Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2019-71-AC1, 2019

Ocean Science Discussions

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: 12 July 2019

Dear Reviewer #1.

Thank you very much for your attention to the manuscript and your review report. Please find below our replies to your comments. The different items from the review report are first cited, followed by our responses.

1) "But personally I found the paper of interest not for that, but rather just for the description of the HRoI method, about which I was completely unaware. Evidently developed

Printer-friendly version

Discussion paper

by Horn in the 1950s, it is an unusual approach to tidal analysis. I'm especially appreciative of the fact it is developed for use in analyzing high and low water (rather than the more standard hourly data), and I can foresee more applications of the method once readers become familiar with it."

» Yes, this paper is also an opportunity to (re-)introduce the Harmonic Representation of Inequalities (HRoI) to the scientific community. Although the method has been around for a long time, many tidal scientists are not aware of it (anymore). We agree that the method can be interesting for others, especially when studying tides in estuaries or when tide gauges run dry around low water.

2) "The one drawback of the method, according to how the authors describe it, is on page 8, lines 10-15, where it seems a 19-year time series is needed."

» Best results are, of course, achieved when using a 19-year time series, because in this case all relevant tidal information is contained within the data. However, shorter time series can also be analysed. The rank R in table 4 indicates which partial tides need to be dropped in the case of shorter time series. In operational usage, we use the method directly if 10 years or more years are available. For time series between 10 and 19 years, 5 of the 39 partial tides are dropped (see figure 6). Analyses with even shorter time series are also possible but with decreasing accuracy; in these cases the transfer of a good prediction from a nearby station often gives better results.

3) "For my own interest, I would liked to have seen more standard methods of prediction included in the tests of Tables 5-6, but I won't insist on this, because it would involve the authors using methods they may not have ready at hand. Others can perform this extended testing."

» The comparison of the HRoI with other methods (e.g. the harmonic method) is not the subject of this paper and would be beyond its scope. We agree that this testing is interesting and important. We are starting to develop tools for extensive comparison of the HRoI and the harmonic method, and we will share these results with the scientific

community when results are available in the future. We also invite others to use the HRoI for their applications and comparisons.

4) “The paper is well-written and the English is quite good, but there is a number of misspellings which I noticed. The authors should run an English-language spell-checker on the text to pick these up. But a spell-checker may not catch: page 5, line 17: frequency depended –> frequency-dependent page 4, line 78: what is "appodization" ?”

» We will look carefully through the manuscript to catch the remaining spelling mistakes. The discussion paper version (one column) had already been improved in this regard, compared to the initially uploaded two-column version (which you probably read according to the cited pages and line numbers). The word “appodization” should be spelled “apodization” and is a window function that is applied (multiplied) to the data in order to reduce side lobes in the periodogram. Otherwise, these side lobes could be identified as true signals by mistake. In the revised manuscript, we will add more information and references in the corresponding paragraph.

5) “Page 4, line 51: I understand why lunar transit times are computed, as they are fundamental to the method, but I do not understand why "lunar coordinates" are also needed. Or do the authors mean merely the mean longitudes needed to evaluate the Doodson arguments¿‘

» The lunar transit times are computed using the algorithm published in chapter 15 of Meeus (1998). Inputs to this algorithm are the right ascension and declination of the transiting body, i.e. the moon. These coordinates are calculated using the lunar theory by Chapront-Touzé and Chapront (1991). We will make the corresponding sentence clearer in the revised manuscript.

6) “Page 4, lines 57-60: Regarding removal of "extreme events" – were these data also removed when the tests of Tables 5-6 were computed? Or do Tables 5-6 include ALL data from 2016 ?”

» The observed water levels of the year 2016 used for comparison are also filtered as described in Sect. 4.1. This way, the tidal predictions are compared to observations that represent the tidal behaviour better than the full data sets including extreme events. We will add this information explicitly in Sect. 5.1.

7) Do any of the German stations experience a double high tide? This occurs in some locations in the English Channel. If that occurs, how does the time indexing change?

» There are no German stations with a double high tide. In its current form, the Harmonic Representation of Inequalities is tailored to strictly semi-diurnal tides because it was developed for the conditions in the German Bight. The possible adaption to other tidal forms is a very interesting question. If the double high tide appears in every cycle (and if this is known to the analyst), it should be no problem to introduce four more equations of the type of Eq. (1); one model equation for each of the heights and times of the second high water assigned to the upper or lower lunar transit. For arbitrary mixed types, the direct calculation of high and low waters with the HRoI seems not to be possible. In these cases, one needs to first calculate the full curve, either with the harmonic method or maybe with the extended HRoI (as mentioned in Sect. 2), and derive the minima/maxima from the curve.

Best regards, Andreas Boesch and Sylvin Müller-Navarra

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

Printer-friendly version

Discussion paper