

Paper for Consideration by TWLWG

Zone model for dynamic tide and water level for ECDIS

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Executive Summary:	This paper proposes a zone model to be used for providing dynamic tide and water level adjustment capability for ECDIS. The proposed model is based on available communication channels from shore to ship to provide dynamic real-time data. Further the model is a holistic approach to the issue of the tide and water level as it includes methods for including the tidal predictions for planning purposes into the same model.
Related Documents:	Report from a breakout discussion at TSMAD29/DIPWG7 meeting in Ottawa, Feb 2015. TSMAD29/DIPWG7 6.4B and C – Dynamic Water Level Data Transfer Product Specification
Related Projects:	HSSC6 decision to develop practical model to allow dynamic tide and water level adjustment for ECDIS

Introduction / Background

1. Tidal and water adjustment – both dynamic for real-time and static for planning purposes – have been in the ECDIS end user wish list for tens of years. So far fulfilling of the wish has been impossible for a type approved ECDIS installed onboard SOLAS class vessel, as it has been explicitly prohibited by the IHO S-52 presentation library

2. At the HSSC6 an action was given for both TWLWG and TSMAD (now S100wg) to provide a model how the tidal and water level adjustment could be allowed for ECDIS. At TSMAD29/DIPWG7, the UKHO presented an initial draft of the Dynamic Water Level Data Transfer Specification, which was well received by both member states and expert contributors that include various ECDIS manufacturers. Subsequently, a break out session was held to discuss how this product might be implemented. One of the items raised was that while transmission via AIS of the data was applicable, the system that was receiving the data still needed information in order to apply and visualize the tidal information. This proposal paper continues from the ideas presented in the TSMAD29/DIPWG7 meeting.

Analysis/Discussion

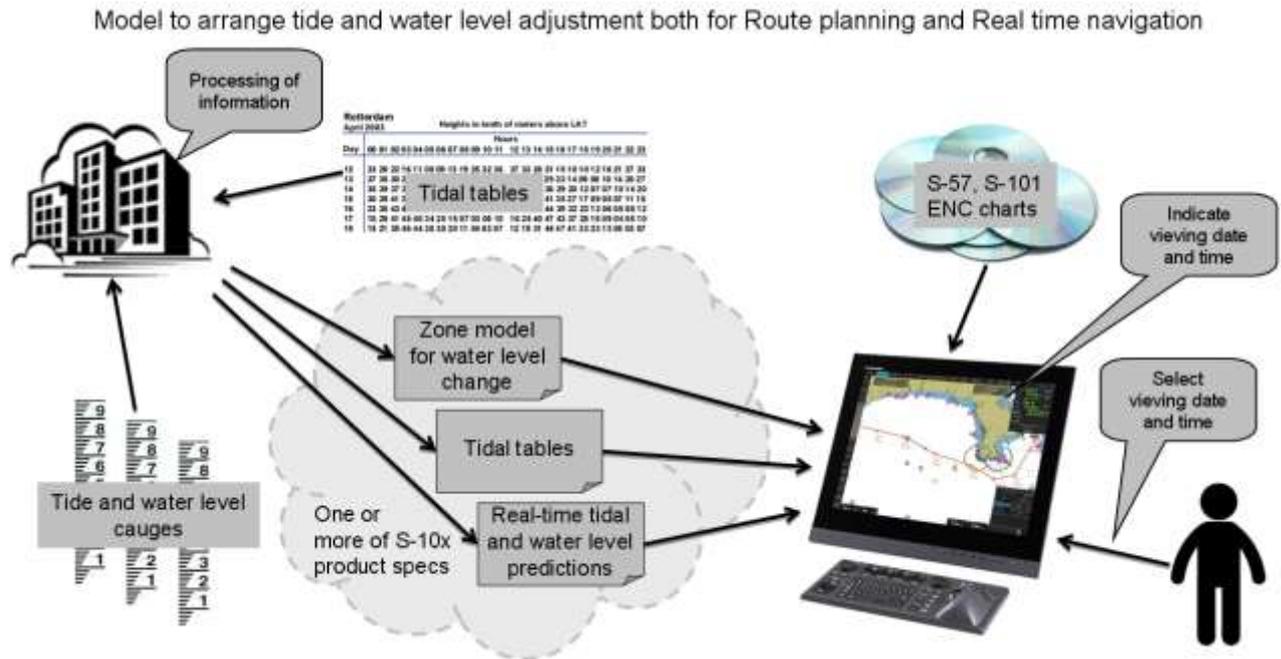
3. Tidal and water level adjustment has been available for small group of users, notably users of Portable Pilot Units (PPU). These PPU are not official ECDIS but dedicated ECS for assisting pilotage. Typically such arrangements use a broadband data link between shore and vessel.

4. This proposal has different technical approach than the solutions for PPUs. This proposal is based on what types of communication channels are available and affordable for SOLAS class vessel. Therefore this proposal is based on possibility to use the AIS ASM (=Application Specific Message) as real time dynamic information communication channel. The low throughput of the AIS ASM for this purpose requires that most of the data required for this method is transferred to the onboard ECDIS using other technical methods than AIS ASM.

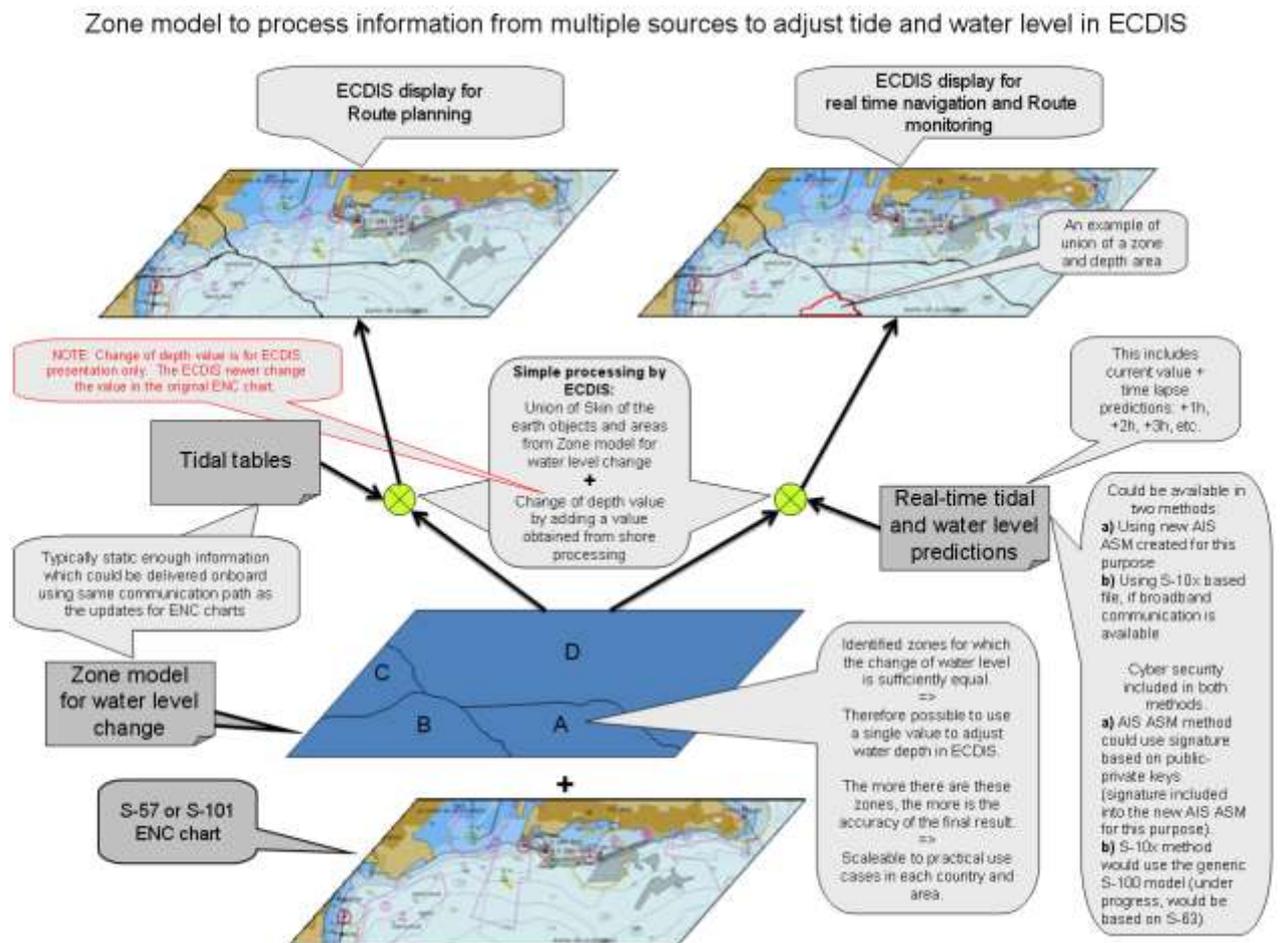
5. The proposed method is based on zone idea. Zones are areas for which the change of water level is sufficiently equal (for example within 1 m, within 10 cm, within 1 cm, etc. depending of the use case and required accuracy). Each zone has unique identifier and therefore the correction value processed by the shore service can directly applied to the area of the zone by the ECDIS onboard. This means also that the processing performed onboard by the ECDIS is simple, transparent and predictable. The result is that the whole adjustment process is controlled by the supplier of the shore service. If the supplier of the shore service is a local Hydrographic office then they can control every detail of this tidal and water level adjustment. In addition, this process would not change the underlying ENC data, thus still compiling to S-52.

6. The proposed zone method is scalable. The resulting accuracy is subject to subdivision of a sea area into the zones. Therefore a single method could be used in a worldwide basis to suit each area and use case.

7. Picture 1 describes the overall view of the zone method and picture 2 describes details of onboard processing by an ECDIS.



Picture 1, Overall view of the zone method



Picture 2, Details of onboard processing by an ECDIS Overall view of the zone method

8. This proposal has a holistic view for the adjusting of the water level issues. This means that this proposal also covers both the need for Route planning before sailing and the need for real time dynamic adjustment when the vessel is already sailing in the area. Both needs can use the same zone model. The difference is the in the method and update frequency of the water level adjustment data for the zones.

9. For the planning purposes electronic equivalent of the tidal tables will be used. This information is quite static in the nature and therefore it can adapt same methods of publishing frequency and delivery method from shore to vessel as the ENC charts. It is envisaged that this would be dataset that is based on an S-100 product specification that would include the encoding (ISO 8211), necessary feature catalogues and portrayal catalogues and all cyber security and service items as for all other S-100 based products. These electronic tidal tables could forecast water level changes a few months ahead (or even longer periods).

10. For real time dynamic use, the information is less static and requires sufficient update frequency. The basic delivery method that is proposed is based on AIS ASM, which is both already available in every vessel (reason: AIS transponder is a mandatory carriage requirement for SOLAS class) and affordable as being free of charge for usage. As the proposed solution is scalable, then next level of higher performance (i.e. possible to achieve increased accuracy) is to use the future VHF Data Exchange System (VDES) (= an IALA plan to establish affordable broadband radio communication channel from shore to vessels. ITU has already given permission for trial use of the future frequencies to be reserved for the use of VDES). The VDES will require that the vessel will buy new radio communication equipment, but the use of it will be free of charge similar to AIS. The VDES will have about 10 times throughput compared to basic AIS ASM.

The ultimate scalable solution is to use 3G/4G/5G/etc. mobile phone based broadband or satellite based broadband. Such a solution will enable scaling of the zone system down to centimetre accuracy at the cost of paying for the transmission of data between shore and vessel.

11. The assigned name for Dynamic water level product is S-112. This proposal includes 3 main items which will be transferred from shore to vessel:

1. Zone model for water level change
2. Tidal tables
3. Real-time tidal and water level predictions

This proposal does not have any opinion if all three above could be components under the given name S-112 or if the case should be subdivided under several S-10x names.

12. The target of this zone model is to give for the shore service full control of this tidal and water level adjustment. Basic parts of the full control are the zones, the adjustment values for the zones and updating frequency. In addition, an essential part of the full control is the conditions under which the ECDIS is allowed to perform the tidal and water level adjustment. Following issues need addressing

1. The file for zone model should include information which ENC charts are applicable to be used with available zones. This information could be in metadata of the zone file. This information would limit the application of the zones only for the ENC charts which the shore service feels acceptable. This information will enable the issuing authority to limit tidal and water level adjustment for such ENC charts which have sufficient amount of depth contours instead of a few in 0, 5, 10, 20, 30, etc. meter model.
2. The dataset for the zone model should include information about achievable accuracy connected to frequency and delivery method of Real time tide and water level predictions. This information is essential for the end user when making decisions around use of his water level adjusted ECDIS. Connection with update frequency gives possibility to specify the timeout of the application of the water level adjustment since last received update. Connection with delivery method gives possibility to specify different accuracy depending on the delivery method (i.e. it is assumed that AIS ASM as delivery method will give less frequent updates for the same zones as VDES, etc.). This information could also be in the metadata part of the zone dataset. This information would reduce over reliance of the end user for the accuracy of information presented in the ECDIS.
3. Items 1 and 2 above give good possibility for scalable solutions. Even for a single harbour approach there could be multiple accuracy levels depending available zone model file and delivery method.

13. Both Tidal tables and Real-time tidal and water level predictions of this model are time stamped. Also both contain parallel information for different times in a time lapse series. The ECDIS is required to have time and date selection by end user for picking correct information for adjusting the water level. This selection in the ECDIS could be global for all areas or it could be connected to the ETA information include into the Route plan (i.e. it is possible to show real prediction what will happen when the vessel sail several hours through an area affected by water level change). The resulting S-100 feature model should be flexible enough to have variable time lapse resolution (for example steps of 1 min, 10 min, 1 h, etc.).

14. This proposal compliments the work done by the UKHO on the specification for the new AIS ASM needed for this service. The AIS-ASM portion of the specification can be easily done after or in parallel with the effort to develop about the feature-attribute model that is needed to represent the tidal zones It was recognized in the TSMAD breakout

session that there was a need for the feature-attribute model and the tidal zone dataset for the AIS-ASM messages to be effective.

15. Cyber security is hot topic today. For the file based delivery this proposal would use standard solution available in the edition 2.0.0 of S-100. The use of the AIS ASM is a separate case. Current AIS nor AIS ASM does not include cyber security. This paper proposes that the required new AIS ASM is defined so that it is possible to calculate a signature over multiple transmitted AIS ASM for this purpose. This signature is then compared by the ECDIS using the public key. For simplicity the private-public key pair used in this application could be the one already available and administrated by IHB for the use of IHO S-63.

Conclusions

16. While the S-100 working group has the expertise in developing S-100 based product specifications, it is not the subject matter expert for developing the features and attributes for tidal zones that are needed as part of the product specification. This proposal shows the way forward for enabling water level adjustment in the ECDIS by developing an S-100 based product specification for tidal zone information that can be used in conjunction with AIS-ASM transmission of tidal data.

Recommendations

17. It is recommended that the TWCWG take into consideration the need for a base dataset that contains the tidal zone information which may include information for predicted tides. In order to create this dataset, an S-100 product specification should be developed in order to have a consensus based underlying data model which includes the features that will need to be included in the dataset. As stated in the analysis, this proposal does not have an opinion on if this piece should be included as part of the AIS-ASM product specification that was developed by the UKHO or if it should be a separate product specification.

Justification and Impacts

18. When implemented this proposal will fulfil a long time wish of the ECDIS users to have the ability to show both predicted and real time tidal adjustment on the ECDIS. In addition, the methodology used in this proposal will not change the underlying ENC data it will just provide a mechanism for the tidal corrections to be applied and displayed on the ECDIS.

Action Required of TWLWG

The TWLWG is invited to:

- a) Discuss and agree the issues presented in this paper
- b) Further develop the final S-112 Product specification based on the ideas of this paper