

## Review of Resolution 5/1932, with respects to TR A6.4

Researched and submitted by Chile

Action Item 4.10.2 of the 2nd TWLWG Meeting.

I. Chile was tasked to review the wording of the Technical Resolution 5/1932, as amended, (A6.4) “Extension of World Network of Tidal Observations” particularly paragraph 3, to improve clarity and meaning.

EXTENSION OF WORLD NETWORK OF TIDAL OBSERVATION	5/1932 as amended	19/2008	A6.4
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1 It is recommended that the world network of tide stations be extended, that some well-distributed stations operate continuously, and that special efforts be directed towards the establishment of stations on the outer coast of the continents and oceanic islands.

2 It is recommended that governments which do not possess departments organized for this purpose be advised by the IHB as to the desirability and means of undertaking the installation of tide gauges, the analysis of the resulting records and the preparation of Tide Tables. This work, carried out for selected stations, is of importance both in the interests of navigation and of science. It is possible that such work might be financed by commercial corporations or by other institutions if they were brought to appreciate its utility.

3 Concerning the extension of the world network of tidal stations with a view to improving co-tidal line charts, it is recommended that hydrographic Offices give increased attention to the need for additional observations of tides and tidal streams in many areas not now adequately examined. It is noted that in certain regions observations extending over 29 days of tides and tidal streams are sufficient.

II. The original query to review the wording of the TR 5/1932 was based in two main aspects:

- a. Is it necessary to carry out currents measurements to make co-tidal charts?
- b. How the topic of interest “Extension of World Network of Tidal Observation” fits with the currents observations requirement?

III. Searches of the following documents were helpful to answer the above questions.

The IHO Hydrographic Dictionary (S-32) (Part 1, Volume1 English, Fifth Edition) does contain definitions enumerated 716 for “chart: cotidal. A CHART showing COTIDAL LINES” and 1093 for “cotidal line. A line on a CHART passing through all points where HIGH WATER occurs at the same time”.

Several publications contain definitions or include a description of co-tidal line charts that tune with the previous one:

- NOAA Glossary - Tide and Current Glossary. January 2000.
- NTC Glossary 2010 Tidal Terminology.
- Cartwright, D.E., 1999. Tides. A scientific History. Cambridge University Press. 110-127.

In the context of question introduced at letter a) the following texts have been selected:

- a. Pugh, D.T. Tides, Surges and Mean Sea-Level, 5:4:2: “.... The tides of the north-west European continental shelf have been mapped in detail.... These charts have been produced from coastal sea-level observations, measurements of offshore bottom pressures and offshore current measurements combined hydrodynamically as described in Appendix A44.  
The mentioned appendix titled Cotidal and Coamplitude Lines, in its first paragraph points out: “The preparation of cotidal and coamplitude charts from observations of sea levels and bottom pressures alone is quite straightforward, but the accuracy with which lines can be traced offshore is usually limited by the scarcity of available data. This data can be supplementary by knowledge of the harmonic constituents of the depth-averaged currents, which are dynamically related to changes in elevations by the momentum and continuity equations”.
- b. Elsevier Oceanography Series, 35, Physical Oceanography of coastal and shelf seas, Pages 170-171: “Analysis is the process of reducing the amount of data to a comprehensible quantity – a harmonic tidal analysis in most cases reduces 1 yr’s hourly observations (8760) to a set of between 60 and 120 pairs of numbers, the amplitudes and phases of the constituents..... This tidal information can be rendered comprehensible by presenting it in cotidal charts..... What is gained by a parallel knowledge of tidal currents? The tidal wave dynamics can be better determined, in some circumstances more information is available for the drawing of cotidal charts and energy budgets can be estimated. The phase difference between elevations and currents indicates the closeness of the wave to being progressive and transmitting energy, when the currents and elevations are in phase, or to being standing and not transmitting energy, when the currents and elevations are in quadrature....” .
- c. An extract from a paper written by Minoru Odamaki which is titled Improving Co-tidal Charts around Osaka Bay, Seto Inland Sea, states: “Traditional co-tidal charts around Osaka Bay were drawn mainly based on the tidal harmonic constants. In this paper, gradients of tidal amplitude and co-tidal hour are evaluated based on the equation of motion using the tidal current harmonic constants. In results, co-tidal and co-amplitude charts have been improved and some distinctive features have been recognized....”.

In summary, co-tidal charts traditionally can be made based only on sea level observations. However, it is well known that hydrodynamics determines how large the tide range will be and when the high and low water will occur. In this context current observations will contribute to improve the accuracy of co-tidal line charts.

Regarding question b) is logical to assume that additional observations of tides will lead to a natural extension of the world network of tidal observation. Moreover, having in mind that the main purpose of paragraph 3 is to point out what should be considered to improve co-tidal line charts, it has been illustrated in the previous selected texts that increasing the number of sites with tidal observations complemented with sea currents observations provide more information for the drawing of better charts.

In conclusion, in Chile's opinion, TR A6.4, in particular paragraph 3 does not require any amendment.