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Ocean Science
Discussions

Interactive comment on "The double high tide at Port Ellen: Doodson's criterion revisited" *by* Hannah A. M. Byrne et al.

Anonymous Referee #1

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General

This is a well written and appropriately brief account of how tidal harmonic constituents may add to give double high or low waters. The authors extend the simple Doodson criteria to cases of non-optimal phase relationships, and illustrate the theory with an example from Port Ellen in the Scottish Inner Hebrides.

Summing harmonics is essentially an exercise in trigonometry, rather than an investigation of tidal Kelvin wave dynamics. A regional study of wave generation and propagation around the amphidrome would be potentially more enlightening. Double high waters occur in a very few places worldwide, almost always associated with tidal amphidromes, where the range is near to zero. As such, as the authors state, this is "not a big topic" in tidal studies. Nevertheless, their extension of Doodson's simple formula

does take it a stage further, and also shows how difficult and unrewarding ever further elaboration of the criteria through the trigonometry approach becomes; the paper should certainly be published for this reason, as well as for the intrinsic analysis.

Specific comments.

Page 1

Line 1 Doodson's was a minimum criterion.

L12 here "neap" is used for the time of minimum local tidal ranges, though because of amphidrome movements during the spring-neap cycle, this may not be near first and last lunar quadrature when small neap ranges occur in the tidal forcing.

L25 "correct" is not the right word. Maybe "an appropriate" is better.

Page 2

L1 a third reason for higher harmonics is streamline curvature around indented coasts and sansbanks.. Godin is a very obscure reference for such a universal truth.

L10 replace "stringent" with "minimum"

Page 3

L 13 explain why phi has a negative sign

Page 4

Bottom line be consistent in Eq. or eq. there may be other examples.

Page 5

Caption last line is incorrect grammar ..should be " when neither a stand, nor a double. . ."

L 6 1/9 no1 1/32

Page 6

L5 an enlarged plot of selected days would help. Fig 1 is a bit too compressed.

L24. Say what is the sampling interval (15 minutes) and correct the source specification. It is not PSMSL. PSMSL is an international body located at NOCL which publishes monthly and annual mean sea levels for IAPSO. UK 15-minute sea level data comes from BODC (also at NOC Liverpool) under contract from DEFRA, SEPA etc. There is a specific form of acknowledgement required. . .see their web site. As DEFRA through the Environment Agency, and SEPA pay a lot of money for this measurement programme they like to get some credit.

L25 show the amphidrome in Figure 4

L27 this is similar to Courtown tides and worth a brief comparison (see Pugh 1982)

L28 180 degrees not 1800.

Page 7

L10 here the authors seem to be calling “Harmonic analysis” narrowly the fitting of daily curves. D and W actually used Y1, Y2..etc. Say so.

Page 8

L3 If they are 15-minute readings, a better symmetry would have been to go from 2330 in day -1 to 0030 on day +1.

L7 “treated by a full harmonic tidal analysis..”

L11 A plot of each of the daily D1, D2, D4 and D6 amplitudes and a discussion would be useful here to understand what is happening.

L14 Note that observations include met effects, seiches and instrument noise.

Page 9

The line darkening doesn’t work well. Surely web publication allows full colour?

Page 10

L8 HA seems now to be called Fourier Analysis. Non-mathematical readers may find this alternative naming confusing. Be consistent.

L15 specifically the advantage for D6 is (9/4)*(44/26). . .say so.

L 32 and noise from Met, seiching etc..

Page 11

L18 This is an important discussion and it would be useful to plot the D4 and D6 amplitudes against D2 here. See Pugh and Woodworth 2014 for what happens at Southampton. This interdependence of the basic and higher harmonics has big influences on the turning points occurrences.

L21 not sure why phase is said to be of “most importance”. . .it’s both amplitudes and phases. . .”perhaps in general” is just too vague and unjustified.

Page 12

L8 Doodson and Warburg discuss the “three plus harmonics” case, on page 222, for amplitudes only.

L21 this just confirms how unrewarding further complicating the criteria would be.

Page 13

L1 and 2 Replace the two “and”s in parenthesis with + . It’s in the definition.

The suggestion that the designation semidiurnal, mixed and diurnal needs redefining to allow for daily changes is valid, but a needless complication. The whole point about this basic descriptor is its simplicity. As an example of how a time dependent Form Factor might go, at lunar zero declination the D1 is near zero, and so the regime form factor ratio could be zero globally (ok, ignoring solar declination), but how would that

improve our simple descriptor of local tides at a port?

In Table 1 the values of R**2 have negative values sometimes. Is it worth considering the implied virtual values of r? might be worth a comment on page 3.

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