

Interactive comment on “Predicting tidal heights for extreme environments: From 25 h observations to accurate predictions at Jang Bogo Antarctic Research Station, Ross Sea, Antarctica” by Do-Seong Byun and Deirdre E. Hart

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Received and published: 14 February 2020

This paper aims to provide a method for making the most from very short period (25 hours) sea level observations by utilising data from a nearby permanent tide gauge site in Antarctica. Ideally the method used would employ simultaneously observed data at both sites, but this is not been possible here so it has been necessary to use predicted data at the permanent gauge. Nevertheless, a satisfactory result has been achieved which, in itself, is of some interest. This then begs the question about what might be achieved with actual observations. At the time of the short observations were made at

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JBARS, the gauge at Scott Base was operational and this data could be used to fully evaluate the CTSM+TCC method.

There is some repetition in the paper and the explanation of some of the figures/tables may be able to be simplified when the figure/table is placed in the body of the paper. A couple of times the paper appears to wander away from the topic and describes the nature of the tide elsewhere in Antarctica which doesn't add anything to the purpose of the paper.

Please see my comments below which I hope will be of benefit to this paper which demonstrates a method to draw the most benefit from the sparse sea level observations that the Antarctic environment allows to be made, not without considerable difficulty. This paper encourages us to make the most of the few opportunities available and on that basis I support it's publication in Ocean Science.

Line 9: The words 'as represented' are unnecessary and at the start of the next sentence change Though to However

Line 20: This sentence could end at regimes as the following words repeat what has already been stated.

Line 29: ...based on as little as 25 h of sea level records when combined. . . Also, h, as used here and elsewhere in the paper, would be clearer if abbreviated to hr (or better still, written in full).

Line 35: I'm not aware of the US operating a gauge in McMurdo Sound and would be interested to know where/when. NZ has a gauge at Scott Base. Does Italy have a long-term gauge at MZS?

Line 36: Only the Italian base is in Terra Nova Bay – the others aren't anywhere near this bay.

Line 37: There is also the problem of securing against damage any cable connection from a subsurface device to datalogging/power equipment ashore.

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Line 42: Of course, hydrographic surveys are ideally carried out when there is minimal sea ice; whether or not there is a permanent gauge site (line 40-41) is not the main factor when deciding when to conduct such surveys.

Line 72: ... in the austral summertime ...

Line 81: Residuals – observed compared to predicted?

Line 83: ... the absence of a permanent tide station at JBARS, ...

Line 94: Pairs in brackets unnecessary repetition from lines 92 and 93.

Lines 96 – 98: As Table 1 will be inserted here this sentence is redundant as it is just repeating what the table contains.

Line 100: ... phase lags showed only slightly different values.

Line 101: for completeness, should the formula for F be stated?

Lines 103 – 111: Is this paragraph necessary? This study relates to a part of the Ross Sea – the tidal regimes around other parts of Antarctica are of no relevance to this investigation. Or maybe you are hinting that as the Ross Sea is different to the rest of the continent the results of this study may not be applicable elsewhere. If this paragraph is deleted then Figures A1 and A2 are no longer required.

Line 113: Delete the '-' in front of CTSM.

Lines 114 – 115: Are the italics necessary?

Line 116: Similar tidal characteristics at the reference and temporary site is given as one of the requirements of the CTSM+TCC method. However, it has been noted in lines 101 – 102 that ROBT is diurnal and JBARS is mixed, mainly diurnal. Are these regimes sufficiently alike to be considered 'similar' for the purposes of this method?

Lines 121 – 122: The records are not temporary – the records are from a temporary site.

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Line 124: My record from ROBT does not have any gaps early February 2017.

Lines 127 – 129: This sentence reiterates the essence of the preceding sentence and, although it begins 'In short', is longer than the previous one. One of these two sentences could be deleted.

Lines 148 – 154: Is the first sentence in this block of lines necessary? The following two sentences describe the process and can stand on their own.

Line 154: Which are the 'initial tidal predictions'? It is not clear to me.

Line 163: Calculations, not experiments?

Line 164: 'in shorthand' seems unnecessary.

Lines 169 - 171: I had to read the first part of this sentence a few times to figure out what is going on. My take is that you obtained 17 datasets each one of which included 10-minute interval predictions spanning 17 days as derived from the harmonic analysis of each of the (17 in total) 25 hr slices of observed data. Is this correct? If not then I have clearly misunderstood, and if it is then that is good but, regardless, I'm not confident that I have it right.

Lines 177 – 187: This discussion about the correlation of tidal range and RMSEs and R^2 values is more difficult to follow than it could be. I feel the two sentences about the February 2 tide 'sandwiched' between the discussions about the results at greater tidal ranges has made the explanation somewhat convoluted. Dealing with the circumstances of the good statistics before moving on to the poorer results will enable this discussion to be expressed in a more succinct manner (and easier to follow).

Lines 188 – 192: Are these two sentences saying the same thing in different ways?

Lines 208, 209, 211, 212 and 213: I find the use of the adjectives 'maximum' and 'minimum' in association with declination to be confusing. Minimum could be taken to be on the celestial equator ($\delta = 0^\circ$) and maximum could be greatest declination either

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north or south. Better to use phrases like 'greatest southern declination' and 'greatest northern declination' to be more specific.

Line 227: Delete 'and'.

Lines 245 – 246: It would be helpful to give the dates for the two periods (ETT and TET). Is the 'minus' in front of tropic on line 246 a typo or does it mean the southern-most declination?

Line 247: ... CTSM+TCC considering only 2 major tidal species ...

Lines 249 – 256: Could this be shortened to just summarise the conclusion arrived at by the other authors. Is there a need to describe what they did – people interested can refer to the references.

Lines 267 - 268: Srun excluded ... Run1 excluded ... Run2 incorporated ... (I think)

Lines 269 and 270: Should both instances of 'exclusion' be 'inclusion'?

Lines 270 – 271: Is there any reason why this suggested line of investigation has not been pursued in this paper?

Line 273: Section 5.2 does not seem to contribute to the main aim of the paper, i.e. to predict tides from 25 hr observations. 5.2 looks at the contrasting tidal environments of two areas and tries to explain why they differ. I think 5.2 could be removed.

Figures A1 and A2: If the paragraph at lines 103 -111 is deleted then these figures are no longer required.

Figure 2: Readers might find this more informative if the map covered the Ross Sea only.

Figure 3: The x-axis label should be 'Time (month/day)'. The description starts 'Seventeen day time series...'. Isn't it seventeen sets of daily (25 hr) data slices as stated in line 130?

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Figure 4: The x-axis for all four plots needs a label (Time (month/day)). The description refers to daily slices of the 17 day ROBT tidal predictions in the first sentence, but the second sentence refers to results of the 369 day 2013 ROBT analysis. Is this correct?

Figure 5: Both plots need a label for the x-axis. The description refers to dashed lines in the plots but these are not shown.

Figure 6: X-axis label (for both plots) should read Time (month/day). In the key, should the Moon's maximum declination be qualified as being either north or south? Line 429: the symbol (open circle) does not match the plot.

Figure 7: X-axis label could be consistent with the other figures. Line 435 has the word 'plus' – this makes me confused about the description. My take is that the plot compares predictions for day x of 2019 (as derived from analysis of data from day y of 2017) with observations made on day x of 2019. Have I got this correct?

Figure 8: X-axis labels again. As with Figure 7, I am confused by the statement that follows '(dashed box in (a))'.

Figure 9: X-axis labelling differs from all other figures – could be altered for consistency. Line 444: should 'estimated' be 'calculated'?

Figure 10: X-axis labels again.

Figure 11: If Section 5.2 is deleted then these figures are no longer required. If retained then the word 'Horizontal' in the description is redundant. Is the area in the Weddell Sea coloured magenta?

Table 2: I would delete the Period and Angular speed columns. Not only are the amplitudes of most constituents in this table small, but by my analysis they also have small signal-to-noise ratios so are weakly determined. This caution about the reliability of these values should be noted.

Table 3: My records from ROBT for 2011 commence 21 November so the values given

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for that year can't come from yearlong observations (as is the case for the others in the table).

Interactive comment on Ocean Sci. Discuss., <https://doi.org/10.5194/os-2019-133>, 2020.