21st NSHC Tidal Working Group meeting

Dublin,8-9 March 2016

Contents:

Abbreviations used in this document

BLAST:	Bringing Land and Sea Together
BSH:	Federal Maritime and Hydrographic Agency of Germany (Bundesamt für Seeschifffahrt und Hydrographie)
BSHC:	Baltic Sea Hydrographic Commission
DMI:	Danish Meteorological Institute (Danmarks Meteorologiske Institut)
EVRS:	European Vertical Reference System
HSSC:	Hydrographic Services and Standards Committee
IHB:	International Hydrographic Bureau
IHO:	International Hydrographic Organization
IMA:	Irish Maritime Administration
MDK:	Flemish Hydrography (Maritieme Dienstverlening en Kust)
NHS:	Norwegian Hydrographic Service (Kartverket sjødivisjonen)
NLHO:	Royal Netherlands Navy Hydrographic Office (Dienst der Hydrografie)
NSHC:	North Sea Hydrographic Commission
SHOM:	French Naval Hydrographic and Oceanographic Service (Service hydrographique et océanographique de la marine)
SMA:	Swedish maritime administration (Sjöfartsverket)
TSMAD:	Transfer Standard Maintenance and Applications Development Working Group
TWG:	Tidal Working Group
TWLWG:	Tidal and Water Level Working Group
TWCWG:	Tides, Water Level and Currents Working Group
UKHO:	United Kingdom Hydrographic Office

Other abbreviations are written out when first used.

Minutes of the meeting

Meeting location:
Irish Maritime Administration, Dublin, Ireland

Participants:
Participants:

Declan Black (Capt.)	IMA	Ireland
Sean Cullen (Hydrographer)	IMA	Ireland
Hans Poppe	MDK	Belgium
Mads Hvid Ribergaard	DMI	Denmark
Patrick Goffinet	BSH	Germany
Rogier Broekman (Chair)	NLHO	Netherlands
Ronald Kuilman	NLHO	Netherlands
Aksel Voldsund	NHS	Norway
Hans Öiås	SMA	Sweden
Chris Jones	UKHO	United Kingdom

1.Opening remarks
Nautical Surveyor, Captain Declan Black, gave a cordial welcome speech to the participants. The chair addressed a special welcome to the new Danish member Mads Hvid Ribergaard. The group asked the new Danish member to thank Palle Bo Nielsen for his valuable contributions and friendly cooperation during many years.

2. Adoption of the agenda
The agenda was adopted with an additional presentation from IRL. Developments in current meters was added to agenda item 12.

3. Minutes of the 20th Meeting
The Minutes were adopted with a chance on page 8. Chapter 12:
NO: "A new tidegauge is installed between the Norwegian mainland and Spitzbergen" should be changed in "A new tidegauge is installed between Iceland and Spitzbergen"

4. Status of Action Items from 20th Meeting

WP (workplan) items are approved by the NSHC. Action items are internal within NSHC-TWG.

Workplan item	Status
16/04	To be discussed at agenda item 8
18/01	To be discussed at agenda item 8
18/02	To be discussed at agenda item 9

Action item	Status
18/01	To be discussed at agenda item 8
19/03	UKHO coordinates this item. Data from UK, NL and SE is available at UKHO. Other Member States are kindly requested to forward their data by 08 April 2016
20/01	Closed – to be removed (To be discussed at agenda item 8)
20/02	Closed – to be removed (To be discussed at agenda item 8)
20/03	Closed – to be removed
20/04	Member States are requested to forward their overview of connection between EVRS and Chart Datum before the end of the year.

The group discussed to place documents on www.nshc.pro open to the public. The minutes of meeting 20 and 21 will be placed after approval of the members. Chris Jones (UK) will collect items and forward them to the webmaster (Bernd Vahrenkamp – DE).

5. Minutes of the 31th NSHC Conference

The TWG had already a comprehensive look into the minutes last year (20th NSHC TWG). The minutes were adopted with one change.

SE: C2 – "The Blast project gave a good contribution and hopefully the upcoming DG Mare projects" should be changed into "The Blast project gave a good contribution and hopefully the upcoming DG Mare objects".

6. Report from IHO TWLWG7, 21-24 April 2015 in Silver Spring (USA)
Chris Jones (UK) gave a presentation on the IHO TWLWG7 meeting 21-24 April 2015 in Silver Spring, USA. The TWLWG and Surface Current Working Group (SCWG) were merged into the Tides, Water Level and Current Working Group (TWCWG). The first meeting of TWCWG, end of April 2016, will be extended to 5 days and include all WP items.

Main Topics TWLWG7:

- Surface Current Product Specification S-111
- Dynamic Water Level Product Specification S-112
- Draft Tidal Height Product Specification
- Study of long-term data sets for global MSL rise
- Comparison of Tidal Predictions
- Establishment and maintenance of Vertical Reference Frameworks for the high resolution bathymetric surfaces
- Determining Ellipsoidal Height of MSL at the Coast – to compute separation models of ellipsoidally-referenced navigable surfaces
- Review of relevant IHO resolutions and Charting Specifications – Resolution 3/1919, Datums & Benchmarks.

7. Presentations from the participants
Aksel Voldsund (NO) gave a presentation on a common reference frame in the Sunnmør area. The goal in this fjord area was to relate both the geoid, the mean sea surface and the LAT surface to the ellipsoid. In that way it should be possible to make seamless models with both bathymetry and topography.in the fjord areas the geoid, and hence also the mean sea surface, is expected to have relatively steep gradients due to the mountaineous area. Little is also known about the sea surface topography inside the fjords. The project will be finished within the end of 2017.

8. Explain and reduce differences in reference surfaces at the international boundaries (WP16-04, WP18-01, AP20-01, AP20-02)
Ronald Kuilman (NL) gave a presentation on AP20-01. The task description of this action item was to redo the work (comparison of LAT-ellipsoid reference surfaces) done in 2010 using the latest references from the member states. New LAT-ellipsoid data was available from DK, DE, UK, FR (partial) and NL. The data, LAT-MSL, from BE was the same as used in 2010. NL used the EGM96 and the GEONZ97 geoid to convert the BE data to LAT-Ellipsoid.

In order to perform the analysis NL has used a spatial resolution of 0.02 degrees. (spatial resolution (m) North-South 2200, spatial resolution (m) West-East 980-1450). For nine boundaries it was possible to compare the LAT-ellipsoid reference surfaces. Due to the lack of data it was not possible to compare the remaining four boundaries. The differences LAT-ellipsoid along the maritime boundary between two neighbouring countries, divided by depth were graphed. There was unanimous agreement that a rate of 1 percent or less (LAT difference divided by depth) was acceptable for the TWG members. The members also agreed to use the GRS80-ellipsoid for the conversion to other surfaces.

For most boundaries the LAT differences divided by depth were around 1 or 2 percent.

An exception was the boundary of German and Denmark. The maximum LAT differences divided by depth was here more than 16 percent.

The Danish LAT surface is made by Prof. Ole Baltazar Andersen, DTU Space, Denmark. It is a blended product of a global tidal model (FES2002) modified using Altimetry data. There has, so far, been no attempt to correct the LAT surface according to Danish tidal stations. The tidal amplitude of the tides in the German Bight in FES2002 seems to be too low, probably due to bathymetry issues. However, this can not explain differences of up to 1.5 meters between the DK and DE LAT surfaces, which is comparable to the full tidal level differences. The LAT product should be revised in the future. However there is no specific time plans for this work for the time being.

The LAT differences were accepted for the boundaries BE-UK, DK-UK, DK-SE, DE-UK and NL-UK. The differences between the other boundaries should be investigated and efforts made to reduce them, Annex E.

9 Exchange between HO's on operational methodologies for GNSS based surveys (WP18/02)

IRL and the UK use VORF.
FR uses BathyElli.
NL is in progress to use Ellipsoid Reference Surveying (NEVREF).
BE is using GNSS surveys since 2011.
NO is using GNSS based surveys offshore.
DE applies GNSS-positioning since 1990. The survey of depths in the coastal area is done since 2005 with RTK-GNSS, reducing the depths to LAT with the German LAT-model. Therefore the correction service SAPOS is used on mobile. Since 2014, BSH has experiences offshore with correction data via satellite. The reduction to LAT is done, using the same LAT-model. The German GNSS-network has been extended with IGS-stations in England, Scotland, Norway and Denmark to provide RTK-solutions on North Sea.

11 Report from IHO SCWG3 13-15 May 2015 Tokyo, Japan

Ronald Kuilman (NL) gave a presentation on the IHO SCWG3 meeting 13-15 May 2015 in Tokyo, Japan. The TWLWG and Surface Current Working Group (SCWG) are merged into the Tides, Water Level and Current Working Group (TWCWG). The first meeting of TWCWG, end of April 2016, will be extended to 5 days and include all WP item.

Main topics SCWG3:

- Review Product specification S-111 v1.4
- Numerous S-111 portrayal options. It is important to create a usable version. There was a need to limit the minimum standards with the potential to develop over the longer term if desired.
- Generate S-111 compatible datasets for demonstration and discussion.

12 Developments in modern tide gauges and current meters

NO: uses pressure tidegauges with 2 pressure sensors. This is used for temporary campaigns (2 months – 1 year). In permanent gauges well floating gauges are used.

UK: the UKHO is not responsible for tidegauges. They advise on where new gauges are required. There is a new heated tidegauge on Antarctica.

SE: reported no change from last year.

BE: uses 1 new GPS tide buoy. The test results improved after BE constructed a 'donut' around the tide buoy. BE employs radar gauges to measure tide. These are located on measuring piles at sea on 4 different locations at sea and on 2 locations in the harbours In the harbours these radar gauges are put on top of a pipe a narrow orifice (stilling well). At sea these are free space gauges.

DE: reported no change from last year.

DK: uses radar tidegauges. DK is responsible for 33 gauges in its waters.

NL: showed the test results of a HF-radar of Rijkswaterstaat.

13 Developments in digital tide tables and website predictions / apps for tides

NO: the tidal information is available at http://www.kartverket.no/en/sehavniva/. Water level data are available through an API (Application Programming Interface), which makes it possible to extract and integrate data with your own systems. Tide tables are only digital available on the internet.

UK: the series of paper tide tables are now in 9 volumes instead of 8 volumes. Volume 1 has been split into two parts.

SE: app from Swedish Maritime Administration, for all platforms available. Data originates from SMA own network of more than 90 tide gauges and/or weather stations along the coast.

BE: tidal information is available at www.meetnetvlaamsebanken.be. Paper tide tables are available in August. The .pdf tide tables are available in December.

DE: tidal information is available at www.bsh.de. There are more than 90 tidegauges available on the North Sea.

DK: tidal information is available at www.dmi.dk

NL: reported no change from last year. Tidal information is available at http://getij.rws.nl/getij_locaties.cfm?taal=nl

15 EMODNET

Sean Cullen (IRL) gave a presentation over EMODNET.
EMODNET is a long term marine data initiative from DG MARE.

EMODNET objectives:

- EU (DG Mare) service contracts for creating pilot components.
- To migrate fragmented and inaccessible marine data into interoperable, continuous and publicly available data streams.

3 Phases:
Phase I (2009 – 2013) – develop prototype with coverage of a limited selection of sea-basins, parameters and data products at low resolution.
Phase II (2013 – 2016) – aims to move from a prototype to an operational service with full coverage of all European sea-basins, a wider selection of parameters and medium resolution dataproducts.
Phase III (2015 – 2020) – will work towards providing a seamless multi-resolution digital map of the entire seabed of European waters providing highest resolution possible in areas that have been surveyed, including topography, geology, habitats and ecosystems; accompanied by timely information on physical, chemical and biological state of the overlying water column as wel as oceanographic forecasts.

16 Tidal reduction methods

Rogier Broekman (NL) gave a presentation on the roadmap to Ellipsoid Reference Surveying (ERS).

Raw database are replayed using high quality GNSS position combined with GRS80-LAT2013-III(TU-Delft). The difference is compared with survey collected using DCSMv5+Premo reduction. A problem that occurs occasionally are GNSS detected height errors. This problem is possibly caused by a fall back of the number of received satellites. Another problem is the gap between LAT2013-III and the Dutch coastline using NLGEO2004 (land geoid). NL expects, after solving these problems, to start in 2016 with the transition from tidal reduction method to ERS.

In 2017 the NEVREF results of TU-Delft will become available. NEVREF is a vertical reference frame for the Netherlands Mainland, Wadden Islands and Continental Shelf. It includes the entire North Sea. Geoid will be created with 1 cm accuracy. For ellipsoidal height of LAT NEVREF aims an accuracy of 0.10m (standard deviation). In 2017 NL will implement the NEVREF results using high quality GNSS system.

17 Draft report of the NSHC-TWG for the 32nd NSHC meeting

The draft report will be made by NL and sent to the members.

18 Any other business

The Terms of Reference is adapted (Annex B).

19 Review of action items

18/01 remains open.
19/03 date is set to 08 April 2016.
20/01 is closed but remains on the list.
20/02 is closed but remains on the list.
20/03 is closed but remains on the list.
20/04 date is set to 31 December 2016.
21/01 new.
21/02 new.
21/03 new.
21/04 new.
21/05 new.
21/06 new.
21/07 new.
21/08 new.

20 Date and venue of the 22nd NSHC TWG meeting & closure

The next meeting will be held in Belgium. Belgium will announce the meeting date and location at a later time. The meeting will be held at least 6 weeks in advance of the NSHC meeting.

The TWG members thank Patrick Goffinet very sincerely for his excellent contribution and friendly cooperation during many years.

The Chair thanks everyone for coming to the meeting and IMA for their excellent support and organization, both of which helped greatly in the success of the meeting. He wishes all a safe journey home.

The meeting is closed at 12:45h.

ANNEX A: Agenda 21st NSHC Tidal Working Group Meeting

08 March 2016

09:00 Opening remarks……. Chairman

- practical arrangements
- opening host country
- introduction round

2. 09:30 Adoption of the agenda…….. ……. Chairman
3. 09:45 Minutes of the 20th NSHC TWG Meeting……..……..All
4. 10:15 Status of Action Items from 20th NSHC TWG Meeting (minutes Annex C, D)……All
5. 10:30 Minutes of the 31th NSHC Conference…….. Chairman
6. 10:45 Report from IHO TWLWG7 21-24 April 2015 in Silver Spring, USA……UK
7. 11:00 Presentations from the participants:
   NO – Norways work towards a close to shore MSS and LAT surface referenced to the ellipsoid

   12:30 LUNCH

8. 13:30 Explain and reduce differences in reference surfaces at the international boundaries (WP 16-04, WP18-01)……All
   - Comparison vertical reference surfaces…….. NL
   - IHO-EU Network WG (IENWG) …….. NL
   - EVRS connection…….. NL
9. 15:30 Exchange between HO's on operational methodologies for GNSS based surveys (WP18-02)……All

09 March 2016

10. 09:00 practical arrangements……Chairman
11. 09:15 Report from IHO SCWG3 13-15 May 2015 Tokyo, Japan…….. NL
12. 09:30 Developments in modern tide gauges and current meters……All
13. 09:45 Developments in digital tide tables and website predictions……..All
14. 10:00 apps for tides……All
15. 10:15 EMODNET presentation……IRL
16. 10:30 Tidal reduction methods……..All
    - ERS-PREMO…….. NL
17. 11:00 Draft report of the NSHC-TWG for the 32nd NSHC conference……..NL
18. 11:15 Any other business …….. All
19. 11:30 Review of Action Items……..NL
20. 12:00 Date and venue of the 22nd NSHC TWG Meeting…….. All
21. 12:15 Closing remarks……Chairman

ANNEX B: Terms of Reference for the North Sea Hydrographic Commission Tidal Working Group

As proposed by TWG 21st

1. Objective

To provide technical advice and promote co-ordination on tidal issues especially within the North Sea Hydrographic Commission (NSHC).

2. Authority

The Tidal Working Group (TWG) is a subsidiary of the NSHC and its work plan is subject to NSHC approval. Subject to approval by NSHC the TWG is especially involved with the regional interpretation and implementation of tidal issues as identified by Tidal, Water Level and Current Working Group (TWCWG).

3. Procedures

a. The TWG should:

1. work according to the agreed NSHC work plan;
2. monitor and report the progress of the work plan;
3. propose new work plan items for consideration by the NSHC.

To support the identification of new work plan items deemed relevant for the NSHC, the TWG should:

4. liaise with relevant Hydrographic Services and Standards Committee(HSSC) working groups, such as TWCWG;
5. Exchange views and experiences concerning tidal issues like unifying vertical datums, analysis, modelling and related issues like sea level rise and surge.

b. The TWG will conduct its business mainly by correspondence. Meetings and workshops should be scheduled as deemed necessary for the accomplishment of the work plan.

4. Composition and Chairmanship

1. The TWG shall comprise representatives of the NSHC Member State and expert contributors if applicable.
2. Decisions should generally be made by consensus, if a majority is required each Member State has one vote.
3. External contributors can contribute to the work plan but are not entitled to vote.
4. The Chair and secretarial support will be from the Member State hosting the meeting.
5. The Chair should monitor and report on the work plan to the NSHC.

ANNEX C: Work plan TWG to be approved by NSHC

Workplan NSHC Tidal Working Group: (Feb 2012)				
Item number (TWG/item)	**objective (WHY/priority)**	**task description (WHAT/HOW)**	**HO involved**	**Status**
WP 16 / 04	Enable GNSS-based tidal reduction and the connection with the vertical datum on land	Follow developments on geoid, MSL and LAT computations for the North Sea area	All	Permanent, see also WP18/01
WP18/01	Improve North Sea wide realization of reference surfaces	Explain and reduce differences in reference surfaces at the international boundaries	All	Permanent
WP 18/02	Improve methodologies for GNSS surveys	Exchange between HO's on operational methodologies for GNSS based surveys	All	Permanent

ANNEX D: Actions for internal coordination within TWG

Item number (TWG/item)	objective (WHY/priority)	task description (WHAT/HOW)	HO involved	status	corresponding work plan item
A18/01	Explain differences in realizations of LAT	Exchange on bilateral basis between involved HO's to investigate further the origin of observed differences at the boundaries between national reference surfaces	All	Permanent	WP 18/01
Action 19/03	Make an overview over existing separation and hydrodynamic models, including metadata	Each member state sends the information to UKHO	All, UK	July 2015	WP 18/01
Action 20/01	Improve North Sea wide realization of reference surfaces	Redo the work done in 2010 using the latest references from the Member States	NL, All	Closed	WP 18/01
Action 20/02	Show insight in the status at all bilateral boundaries	Create a matrix showing the status at all boundaries wrt Chart Datum, LAT, MSL and ellipsoidal boundaries	NL, All	Closed	WP 18/01
Action 20/03	Better capitalize the work done by the NSHC TWG	Use the webportal for NSHC TWG on the IHO website	UK, All	Closed	None
Action 20/04	Gain insight the connection between EVRS and chart datum	Create overview of connection between EVRS and Chart Datum	NL, All	Dec 2016	WP 16/04
Action 21/01	Investigate the differences at the BE-FR border between national LAT reference surfaces	Investigate all LAT differences at the border of more than 1 percent (LAT difference/depth)	BE, FR	Dec 2016	WP 18/01
Action 21/02	Investigate the differences at the BE-NL border between national LAT reference surfaces	Investigate all LAT differences at the border of more than 1 percent (LAT difference/depth)	BE, NL	Dec 2016	WP 18/01
Action 21/03	Investigate the differences at the DK-DE border between national LAT reference surfaces	Investigate all LAT differences at the border of more than 1 percent (LAT difference/depth)	DK, DE	Dec 2016	WP 18/01
Action 21/04	Investigate the differences at the DK, NO border between national LAT reference surfaces	Investigate all LAT differences at the border of more than 1 percent (LAT difference/depth)	DK, NO	Dec 2016	WP 18/01

Action 21/05	Investigate the differences at the FR-UK border between national LAT reference surfaces	Investigate all LAT differences at the border of more than 1 percent (LAT difference/depth)	FR, UK	Dec 2016	WP 18/01
Action 21/06	Investigate the differences at the DE-NL border between national LAT reference surfaces	Investigate all LAT differences at the border of more than 1 percent (LAT difference/depth)	DE, NL	Dec 2016	WP 18/01
Action 21/07	Investigate the differences at the NO-UK border between national LAT reference surfaces	Investigate all LAT differences at the border of more than 1 percent (LAT difference/depth)	NO, UK	Dec 2016	WP 18/01
Action 21/08	Investigate the differences at the NO-SWE border between national LAT reference surfaces	Investigate all LAT differences at the border of more than 1 percent (LAT difference/depth)	NO, SE	Dec 2016	WP 18/01

ANNEX E: Status differences at all boundaries wrt LAT-2016

Status differences at all boundaries wrt LAT - 2016

LAT

	BE	DK	FR	DE	NL	NO	UK	SW	IC
BE									
DK	1								
FR	2	1							
DE	1	4	1						
NL	4	1	1	4					
NO	1	2	1	1	1				
UK	3	3	4	3	3	2			
SW	1	3	1		1	2	1		
IC	1	1	1	1	1	1	1	1	

Status differences at all boundaries wrt LAT - 2010

LAT

	BE	DK	FR	DE	NL	NO	UK	SW	IC
BE									
DK	1								
FR	2	1							
DE	1	2	1						
NL	4	1	1	4					
NO	1	2	1	1	1				
UK	4	2	4	2	4	2			
SW	1	2	1		1	2	1		
IC	1	1	1	1	1	1	1	1	

At WP 20/02 the following options are identified:

1. no common LAT boundary
2. differences on a common boundary but not checked
3. differences on a common boundary checked to be not significant
4. differences on a common boundary checked to need to be reduced