

Chair's Report to CDWG13

13th CDWG Meeting

7 September 2021

VTC



Thomas Hammarklint

Baltic Sea Hydrographic Commission (BSHC)



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 ENC's, 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



Chart Datum Working Group (CDWG)



BSHC Chart Datum Working Group

"To implement a common reference level in the Baltic Sea"



Photo: Chart Datum Working Group 13th meeting, 7 September 2021, VTC

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

Members of CDWG:

Denmark Mrs Gitte Hauerberg Iversen
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 Mr Sander Varbla
Finland Dr Mirjam Bilker-Koivula
Finland Mrs Anni Montonen
Germany Dr Gunter Liebsch
Germany Dr Joachim Schwabe
Norway Mr Aksel 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 Mr Mikael Stenström

Representative of BOOS:

Sweden Mr Thomas Hammarklint



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.

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

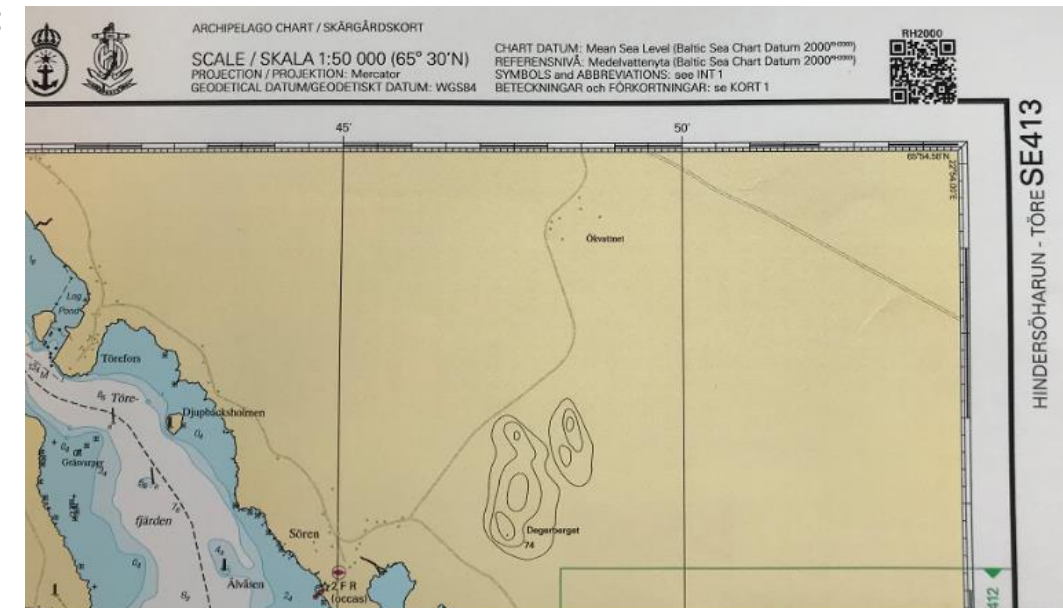
Sweden	RH2000	Denmark	DVR90
Germany	DHHN2016	Poland	PL-EVRF2007-NH
Lithuania	LAS07	Latvia	LAS2000,5
Estonia	EH2000	Finland	N2000

➤ 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)



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. Leisch³, P. Westfeld⁴, T. Hammarik⁵, J. Mononen⁶ and G. B. Andersen⁷

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 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.

63

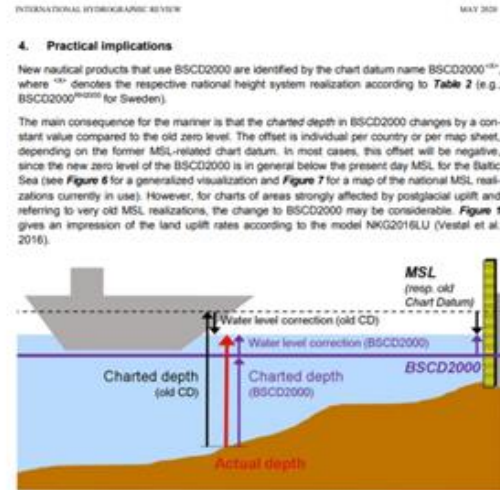


Figure 6: Schematic cartoon of the old MSL-based chart datum and the new BSCD2000

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

76

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.

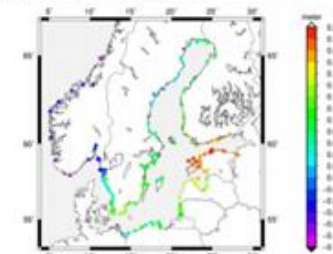


Figure 7: Differences between the reference levels of the old national chart datums with respect to Baltic Sea Chart Datum (BSCD2000) in Sweden and Finland, the old reference levels are equal to the calculated MSL in the year 2000 (according to different national conventions). The values from Norway shows the MSL over the period 1996-2014, relative BSCD2000¹⁰⁰⁰. In Estonia, Latvia and Lithuania, the Kronstadt reference level is used as old chart datum. In Poland, the local Polish Height System Amsterdam NH₀₀ 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 BODOS (2019).

77



CDWG Terms of References



BSHC Chart Datum Working Group

BSHC Chart Datum Working Group Terms of Reference 7 September 2021

Approved by the BSHC 26th Conference, 22 September 2021

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



CDWG Work Programme



BSHC Chart Datum Working Group

BSHC Chart Datum Working Group Work Programme 7 September 2021

Approved by the BSHC 26th Conference, 22 September 2021

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.

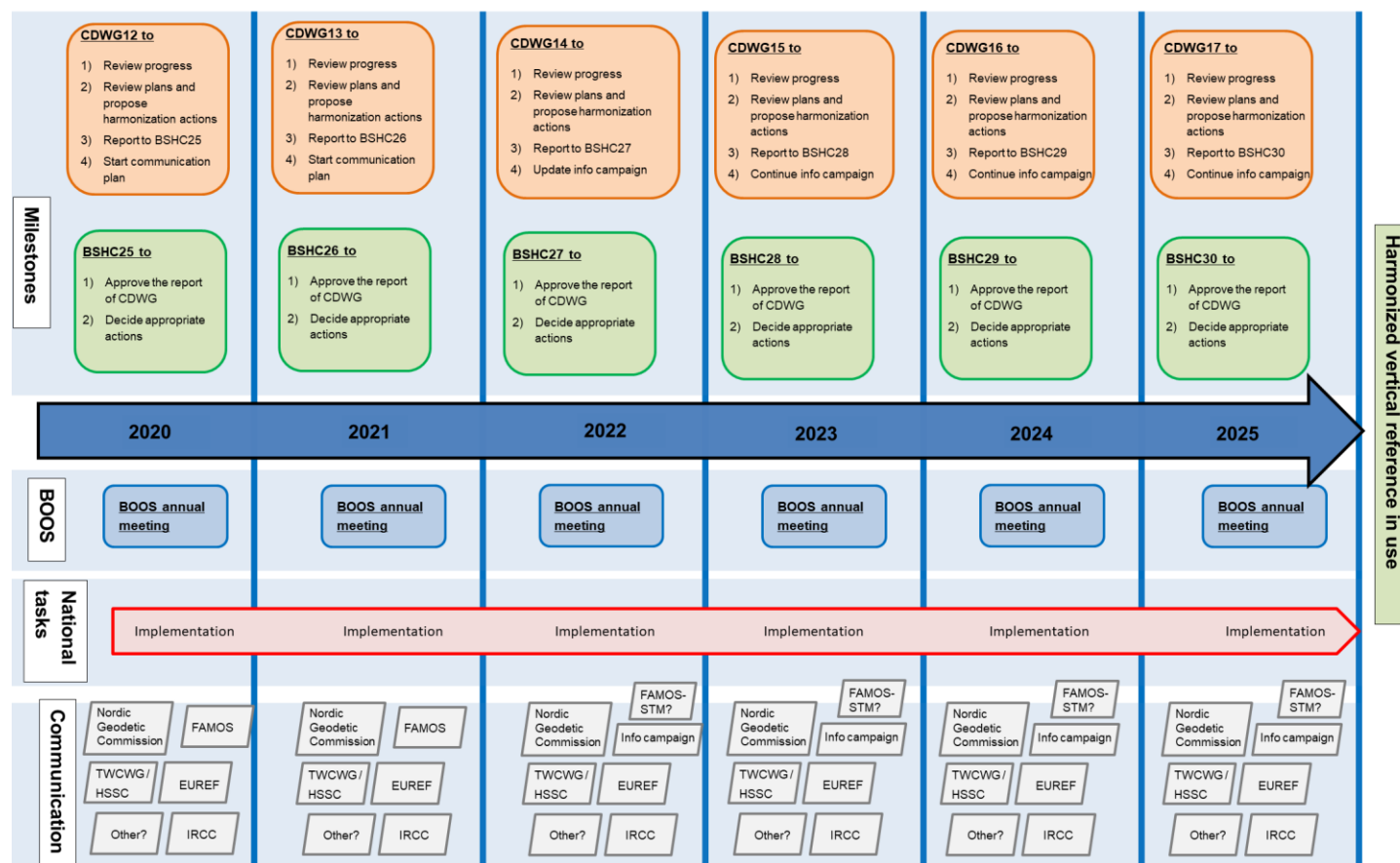
Tasks:

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 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 other relevant institutes and organizations.
7. Support other IHO working groups and European projects in issues concerning vertical references.



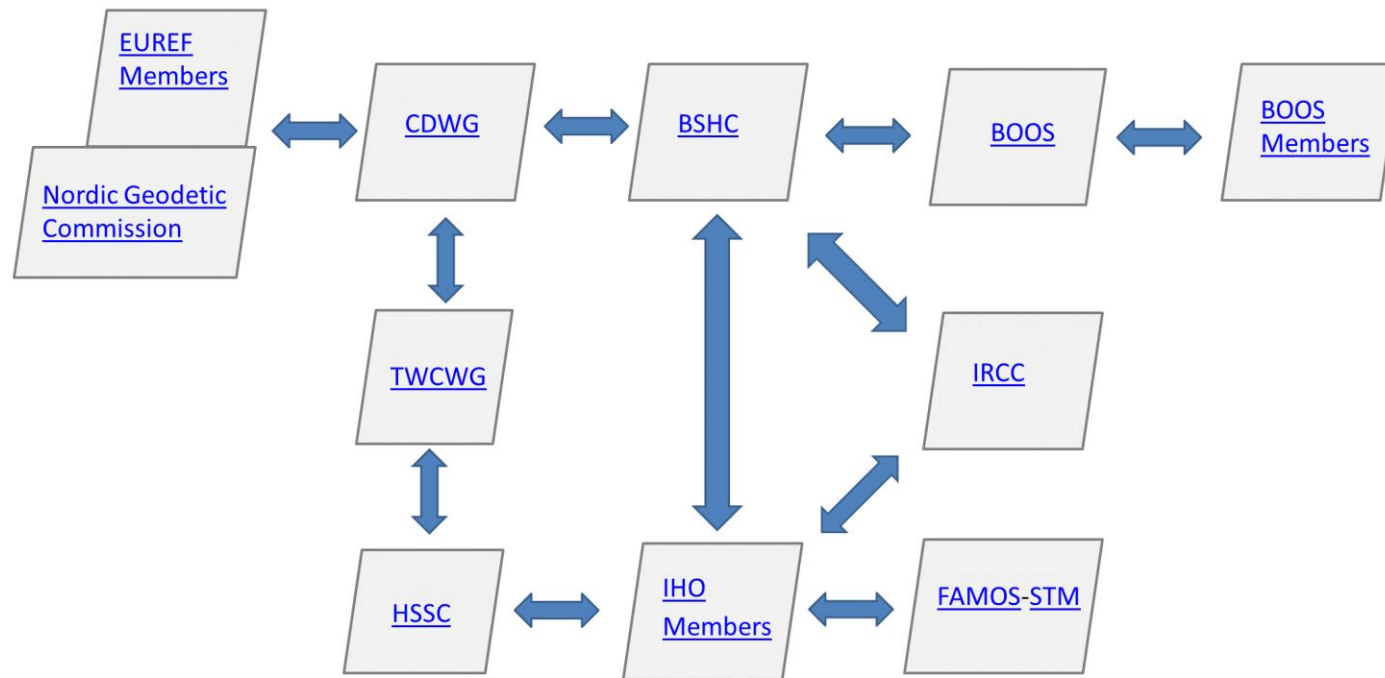
CDWG Roadmap

RoadMap BSHC CDWG / Harmonized Vertical Reference / Time Line 2021-09-07



CDWG Implementation process

CDWG Implementation process 2021-09-07



CDWG12 List of Actions



BSHC Chart Datum Working Group (BSHC CDWG)

List of Actions
BSHC CDWG12
3-4 March 2020
 Courtyard Marriott Gdynia Waterfront Hotel
 Gdynia, Poland

18 August 2021

Action #	Who	Action	Time schedule	Remarks/Status
1	Chair	Chair to ask Dr. Sergey V. Reshetniak to deliver the letter concerning the geodetic data to DNO.	Done during the meeting	Done 2020-03-11 Letter delivered by Dr. Sergey V. Reshetniak to DNO
2	Patrick	To study how to publish BSCD2000 definition in International Hydrographic Review (IHR).	End of May 2020	Done 2020-03-10 Article published in IHR in May 2020.
3	Patrick	Provide the German datum web-links to Thomas.	During the meeting	Done 2020-03-03
4	Mirjam	Present the FAMOS geoid finalizing efforts in the NKG geoid WG meeting.	Next NKG geoid WG meeting 10-11 March 2020	Done 2020-03-11
5	Jonas/Jochaim	Inform all relevant parties (FAMOS parties and data owners) about CDWG plans for finalization of FAMOS geoid.	End of April 2020	Draft sent out 2020-05-25
	Chair	Add the new CDWG ToRs.	End of meeting	Done 2020-03-04
	Chair to send the official email	Finalizing the proposed addendum for FAMOS gravity data use to be sent with the official letter.	End of August 2020	Final addendum sent out to FAMOS data owners 2020-06-18 Addendum signed by all FAMOS data owners 2020-09-14
6		Exchange existing FAMOS interim geoid models.		Done 2021-06-22
7		Quality checking of the current FAMOS gravity database release ver 3.		Done 2021-05-21
8		Prepare the final gravity DB release.		Done 2021-06-01
9	Secretary	Draft minutes to Chair	2020-03-13	Done 2020-03-12
10	Chair	To check the draft minutes and send to participants for comments	2020-03-16	Done 2020-03-13
11	Participants	To comment the draft minutes	2020-03-27	Done 2020-03-27




Outcome from BSHC25/2020

No actions were given from BSHC25 to CDWG.

Baltic Sea Chart Datum 2000 in IHO GI Registry

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



IHO
International
Hydrographic
Organization

IHO Geospatial Information Registry

Please sign in Sign in Join

KHOA Korea Hydrographic and Oceanographic Agency

HOME

HELP&GUIDANCE

GI REGISTERS

PROPOSAL

TEST BED

Open Online Platform

2nd GI Registry(Old)

Data Dictionary Register

Home / GI REGISTERS / Data Dictionary Register

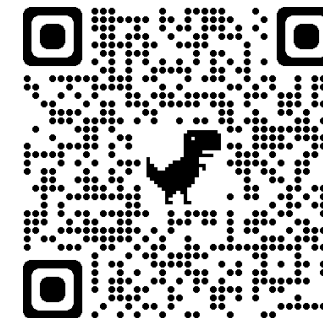
Feature Type 366 Information Type 26 Attribute Type 667 Complex Type 92 Enumeration Value 2273 Codelist Value 117

Domain ALL Status Valid Type ALL Category Name

[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	Attribute type	Name
	Enumerated type	Vertical Datum
Reference		
Reference Source	Baltic Sea Hydrographic Commission	

COPYRIGHT © IHO Geospatial Information Registry. ALL RIGHTS RESERVED.
KHOA Acknowledgements



Meetings and major outcomes 2020

- NSHC TWG23, 5-6 February 2020, Reykjavik, Iceland
Present the CDWG work

[Website](#) / [Minutes](#)
[Presentation](#)

- BSHC CDWG12, Gdynia, 3-4 March 2020, Gdynia, Poland
Review and update of Actions since the last meeting

[Website](#) / [Minutes](#)

- NKG meeting, 10-11 March 2020, Reykjavik, Iceland

[Website](#)

- BSHC25, 22 September 2020, VTC
Present the CDWG work and new Actions to CDWG

[Website](#) / [Documents](#)
[Report](#) / [Presentation](#)

- BOOS Annual Meeting, 4-6 November 2020, VTC
Present the CDWG work

[Website](#) / [Minutes](#)
[Presentation](#)



Meetings and major outcomes 2021

- TWCWG5, 16-18 March 2021, VTC
Development of S-104 Specification on Water level etc.

[Website](#) / [Documents](#)

- BSHC CDWG13, 7 September 2021, VTC
Review and update of Actions since the last meeting

[Website](#) / [Minutes](#)

- BSHC26, 21-23 September 2021, VTC
Present the CDWG work and new Actions to CDWG

[Website](#) / [Documents](#)
[Report](#) / [Presentation](#)

- BOOS Annual Meeting, 24-26 November 2021, VTC
Present the CDWG work

[Website](#) / [Minutes](#)
[Presentation](#)



Differences between old reference levels and BSCD2000

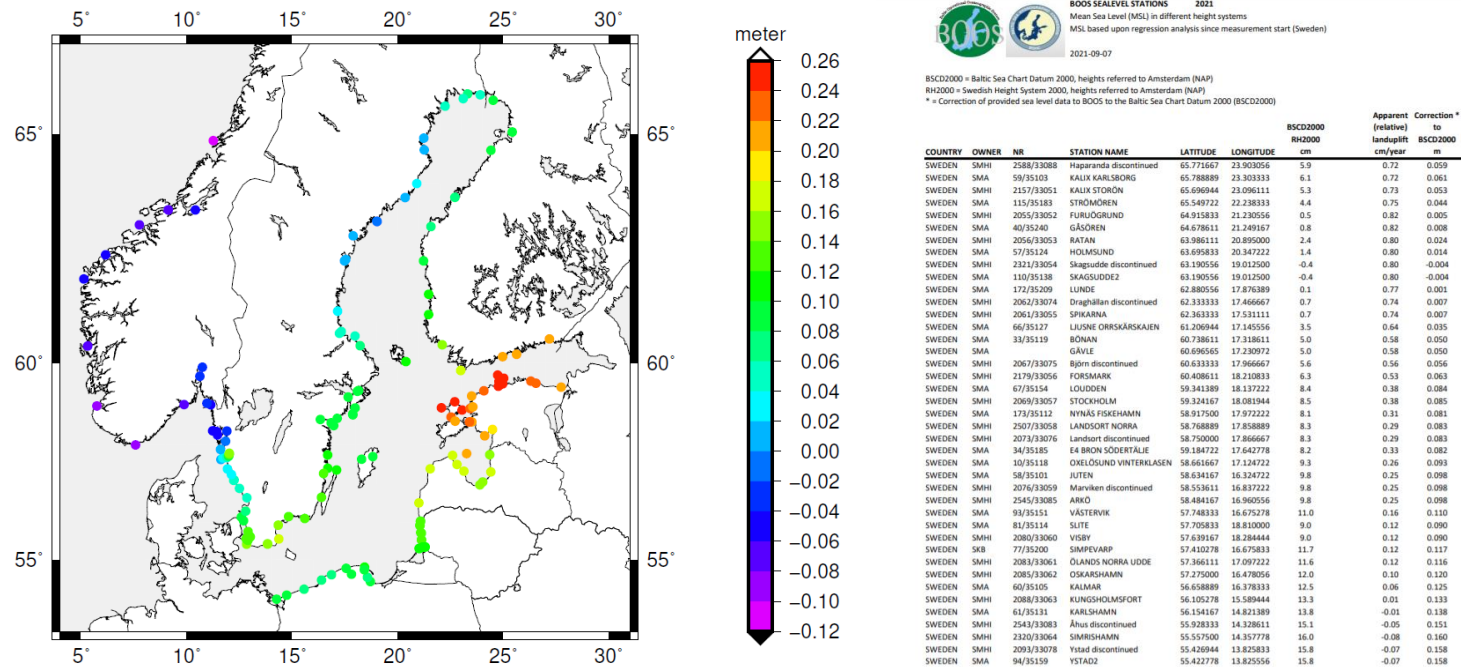


Fig. 4b: Differences between the reference levels of the old national chart datums with respect to Baltic Sea Chart Datum 2000 (BSCD2000). In Sweden and Finland, the old reference levels are equal to Mean Sea Level transferred to year 2021 (according to different national conventions). The values from 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](#).



Germany - implementation status BSCD2000

Email message from Patrick Westfeld, 5 August 2021:

Heureka, yesterday, BSCD2000 was officially introduced as chart datum for German waters in the Baltic Sea!



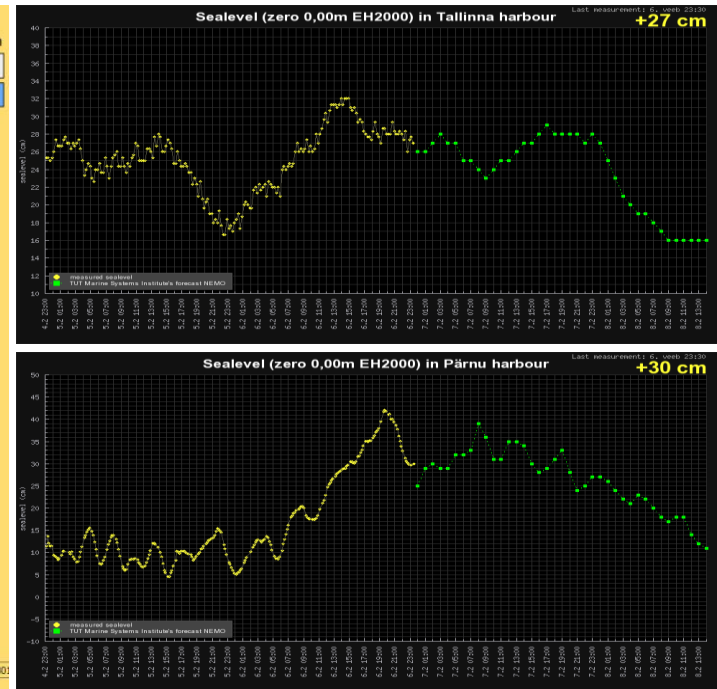
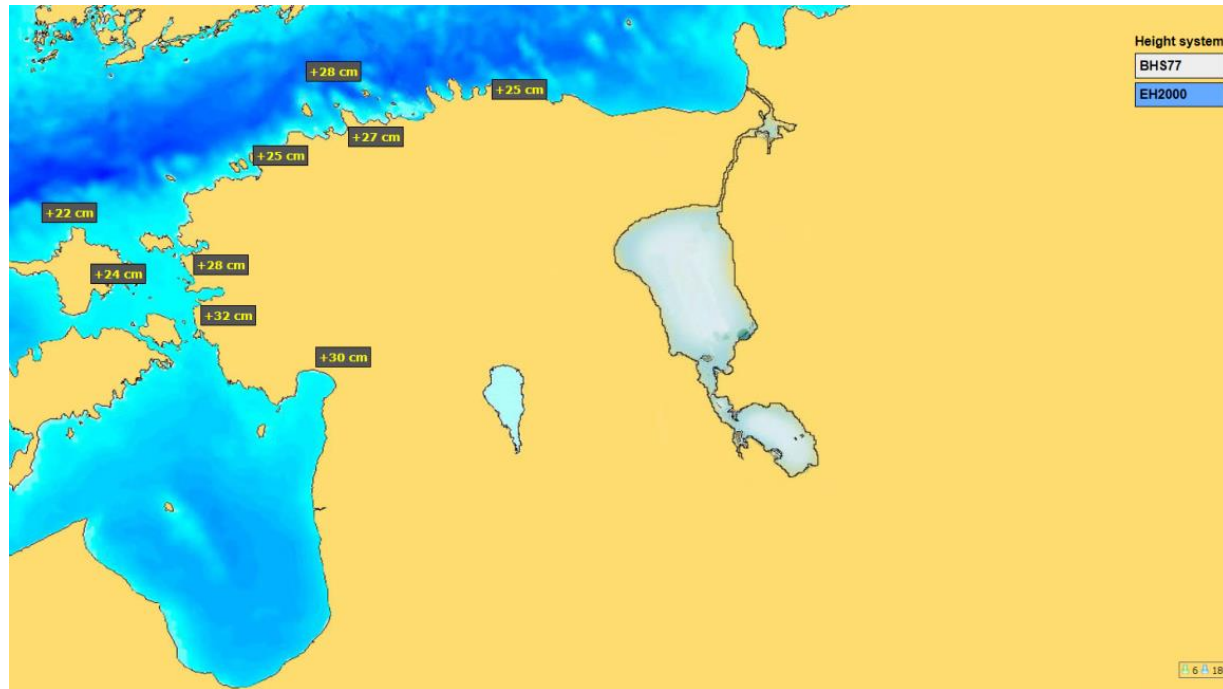
Estonia - implementation status BSCD2000

Notices to mariners (2017-12-01):

<https://www.transpordiamet.ee/media/4634/download>

Sea level information:

<http://on-line.msi.ttu.ee/meretase/?en>



Sweden – implementation status BSCD2000 in nautical charts



Updated 2021-06-21



Implementation status 2021

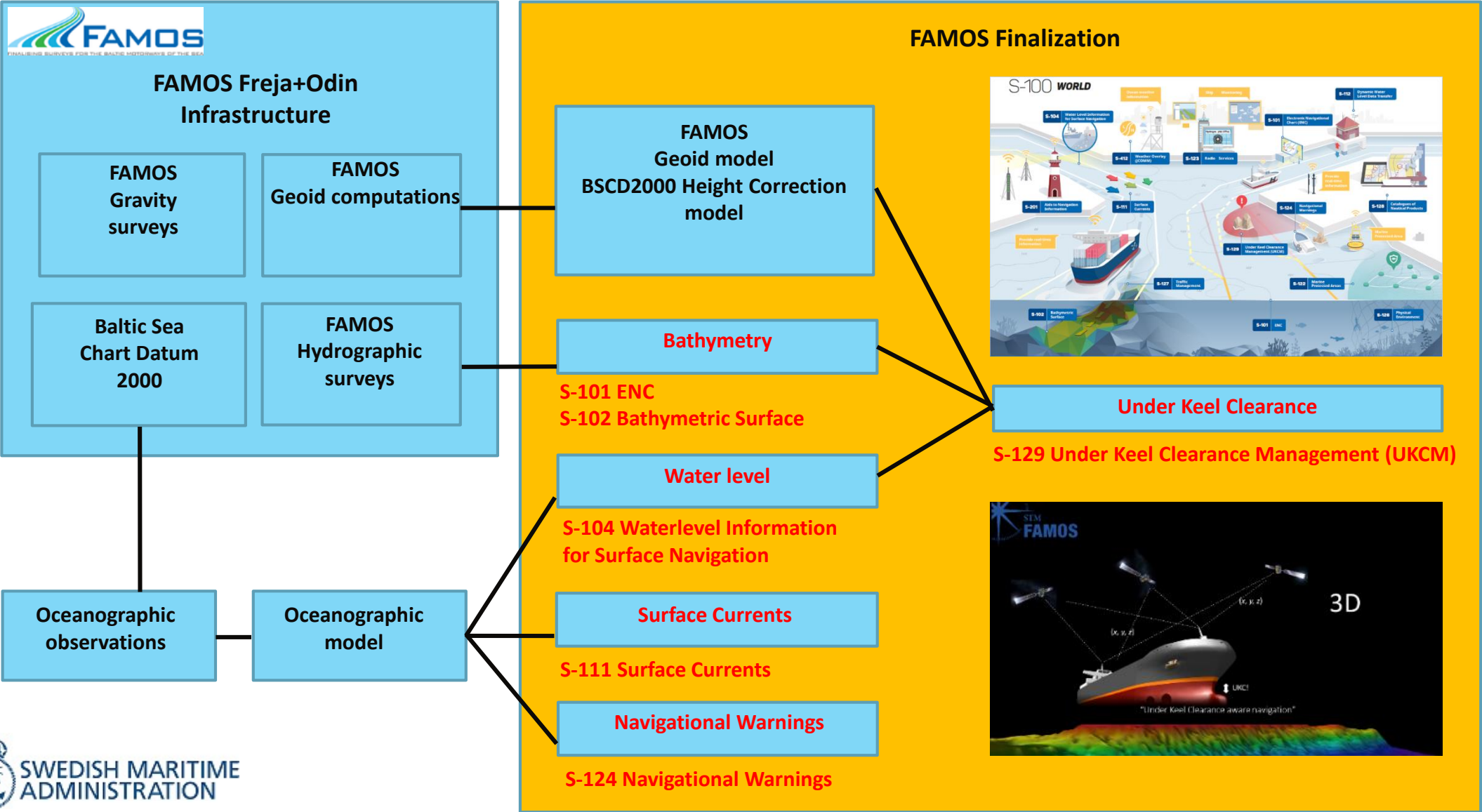
Summary of implementation status 2021:

Country	Status	Other remarks
Denmark	Chart datum in practice close to EVRS-based chart datum.	Will follow the Swedish approach and implement BSCD2000 when Sweden do in waters close to Denmark.
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.	Levelling 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: 13 harbour ENC-s, 72 berthing ENC-s, 6 harbour paper charts, 11 berthing paper charts and 2 chart album that contains charts from two height systems. Notices to Mariners 2017-12-01 . New reference homepage and booklet .
Finland	Ongoing. All decisions are taken already in 2008 and 2015. Implementation plan finalized 2018-12-12. The N2000/BSCD2000 has been implemented in the data models of bathymetric data and fairway management system and chart production system. BSCD2000 will be introduced on the nautical charts, starting in late 2021 with a new hydrographic chart data management and production system AHTI.	Finnish Meteorological Institute (FMI) has started a project concerning water level information in the Baltic Sea. Differences between MSL and N2000/BSCD2000 are provided as a table . Sea level observations and forecasts will be available in BSCD2000 for the public simultaneously with Traficom nautical charts, starting 2021. 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 German Waterway and Shipping Administration.
Latvia	BAS77 still used. New national height system LAS2000,5 (EVRS-based) into use in 2015. At the end of previous year MAL published first harbour navigation chart that are referred to MSL (BSCD2000, LAS-2000,5). Further planned actions are to step by step implement BSCD2000, LAS-2000,5 to new editions of charts in a following sequence – harbour charts, coastal charts, general charts.	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. Latvia have 3 new ENC-s with the new reference datum.
Lithuania	BHS-77 still used. National height system LAS07 (EVRS-based) came into force 2016-01-01.	National height system is LAS07 (EVRS based), into use in 2016. 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	Currently - local datum Amsterdam NN55 is in use. New datum PL-EVRF2007-NH/BSCD2000 is been defined. Corrections have been established between the local vertical datum (Amsterdam NN55) and the EVRF for coastal water level stations. 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.	Poland have an legal act about reference systems, which allows to use other than PL-EVRF2007-NH datum no longer until the end of 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	Actions and plans are dependent on the implementation of the new state coordinate system.	A new State Coordinate System 2011 (GSK-2011) for consumers, navigation, geodesy and cartography implemented 1 January 2017. Any decisions concerning the transition to the harmonized vertical reference could be done not earlier than the end of GSK-2011 implementation.
Sweden	Ongoing. All decisions are taken. Many charts already published. All water level information is related to RH2000/BSCD2000, since 2019-06-03. The difference between mean sea level and BSCD2000 at the water level stations are presented in this table .	Implementation is a part of the "Chart Improvement Project", to be concluded on time at the latest in 2024. Cooperation with SMHI on water level information. Notices to Mariners 2019-05-15 . Information campaigns in 2019 for ports, pilots and other interested parties. Several articles written in magazines and on webpages. New info Sheet about BSCD2000 from SMA/SMHI .

2021-09-07



FAMOS Finalization project (no funding)



Thanks!



Thomas Hammarklint
Swedish Maritime Administration (SMA)
Thomas.Hammarklint@sjofartsverket.se

