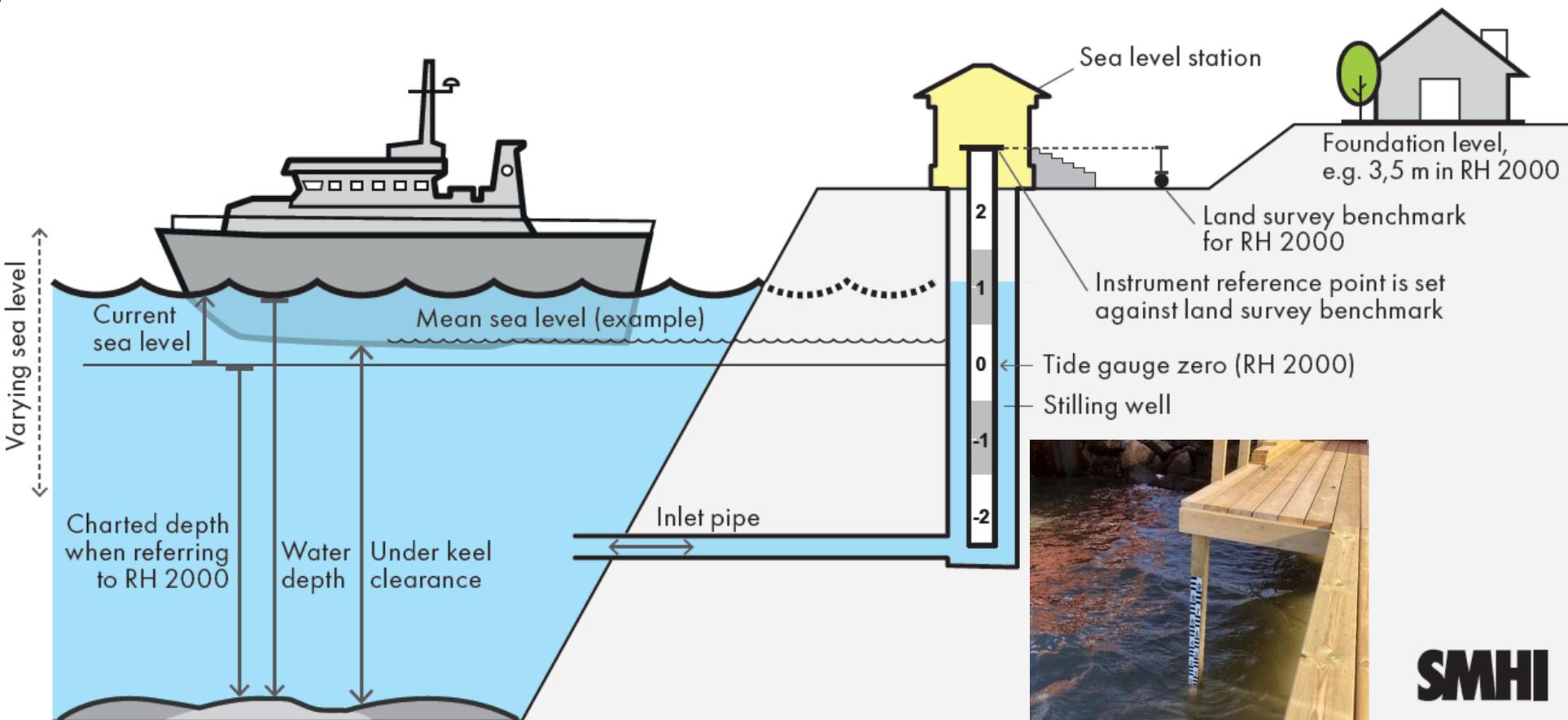


Illustration Veronica Wärm SMHI

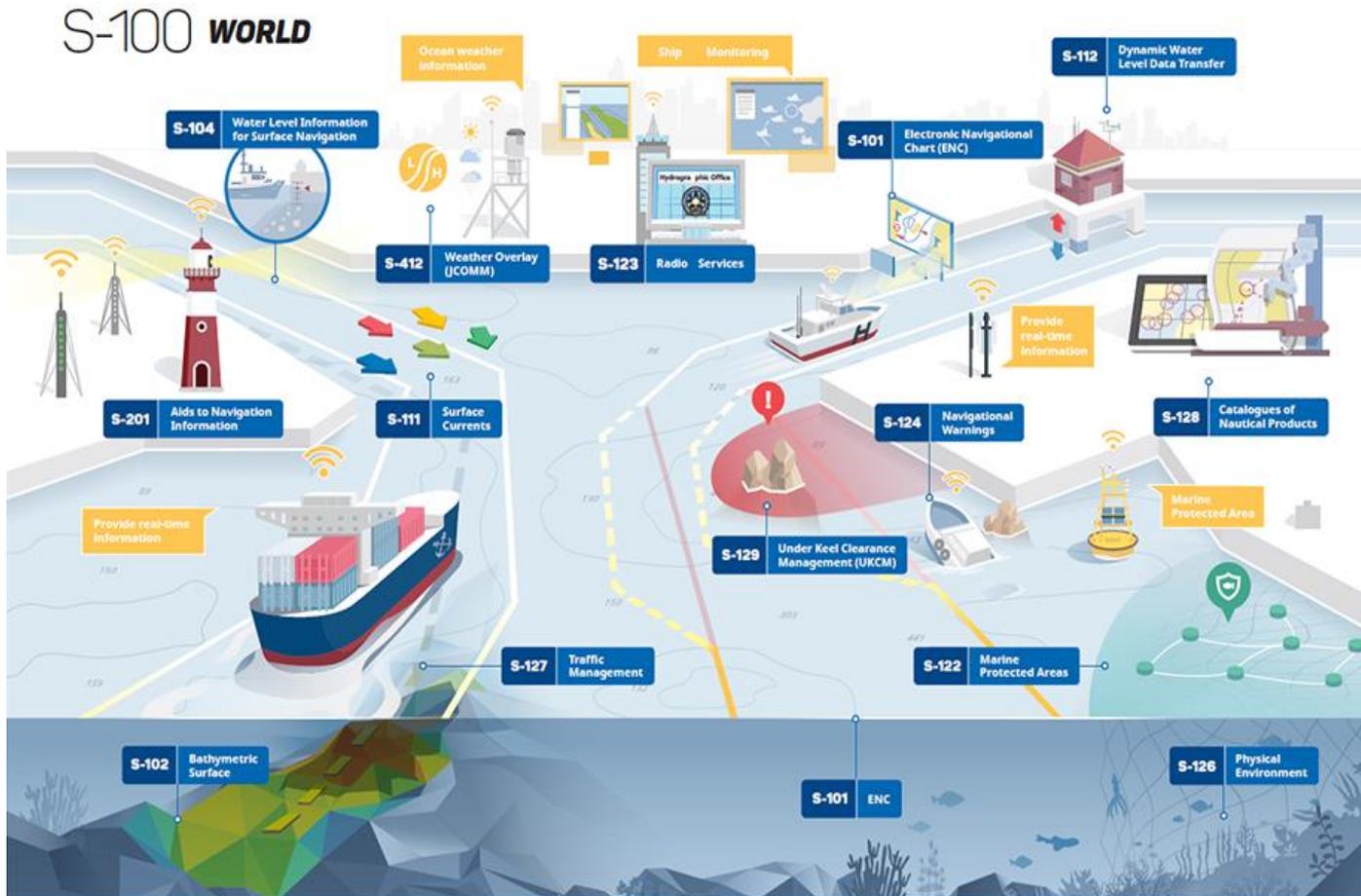
SMHI



Future Maritime Services S-100



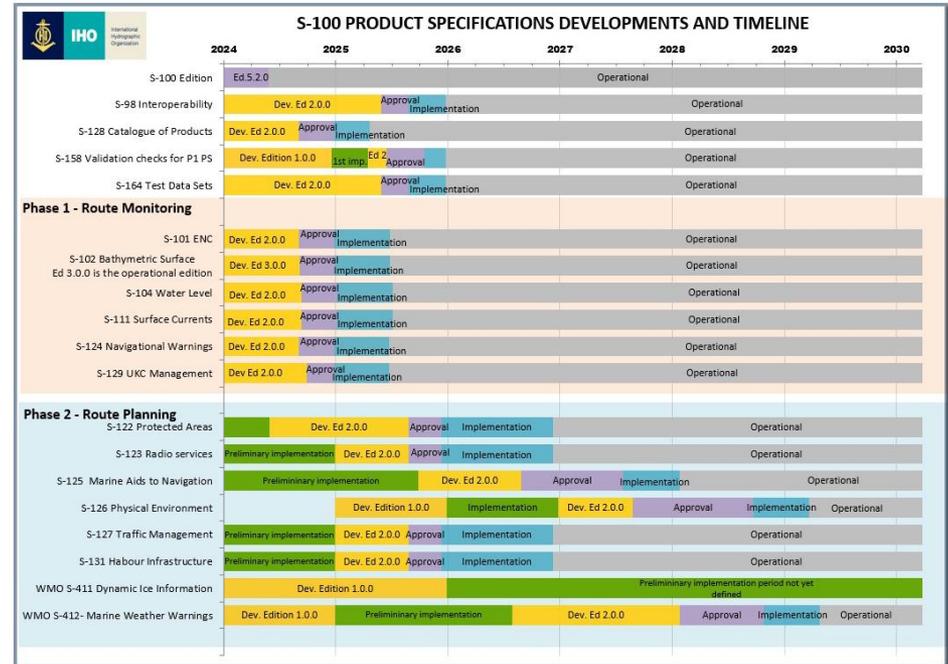
IHO



S-100 Implementation

IHO S-100 Implementation Strategy

Table A – IHO list of S-100 products with special focus	
First step – Route monitoring mode	
S-101	Electronic Navigational Chart (ENC)
S-102	Bathymetric Surface
S-104	Water Level Information for Surface Navigation
S-111	Surface Currents
S-124	Navigational Warnings
S-129	Under Keel Clearance Management
Critical Framework	
	IHO Geospatial Information Registry
S-98	Interoperability Specification
S-100	Universal Hydrographic Data Model
S-128	Catalogue of Nautical Products
S-164	Test Data Set for S-100 and ECDIS Type Approval
Second step – Route planning mode	
S-122	Marine Protected Areas
S-123	Marine Radio Services
S-125	Marine Aids to Navigational (AtoN)
S-126	Marine Physical Environment
S-127	Marine Traffic Management
S-131	Marine Harbour Infrastructure



This S-100 timeline is updated: 02 07 2024



Real Time Hydrographic and Environmental Information Service

Infrastructure



Co-financed by the Connecting Europe Facility of the European Union

Gravity surveys

Hydrographic surveys

Bathymetry database

Geoid model

Baltic Sea Chart Datum 2000

Oceanographic observations

Oceanographic model



COPERNICUS MARINE ENVIRONMENT MONITORING SERVICE
Providing PRODUCTS and SERVICES for all marine applications

S-100 products



Bathymetry

S-101 ENC
S-102 Bathymetric Surface

Under Keel Clearance

S-129 Under Keel Clearance Management (UKCM)

Water Level

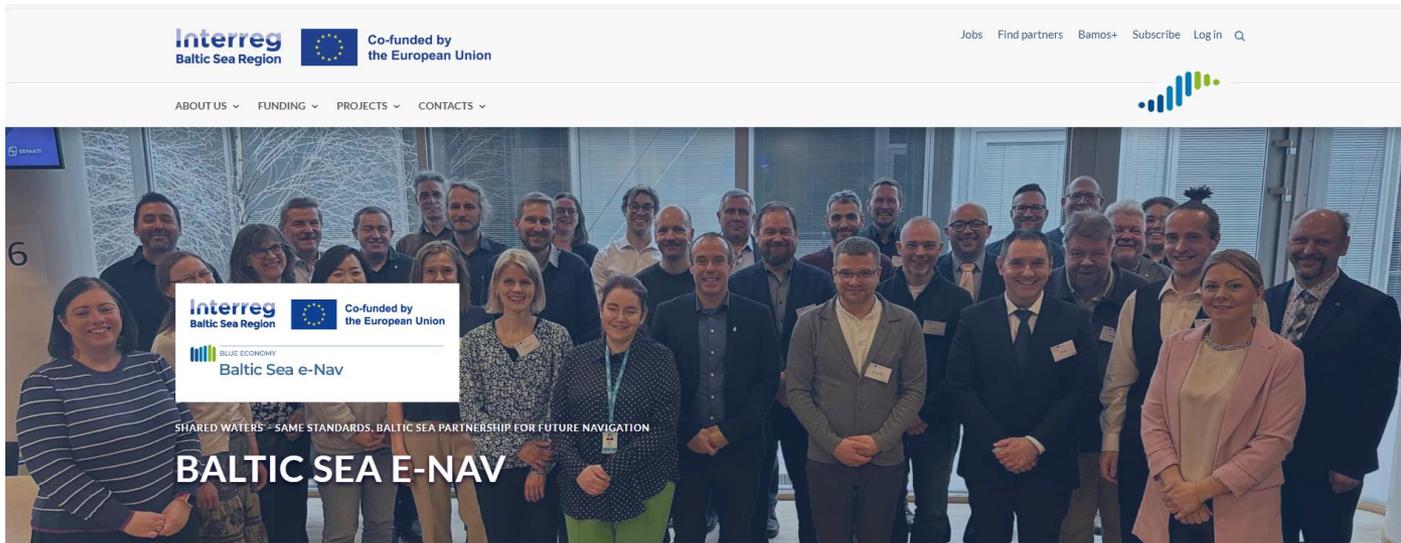
S-104 Water Level Information for Surface Navigation

Surface Currents

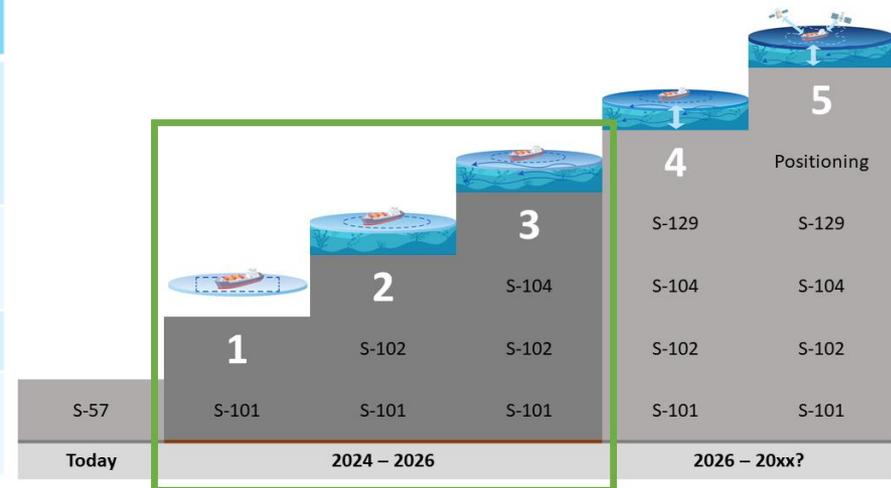
S-111 Surface Currents



Baltic Sea e-Nav Interreg project 2023-2026

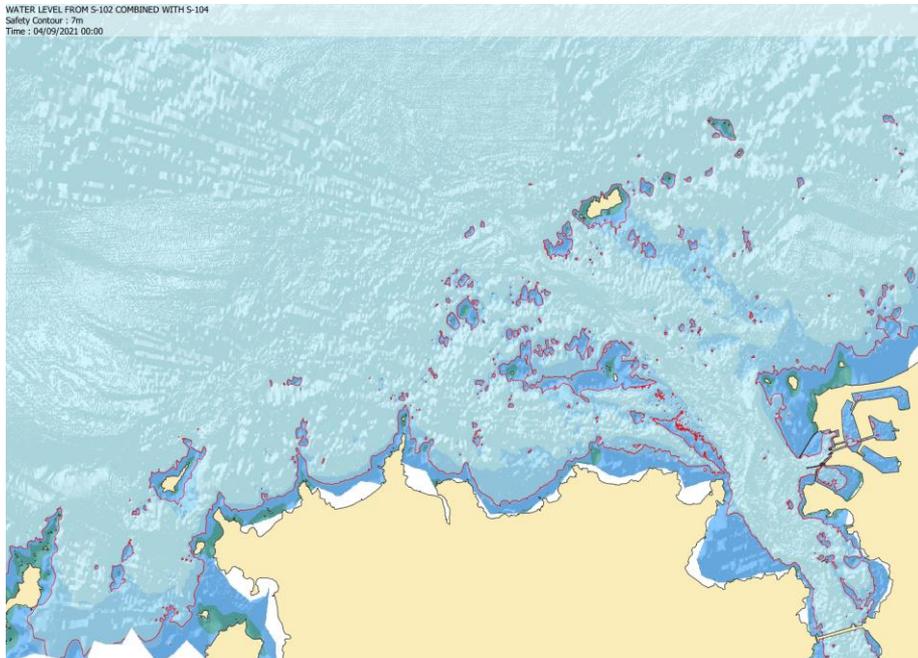


Goal	Period
Develop production capabilities for S-101 ENC, S-102 bathymetry and to some extent S-104 water level	2023-2025
Establish harmonization rules for S-10x-products, under the BSHC umbrella	2024-2026
Test, evaluate and refine the S-10x products	2025
Commercial rollout for S-101 and S-102 in the Baltic Sea. S-104 in parts of FI.	2026

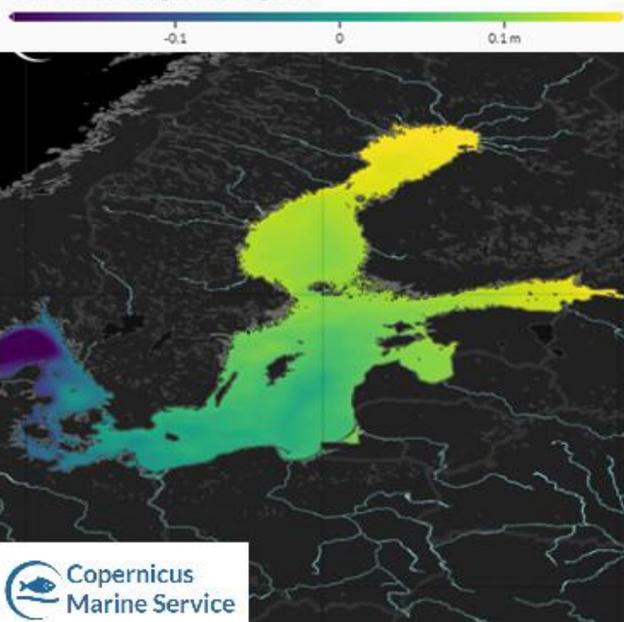


S-104 Water Level

WATER LEVEL FROM S-102 COMBINED WITH S-104
 Safety Contour : 7m
 Time : 04/09/2021 00:00



Sea surface height above geoid

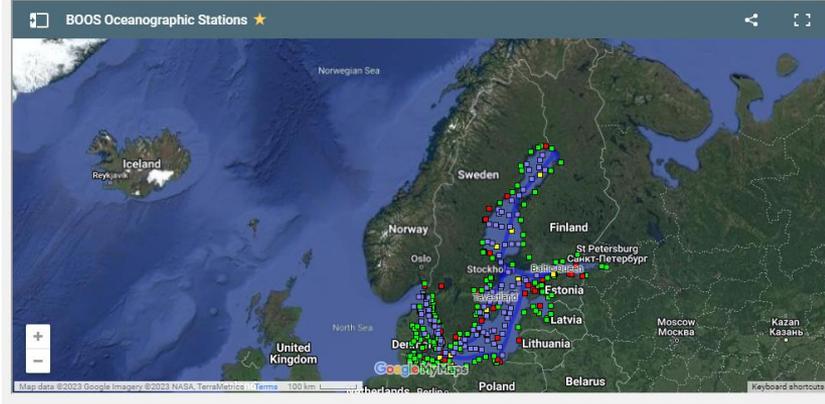


BOOS > BOOS Stations

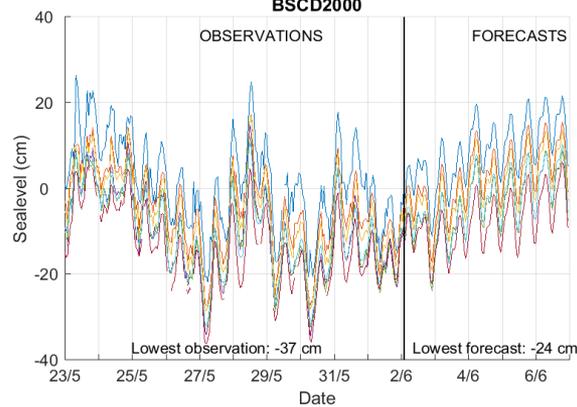
BOOS Stations



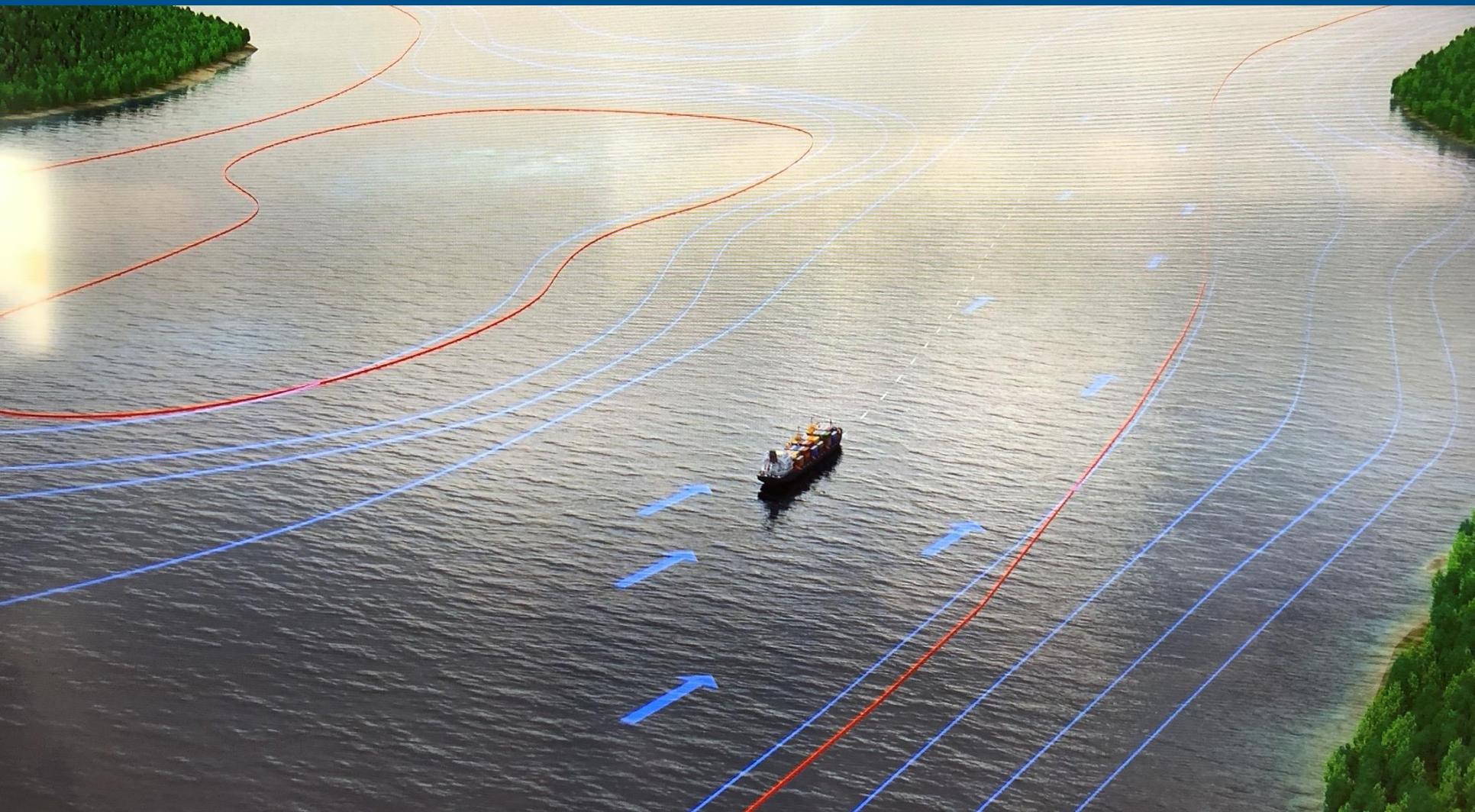
BOOS
 EuroGOOS Baltic Regional
 Operational Oceanographic System



Sealevels Göteborg
 2023-05-23 to 2023-06-06
 Issued: 2023-06-02 02:00 UTC
 BSCD2000



Future Navigation



Thanks!



Thomas Hammarklint

Swedish Maritime Administration (SMA)

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