

Interactive comment on “Reassessment of long-period constituents for tidal predictions along the German North Sea coast and its tidally influenced rivers” by Andreas Boesch and Sylvin Müller-Navarra

Andreas Boesch and Sylvin Müller-Navarra

andreas.boesch@bsh.de

Received and published: 22 August 2019

Dear Phil,

Thank you very much for your additional comments to our manuscript. Please find below our replies to your comments. We will upload the revised manuscript as soon as possible.

1) “One is that paper does have the feel of a highly-technical internal report and it might help to have an introductory paragraph in Section 6 (perhaps) to show that you know

C1

that there have been other methods for analysing HL waters in the past.”

» We will add some more references to other methods of tidal predictions in the revised manuscript. Thank you for your literature suggestions.

2) “Another is the comment by R1 about comparing the method used here to more standard harmonic methods, which you replied to in your paragraph (3) saying this was work in progress. But surely a tidal agency like the BSH is called on to produce hourly (or similar) tidal values for use in science or practical applications and you must have those data sets to hand. As regards the present paper it would not take much work to make a comparison for one or two places (say Cuxhaven). Last year I picked up a leaflet at the BSH which says ‘complete predictions of water level curves at Cuxhaven have been available on the internet since May 2010’.”

» The tidal information service from BSH does not provide hourly predictions on an operational basis (yet). As we start to have 19 years of 1-minute data from more and more tide gauges, we are currently setting up the programs to use this high resolution data in our routine tidal predictions. For previous years, only the HL water recordings were saved for most tide gauges. As the request for a comparison with the more widely used harmonic methods has been expressed in all review reports, we will include a short comparison for two stations (probably Cuxhaven and Hamburg) in the revised manuscript. The leaflet that you are referring to probably covers the water level and storm surge forecasting service (not the tidal information service). These water level curves (with and without surge) are produced by different methods, in which the tidal data calculated with the HRoI (times and heights of high and low waters) is used as an input.

3) “I understand the method for a particular station of course, but the rankings must be different for different stations so I was unclear how you arrived at the final choice. Could you make that clearer?”

» The rankings displayed in Table 4 are a synthesis from the data of all analysed tide

C2

gauges. This will be mentioned in the caption of the table and will be made clearer in the corresponding paragraph. The goal of Table 4 is to produce one comprehensive list that reflects the information from all tide gauges in the area under investigation. A tailored analysis for an individual tide gauge is of course possible (and needed), if the general list does not lead to good results.

4) Most of the other remarks have been directly incorporated into the revised manuscript (thanks for all the details). Here are the answers to your questions:

4a) "I suspect that when most agencies produce tidal constants for a particular year they do not remove big storms; they are part of the sea level climatology, leading inevitably to ambiguity as to what defines the tide. So, in your case does this storm surge removal make any difference to the results?"

» We try to predict water levels considering past long-term meteorological conditions (as good as this is possible). A single extreme event, like a severe storm surge, is not representative of the tidal behaviour at a site (and cannot be forecasted in the framework of tidal predictions). The model function (sum of harmonics) is also not made to properly account for these extreme events and the least squares method is likely (depends on the number of storm surges) to give results that lead to slightly higher heights at all times, if the storms are not removed. We do not have numbers at hand on how much this storm surge removal influences the results (this will also depend on the number of extreme events in an individual time series). Part of this topic is the fundamental question on how to define the (astronomical) tide.

4b) "Tables 5 and 6 - is it necessary to have gauge number in these tables"

» The numbers are necessary, because the short names for the tide gauges are not always unique, e.g. Borkum (Fischerbalje) vs. Borkum (Südstrand).

4c) "Figure 8-11. It might be good to make 8 and 10 into 8(a,b) and 9 and 11 into a new 9(a,b)."

C3

» We would like to keep these figures separated, as they cover slightly different aspects of the residual analysis.

Best regards, Andreas Boesch and Sylvain Müller-Navarra

Interactive comment on Ocean Sci. Discuss., <https://doi.org/10.5194/os-2019-71>, 2019.

C4