

Tides, Water Level and Currents Working Group
VTC, 04-06 November 2025
Minutes and Action Items – (TWCWG 10)

(Paragraph numbering is the same as the Agenda Item numbering and does not necessarily reflect the order in which matters were discussed. ISO three-letter country codes have been used to identify individual participants)

Section 1. Opening

1.1 Opening Address.

The Chair, Chris Jones (GBR), welcomed all in attendance. A special note of thanks to all for their dedication in attending the VTC especially for those attending from very early or late time zone differences. The Chair informed all present that the intention was to record the meeting, it is protocol to make everyone aware of this. He made it clear that if there are any dissensions the meeting cannot be recorded. He informed all present that the meeting would be recorded in order to assist the Chair, Vice Chair and IHO Assistant Director in constructing the report and it will not be made available to delegates. He enquired if there were any objections to the meeting being recorded, no objections were received.

The Chair informed those in attendance that it was once again an ambitious agenda and all best efforts to maintain the timings, as indicated in the program, would be made.

The Chair handed over to Ruth Farre, Vice Chair (ZAF), where she added her opening remarks and comments, wishing all a successful meeting and re-iterating the comments of the Chair.

1.2 IHO welcome.

Sam Harper, Assistant Director at the IHO, reiterated the Chair and Vice Chairs comments. He thanked all for their attendance and noted it was good to see how many people were online. He thanked the attendees for their dedication in joining the meeting at various hours of the day, and, with the number of attendees in the region of around 60, this showed the commitment to, and importance of, the TWCWG sphere of influence. He indicated the technical nature of the meeting content would represent a challenge to maintain the concentration level, however he was looking forward to a successful meeting.

1.3 Meeting Expectations.

Apologies were expressed for this meeting being a VTC, however the Chair noted that an in-person meeting is planned for November 2026 onwards for the TWCWG annual meeting schedule to meet the required deadlines as set by HSSC.

He went through the logistics of this meeting explaining how the meeting would be run. It was requested that all were to keep cameras switched off and microphones muted. Cameras could be turned on if a member wished to speak, additionally they could 'raise your hand' option, or type 'floor' into the chat. The Vice-Chair was asked to monitor this as well as the chat. The meeting was recorded and the chat logs kept for minute purposes. As is always the case, the Chair asked all speakers to speak as slowly and clearly as they could, as he fully appreciated that English is not the first language of most participants. Those in attendance were reminded to ask for any clarification on any points of discussion that were not understood, as it is not a problem to repeat information.

The Vice Chair asked all present to please keep a note of any action items they volunteered to work on or that pertained to them as this would assist in projects getting completed timeously. She discussed the importance of registering for both the IHO portal and the meeting for administrative purposes as well as distribution of

relevant documentation.

Section 2. Administrative Arrangements

As a VTC meeting, administrative arrangements are not applicable. An official “photo” would be taken during the meeting with as many cameras turned on as possible.

2.1 Adoption of the Agenda and Apologies

The agenda was adopted and approved. The TWCWG9 minutes were accepted. Several apologies were received, namely Fernando Oreiro (ARG), Joyce Nengwenani (ZAF), Peter Stone (USA) and Greg Seroka (USA) including several other members from the USA due to the extended furlough of the USA’s government.

2.2 Programme and Timetable of the Sessions.

The Chair introduced the draft timetable; it was explained that this was intended for guidance only and was not intended to be a rigid structure. Where necessary time spent on individual topics would be amended to allow an appropriate discussion. Regarding ‘Meeting Administration’ the Agenda Items might be discussed ‘out of sequencing order’, and that timings were approximate and subject to change. Breaks would be taken as required.

It was announced that the Vice Chair will take the minutes and create the Actions List. As the Current Chair and Vice Chair were in their second year of their 3-year term there would be no re-election of the Chair & Vice-Chair. Re-election/election of the Chair & Vice-Chair would take place at the end of TWCWG11 (2026).

2.3 Report on Intersessional Activities including HSSC17.

The Chair reported back on intersessional activities, starting with the main development being the S-100 product specifications (PS) for S-104 and S-111 edition 2.0.0 now being complete and are being trialled by some member States (MS). In parallel, the work done on the validation products S-158:104 and S-158:111 edition 1.0.0 has been completed and is ready to be distributed to MS via circular letter from HSSC for use and implementation for validation. They are also available on the TWCWG GitHub portal.

The Chair gave feedback on the intersessional work with special mention on the **Survey on tides, water level and currents; data production method and data format** (S-104 & S-111 products) that was re-conducted by KHOA; this work was greatly appreciated and he thanked them for co-ordinating the work with feedback being addressed under Agenda Item 4.10. Feedback would be given on the work undertaken by the S-44 (Standards for Hydrographic Surveys) sub-working group which have made exceptional progress, kindly led by Felipe Rodrigues from Brazil (Agenda Item 5.1). Norway was thanked for the collaborative spreadsheet that was created where MS could provide details on their different approaches for S-104. The spreadsheet has been placed on the [TWCWG GitHub registry](#).

The Chair reported back on his attendance at HSSC17 which took place 4-9 May 2025 in Norway. The TWCWG9 report was very well received, and a PDF version of the report has been uploaded to the TWCWG portal. The work plan for 2025/2026 was also approved. A package of the various proposed resolution changes from M-3 is being created by HSSC and will be made available for Council-9 for endorsement. Various discussions on Metanorma (open-source framework) for creating and maintaining standards documents which are technically sound, consistently formatted and ready for publication across platforms took place (<https://www.metanorma.org>). The IHO is a part of the committee and Metanorma has been adopted as part of IHO on the PS. There is no specific action on TWCWG regarding this, however the HSSC is moving to using this platform as a standard for creation of documents. There is an extensive online tutorial available at (<https://www.metanorma.org/learn/>).

The Chair reported that HSSC had reiterated that maximising attendance/participation at working group meetings was very important as per IHO CL28/2025 (*Approval of IHO resolution – Maximizing Active Participation in IHO Events*). In summary: *In application of this IHO Resolution, it should be noted that from now on, meeting hosts should make use of technology to maximize active participation in IHO events, in addition to in person attendance, as far as is practicable and within their capacity. The appendix details the Key Principles for Determining Meeting Modalities, Best Practice for Remote-Active Attendees and Best Practice for Meeting Hosts.*

The Chair briefed on the work on S-11 Part C, *Guidelines for the co-ordination and management of the development of S-100 electronic navigational data services*, which is commonly referred to as ENDS. There are descriptions of S-104 and S-111 and the Chair, along with members of the project team working on the PS provided comments to HSSC on this topic.

The Chair gave a brief report to GLOSS18 in March 2025 on what TWCWG is doing, our activities and feedback on our last meeting . It is clear that there are a lot of synergies between TWCWG and GLOSS and this will be covered under the GLOSS briefing by their new Chair (Agenda item 7.1). The Chair also mentioned the progress being made on S-104 and S-111.

The “official” screenshot photo was captured by Sam Harper.

2.4 Matters arising from TWCWG9/Review of Action Items. (ACTION ITEM 1)

There were approximately 40 Action Items that arose from TWCWG9 and needed attention. The Chair had updated the status of these actions and which had been completed. He noted that as we progressed through the meeting this list would be refined and completed actions would be removed from the action list.

| Action Item | Agenda Item | Comments | Status | Actions |
|-------------|--|--|------------|---|
| 1 | 2.4.1 Strategies and accommodations for use of changed scope S-104 | Establish a correspondence group to develop the themes relating to Phil MacAulay’s (CAN) initial outline, detailed in “Strategies and accommodations for use of changed scope S-104:” | Ongoing | CAN BRA GBR PORTOLAN ARG AUS FIN NOR DEN ESP |
| 2 | 2.4.2 GI Registry Entry definition of Low Water | <ul style="list-style-type: none"> • Still to be addressed • To be carried out and feedback to be given at TWCWG11 | In Process | CAN |
| 3 | 2.4.3 Representing station- based data in regular grid format without models | <ul style="list-style-type: none"> • Re-engage the subgroup to look at and discuss the strategies and methods of application of what could be done. • Provide a list of the various strategies - collate all the various methodologies being used for applying either models or predictions to the grids | Ongoing | CAN ALL |

| Action Item | Agenda Item | Comments | Status | Actions |
|-------------|-------------|--|--------|---------|
| | | <ul style="list-style-type: none"> Any available documentation to be uploaded to GitHub | | |

Section 3. Programme Matters

3.1 Standard Constituent List.

The Chair reported that there have been no new updates. The Standard Constituent List can now be seen as more of a reference document than a living document as it is doubted that any more updates, contributions or changes will be made to it. For new TWCWG members, the Chair gave a brief overview of the list. It contains a list of a large number of harmonic constituents commonly in use, showing the Constituent Name (grouped by species of constituent). The list provides the speed of the constituent in degrees per hour, the Extended Doodson Number (XDO) (numerically and alphabetically) and the application of the nodal correction to each constituent.

This list now links closely to the work of the IAPSO Best Practice study group. During an IAPSO workshop, a year ago, discussions suggested identifying the ‘core’ harmonics in the main list and explaining why there are sometimes 2 ‘versions’ of the same harmonic constituent. No decision was reached on this topic. The IAPSO representative present suggested that a clear indication of which constituents were purely astronomical in origin and which were shallow water constituents could be a useful addition to the list. After some discussion it was concluded that this might possibly be subsumed within the IAPSO work.

3.2 The study of long-term data sets for the determination of global sea level rise and changes in tidal range.

The Chair reported that during TWCWG9 a decision had been made to revise the title of Agenda Item 3.2 so that it better reflects the intended task. The proposed new title is **“Maintain changes in tidal ranges to reflect epoch information related to Chart Datum (CD)”**, which aligns well with Agenda Item 3.9.

A combined title was also proposed: **“The study of changes in tidal range reflected in epoch information related to Chart Datum (List of Vertical Datums).”** Since the work under Item 3.2 is now closely linked with Item 3.9, it was suggested that merging the two agenda items would be appropriate.

To support this, the merged item may require a further refinement of the title to fully represent both tasks. The Chair and Vice-Chair agreed to take on this action.

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|---|--|----------|
| 4 | Epoch information could be added to the list of vertical Chart Datums. This should be applied if and when needed, thus the epoch will indicate when the update was applied. | ALL Chair (GBR) Vice-Chair (ZAF) | TWCWG11 |
| 5 | Reword the title and amalgamate the requirements for items 3.2 and 3.9 | Chair (GBR) Vice-Chair (ZAF) | TWCWG11 |

3.3 Compare Tidal Predictions generated as a result of analysis of a common data set by different analysis software (including Application for International Association for the Physical Sciences of the Oceans (IAPSO) Best Practice Study group on Tidal Analysis)

Dr Andrew (Andy) Matthews (NOC) gave an update on the effort via IAPSO, GLOSS and NOC; reiterating that

the purpose was to write a best practice document/ more practical guide for tidal analysis. Once completed, this document will be submitted to the IOC Ocean Best Practices website (www.oceanbestpractices.org). This project has unfortunately been put on hold until the new funding process has been completed. NOC has collated all the information and created a 'Chapter 1' which is the first draft. Chapter 1 has been placed on GoogleDrive

(https://drive.google.com/drive/folders/1laAEPo4Q5yh2Dawa3OPq_HDtvEoUyxGk?usp=sharing) along with an example of a constituent set. The document content is now mostly complete and just requires "cleaning up/ polishing"

A plea for assistance from TWCWG MS to check Chapter 1 to confirm if the content is correct, if anything still needs to be included or cleaned-up to improve the document. The document is low on images such as various astronomical content. The vice-chair has kindly offered to share her intellectual property on this. AUS advised that the Australian Hydrographic Office (AHO) are currently involved in creating guidance notes for a new edition of Statement of Requirements (SOR) for their Hydrographic Industry Partnership Program (yet to be released but before end of 2025). Within this they will be providing more detailed guidance on the determining of vertical datum using tidal data with minimum of 35 days of observations. They were not able to await the publication for the Best Practice guide before creating this revised SOR. But when these documents get publicly released AUS can make them available to Andy Matthews under this IAPSO best practice guide.

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|--|-------------------------------------|-------------|
| 6 | 1. Anybody wishing to be involved in checking the IAPSO Chapter 1 can email Andy (antt@noc.ac.uk) to gain access to the document. 2. MS participating in this action to submit comments/feedback on the Chapter 1 directly to Andy Matthews | ALL USA NOR GBR NOC | 24 Dec 2025 |

3.4 Historical data recovery/data archaeology.

NOC and GBR gave a brief history and feedback on the status of Historical data recovery/data archaeology. NOC reported that the GLOSS Data Archaeology Working Group is open to anyone who wishes to join and help. They have currently got 68 contacts from 23 countries. At their last meeting a list of actions was established around what they want to achieve. GLOSS is formalizing the Terms of Reference which is about to be circulated to GLOSS for approval. NOC mentioned that their funding does not come from the IOC, but comes from local funding or institutional funding for this project.

Andy Matthews referenced the creation of a webpage <https://gloss-sealevel.org/data-archaeology> (note this link is not fully developed yet) – but in time this will be designed to share experiences, best practices, known difficulties, links to other groups etc.

Through work to establish a contact list per country of people interested in Sea Level Data Archaeology activity, so far there have been 68 contacts from 23 countries (as of March 2025; likely more now). – see https://docs.google.com/spreadsheets/d/1_4TSiOee9goKXIfLeXWJN70RfioTkh3RRAdBF7d6Es/edit?gid=0#gid=0.

Anyone wishing to join the group can contact laurent.testut@univ-lr.fr or nathalie.giloy@shom.fr. (**ACTION ITEM 7**)

3.5 Establishment and Maintenance of VRF for High Resolution Bathymetric Surfaces.

The Chair introduced the agenda item by giving a brief background on the North Sea Hydrographic Commission Tides Working Group meeting (NSHC TWG). The NSHC TWG have been coordinating work on national vertical

reference frames, working on the problems with seamlessly integrating multiple boundary differences where there is a difference in LAT between countries. He reminded MS that this is a standing item and any MSs that have feedback or updates on this topic are welcome to share their experiences.

DEU, Andreas Boesch as Chair of the NSHC TWG, gave a summary of the work being undertaken by the NSHC TWG. He explained that each MS of the NSHC TWG provides their Ellipsoid to LAT separations for their respective national waters coverage of the North Sea region. The activity has been on their work plan for several years and complete coverage of the North Sea has now been achieved. NLD has been leading the work to compare overlapping parts of surfaces along maritime boundaries. The current goal is working on the differences along the boundaries to create a seamless datum. The metric used in assessing the differences at the boundaries is that the 'along-maritime boundary' differences should be less than ½ of the maximum TVU (as defined in S-44, Order 1a). This has been achieved. The NSHC TWG has an Action to look at how this surface (LAT/CD etc.) is calculated, and then make it available for other MS to access. Additionally they are tasked to investigate how this affects navigation over various VRF and how best to circumvent this challenge. CAN indicated that they are having discussions on this same issue and has requested to sit in on one of the NSHC TWG meetings. The Chair and CAN will discuss this offline.

3.6 Determining ellipsoidal height of MSL at the coast.

The Chair introduced the topic, reflecting that it is closely linked to the previous agenda item 3.5, owing to the fact that long term GNSS-heighted water level / tide gauge control points are an important part of the process (often the starting point) of constructing ellipsoidally-referenced 'tidal / bathymetric / navigational' reference surfaces.

NLD (Ronald Kuilman), gave a short update on some work having been done by a colleague, Merte Peeters, who presented at [Hydro 2025 in Liverpool \(28 – 30 October 2025\)](#) on the topic of "Establishing an accurate Mean Sea Level Model in the Dutch Caribbean using vessel based PPP-GNSS measurements". The research aims to create a method for determining a vertical separation model in data-sparse environments using already existing survey data. With this research, Merte Peeters wants to raise awareness for the vulnerability of these island states for sea level rise and meteorological events such as hurricanes. Accurate vertical datums can contribute significantly to coastal development in order to make these islands more resilient. The NLD indicated that once this research is published he can make it available to TWCWG. The research has been awarded the [2025 Alan Ingham award](#).

3.7 Inventory of Tide gauges used by IHO Member States.

The Chair gave some background on this topic. Updates have been received from MSA and DEU during 2025. The list is not only an *Inventory of Tide Gauges* but **Current meters** used by MS as well. He reminded all present that the information was available on the TWCWG webpage. Any new information and/ or updates to please be forwarded to the Chair. MS were reminded to check that the links in the document still work.

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|---|---|----------|
| 8 | <ol style="list-style-type: none"> 1. Member states to review content and check web links still point to correct location. 2. Submit changes to Chair and Vice-Chair. 3. Updated version to be placed on IHO website | <p>ALL Chair (GBR) Vice Chair (ZAF) IHO</p> | TWCWG11 |

3.8 Actual Tides On-line Link status.

No updates have been received. The pages are a much more comprehensive list compared to the original created many years ago and a tab on currents was included. The list includes resources for predictions, historical data and modelled data for those who wish to locate such data sources. The Chair suggested that the parent website should be included in an attempt to make it less work to check each and every website link. The Chair stated that he understood that that was a very tedious and time-consuming task to check all the links, NOC reported that there is an API on the ioc-sealevelmonitoring.org website that could automate this process of checking and updating the links. The Chair said that this was possibly something that TWCWG and GLOSS could collaborate on to keep this list updated and ensure coherence. The Chair reiterated that he would monitor the progress on GLOSS's work to create a singular portal, once that is complete we can bring this agenda item to its natural conclusion.

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|---|---|----------|
| 9 | <ol style="list-style-type: none"> 1. Member states to review content and check web links still point to correct location. 2. Member States to add parent website to the list 3. Submit changes to Chair and Vice-Chair. 4. Updated version to be placed on IHO website | <p>ALL Chair (GBR) Vice Chair (ZAF) IHO</p> | TWCWG11 |

3.9 List of vertical datums in use to describe Chart Datum.

This was addressed under Agenda Item 3.2

Section 4. S-104 & S-111 Updates, Progress reports & Updates, Use Cases

4.1 Water Level Information for Surface Navigation (S-104)

This item was covered under 4.7 post edition 2.0.0

4.2. S-104 & S-111 Papers: presentation and discussions

4.2.1 S-104 and S-111 Coordinate Reference System (CRS) issues.

FIN (Jyrki Mononen) presentation entitled “*S-104 and S-111 CRS definition issues*” addressed the S-104 and S-111 Coordinate Reference System (CRS) related issues they have been experiencing within their user case studies. The CRS should work interpretively/together with the ECDIS system, however there were some issues that arose during the tests in the Baltic Sea eNav project trial. The presentation addressed the main issues and proposals on how to rectify them. One of the proposed solutions would be within the specifications for S-104 and S-111 where the horizontal reference system is defined differently between each of S-104 (EPSG:9057), S-111 (EPSG:9057), S-101 (EPSG:4326) and S-102 (EPSG:4326) thus creating conflicts. As a result, FIN suggested that S-104 and S-111 can't be used in ECDIS with S-101 and S-102 as they are not in generic WGS 84 EPSG:4326.

So in conjunction with the S-102 Product Specification (PS), CRS for S-104 and S-111 should be the same as S-102. FIN proposed changes to S-104 and S-111 Chapter 5.1 by removing some of the CRS wording to allow for the generic WGS84. These proposed changes would then make allowance for UTM and UPS coordinate systems. The proposed changes will be cleaner, simplified and will allow for enhanced compatibility with other S100 products. The proposed changes can be viewed on the TWCWG10 meeting documents (*Proposal-S-104_Chapter5.1_redline.pdf* and *Proposal-S-104_Chapter5.1_clean.pdf*). AUS commented that within the PS it does allow for the use of the generic or any of the EPSG's listed in the PS. The specific EPSG's chosen in the list was for the supply of data (not within S-102 purposes); for other purposes the producer has the ability to

maintain the higher accuracy positions of the data being used. The generic use of WGS84 would be for the variable data with a variable data length, however to maintain the horizontal uncertainty the variable WGS84's would come into play. The way AUS has dealt with using just the generic WGS84 while maintaining horizontal uncertainty is by bringing in a maximum age/ vintage of S-102 products to ensure that positional information is in line with real time positions. If you had a mix of data sets that go back 20 or 30 years it results in variable horizontal uncertainties. So the inclusion of the multiple WGS84 EPSG's was for the producer to supply product for other purposes. FIN responded that there possibly needs to be a clarification, as they are using a different epoch to the generic so the ECDIS system cannot integrate the products. The products should all have the same EPGS codes.

AUS asked that if the S-104 PS stated that the datums must match S-102 for navigational purposes, would not this already cover this without changing the PS? FIN responded that they understood AUS's concerns, however the issue is that the generic should be used in the production systems, even though they are using a different epoch versus the generic. The ECDIS system cannot integrate the different CRSs. USA (Raphael Malyankar) mentioned that the system that ingests the product needs to understand what the realisation of EPSG:4326 is and how to convert it.

CAN understood the need for alignment with S-101 and S-104 for viewing consistency and asked at what level does horizontal accuracy/inaccuracy in S-104 become important relative to its native relative changes in space? AUS commented that within the PS it does allow for the use of the generic or any of the EPSG's listed in the PS. Within S-102 and S-104 horizontal uncertainty becomes critical when dealing with 1m gridded data sets. In AUS plate tectonic movement is ~7cm pa which means data over 5 years starts impacting accuracy of gridded data. Datasets will be highly impacted due to plate tectonics.

Chair asked FIN if there is something that can be "worked around" in order to make this work. FIN (Anni Jokiniemi) responded that they had created a "quick-fix" it in order to make it work however it would be easier to create a common CRS across the board.

USA (Raphael Malyankar) suggested that this matter could be raised with the S-101 and S-102 teams. He asked if there is anything preventing them from using EPSG:4326. The original allows for the multiple CRS's as well as the generic, however FIN proposes that this specification should be simpler and "cleaner" to avoid ECDIS system from being confused between EPSG:4326 and other EPGS Codes. The Chair stated that this might need to be addressed in the S-104 / S-111 PTs.

4.2.2 – 4.2.3 Proposal-S-104 Chapter 5.1

These were addressed under 4.2.1. with the documents having been uploaded to the TWCWG10 meeting portal.

4.2.4 Exchange Catalogue metadata attribute *productSpecification* multiplicity must be changed

PRIMAR (Kevin Black) briefed the members on the two papers PRIMAR submitted to the Chair. He requested that the working group go through the 2 papers. Both papers can be downloaded from on <https://portal.iho.int/page/meetings/2002>

The first paper addressed the multiplicity of the *productSpecification* attribute. At present the S-100 and S-111 specify it as 1 (meaning only one PS can be referenced per catalogue). This heavily restricts the ability to package everything into one catalogue file and multiple versions of those products and is also time consuming for the producer. The proposal is to change the "1" to 1* (meaning it allows the combination of different product types within one distribution file (Exchange File). This should allow different packaging to be made simpler and will assist the producer by making production less cumbersome. By implementing this change this would allow for a simplification down to one package to be delivered verses multiple packages by the

producer.

The Chair suggested that this may need to be brought up in a future S-111 project team meeting due to the USA being unable to attend.

4.2.5 Provision of Exchange Catalogue specific XSD for S-104 and S-111

PRIMAR (Kevin Black) gave an introduction and outline of the paper on Exchange Catalogue specific XSD. At the S-100WG10 meeting in September 2025 approval was given for the PS developers to consider providing Exchange Catalogue specific XSD's. This is the outline of having the basic S-100 exchange catalogue format and any subsequent products based on S-100. There are specific requirements for each of the PS in those files, it would greatly help in the production, checking and delivery of the files if XSD files could be produced by the project teams who are responsible for the PS. The creation of the XSD files would be of great value in order to automate the validation checks of these products and eliminate the chance of multiplicity.

PRIMAR requested that the S-104 and S-111 project teams note this paper, consider adopting and incorporation the XSD files into the PS. The XSD files will then be a plugin to check producer products.

USA (Raphael Malyankar) asked how PRIMAR planned to use the XSD files. PRIMAR responded that they (and other RENCs) would utilise XSD files to not only assist in the building of tools to create catalogue files for export, but will use XSD to define checks for incoming data from producers. XSD files, if implemented, can be updated with new specifications, to reflect changes. As such XSDs can then be ingested into PRIMAR systems to allow quicker responses to changes in PS and maintain complete consistency with the intentions of the changes made.

The XSDs can be used (in PRIMAR) to parse the incoming files from data producers to assist them with direct feedback in S-100 product output consistency and quality (everyone is learning how to produce these files, and will do it differently). Specifically, validation can then be easily aligned with the version of the PS delivered, as multiple versions of live PS can exist, and cross edition management is much easier with XSD use. Thus it's not just to be used for when RENCs create catalogue files for distribution; it is central to automating the incoming/outgoing S-100 pipeline and ensuring data producers have clarity on expected quality (so that consistent feedback is received from different agencies, due to XSD utilisation across organisations).

Who creates these XSDs is a key question. There are limitations in bandwidth everywhere; but to ensure consistency in the S-100 world, to remove the possibility of being open to interpretation and implementation of the various PS constraints, especially with various live versions of each PS in play, XSDs are a strong option that deliver consistency. XSD also very useful for software producers to use to implement in their production tools.

4.3 **Surface Current Product Specification (S-111)**

Covered under Agenda Item 4.2

4.4 **S-104 Validation and S-158:104; updates**

Both S-104 Validation and S-158:104 and S-111 Validation and S-158:111 have been completed and forwarded to HSSC. These are edition 1.0.0 that conform to the S-104 and S-111 edition 2.0.0 respectively. HSSC will circulate that these specifications are available via circular letter. They have been uploaded to the TWCWG GitHub repository (<https://github.com/iho-ohi/TWCWG>).

Should TWCWG create new editions of S-104 and S-111, the validation checks will be aligned and updated

accordingly.

4.5 S-111 Validation and S-158:111; updates

This agenda item was included in item 4.4 above.

4.6 The TWCWG GitHub repository; S-104 Spreadsheet.

NOR reported back on the progress that has been made with the creation of the spreadsheet which is designed to collate MS information on 'how to create S-104'. She stated that it is available for completion by MS under the S-104 folder on the TWCWG GitHub site and suggested that it be considered a 'living document'. The purpose of the spreadsheet is a way for MS to share their approaches to S-104 products. This is a simple spreadsheet with drop down menus to select from and add in comments. It is a route for MS to find other MS's using the same method they are using or wanting to use. The chair thanked NOR for implementing this and noted that it is a very useful tool. A suggestion was to possibly combine this information with the KHOA survey data. If MS are unable to complete the spreadsheet on GitHub (<https://github.com/iho-ohi/TWCWG> S-104/HOs different approaches) it can be downloaded from the meeting documents, completed and emailed to NOR where Hilde will add the information to the spreadsheet on GitHub.

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|--|---|----------|
| 10 | MS to register on the GitHub repository to gain access to information provided there | ALL | TWCWG11 |
| 11 | Add the URL for the GitHub Repository to the IHO website https://github.com/iho-ohi/TWCWG | IHO Chair (GBR)/ Vice Chair (ZAF) | TWCWG11 |
| 12 | Presentation on the basic use of GitHub or an introduction to GitHub/basic 'how to use' training to be carried out. (Carried over) | IHO CHAIR (GBR) USA (Greg Seroka) | TWCWG11 |

4.7 Next editions of S-104 and S-111 (When? Changes beyond Ed 2.0.0)

Portolan (Raphael Malyankar) gave feedback on this agenda item. He noted that the topics raised by PRIMAR (agenda items 4.2.4 and 4.2.5) regarding changes to the PS to include multiplicity, XSD and other possible requirements. He indicated that the request from PRIMAR would need to be considered for possible new editions as this is a complicated process. He added that a revision or amendment to the existing editions as this would be a much simpler process to get through the system.

Portolan (Raphael Malyankar) had received a note / paper from USA (Greg Seroka) and that was forwarded to the Chair. He said that the paper was more of a "shopping list" for the revision to give greater clarification. Raphael has discussed this paper with Greg and it is on hold until the USA government furlough is over, as proposals and suggestions for the new editions will need to be discussed with the PT.

The Chair reported back that, as discussed at TWCWG9, the possible creation of an "S-105" product has been placed on hold in order for MS to focus on current S-104 and S-111 products. He had informed HSSC17 of this decision with which they agreed. CAN informed all that they are going ahead with a "S-105" product, by adapting the current S-104 PS, to include all the aspects that were stripped out of the existing S-104. They are doing this in order to get all the mechanisms in place for other MS should or when TWCWG proceeds with

this.

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|---|--------------------|----------|
| 13 | CAN (Phil MacAulay) to make available this information for wider use by the TWCWG | CAN CHAIR (GBR) | TWCWG11 |

4.8 S-104 & S-111 Member State developments, Use cases

The Chair indicated that he had received presentations from AUS, DEU, GBR, NOR and USA. He handed the floor to each in turn to present.

AUS gave feedback on their developments. The AUS Hydrographic Service (AHS) has signed a contract to outsource the development of both S-104 and S-111 using single point predictions which were 20 min datasets and using a 10 second arc versus gridding. This set-up has allowed for a single resolution versus different grid sizes and was split into 10 daily files for ease of data loading versus file size. As a result, for a full 12 month year they received 36 data files. The examples they received from the contractor were then displayed in the KHOA S-100 viewer so they could see what the information looked like and how it would be viewed on the ECDIS. For S-111, the dataset range was used as a single point and produced a good quality product. AUS has just published their S-100 product roadmap indicating what products and areas they will be releasing in the near future. What they have found is that the data products checks are good, but additional checks had to be implemented to create the metadata in order to meet the AUS requirements for metadata and associated checks. AHS is now investigating the feasibility of the contracted company creating the products or just the scripts before commencing with their roadmap.

NLD enquired about the file sizes they were receiving. AUS said the file sizes were very large, but well within the PS's limit of 10Mb. CAN queried how AUS was creating the S-111 product. AUS said that they were using 20 min datasets extrapolated over the area as single points. This method is an indication of the current versus what is happening in reality. Additionally they are using the S-102 boundaries in conjunction with S-104 and S-111.

NOR presented on their use of S-104 and S-111 for Norway's pipelines. Although they have no new information to add to the products they have progressed very well over the last year and are almost ready to make the products available through PRIMAR. The programming code is in python using S100.py and running on Databrick. NOR is using the naming convention 104NO00DYYYY or 111NO00DYYYY.h5. The available data is for the whole country and the area has been split up into polygons with the model forecasting for these polygons. For S-104 the predicted tides and forecast tides will be delivered as one file containing 10 minute data for 5 days in a grid size 0.01° longitude and 0.005° latitude. This delivers a file size of approximately 6Mb. Where CD changes there is a steep change in the values to align with the change in CD.

For S-111 the information input is based on the model used by their Meteorological Office. The model covers quite a large area and the forecast is hourly data for 5 days at a depth of 5m. There is still a lot of work to do on the specifications, validation and metadata but NOR is moving forward in a positive direction. Still have to do work on the cancellations, new data etc. Feedback still needs to be collated once they have done user case studies.

Various questions were directed to NOR such as how they manage real time data, the frequency of the delivery and how far offshore the models predict. NOR responded, saying that they do not use real time data or surge data, just the forecasts in S-104 which they already use for their predictions. The model they use is a hydrodynamic model. They supply predictions twice daily and the model predicts to about 12 nautical miles

offshore.

DEU shared the status of Germany's developments on S-104 and S-111. The principal idea is high quality forecasts at their tide gauges (TG). Harmonisation of the recorded data and the forecasts should lead to area-wide accurate water level over the area. DEU uses a HBM numerical ocean model with 900m grid spacing, 140 hours forecast length of 15 min time steps and 12 hourly update intervals. Statistical method for optimizing model forecasts. Harmonisation is done by calculating the difference between the HBM numerical ocean model and Model Output Statistics (MOS) models at each TG. Interpolation of correction time series is carried out by means of squared inverse distance weighting. This method produces results similar to more complex methods however it requires a high density of TG locations. The results of this method are limited by the resolution in the models and does not work well in areas where the flats dry at low tide, so these areas are being masked when tidal flats are dry. DEU's test sets for S-101 and S-102 are limited to pilots for user case studies and are awaiting feedback. The integration of S-104 and S-111 is underway, with test datasets available soon.

CAN asked if the correction weighting was a simple inverse distance weighting or did it consider spatial connectivity, islands, drying areas etc. DEU stated that it was simply a distance and mathematical calculation at present, so the models do not recognise land. CAN mentioned that in their initial project (~2020) they looked at different interpolation techniques, including some more complicated ones that consider islands and coastlines as boundaries. The pure inverse distance weighting turned out to work best or was good enough in terms of effort and results. CAN followed up with an additional question, asking what the latency of the parent model itself was, prior to the creation of the S-100 files, as well as what the time between the model runs and the final output was. DEU responded that they had not yet arrived at a point where this information is available yet, however it is relatively fast

CAN asked how DEU calculated uncertainty when producing S-104 and S-111 products using numerical models. In response DEU say that this was something they still needs to address.

USA (John Kluge (AJ) from NOAA-NOS) shared the NOS/OCS/Coastal Survey Development Lab (CSDL) NOAA's Precision Marine Navigation Projects for S-104 and S-111. The purpose of the project is to use the NOS Operational Forecast System (OFS), specifically the Surge and Tide OFS (STOFS), for mariners by converting the outputs to Standardised S-104 and S-111 HDF5 formats. Some of the main goals of the project are to produce standardised, timely hydrodynamic forecasts for use in navigational systems according to S-100 standards. The Automation of the conversion of STOFS-2D-Global to S-104 HDF5 format and STOFS-3D-Atlantic to S-111 HDF5 format for operational use. Also to develop a modular, reusable, extensible software package. NOS is currently developing Python workflows to convert hydrodynamic model outputs to generate both the S-104 and S-111 products. They are also using Earth System Modelling Framework's (ESMF) Python wrapper (ESMpy) for high speed interpolation to a regular grid and building a Python package to unify and extend both workflows. AJ showed results of the progress made to date with both the S-111 and S-104 creation, the resolutions and sizes of the grids. He discussed the challenges they were experiencing such as the regular grid creation, interpolation methodology, file sizes size of the packages (which in some cases are ≥ 10 GB) and the Python environmental difficulties.

BRA asked if there were any articles available that describe how NOS used xGEOID20B as the vertical reference for STOFS. AJ indicated that at present there were no articles yet as this process is still at the very early stages.

GBR (Thomas Cropper) gave updated feedback on the Sea Trials for S-104 and S-111 that is being conducted between the UKHO and SHOM. The sea trails have, and are, being conducted in the English and French Channels with Stena Lines sea ferry testing the S-102, S-104 and S-111 products. Images from the ECDIS display of the screen on board the ferry were shown with feedback from the users saying that they would like the threshold for the currents value lowered so that even small currents can be seen as the symbol is too small on

the screen. Initially there was a double value (double arrows) at the boundary of the cell. This was due to rounding of the interval step value which had been rounded too much and the ECDIS read it as 2 values instead of 1. At the UKHO, for S-104 they have not ruled out any of the methods such as harmonic values and are also looking at similar methods as Germany. They are electing not to put uncertainty with S-111 due to cost and feedback from the end-users who have indicated that it is of no use to them. The Stena Line vessels move between the 2 ports and has an echo sounder on-board which records depth, position and time. The UKHO and SHOM were able to use the exact depth, reported draft, position and time, and compare it to the S102 and S-104 forecast. The results of the comparison showed that the S-104 product was a better match than the information given from point values in TotalTide (UKHO's digital tide model). Moving forward it is envisioned that eventually the S-102 and S-104 would be able to have a safety margin included and then to include and use the uncertainty or for S-104 to allow for optimisation of vessel requirements.

4.9 Engagement with S-100WG and other relevant subordinate bodies

The Chair and Portolan (Raphael Malyankar) provided feedback on this agenda item. From these engagements there is real concern regarding file size of the S-100 product packages. The S-100 WG have asked for a paper from NIPWG and TWCWG on grid and file size. The WGs have been asked to consider how often updates are done, as well as grid sizes and file sizes. The PT will need to come up with a paper, a collation of how things are currently being done as the proposed maximum file size in the S-100 specifications is 10mb. The S-100 WG require the paper before HSSC in 2026. The Chair indicated that the S-104 and S-111 PT's will need to have this completed before March 2026.

USA (Raphael Malyankar) stated that he is busy working on a simplified version of the required paper and will circulate this to the PTs to be adjusted for S-104 and S-111 products. He showed an example of what the paper looks like. There is no fixed requirement for what this paper needs to address, so a free form paper with the relevant information can be created.

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|---|-------------------------|------------|
| 14 | <ol style="list-style-type: none"> Portolan to supply the Chair with the "free Form paper". The Chair to populate the free form with PT comments/updates. Chair to Submit to S-100WG | CHAIR (GBR) Portolan | March 2026 |

4.10 Survey on tides, water level and currents; data production method and data format (S-104 & S-111 products)

ROK presented the results of the survey conducted throughout the year. ROK had received a total of 16 responses from MS during the month of September 2025. Each MS country's responses had been placed into a table and reviewed during the meeting, thus showing the status of MS developments and the methods of production used. Due to some MS not being able to access the online survey, the survey was emailed out as a fillable document in October 2025. As TWCWG10 was in the first week of November 2025, only the MS who completed the survey in September were listed in the table. With the additional surveys received in October, the total number of responses received overall was now a total of 25. The overall total responses were included in the graphical summaries. The most commonly used grid format is the DCF2 (regular grid). Most MS are using S-104 for the entire coast or specific coastal areas. Data is being delivered at different update intervals either daily or twice daily. It was noted that the surveys showed that most of the answers, and subsequently their approach, are specific to each MS's specific needs. One area of concern was that the metadata is proving difficult to produce.

The survey also noted the difficulties that MS were experiencing. For S-104 some of the major difficulties being

experienced were model accuracy and validation tests, HDF5 conversion, lack of standardized testing/integration platforms, time consuming metadata preparation and management, as well as limited personnel and resources. With regards to S-111 similar difficulties as S-104 were being experienced as well as large data file sizes which exceeded the 10GB limit.

KOR indicated that they were happy to continue this research as a semi- permanent action. NOR stated that she would take the information from the survey and incorporate it into the spreadsheet that was created for item 4.6.

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|--|-------------------------------------|-------------|
| 15 | 1. Survey on tides, water level and currents; data production method and data format (S-104 & S-111 products) to be recompiled using information from both the Sept and Oct 2025 Results. | KHOA ALL CHAIR to co-ordinate | TWCWG11 |
| | 2. Results to be presented at TWCWG 11 | | |
| | 3. NOR to the information from the survey and incorporate it into the spreadsheet that was created for item 4.6 | NOR | TWCWG11 |
| | 4. MS's to complete the spreadsheet available at: https://github.com/iho-ohi/TWCWG/tree/main/S-104/HOs%20different%20approaches | ALL | 30 Sep 2026 |

Section 5. S-44 Standards for Hydrographic Surveys, Progress report & Updates

5.1 Offer by the Hydrographic Surveys WG (HSWG) for TWCWG collaboration to improve tidal observation uncertainty standards within the relevant sections of S-44 (Standards for Hydrographic Surveys)

BRA presented on the proposal from HSWG for TWCWG collaboration to improve tidal observation uncertainty standards within the relevant sections of S-44. A compilation of the PTs suggested improvements, collected from TWCWG8 to the present day was undertaken. An overview was given of the relevant sections and proposed changes were highlighted, along with the reasoning behind the proposed changes.. For the glossary, a harmonisation process was carried out. This was done by aligning of definitions across multiple platforms and publications including S-104 and S-111 PS. This exercise will assist in the updating of other publications should the need arise.

The PT have effectively done general revisions of the Introduction, revised the Glossary for clarity and S-111, S-32 and S-104 alignment. In Chapter 1 the proposed updates have explicit recommendations by depth and coverage/search. Chapter 2 was updated with datum EPOCH and the THU/TVU at 95% (random-component composition). Chapter 4 addressed errors of water level measurement and the treatment of systematic errors. Finally Chapter 6 and 7, as well as Annex A, the proposed updates reinforced the metadata, terminology and included Matrix examples.

A detailed "red line" document has been created once again showing the proposed changes as well as the reasoning behind each change. This has been sent to HSWG for evaluation and approval.. The IHO reported that HSWG have received this extremely comprehensive document. It was discussed at the last HSWG meeting and they are in the process of assimilating the information. The Chair thanked the project team, led by Felipe Santana, for the excellent and thorough work they have all put into this project.

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|--|--|----------|
| 16 | BRA to supply the proposed addendum/paper to Chair and Vice Chair for distribution to MS for comment, amendments and final approval. | BRA ALL Chair (GBR)/ Vice Chair (ZAF) | TWCWG11 |

Section 6 IHO Resolutions and Charting Specifications

6.1 Review of relevant IHO Resolutions.

ZAF had nothing to report (NTR).

6.2 IHO Resolutions - Chart Datum definition in non-tidal areas (and tidal areas).

During TWCWG8, BRA showed a presentation on a survey carried out concerning datums in non-tidal waters. At TWCWG9 it was suggested that a document be compiled with proposed clarifications. BRA (Felipe Santana) compiled the aforementioned document entitled “*Questions & answers about Chart Datum on Tidal, non-tidal and mixed rivers: to support the understanding of M-3 publication*”, from inputs credited to each contributor. This Q&A compiles practical viewpoints and field experience on defining and maintaining Chart Datum (CD) across tidal, non-tidal, and mixed river environments, with the goal of clarifying how IHO M-3 guidance is interpreted in real charting workflows. It addresses uncertainty components, short-record effects, percentile selection for rivers and lakes, implications of changing CD realizations, and prioritization for updates; always with navigational safety and product consistency in mind. Contributions were provided by hydrographic offices and specialists from multiple countries, offering a spectrum of methods (e.g., LAT/LLWLT, ALAT/OLR, LWRP/CRD, geodetic linkages to MSL/NAVD88) and update practices (ERS + separation surfaces, epoch rollovers). The responses are presented verbatim or synthesized where consistent, with clearly stated recommendations to help readers translate policy into production steps. It was suggested that this document be circulated amongst the TWCWG MS for comment. The Chair indicated that this could be viewed as a complimentary guide to M-3 but with this amount of detail it is more of a supplement that would be easier to add. IHO stated he would have a look at the document, establish the intended usage and would revert on the best way forward.

It was suggested that the definition of ‘*Seldom...*’ included in C-13 or another document be re-defined. The IHO fed back that rather than change the technical resolutions, which is a long process, make a technical note/supplement to them. It was suggested that the *List of Vertical Datums* could be used to describe Chart Datum (agenda item 4.9). USA (Peter Stone) suggested that TWCWG could possibly use these suggestions/comments for the update on the IHO manual of hydrography that needs to be completed in 2026.

| ACTION ITEM | Action Required | Actions | Deadline |
|--------------------|--|---|-----------------|
| 17 | <ol style="list-style-type: none"> 1. “Questions & answers about Chart Datum on Tidal, non-tidal and mixed rivers: to support the understanding of M-3 publication” to be circulated to MS for Comment 2. IHO to establish where best to include the final document (and which publication) and how best to include it (supplement, annex, enclosure etc.) | BRA ALL Chair (GBR)/ Vice Chair (ZAF) IHO | TWCWG11 |

6.3 Review of relevant IHO Charting Specifications.

The Chair revisited an outstanding action from both TWCWG8 and TWCWG9, where CHL commented that B-406.1 mentions positions to the *nearest minute*, however, this does not conform to B-130 and B-131 which indicates that locations must be to the *decimal minute or second*; creating discontinuity. It was agreed by MS that this should be changed to the *nearest minute as a minimum*. In the Spanish version, paragraph B-496.4 does not appear in the English version and should thus be removed from the Spanish version. The Chair

indicated that this was in process of being completed

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|---|--------------------|------------------------|
| 18 | 1. Report discrepancies between B-406.1, B-130 and B-131. 2. Suggest amending all 3 to read ' <i>...nearest minute as a minimum...</i> ' | IHO Chair (GBR) | End of 2025 TWCWG11 |
| 19 | 1. In the Spanish version remove para B-196.4 | IHO Chair (GBR) | End of 2025 TWCWG11 |

Section 7 **IOC Programmes**

7.1 Update on IOC Global Sea Level Observing System (GLOSS) Programme items and events.

Begoña Pérez Gómez, the new Chair of GLOSS, reported back on GLOSS activities. She started her presentation with a brief overview of the history of GLOSS and its main function. Their work was originally built around the GLOSS Core Network of 290 tide gauge stations across more than 90 countries and territories with an aim to ensure high-quality global coverage. GLOSS now has more than 2000 tide gauges contributing to their data portals. GLOSS is funded by diverse national institutions worldwide (oceanographic, hydrographic, geographic, met offices, seismological entities, ports etc.) represented in the GLOSS Group of Experts. GLOSS is one key element of GOOS (Global Ocean Observing System).

The GLOSS Chair highlighted their challenges and concerns whereby one of the main goals is understanding the impacts of climate change on MSL and extreme sea level events along coastlines worldwide. The data collected contributes to ocean circulation studies, storm surge forecasting and early warning systems, including those for tsunamis, aid to navigation, port operations and geodetic applications. While serving existing and emerging international and global programs (GOOS, IHO, WMO, WCRP, Tsunami Early Warning, EMODnet and Copernicus) and maintenance, funding and data policy.

The [XVIII GLOSS Group of Experts meeting was held 11-14 March 2025](#), with support from the Panama Canal Authority and the Panama Maritime Authority with over 40 experts in person and 15 online participants from 30 Member States. During the meeting the priority actions for GLOSS were identified and these were explained to the TWCWG10 attendees. One of the main priorities identified was the unification of data access. The objective is to reorganize and reclassify data, to unify metadata and use controlled, standardized language, replacing vague terms like “delayed mode” with clear quality levels, ensure unique time series across all data streams, link data resolution and quality control (QC) levels to specific applications and communicate this to users via a Unified Data Portal. The unified Data portal will use linked ERDDAP servers at each data centre as the backend. It will develop a centralized front-end (led by VLIZ), allowing integration into existing websites (e.g., NOC) and make the data centre hosting invisible to the end user.

A WG on Sensor Performance and Emerging Technologies including GNSS IR was established and a draft WG structure and ToR’s were created. The WG on Quality Control, Data Processing and Data Management held an intersessional meeting and feedback was given on their progress. The GLOSS Chair gave feedback on their cooperation programmes, expansion of tide gauge networks as well as Capacity Building activities. GLOSS is in the process of updating their participants list and once this is completed they will share this with TWCWG.

The GLOSS chair reported that the TWCWG Chair attended online where he gave a report of the TWCWG activities to the GLOSS group. She re-iterated the important synergies and collaborative efforts between the two group’s activities.

7.2 Update on IOC Tsunamis & Other Hazards Related to Sea-Level Warning & Mitigation Systems (TOWS) Programme items and events.

The Chair announced that International World Tsunami Awareness Day was on 05 November 2025, this is an UN-recognized day to promote awareness and preparedness for tsunami-related disasters.

CHL (Julio Castro) gave an update on the IOC Tsunamis and other hazards related to sea level warning and migration service tools (TOWS) meeting held 24-25 February 2025. The main topic of the meeting was the global tsunami exercises that were taking place namely PacWave 24, CaribeWave 24, NEAMWave 23 and IOWave 23. Approximately 100 communities were recognised under the UNESCO Tsunami Ready Programme, along with the reports on volcanic and meteotsunami warnings have been created and published. The names of the reports are “*Monitoring and Warning for Tsunamis Generated by Volcanoes*” (IOC Technical Series no 182) in 2024 and “*Meteotsunamis: definition, detection and alerting services investigation*” (IOC Technical Series no 200) in 2025. During the meeting the following were discussed:

- a. SMART cables and tsunami buoy deployments
- b. The inclusive SOPs for children and persons with disabilities, with a focus on Indonesia and the Caribbean.
- c. The adoption of the Common Alerting Protocol (CAP) for multi-hazard warnings.
- d. The TOWS-WG reinforced the importance of global participation to reduce coastal disaster risks. Sea level observations and wave exercises are core elements of tsunami warning systems.

Discussions were held on the importance of sea-level monitoring as it is a critical component for tsunami detection and confirmation. MS are always encouraged to maintain and share this data in real time to tsunami warning centres. Priority areas with gaps in monitoring were identified and included the Philippine Sea, Caribbean, South China Sea and Timor Sea. The IOC continues to advance ocean science and resilience for safer coasts worldwide, with a goal of 100% of at-risk coastal communities to be Tsunami Ready by 2030.

CHL then gave feedback on three recent tsunami events and the general actions and emergency response procedures that were undertaken. These events were the Kamchatka, the Magallanes and the Drake events. ZAF reported that the South African Navy Hydrographic Office (SANHO), as NAVAREA VII Coordinators, had recently taken part in the successful IOWave 23 exercise. The exercise had given their Maritime Safety Officers invaluable practice in case of an emergency.

Section 8 Capacity Building

8.1 Tides and Water Levels Workshop training material.

ZAF introduced the topic of discussion and called for any comments or revisions that needed to be made to the existing work already completed. No comments, corrections or inclusions were received.

ZAF re-introduced the work that the SANHO and the Institute for Maritime Technology (IMT) had done on a digital platform for blended learning. This platform was created using the information and outcomes for the Cat B Hydrographic Survey Officers curriculum on tides, water levels, vertical datums and oceanography (including currents). ZAF stated that the SANHO and IMT are aware of some technical issues, however the project is currently on hold as the IT specialist had retired and they were awaiting staffing of the post. The integration of ‘progress tests’ are still in development. The SANHO requested volunteers to go through the content of the modules and identify any wording/content changes that may be beneficial and to supply ZAF with any suggestions on additional content along with any possible questions for the ‘progress tests’.

The USA (Peter Stone) had supplied the Chair with feedback on NOAA's work in capacity building. The Chair reported back that NOAA was preparing for a course in English in Barbados. An in person [Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions](#) (ICG-Carib) course on the general principles of tide gauge installation and data processing and analysis, with a section on how TG information is used in Tsunami warning systems was presented in November 2025. MS were reminded of the request from the USA (Action item 31 from TWCWG9) regarding the lack of supporting documents/manuals in Spanish. The Chair requested if any MS knows of, or has, any manuals/documents in Spanish, to please let Peter know as it would be extremely beneficial to have these copies to assist with the training.

As a result of the discussions regarding S-104 and S-111, multiple MSs indicated that they had inadequate understanding of these products. A requirement for S-104 training for these smaller HOs has been identified. This mini-training course/workshop will need to identify exactly what type of training is required and should include a general introduction to S-100, what it is and how it will work. Additionally, what is S-104 and its purpose, with a possible introduction on how these products will be created, the terminology used in discussions should also be covered. A training course/workshop will need to be requested via CBSC.

| ACTION ITEM | Action Required | Actions | Deadline |
|--------------------|--|---|---|
| 20 | USA requires Spanish manuals/ documents or training material for Capacity Building. If MS have such material to please inform Peter Stone. | ALL USA (Peter Stone) GLOSS | TWCWG11 |
| 21 | <ol style="list-style-type: none"> 1. A training course/workshop on S-104 to be requested via CBSC for TWCWG MS 2. Need to identify exactly what type of training is required. Should include a general introduction on S-100, what it is and how it will work. 3. What is S-104 and its purpose with an introduction on how these products will be created, the terminology used in discussions should also be covered | Chair (GBR) IHO USA (Greg Seroka) | TWCWG11 |
| 22 | <ol style="list-style-type: none"> 1. ZAF(ruthfarre241@hotmail.com) to email access to eLearning portal to WG members 2. ZAF to create a Google document and email link to WG. 3. Submit feedback and comments for content improvement to ZAF. | ZAF AUS CAN BRA DEU NDL NOR USM (Stephan Howden) | Completed 11/11/2025 Completed 11/11/2025 August 2026 |

Section 9 Any Other Business

9.1 Minimum metadata requirements for tide & water level gauges

Andrew Matthews from NOC introduced the topic with a brief explanation of intent. NOC displayed an example of the metadata scheme they have developed where Copernicus metadata fields were used as the basis. This is a GLOSS, GOOS, OCG, WMO Integrated Global Observing System and IHO item that they all have in common and is ongoing work. Every year [OceanOps](#), a group of technical experts who can help networks implement these indicatives and produce products summarising the status of the whole GOOS network, provides a report card which is an overview of the networks and provided data (<https://www.ocean-ops.org/reportcard/>). GOOS has introduced a “passport” for observational platforms, which is an example of the metadata for each sensor supplying data. Within the passport, the fields in dark blue are compulsory while the fields in red are computed/harvested. The fields in light blue are “nice to have”, but not required. The most important field is the WIGOS ID which is the WMO’s “new” identifier. The WMO’s identifier is applied for and is allocated by OceanOps.

CAN asked if there is any move to collect metadata from gauge network/database APIs that have all this data, or could it add appropriate metadata to their existing metadata. NOC responded yes, that is what they are aiming for in GLOSS. Probably the best thing people can do at the moment is if their data is available in real time from <https://ioc-sealevelmonitoring.org/>, make sure the metadata is accurate there for the OceanOps to extract for the passport.

9.2 Manual on Hydrography C-13 Chapter 4 Tides & Tidal Streams

The Chair reported that the HSWG lead of the project team tasked with reviewing and re-writing of the Manual on Hydrography (C-13), Martin Tunwell (XOcean), had contacted him. They are about to begin working on the updating of Chapter 4: Tides & Tidal Streams over the next few months and a formal request to TWCWG to assist with this review has been received.

| ACTION ITEM | Action Required | Actions | Deadline |
|-------------|--|--|----------|
| 23 | 1. Request from HSWG on Chapter 4 Manual of hydrography <ul style="list-style-type: none"> • Propose changes to Chapter 4 and put those proposed changes to TWCWG for comment/approval/amendments • Present to results at TWCWG 11 • Submit to HSWG | Chair (GBR) AUS BRA CAN FIN (Anni Jokiniemi) NOC NOR SPN USA (Peter Stone) USA (Kurtis Redding) | TWCWG11 |

9.3 LAT Epochs

AUS gave a presentation on their investigation into changing LAT Epoch. All AUS standard port tide gauges have a minimum of 20+ years of observations. The end result of the study, whereby the original epoch period was compared with a projected epoch period, showed possible changes to LAT over time; thus a difference which indicated a rise in the LAT value. The comparisons never gave a negative value. The main reason for the study was to determine the chart datum (LAT) and to investigate HAT differences. These comparisons showed a marked increase due to sea-level rise as well. The end result was that AUS does not currently need to change epochs, as the current epoch errs on the side of safety as sea-level rise was incorporated into tide predictions for the mariner.

Section 10 Work Plan and ToRs

10.1 TWCWG Work Plan 2025-2026 updates

The work plan for 2025-2026 was amended and will be submitted to HSSC18.

10.2 Review TWCWG ToRs and RoPs.

Nothing to report. The ToRs and RoPs are available on the 'Main IHO TWCWG' website, last updated Feb 2024. (https://portal.iho.int/share/files/AAAAAAApQ0/TWCWG%20ToRs%20and%20RoPs/TWCWG_TOR_20240201.pdf)

Section 11 Venue and dates of the 11th TWCWG Meeting (TWCWG11)

TWCWG11 - Possibly Finland, RSA or UK (Monaco (IHO) as a back-up) 10-13 November 2026

TWCWG12 – tbc November 2027

TWCWG13 – tbc Australia November 2028

Section 12 Review of Action Items from TWCWG10

The Action Items were reviewed and all members present accepted these without further amendment.

Section 13 Development of TWCWG10 report to HSSC18

The Chair stated that this was in hand, He and the Vice-Chair would have this ready for HSSC18.

Section 14 Draft Agenda for TWCWG11

The Chair stated that this was in hand.

Section 15 Closing

The Chair expressed his appreciation to all for making the meeting possible with the various time zones and their commitment to TWCWG. He also thanked everyone for their contributions to the meeting and their engagement for the last 3 days. He stated that S-104 and S-111 still need further development which resulted in extra actions that have been added, as well as longer term actions for uncertainty and checks. The Vice-Chair and IHO echoed the Chair's appreciation for all present for their contributions and engagement during the meeting, with the IHO highlighting some of the very interesting topics that were covered. The Chair, Vice-Chair and IHO stated they were looking forward to seeing as many people as possible at the in-person meeting in November 2026.

The meeting was closed at 1435 hrs UTC on 06/11/2025