



**BALTIC SEA
HYDROGRAPHIC
COMMISSION**



BSHC28_C3_CDWG_Presentation-SE

28th BSHC Meeting
19 - 21 September 2023
Helsinki

Thomas Hammarklint



Objectives

1. Status of CDWG work: Meeting 2023 / Implementation status 2023
2. CDWG Member List
3. CDWG Terms of Reference
4. CDWG Work Programme
5. Future Maritime Services S-100 with examples of S-104 and S-111
6. How member states benefits best of CDWG
7. Actions requested from the BSHC28 Conference



1. Status of CDWG work: Meetings / Implementation status

[BSHC28 C3 SE CDWG Report](#)

Since the BSHC 22nd Conference 2017, *Mr Thomas Hammarklint* has acted as Chair.

The communication within the CDWG has been done mainly by e-mail correspondence. The last meeting (CDWG14) was held 28-29 March 2023 in Göteborg, Sweden and 16 delegates attended the meeting. The main objectives of the CDWG 14th meeting was to update the [TORs](#), [Work programme](#), [List of Actions](#), [national implementation status](#) and plans of the [Baltic Sea Chart Datum 2000](#), coordinate our work and plan the continuation of the FAMOS Continuation project, e.g. finalize the BSCD2000 Height Reference Grid for the whole Baltic Sea. On behalf of the BSHC; began planning for the coordination of the implementation of IHO Standards S-104 Water Level and S-111 Surface Currents.

A proposal from the BSHC Strategic Correspondence Group ([BS-SCG](#)) to change the name of the working group have been discussed and a proposal for a new name of the working group have been drafted [[CDWG14 Chairmans Report](#)]: *Chart Datum, Water Level and Currents Working Group* (CDWCWG). An approval of the amendments to the TORs and Work Programme and a decision on the proposed name of the working group will be taken at the BSHC Conference ([BSHC28](#)), 19-21 September 2023 in Helsinki.

BSCD2000 have been registered as chart datum 44 in [IHO Geospatial Information Registry](#).

An [article about Baltic Sea Chart Datum 2000](#) has been published in the International Hydrographic Review (IHR) in May 2020.

The CDWG work have been or will be presented at the following meetings and conferences in 2022-2024:

- NKG, 5-8 September 2022, Copenhagen, Denmark
- NSHC TWG24, 27 September 2022, VTC
- BSHC CDWG14, 28-29 March 2023, Göteborg, Sweden
- BOOS Annual meeting, 9-11 May 2023, Helsinki, Finland
- BSHC28, 19-21 September 2023, Helsinki, Finland
- BSHC27, 20-22 September 2022, Stockholm, Sweden
- BSHC CDWG Start-up meeting, 12 October 2022, VTC
- NSHC TWG25, 7 February 2023, VTC
- EUREF Symposium, 23-26 May 2023, Göteborg, Sweden
- TWCWG8, 20-23 February 2024, Monaco

The [CDWG Website](#) have been updated with a lot of new information.



Chart Datum Working Group (CDWG)



Home ABOUT SERVICES RELATIONS WORKING GROUPS MEETINGS AND SEMINARS CONTACT PRIVACY POLICY

Chart Datum Working Group (CDWG)

“To implement a common reference level in the Baltic Sea”



Photo: Chart Datum Working Group 14th meeting, 28-29 March 2023, Göteborg, Sweden

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

Members of CDWG:

Denmark	Mr Nikolaj Møller
Estonia	Mrs Gabriela Kotsulim
Finland	Mr Jarmo Mäkinen
Germany	Dr Patrick Westfeld
Latvia	Mr Bruno Špēls
Lithuania	Mr Mindaugas Zakarauskas
Poland	Mr Witold Stasiak
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
Finland	Dr Mirjam Bilker-Koivula
Finland	Mrs Anni Jokiniemi
Germany	Dr Gunter Liebsch
Germany	Dr Joachim Schwabe
Latvia	Mr Armands Murans
Latvia	Mr Kristis Dzenis
Latvia	Mr Mārtiņš Rēvalds
Lithuania	Mr Emilis Tertelis
Norway	Mr Aksel Voldsund
Poland	Mr Krzysztof Pyrchla
Poland	Mrs Małgorzata Pająk
Poland	Dr Monika Wilde-Piórko
Poland	Dr Malgorzata Szelachowska
Sweden	Prof. Anna Jensen
Sweden	Dr Jonas Ågren
Sweden	Dr Per-Anders Olsson
Sweden	Mrs Johanna Linders



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



Home ABOUT SERVICES RELATIONS WORKING GROUPS MEETINGS AND SEMINARS CONTACT PRIVACY POLICY

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

Members of CDWCWG:

Denmark	Mr Nikolaj Møller
Estonia	Mrs Gabriela Kotsulim
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Sweden	Dr Jonas Ågren
Sweden	Dr Per-Anders Olsson
Sweden	Mrs Johanna Linders

+ additional members?



Implementation status 2023

Summary of implementation status 2023:

Country	Status	Other remarks
Denmark	Chart datum in practice close to EVRS-based chart datum (DVR90).	BSCD2000 is implemented in ENC and will be implemented in paper charts in the order of reprinting.
Estonia	All decisions are taken and the implementation is ongoing. Used in charts and water level information from 2018-01-01. Water level presented both in BK77 and EH2000/BSCD2000. The changes is up to 30 cm in new charts.	Leveling for national height system has been finalized. Data in depth database will be transformed. New charts with the new reference will be produced continuously. The first charts have been produced in 2018 and so far the following has been completed: 17 harbour ENC-s, 75 berthing ENC-s, 10 harbour paper charts, 11 berthing paper charts and 2 chart album that contains charts from two height systems. Notices to Mariners 2022-12-01 . Info Sheet . Web application Nutimeri displays Estonian Transport Administration's official electronic navigational charts.
Finland	Ongoing. All decisions are taken already in 2008 and 2015. Approach charts from Tornio to Vaasa have been published. The publication status of N2000 charts and Finnish nautical charts portfolio .	Finnish Meteorological Institute (FMI) provides water level information in both systems (MSL and N2000/BSCD2000). Differences between MSL and N2000/BSCD2000 are provided as a table . Sea level observations and forecasts will be available in N2000/BSCD2000 for the public simultaneously with Traficom nautical charts. New video about the N2000 fairway and nautical chart reform.
Germany	EVRS realization in use in practice. The vertical chart datum of BSCD2000 is close to the national height system of Germany (ETRS1989+DHHN2016). All published products will refer to this datum. In August 2021, BSCD2000 was officially introduced as chart datum for German waters in the Baltic Sea.	The database refers to national height system. The official introduction was decreed in January 2018 and is binding for all institutions coming under the jurisdiction of the Federal Waterways and Shipping Administration (WSV). Information about the new reference .
Latvia	Decisions has been done in middle 2020 and implementation continues. New national height system LAS2000,5 (EVRS-based) into use in 2015. LAS-2000,5 to new editions of charts in a following sequence – harbour charts, coastal charts, general charts. Harbour charts are either already implemented to BSCD, LAS-2000,5 or they are in progress.	BAS77 still used. Differences between BAS77 and Baltic Sea Chart Datum 2000 is well known and can be accessed by web-application and info in all nautical charts how to transform depths to BSCD2000. Details regarding depth conversion to BSCD2000 are given in chart notes.
Lithuania	National height system LAS07 (EVRS-based) came into force 2016-01-01.	BHS-77 still used. The difference between BHS-77 and LAS07 is well known (about 13 cm) and is also written in nautical charts. Tide gauges in Lithuania belongs to the Lithuanian Hydrometeorological Service. Data from tide gauges are presented in BHS-77.
Poland	A written decision was issued by HOPN in July 2021 - Guidelines and timetable for the implementation of PL-EVRF2007-NH (BSCD2000). Bathymetric measurements collected in the bathymetric database were transferred to the vertical reference system PL-EVRF2007-NH. In 2021, gravimetric measurements in Polish waters were completed. September 2021 - information campaign about a new chart datum. 2021 – 2023 new editions of all INT harbour, approach and coastal charts.	Local datum Amsterdam NN55 still in use. Poland have a legal act about reference systems, which allows to use other than PL-EVRF2007-NH datum until 2023. Institute of Meteorology and Water Management (IMWM) runs the Polish water level stations. The difference between the local datum and PL-EVRF2007-NH (BSCD2000) is less than 9 cm.
Russia		
Sweden	Ongoing. All decisions are taken. Many charts already published. Implementation is a part of the "Chart Improvement Project", to be concluded at the latest in 2030. All water level information is related to RH2000/BSCD2000, since 2019-06-03.	Cooperation with SMHI on water level information. The difference between mean sea level (MSL) and BSCD2000 at the water level stations are presented in this table . Information campaigns is ongoing for ports, pilots and other interested parties. Notices to Mariners 2019-05-15 . Several articles written in magazines and on webpages. Info Sheet about BSCD2000 from SMA/SMHI .

2023-03-28



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

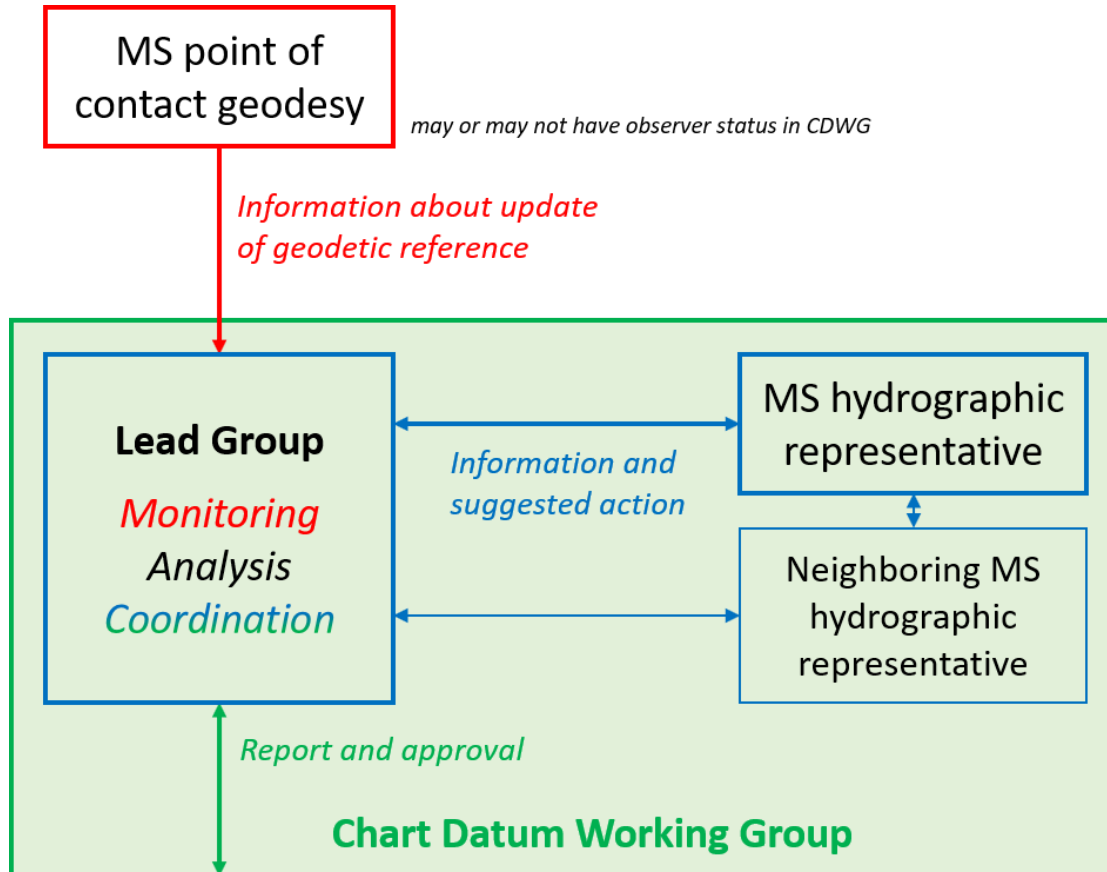
Mean Sea Level (Baltic Sea Chart Datum 2000)

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



Continuity Management of BSCD2000

Organizational scheme and workflow of the CM group



Digital Object Identifier (DOI) and BSCD2000 Geoid model download

DOI: 10.58440/iho-bscd2000

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

The DOI's URL currently linking to:

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

This can be adjusted at any time

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, YOUR publication, etc.) in the future.



International Hydrographic Review Article

An article about the CDWG work and the implementation of the Baltic Sea Chart Datum 2000 has been published in the International Hydrographic Review (IHR) in May 2020, page 63-83:

https://iho.int/uploads/user/pubs/ihreview_P1/IHR_May2020.pdf

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. Agren², G. Liebich³, P. Wirstler⁴, T. Hammarik⁵, J. Mononen⁶ and O. 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 Normaal Amsterdams 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 Vertical Européen (EVRS) et au Système de Référence Terrestre Européen (ETRS89). En particulier, le zéro hydrographique du BSCD2000 est conforme au Normaal Amsterdams Peil (NAP). Le BSCD2000 est sur le point d'être adopté en tant que niveau de référence des cartes communes 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.

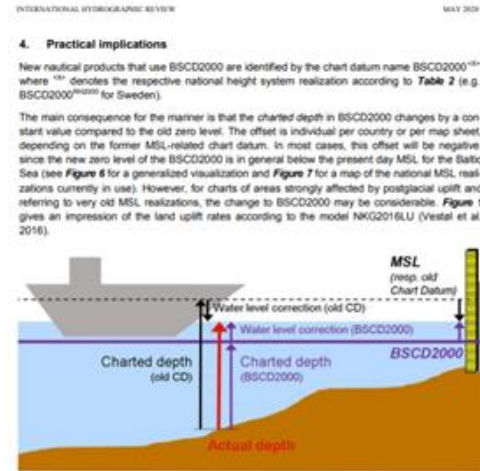


Figure 6: Schematic cartoon of the old MSL-based chart datum and the new BSCD2000

At the same time, real-time water level information (water level observations, corrections to the charted depths, forecasts, etc.) will also be changed according 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

INTERNATIONAL HYDROGRAPHIC REVIEW MAY 2020

adopt BSCD2000 as the name of their chart datum without having to actually change their charted depths. Therefore, this section only gives an overview about the general situation in the respective countries. Table 2 summarizes the national geodetic reference frames, positioning services and HRS realizations that can be used with BSCD2000. Regularly updated details about the implementation status as well as instructions for users, e.g. leaflets, are provided via the CDWG website (<http://www.bahc.pro/working-groups/cdwg>).

In Sweden and Finland, a calculated MSL has been used as reference level (chart datum) for nautical charts and water level information. The reference level for regularly updated epochs (estimated present-day MSL) was estimated from long time series of annual mean values of mareograph observations. Depths from printed charts needed to be converted semi-automatically by means of a correction formula in order to correct for the time difference and to make the charted depth compatible with the provided water level information. As motivated in Section 2, this two-step approach implied a lot of work to keep the nautical products updated and consistent. At the same time, it was not straightforward and error-prone for the mariner.

Thus, decisions to make a transition to BSCD2000 in Sweden and Finland have come a long way. In Sweden, both water level information and 50% of all nautical charts are now using BSCD2000. In Finland, part of the bathymetric and chart data have already been transformed to BSCD2000. Water level information is ready to be provided in BSCD2000 when first charts will be published in the new datum. Figure 7 details the estimated height of the current calculated MSL relative to BSCD2000 for selected mareographs in Sweden and Finland.

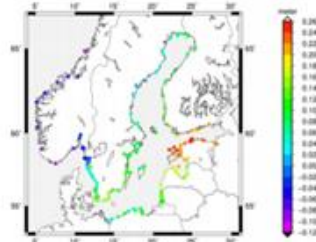


Figure 7: Differences between the reference levels of the old national chart datums with respect to Baltic Sea Chart Datum (BSCD2000). In Sweden and Finland, the old reference levels are equal to the calculated MSL in the year 2020 (according to different national conventions). The values from Norway show the MSL over the period 1996-2014, relative BSCD2000¹⁹⁹⁰. In Estonia, Latvia and Lithuania, the Kronstadt reference level is used as old chart datum. In Poland, the local Polish Height System Amsterdams AP₁₆ is used as chart datum. Notice how postglacial rebound reduces the magnitude of the calculated MSL, relative BSCD2000 in the Bay of Bothnia: it is now just a few cm close to the location of maximum uplift. The values are taken from IHO's (2020).



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



Difference between old reference system and BSCD2000

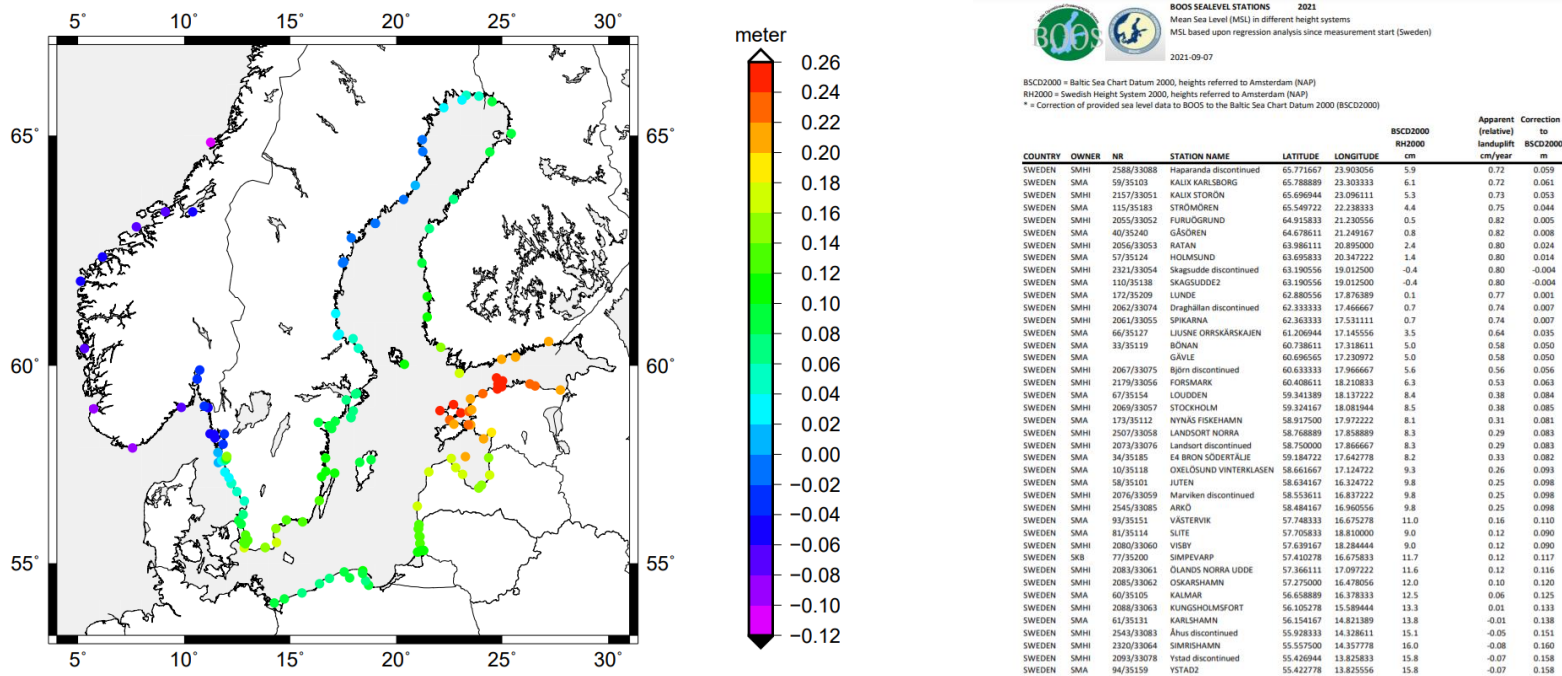


Fig. 4b: Differences between the reference levels of the old national chart datums with respect to Baltic Sea Chart Datum 2000 (BSCD2000). In Sweden and Finland, the old reference levels are equal to Mean Sea Level transferred to year 2023 (according to different national conventions). The values from Norway shows the Mean Sea Level over the period 1996-2014, relative NN2000/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 mean sea level in the Bay of Bothnia; it is now just a few cm near the land uplift maximum. The values are shown in this [Table](#).



2. CDWG List of Members

Members of CDWG:

Denmark	Mr Nikolaj Møller
Estonia	Mrs Gabriela Kotsulim
Finland	Mr Jarmo Mäkinen
Germany	Dr Patrick Westfeld
Latvia	Mr Bruno Špēls
Lithuania	Mr Mindaugas Zakarauskas
Poland	Mr Witold Stasiak
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Poland	Dr Malgorzata Szelachowska
Sweden	Dr Jonas Ågren
Sweden	Dr Per-Anders Olsson
Sweden	Mr Mikael Stenström

Representative of BOOS:

Sweden	Mr Thomas Hammarklint
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3. CDWG TORs



BSHC Chart Datum Working Group

BSHC Chart Datum Working Group Terms of Reference 8 August 2023

To be approved by the BSHC 28th Conference, 19-21 September 2023

Proposed amendments marked in red

The BSHC18 (September 2013) decided to continue CDWG work and wished the harmonized Baltic Sea vertical reference to be implemented.

The Working Group should

Report to the BSHC Conferences.

1. To continue implementation of the Baltic Sea Chart Datum 2000 (EVRS with land-uplift epoch 2000).
2. To prepare the road map for transition, including e.g.:
 - to establish a network of relevant bodies involved into the transition and efficiently communicate and give guidance within this network
 - to invite relevant bodies to inform the users
 - to review of progress of national plans and actions
 - to propose harmonization actions.
3. To cooperate with relevant bodies on water level related issues e.g.:
 - to promote studies on the validation, status and distribution of water level information, and to promote studies on interpolation and prediction of water levels
 - to promote studies on displaying schemes for joint Baltic Sea water level information
 - to promote studies on recommendations to IHO bodies how the sea level and its variations should be shown on nautical paper and ENC charts and publications, and conveying water level information to mariners [ref. IHO Technical Resolutions].
4. To support development of a common harmonized height reference, including further development of a common geoid model for the whole Baltic Sea area:
 - to promote geoid computations and gravity measurements in the Baltic sea, as is needed to realize the Baltic Sea Chart Datum 2000



4. CDWG Work Programme



BSHC Chart Datum Working Group

BSHC Chart Datum Working Group Work Programme 28 March 2023

To be approved by the BSHC 28th Conference, 19-21 September 2023
Proposed amendments marked in red

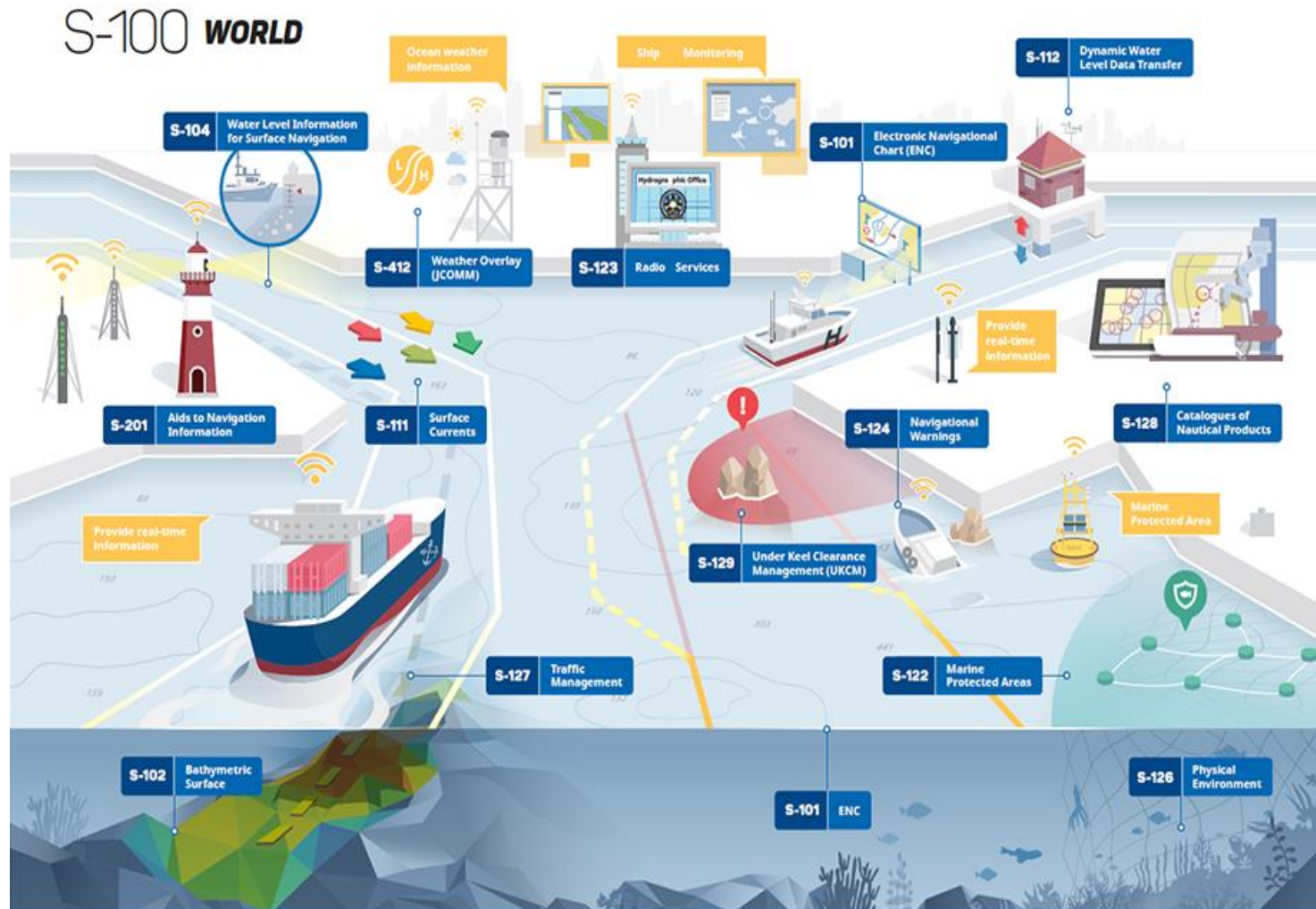
Note: This Work Programme includes those Tasks which were identified as the priority issues and which are expected to be fostered from 2021 and onwards bearing in mind the resources the BSHC members have.

Tasks:

1. Guide the implementation process of vertical reference within the Baltic Sea region.
 - a. To monitor and follow up the status of the relevant actions identified.
 - b. To ensure efficient communication with relevant bodies.
 - c. To propagate and explain the idea of harmonized chart datum.
 - d. To foster national efforts for realization and coordinate the implementation of S-104 and S-111 in the Baltic Sea.
2. Review of progress of national plans and actions.
3. Propose harmonization actions.
4. Promote studies and further development of a common geoid model and dynamic topography for the whole Baltic Sea, mainly by supporting and collaborating with relevant projects, e.g. organizing ship time for gravity measurements. Invite member states to consider gravity measurements and geoid computation and provide an overview where additional gravity measurements are needed.
5. Promote improvement of precise real-time GNSS navigation for the future.
6. Cooperate with BOOS and invite other relevant institutes and organizations for the implementation of S-104 and S-111 in the Baltic Sea.
7. Support other IHO working groups and European projects in issues concerning vertical references water level, currents and reference systems.

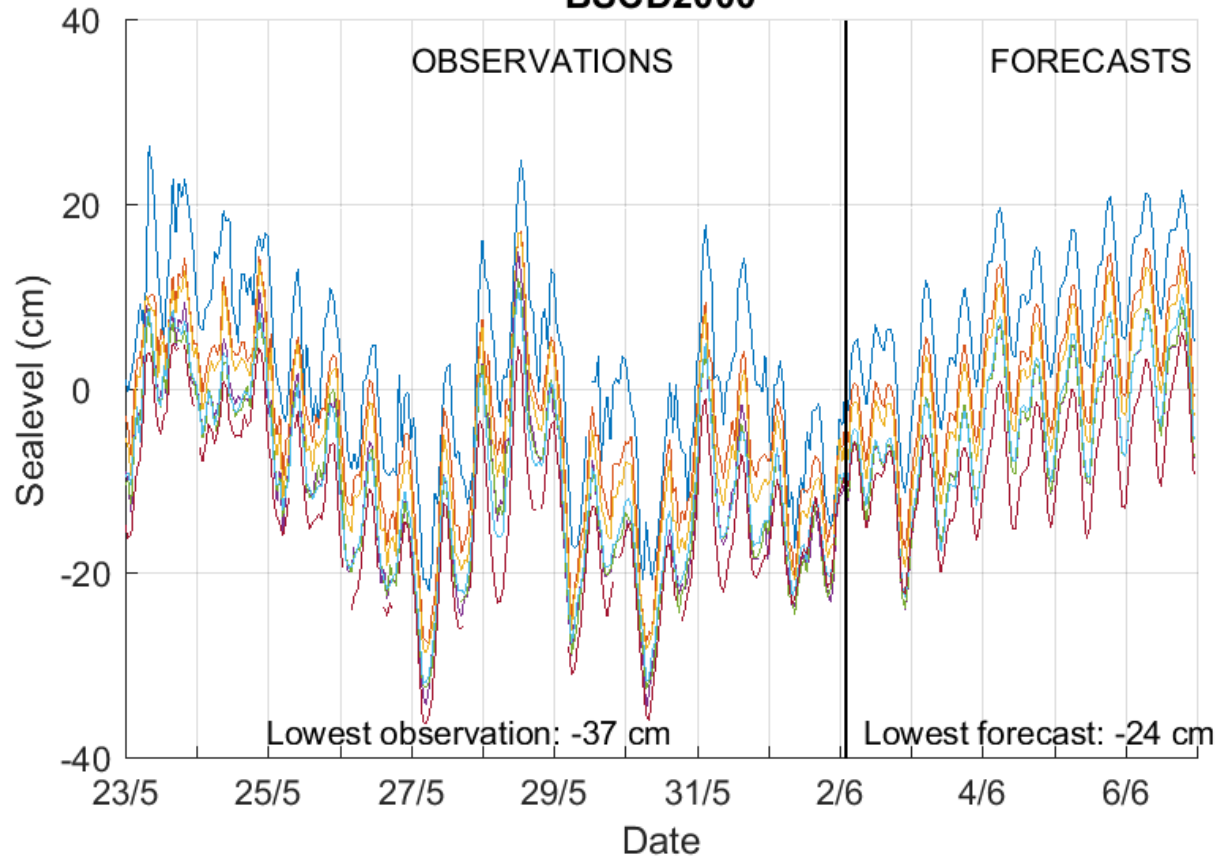


5. Future Maritime Services S-100

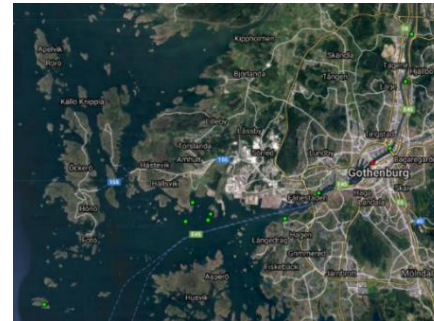


Example of a potential S-104 Water Level product (Port of Göteborg and upstream Göta River)

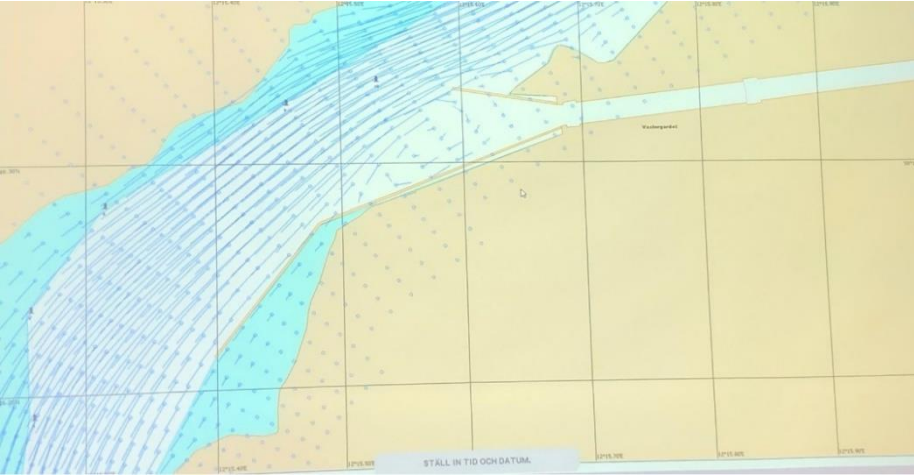
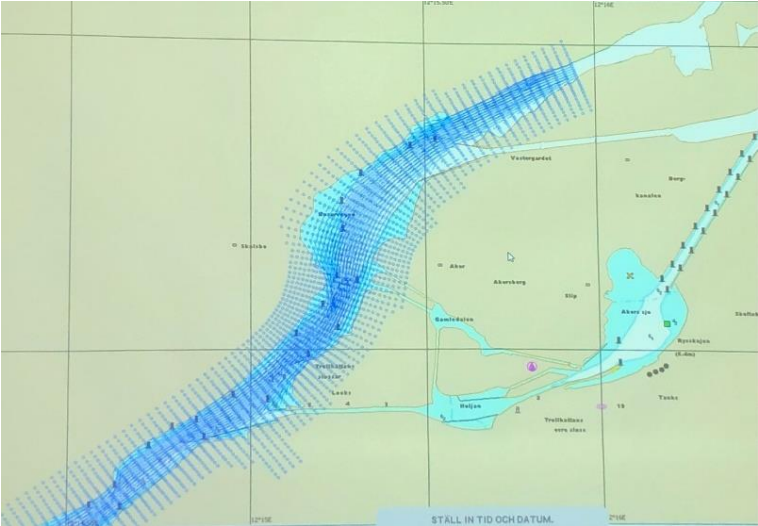
Sealevels Göteborg
2023-05-23 to 2023-06-06
Issued: 2023-06-02 02:00 UTC
BSCD2000



- Agnesberg
- Tingstad
- Hisingsbron
- Eriksberg
- Tångudden
- Krossholmen
- Vinga



Example of a potential S-111 Surface Current product (Trollhättan Locks Area, Göta River)



6. How member states benefits best of CDWG

- Sending representatives to meetings
- Answering to questionnaires – helps coordination of implementation
- Fostering national transition to the Baltic Sea Chart Datum 2000 (BSCD2000) and **implementation of S-104 and S-111**
- Invite representatives with oceanographic skills to the working group
- Supporting complementary gravity surveys and common geoid model computation in the Baltic Sea – i.e. participating in the FAMOS Continuation project



7. Actions requested from BSHC 28th Conference

The BSHC 28th Conference is requested to:

1. note this report
2. approve the proposed amendments to the TORs and Work Programme (Annex 1 and 2)
3. endorse the new name of the working group: *Chart Datum, Water Level and Currents Working Group (CDWCWG)*
4. give further guidance to CDWG, as seen appropriate



Thanks!



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