# Regional product harmonisation guidelines for S-104 and S-111 in the Baltic Sea

**Baltic Sea e-Nav S-104/S-111 Workshop**

2026-03-26

Thomas Hammarklint

# Baltic Sea Hydrographic Commission (BSHC)

BALTIC SEA HYDROGRAPHIC COMMISSION

IHO

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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, Water level and Currents Working Group 2nd meeting, 25-26 March 2025, Tallinn, Estonia

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

**Members of CDWCWG:**

| | |
|---|---|
| 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 Bartosz Zembrzuski |
| 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 Xaver Lange |
| Germany | Mr Thorben Knoop |
| 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 | 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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# Implementation status 2026

## Summary implementation of BSCD2000, S-104 and S-111 status 2026:

| Country | Status BSCD2000 for charts | Status BSCD2000 for water level (see mwreg_boos) | Status S-104/S-111 |
|---|---|---|---|
| Denmark | Chart datum in practice close to EVRS-based chart datum (DVR90/BSCD2000). BSCD2000 is implemented in ENC and will be implemented in paper charts In the order of reprinting. | All Danish water level stations are connected to DVR90 (BSCD2000). Data distributed to BOOS/CMEMS in relation to DVR90/BSCD2000.<br><br>Responsibility of Danish Meteorological Institute (DMI), Danish Coastal Authority (Kystdirektoratet), Danish Environmental Protection Agency (Miljøstyrelsen) and The Danish Agency for Climate Data (KDS). | DMI and FCOO (Forsvaret Center for Operativ Oceanografi) is responsible for water level and current information. Have a plan for S-104 and S-111.<br><br>DGA and DMI coordinates the work. |
| Estonia | All decisions are taken and the implementation is ongoing. All Berthing and Harbour cells and larger paper scales are in the new height system BSCD2000. Official use in charts and water level information from 2018-01-01. Notices to Mariners 2022-12-01. Info Sheet. Web application Nutimeri displays Estonian Transport Administration's official electronic navigational charts. | All Estonian water level stations are connected to EH2000 (BSCD2000). Data distributed to BOOS/CMEMS in relation to EH2000/BSCD2000. The difference between the old system BHS77 and EH2000 reaches up to 26 cm in the Gulf of Finland.<br><br>Responsibility of Taltech Marine Systems Institute (MSI) and Estonian Environmental Agency (EEA). | Discussions are ongoing between EMA and MSI. MSI and EEA are responsible for water level and current information.<br><br>EMA coordinates the work. |
| Finland | In progress. Nautical charts have been published in N2000/BSCD2000 in the Bothnian Bay and all the way down to the Archipelago Sea; see the publication status of N2000 charts and Finnish nautical charts portfolio. New video about the N2000 fairway and nautical chart reform. The plan is for all nautical charts in Finnish waters to be revised and published in BCD2000 by early 2027. | Water level information provided in both systems, mean sea level (MSL) and N2000 (BSCD2000). The differences between MSL and N2000 is provided as a Table. Water level observations and forecasts will be available in N2000 for the public simultaneously with Traficom nautical charts. Data distributed to BOOS/CMEMS in relation to N2000/BSCD2000.<br><br>Responsibility of Finnish Meteorological Institute (FMI). | The first test products of S-104 and S-111 will be created by FMI in the Baltic Sea e-Nav-project until 2026. FMI is responsible for water level and current information.<br><br>Traficom and FMI coordinates the work. |
| 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 has officially been introduced as chart datum for German waters in the Baltic Sea. 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). | All German water level stations refers to the national height system DHHN2016 (BSCD2000). Data distributed to BOOS/CMEMS in relation to DHHN2016/BSCD2000. BSH coordinates the data delivery.<br><br>Responsibility of Federal Waterways and Shipping Administration (WSV). | BSH is responsible for water level and current information.<br><br>BSH coordinates the work. |
| Latvia | All Paper Charts of Latvia are already implemented to LAS-2000,5/BSCD2000 since 2024-01-24. All approach and other scale band ENC's are implemented to BSCD2000. Further planned actions are to continue production in BSCD2000 and to implement it into the S-100 standard. | All water level stations is connected to LAS-2000,5 (BSCD2000). Data distributed to BOOS/CMEMS in relation to LAS-2000,5/BSCD2000.<br><br>Responsibility of Latvian Environment, Geology and Meteorology Centre (LVGMC). | Meeting between MAL and LVGMC officials has been held about S-104 and S-111.<br><br>MAL coordinates the work. |
| Lithuania | National height system LAS-07/BSCD2000 came into force 2016-01-01. BHS-77 still used in the charts. The difference between BHS-77 and LAS-07 is well known (about 13 cm) and is also written in nautical charts. The transfer is in progress. Expected end at the beginning of 2027. | All water level stations is connected to LAS-07 (BSCD2000). Data distributed to BOOS/CMEMS in relation to LAS-07/BSCD2000.<br><br>Responsibility of Lithuanian Hydrometeorological Service (LHMS). | Data owner has been identified. LHMS is responsible for water level information and Klaipeda University (KU) for currents.<br><br>LTSA coordinates the work. |
| Poland | The implementation of the PL-EVRF2007-NH/BSCD2000 in PL waters are completed. All charts have been updated to the new system. The last chart (chart No. 500 – general band) was updated in December 2024. All bathymetric data have earlier been transferred to the vertical reference system PL-EVRF2007-NH/BSCD2000. | All water level stations is connected to PL-EVRF2007-NH (BSCD2000). Data distributed to BOOS/CMEMS in relation to PL-EVRF2007-NH/BSCD2000.<br><br>Responsibility of Institute of Meteorology and Water Management (IMGW-PIB). | Agreement with IMGW and Institute of Oceanology of the Polish Academy of Sciences (IOPAN) to provide observed and modelled water level and surface currents data, respectively.<br><br>HOPN coordinates the work. |
| Sweden | In progress. All decisions are taken. Many charts (ca 50%) already published. Implementation is a part of the "Chart Improvement Project", to be concluded at the latest in 2030. Information compaigns is ongoing for ports, pilots and other interested parties. Notices to Mariners 2019-05-15. Several articles written in magazines and on webpages, for example New Reference Level in Charts and Products. | All water level information is presented in relation to RH 2000 (BSCD2000), since 2019-06-03. Some applications can also present data in relation to mean sea level (MSL). The differences between MSL and RH 2000 is provided in this Table. Data distributed to BOOS/CMEMS in relation to RH 2000/ BSCD2000. SMHI act as regional coordinator in the Baltic Sea and coordinates the data delivery.<br><br>Responsibility of Swedish Maritime Administration (SMA) and Swedish Meteorological and Hydrological Institute (SMHI). | Close cooperation started between SMA and SMHI, which both takes part in the Baltic Sea e-Nav-project and testfiles has been produced. Further developments and actions will be taken in a new upcoming project in 2026.<br><br>SMA coordinates the work. |

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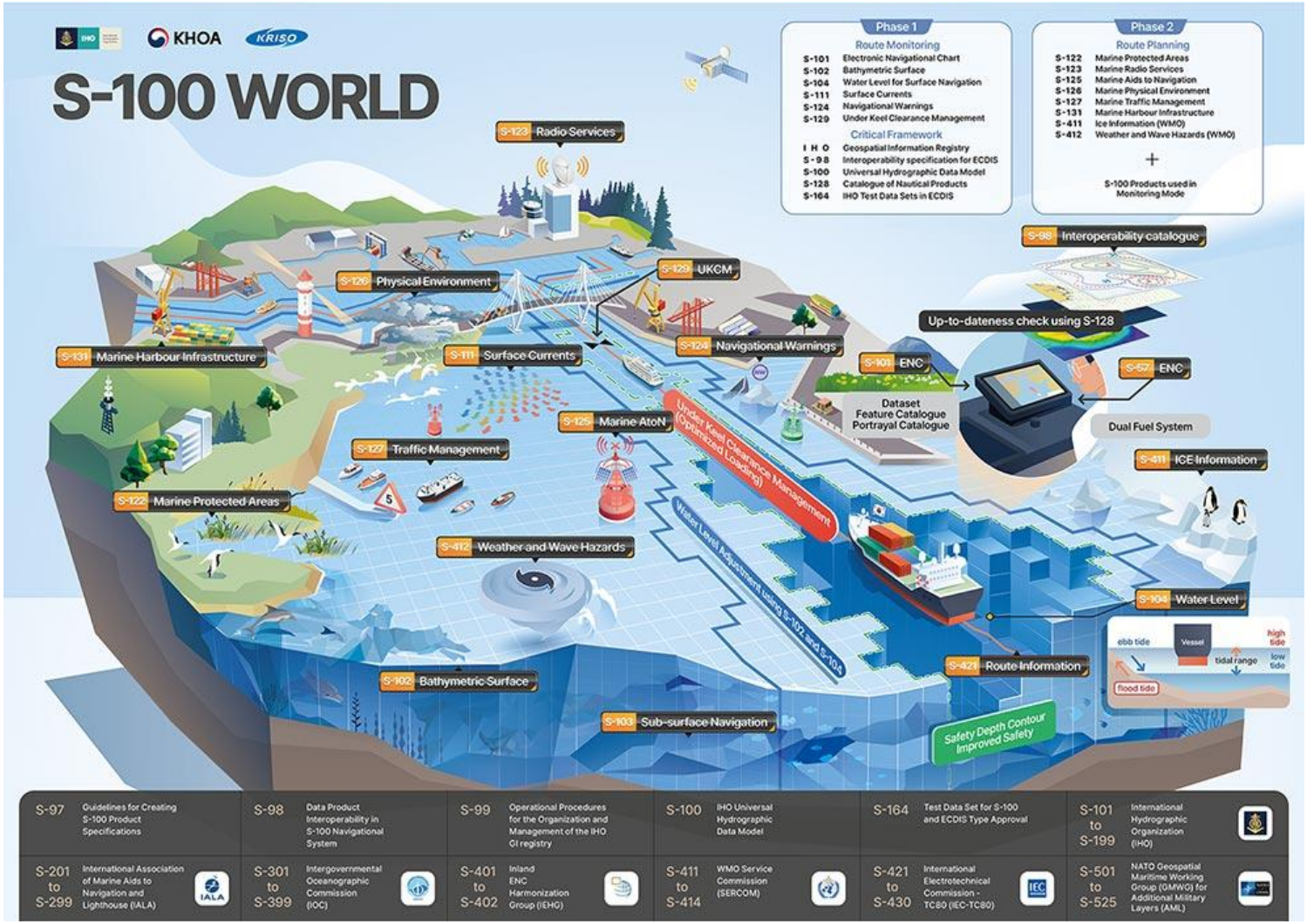
# Future Maritime Services S-100

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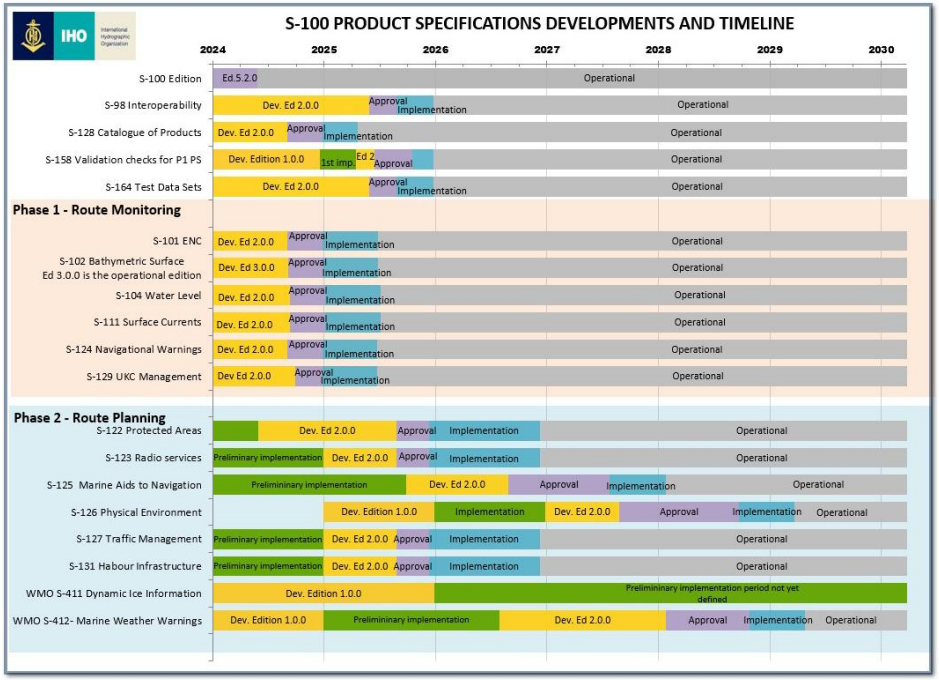
# S-100 Implementation

## 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*

**2025** → **2026** Ships allowed to use S-products → **2027** → **2028** → **2029** S-products are mandatory

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# S-100 Implementation Sweden

| Products | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|
| ENC S-101 | | | | | | | | | |
| Bathymetry S-102 | | | | | | | | | |
| Ensuring confidentiality rules for S-102 | | | | | | | | | |
| Catalogue of Nautical Products S-128 via PRIMAR | | | | | | | | | |
| Water Level S-104 (in cooperation with SMHI*) | | | | | | | | | |
| Surface Currents S-111 (in cooperation with SMHI*) | | | | | | | | | |
| Navigational Warnings S-124 | | | | | | | | | |
| Marine Protected Areas S-122 (in cooperation with SwAM*) | | | | | | | | | |
| Marine Radio Services S-123 | | | | | | | | | |
| Marine Traffic Management S-127 | | | | | | | | | |
| Marine Harbour Infrastructure S-131 | | | | | | | | | |

*SMHI – Swedish Meteorological and Hydrological Institute, SwAM – Swedish Agency Marine and Water Management

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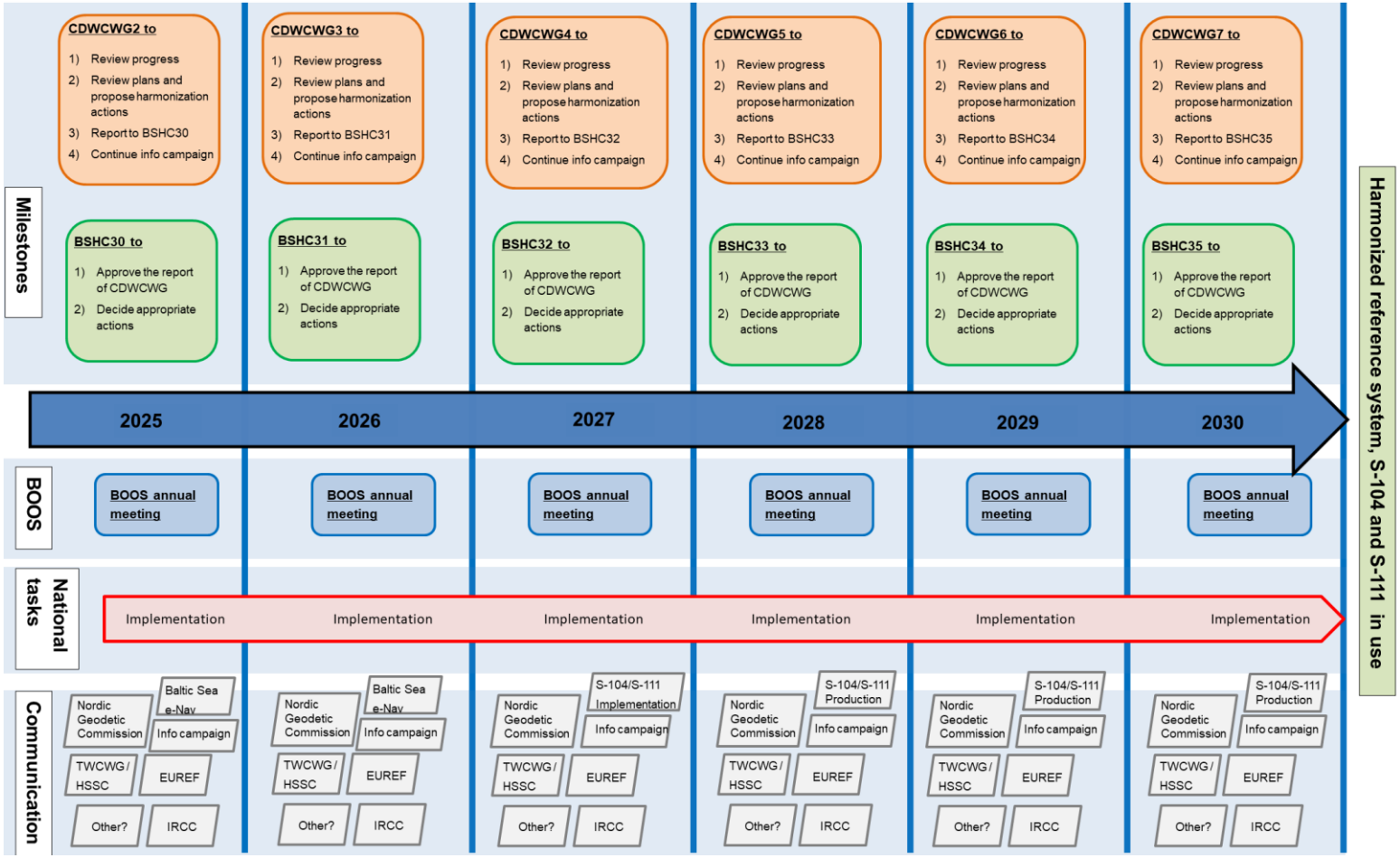
# CDWCWG Roadmap

**RoadMap**
**BSHC CDWCWG / Harmonized Reference System / S-104 and S-111 Implementation / Time Line**
**2024-10-11**

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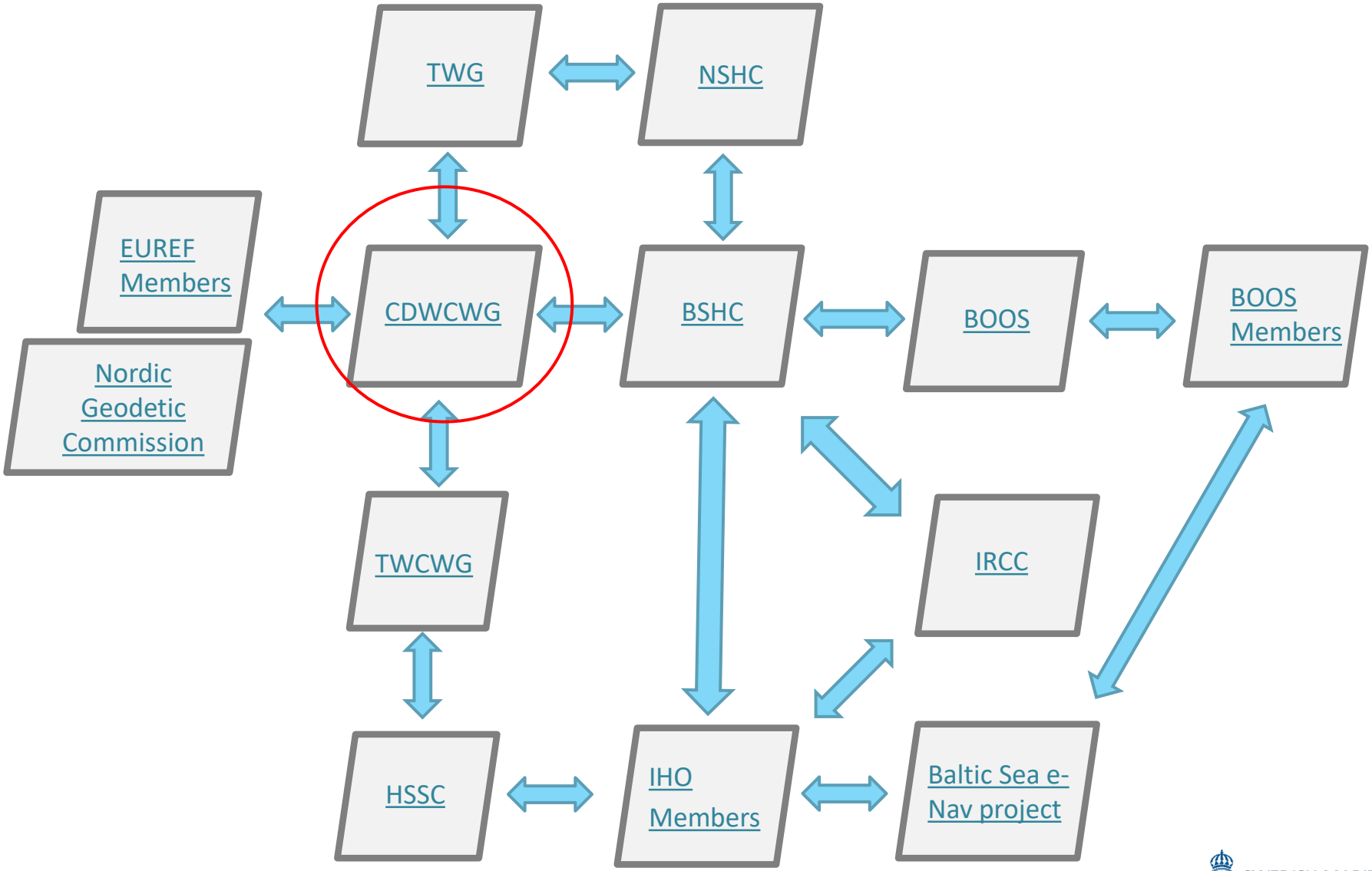
# CDWCWG International relations

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# Real Time Hydrographic and Environmental Information Service

## Infrastructure

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

Gravity surveys

Hydrographic surveys

Geoid model

Baltic Sea Chart Datum 2000

Bathymetry database

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

**Water Level**

S-104 Water Level Information for Surface Navigation

**Surface Currents**

S-111 Surface Currents

**Under Keel Clearance**

S-129 Under Keel Clearance Management (UKCM)

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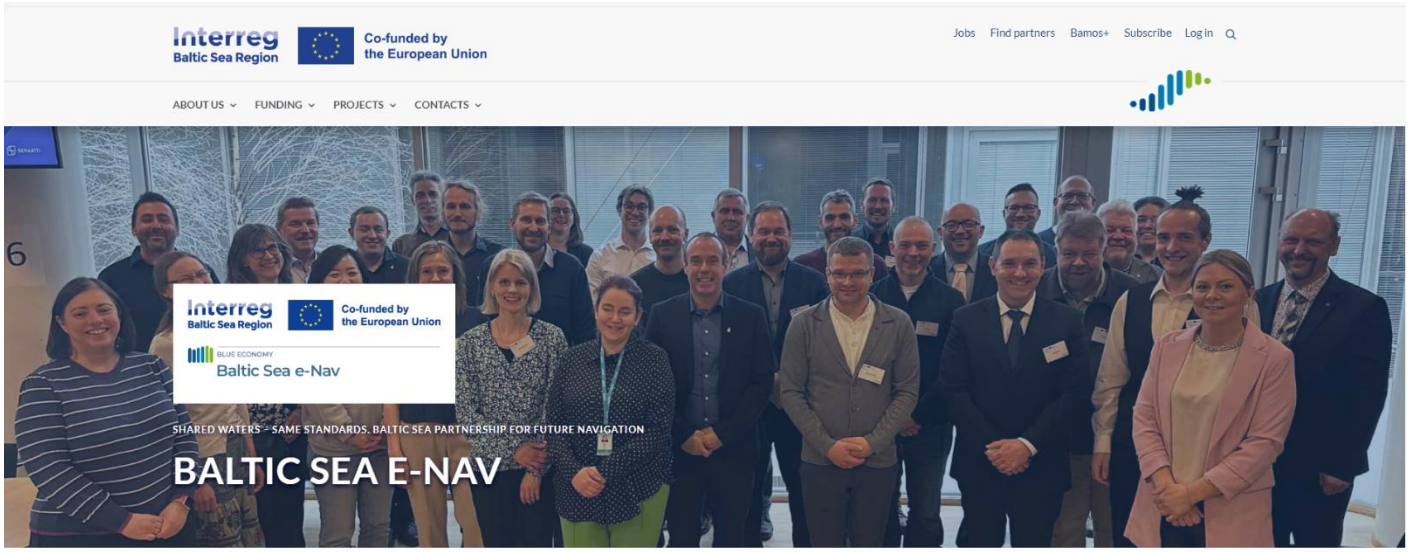
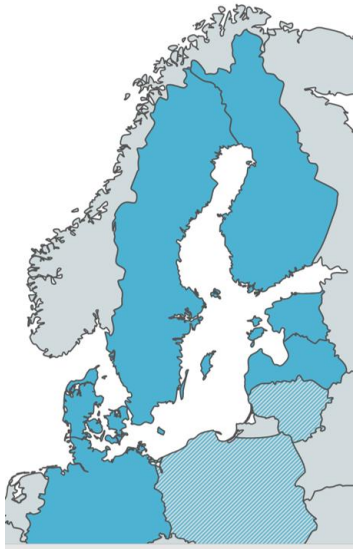
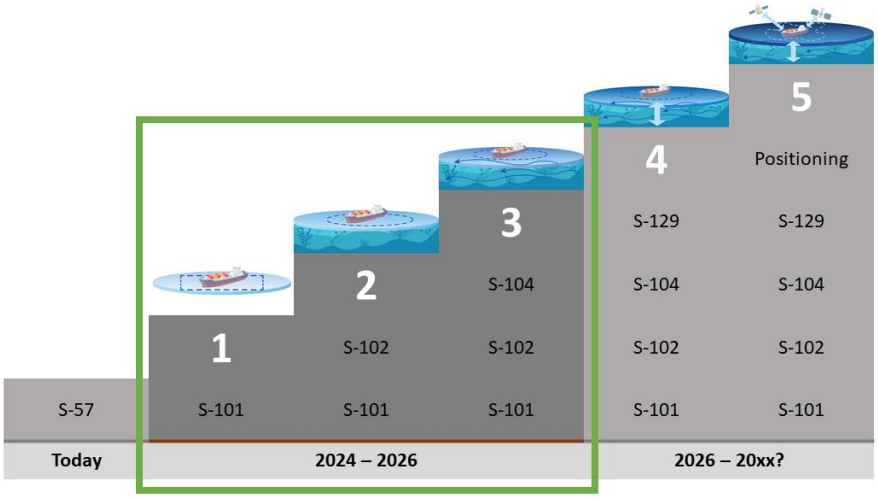
# Baltic Sea e-Nav Interreg project 2023-2026



| Goal | Period |
|---|---|
| **Develop production capabilities** for S-101 ENC, S-102 bathymetry and to some extent S-104 water level and S-111 surface currents | 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 and S-111 in parts of FI. | 2026 |

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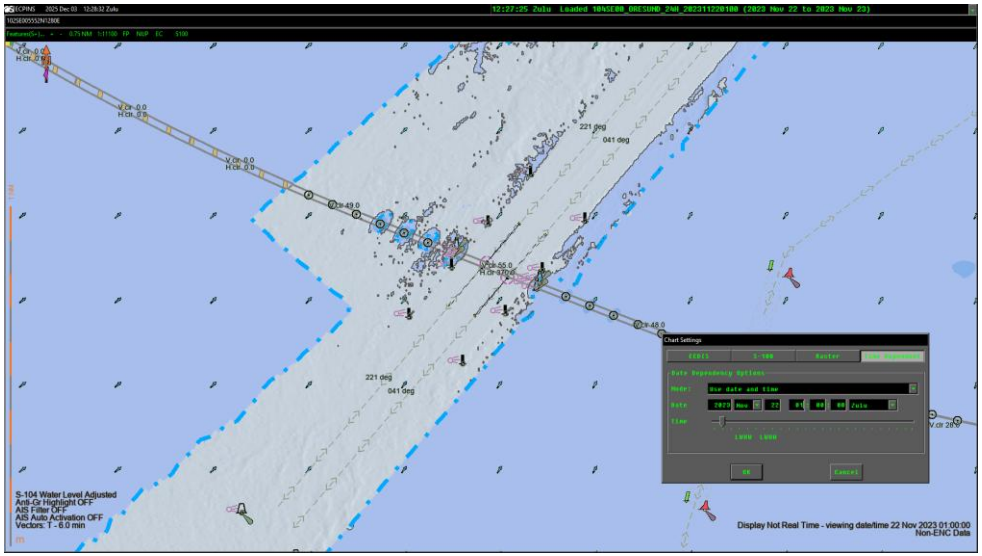
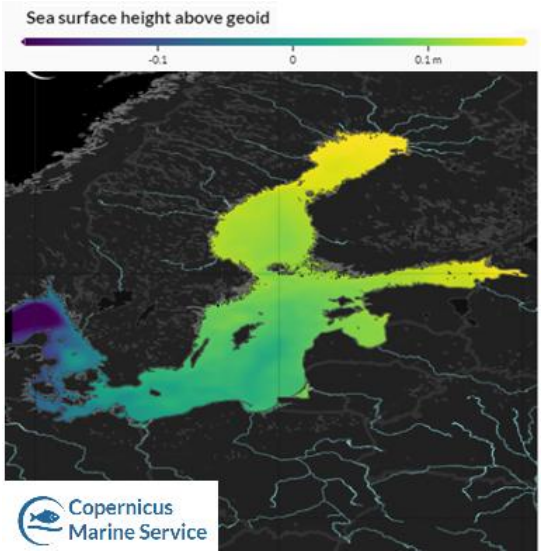
# S-104 Water Level

Interreg Baltic Sea Region
Co-funded by the European Union
BLUE ECONOMY
Baltic Sea e-Nav

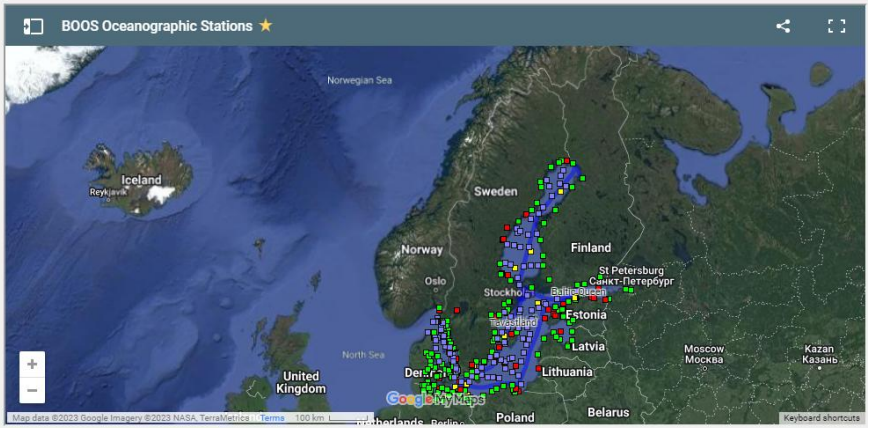


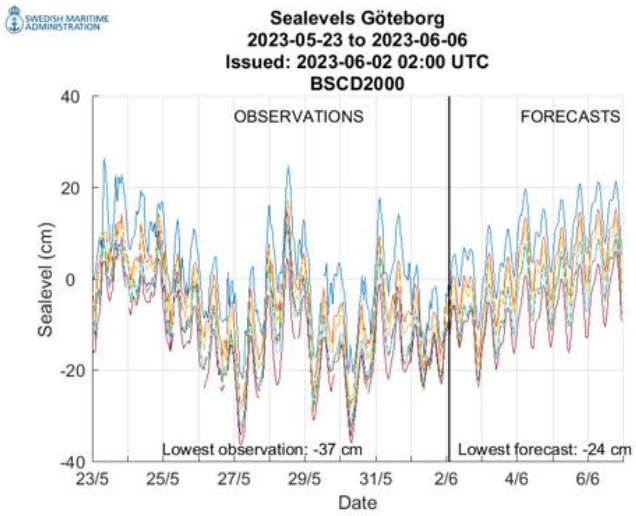




BOOS > BOOS Stations

## BOOS Stations

BOOS
EuroGOOS Baltic Regional Operational Oceanographic System

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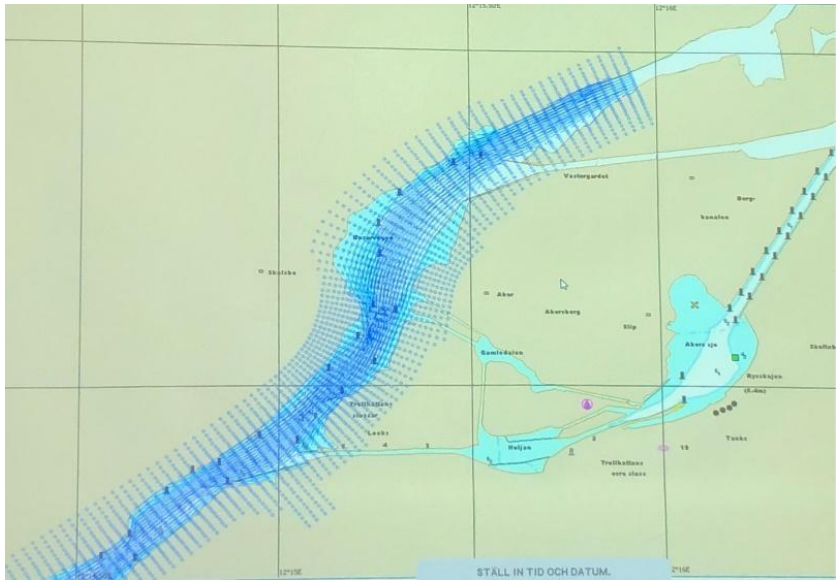
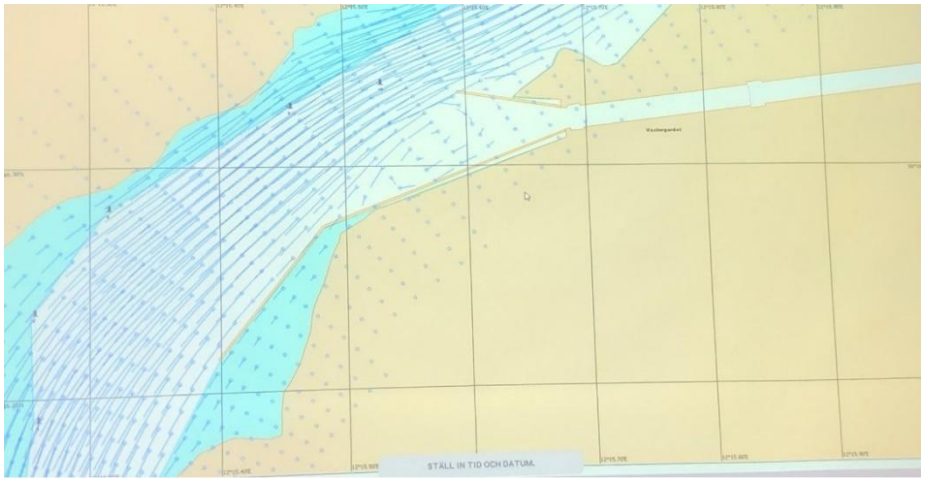
# S-111 Surface Currents



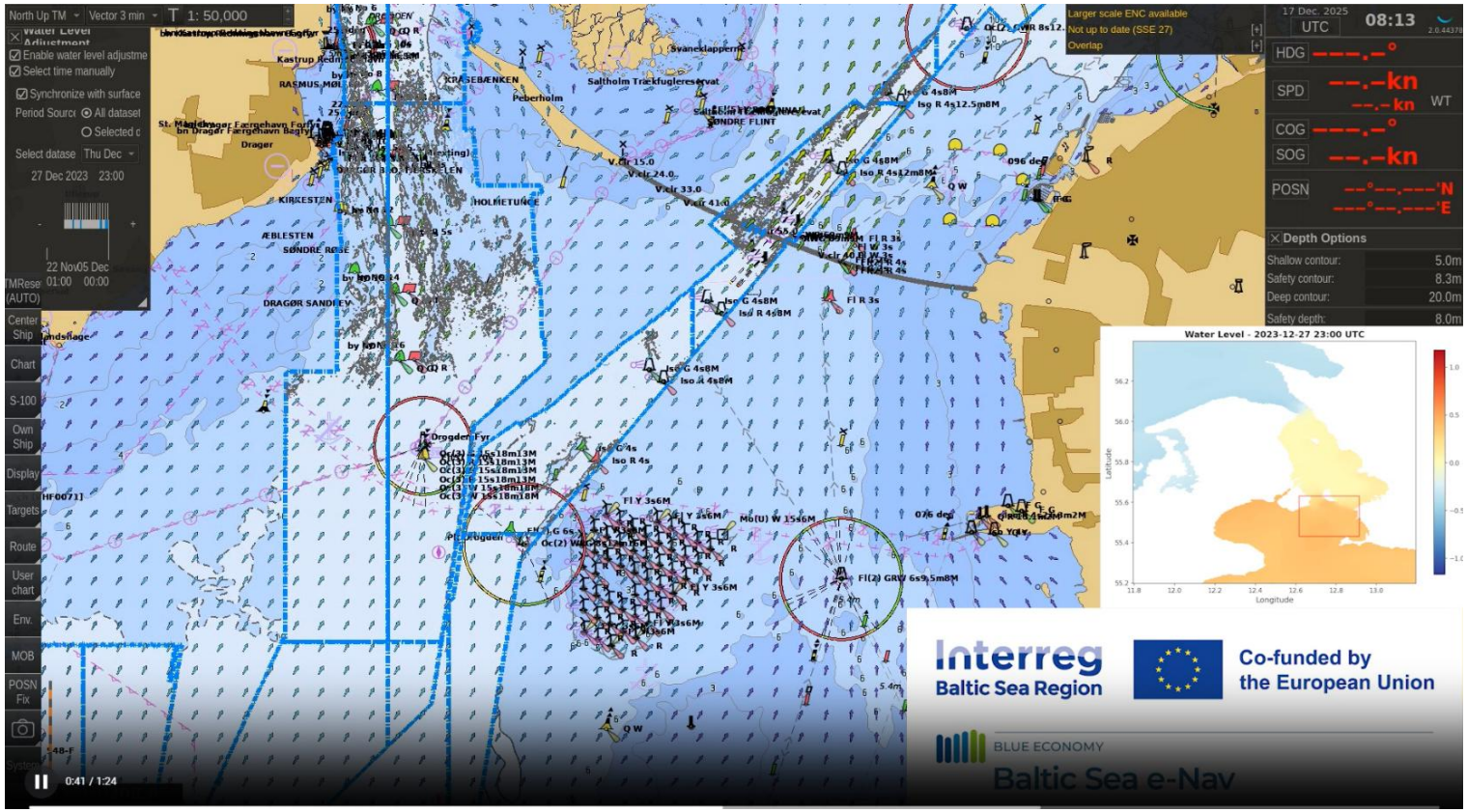

# PRIMAR´s uploading scheme of S-1xx products

| Service Aspect | S-101 Service | S-102 Service | S-104 Service | S-111 Service | Comments |
|---|---|---|---|---|---|
| **Available and Operational** | Now | Now | Now | Now | |
| **Current Suppliers** | Canada | Canada, Estonia, Norway | Canada, Estonia, Norway | Canada, Estonia, Norway | |
| **Upload Mechanism** | PRIMAR VPN, API | PRIMAR VPN, API | PRIMAR VPN, API | PRIMAR VPN, API | |
| **Accepted Versions** | 2.0.0 | 3.0.0 | 2.0.0 | 2.0.0 | |
| **Validation Type** | PRIMAR Upload Checks/External Validation Tools | PRIMAR Upload Checks/External Validation Tools | PRIMAR Upload Checks/External Validation Tools | PRIMAR Upload Checks/External Validation Tools | |
| **Validation Speed** | Updates 1 day New Editon 2 days New Cells 3 days | Immediate Auto-release | Immediate Auto-release | Immediate Auto-release | If S-102, S-104 and S-111 pass the upload checks they can be released straight away if auto-release is used. S-101 same as for S-57. |
| **Release Schedule** | Live/Continuous | Live/Continuous | Live/Continuous | Live/Continuous | Since the suppliers in most cases have access to release their data themselves, the release schedule is set to live/continuous for all products |
| **Release Format** | S-100 Exchange Set | S-100 Exchange Set | S-100 Exchange Set | S-100 Exchange Set | |
| **Release to** | Distribution Network | Distribution Network | Distribution Network | Distribution Network | |
| **S-128 Generation** | Yes | Yes | Yes | Yes | |
| **Digitally signed by PRIMAR** | Yes | Yes | Yes | Yes | |

# Baltic Sea e-Nav Testbed Öresund

Animations of S-102 (bathymetry) , S-104 (water levels) and S-111 (surface currents):

- Öresund 2023-11-22–2023-11-23 | observations
- Öresund 2023-12-21–2024-01-03 | observations
- Öresund 2024-09-30 | observations

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# Outcome from BSHC30/2025

**Actions given from BSHC30 to CDWCWG:**

- Share with NSHC findings on Product harmonisation guidelines for S-104 and S-111 (BSHC30/5)

**Decisions taken related to CDWCWG:**

- To approve the amended Terms of Reference (with small comments) of CDWCWG (BSHC30/D3)
- To endorse Product harmonisation guidelines for S-104 and S-111, with the aim to be approved at next year´s BSHC Conference (BSHC30/D4)

**Other news:**

- Lithuania is now a member of IHO and hence a full member of BSHC (BSHC30/B)
- BSHC30 elected Mr. Tomas Kolendo from Lithuania as the next BSHC Chair (BSHC30/F)
- Mr. Thomas Dehling from Germany was elected as Vice-Chair (BSHC30/F).

# Regional product harmonisation guidelines for S-104 and S-111

Interreg Baltic Sea Region | Co-funded by the European Union | BLUE ECONOMY Baltic Sea e-Nav | IHO International Hydrographic Organization | Baltic Sea Hydrographic Commission BSHC

Interreg Baltic Sea Region | Co-funded by the European Union | BLUE ECONOMY Baltic Sea e-Nav

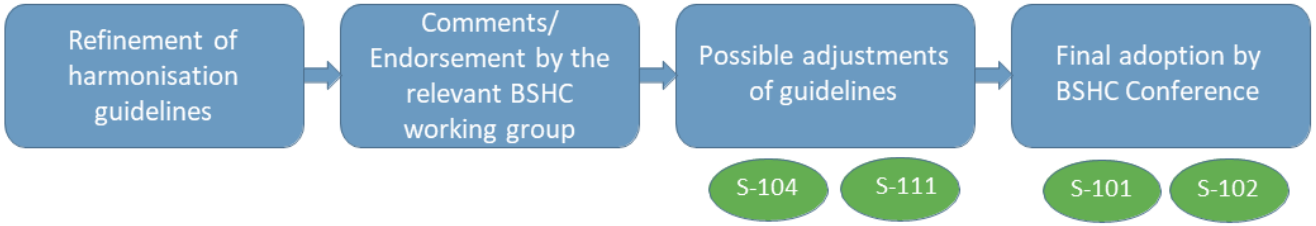
## Regional product harmonisation guidelines for S-104 and S-111

### Harmonisation activities

Interreg Baltic Sea Region | Co-funded by the European Union | BLUE ECONOMY Baltic Sea e-Nav

- Activity lead of harmonisation activities: Traficom
  - A2.3 Refinement of regional product harmonisation guidelines
  - A3.2 Formally adopt regional product harmonisation guidelines and establish delivery capabilities
- Standard-specific task forces (S-101, S-102, S-104 & S-111)

Workflow and status of harmonisation activities:

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# Regional product harmonisation guidelines for S-104 and S-111

Interreg Baltic Sea Region | Co-funded by the European Union

BLUE ECONOMY Baltic Sea e-Nav

**Summary of the harmonisation recommendations for S-104 and S-111**

*1. Recommendation: Baltic Sea Chart Datum 2000 (BSCD2000) should be used as vertical reference system for water level information in S-104.*

*2. Recommendation: For S-111, the current values should be presented at a given depth relative the sea surface.*

*3. Recommendation: Same horizontal reference system should be used for S-104 and S-102.*

*4. Recommendation: It is recommended to provide a S-104 water level and S-111 surface currents products based on sufficient resolution and reliable quality required to resolve the oceanographic conditions in the area.*

*5. Recommendation: The data producers or Hydrographic Offices are responsible for the production and delivery of S-104 water level and S-111 surface currents within their area of responsibility for the production of ENCs.*

*6. Recommendation: Neighbouring countries should agree on harmonisation of data coverage and reduce differences of S-104 water level and S-111 surface currents products meeting at borders of areas of responsibility. No data overlap should occur across borders.*

*7. Recommendation: It is recommended that every time a model run is finalized (typical every six hours, covering at least five days of data), the S-104 water level and S-111 surface currents products will be updated and delivered to the RENC to be made available for the end-users. If a model run is very delayed or incorrect, a cancellation of the products should be considered.*

*8. Recommendation: It is recommended to continously monitor and validate the quality of the S-104 water level and S-111 surface currents products to ensure usability and trust.*

*9. Recommendation: Set uncertainty values in the metadata of the S-104 water level and S-111 surface currents products, to provide mariners with valuable information, enabling them to determine which data is more reliable or up to date for safe navigation.*

*10. Recommendation: The data producer or the Hydrographic Office should perform a technical validation according to S-158 of the produced S-104 and S-111 data files (HDF5-format), put a signature, i.e. create and attach a signature file (xml-format) for each data file and deliver the wrapped data set to the RENC.*

*11. Recommendation: The Hydrographic Offices and data producers aim to have continuous S-104 water level and S-111 surface current products, especially in areas where S-102 bathymetric surface are available. Therefore, the Hydrographic Offices and data producers are recommended on defining parameters (e.g. coverage and resolution adjustments or by interpolating) to assure continuous surface, ensuring usability for mariners.*

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# Future navigation

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# Thanks!

Thomas Hammarklint

Swedish Maritime Administration (SMA)

Thomas.Hammarklint@sjofartsverket.se

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