Ocean Science
Discussions

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Interactive comment on "Recent sea level rise on Ireland's east coast based on multiple tide gauge analysis" *by* Amin Shoari Nejad et al.

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Comments on 'Recent sea level rise on Ireland's east coast based on multiple tide gauge analysis' by Nejad et al. (OSD)

This is a short data report paper, discussing the Dublin tide gauge record, and also three other shorter records nearby. It discusses the trend and interannual/decadal vaariability in Dublin MSL which has of late demonstrated a high rate of sea level rise.

I have nothing against the paper being published eventually, but as it stands it is very rough and there are some things I didn't understand and could maybe be done better. Below I list some comments on the text, some trivial, in the order in the paper. But first

a couple of the more important ones.

One is that there is no attempt in the Discussion to relate the interannual variation in Dublin, since 1980 in particular, to that on the UK or European coast. There is only a gesture of a reference to global studies such as Dangendorf's. There is also an implicit tone of worry that the recent behaviour of Dublin MSL must be anomolous somehow compared to the more flat character of the record before 1980.

One thing that could be done is relate Dublin to Newlyn or Brest, data are readily available from the PSMSL. The important thing is that we know that interannual variability of MSL is coherent along the European coastline, see for example Figure 11 of Calafat et al. (JGR, 2012) or Figure 23 of Hogarth et al. (PinO, 2020). Then see, for example, the 'UK sea level index' in Figure 3(a) of Woodworth et al. (GJI, 2009), or Figure 22 of Hogarth et al. You will see that the larger MSL leading up to 1990, followed by a fall, then a higher rate of rise from the mid-1990s, is not so different to Dublin in Figure 15. Your Discussion should contain this sort of thing.

Another is Figure 1 which is what the PSMSL calls an 'RLR diagram'. It is confusing in having two LAT levels, and 'var' for one which is not explained. And there are two 0.1 m differences shown which, as far as I can see, are not supported by documentation but are just your interpretation.

But at the end of page 6 we read 'The Port Authority provides a datum diagram with a vertical distance of 2.61 m between ODM and LAT'. And yet for Port Authority in the diagram you imply information from the PA is for that to be 2.51. Why?

So, as far as I understand it, I would redraw this diagram: remove LAT (var) and the two 0.1 values. And show for the PA, 2.38 for ODM to Port Datum and 2.61 for ODM to LAT, as you say on bottom of page 7, if that is the case. And then the dispute is simply one between the IIS and PA information which you can say in words - you hardly need a separate Figure 4 then.

As for the 2.811 for the MI, don't you think that could be a simple typing error of 2.61?

Finally, the PSMSL RLR diagrams are defined in terms of real benchmarks and not national datum constructs as you have here. It would be good to add the heights of the couple at Dublin on the PSMSL web site to Figure 1, if you agree with them, of course.

Minor comments. Hope useful:

11 - for this period –> for 2003-2015 [to avoid confusion with 2016-present]

16 - Reword: Long-term and decadal secular trends and instantaneous rates are ..

Or something like that. Actually you don't give uncertainties for the instantaneous rates.

26 - Sea level (SL) .. As you use the acronym later

27 - I suspect levels more or less stabilised by about 6K years ago. You should read the geology papers again

30 - I am not sure I would mention Kiely and precipitation. There must be many papers on temperatures etc. in Ireland. But ok, if you want. If so,

... in the North Atlantic Oscillation ...

and give a reference to Hurrell.

36 - you don't do any modelling?

41 - you quote errors in a strange way with brackets. I would drop them. Doesn't matter. Missing error 0.23 +/- 0.30. Add 'respectively'

44 - given that

45 - your references are not in OS format, e.g. comma missing in (Dangendorf et al., 2017)

48 - four –> three

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[Discussion paper]

54 - have been –> are

55 Conclusions

60 - you write Dublin port sometimes and Port sometimes, and bay here should be Bay I guess

65 - say the 78-88 data are relative to LAT, according to Table 1

Table 1 is not mentioned in the text by the way

70 - say 'withing millimetric accuracy' to avoid this clumsy notation

Reword: This digitised data was reported relative to LAT datum.

71 - define PSMSL

what does (n.d.) mean. Please give the web address in the references and also a reference to Holgate et al. (2013) as requested on the PSMSL web site

72 - in the responsible

76 - (LAT) –> LAT

79 hereafter called the Greene data set

I got confused here first time as the following 3 paras are all about (5). Right? You should make that clear by saying something like:

As regards the Greene data between 1968-1982, ..

And I would run the three paras together.

81 - photos –> photographs

.. charts, from which high ... easily read. ... in the form ... charts in 3 large A3 books. Remaining data ... were in digital form.

I don't understand the digitisations started in 1998. That doesn't correspond to any of

the above dates.

Therefore, before ... were simply extracted ... spreadsheet tables .. read off the charts and input ..

meters –> metres

79 accuracy –> temporal sampling (?)

94 who cares about this 1963-67 business which is not mentioned previously and you dont use anyway. I'd drop this para.

Table 1: Under Frenquency, Annual what? Say MHW, MLW and MTL. Then below '10-min sea levels' etc.

For Port Authority, you have 2002-9 here and 2001-9 at line 71

For NTGN, you have 2006-19 here and 2006-17 at line 75

Figure 1 - see my comments above. You should say that Revised Local Reference (RLR) datum is a datum defined by the PSMSL in terms of known benchmark levels.

108 - Marine Institute (MI).

110-112 I don't understand this. Maybe:

The tabluated annual and monthly data for 1938-88 are .. overlapping with what (?) Nothing overlaps as far as I can see.

112 again this says 2002-9 and line 71 says 2001-9

114 exist

117 millimetre

is the 2.599 an average or a median value?

199 - perhaps say 'under-report' here. It sounds like what you are saying is not reso-

lution as such, as I would expect any random error with poor resolution to average out in all the levels. It sounds like you are saying there is a bias to round down in the PA data. If so, could you reword this?

Figure 2 and others - Year on the x-axis should be Time (Year). Doesn't matter much.

Figure 3 and page 7 - I got quite confused by figure 3. The blue is the Greene data for 68-2013 as far as I can see. The caption says red. The green is the PA for 2002-9 in black, ok. The black for NTGN, ok. What is the red? Its span does not correspond to anything in Table 1.

Anyway, can you explain better what you are doing here. I assume you are using HW throughout and not mean sea level, as the y-caption says, and anyway there is no datum mentioned for the level.

Otherwise, line 130, The HW (Greene) data sets ...

131 - bridge the gap. What gap? There is no gap in Table 1 or in (4) on page 3.

A few more words would help.

154 - ... above LAT for Dublin.

Fig 6 - Level on y-title

176 - .. by three ..

177 - ... Dublin Port (maximum distance 60 km) are ..

178 - .. different sampling frequencies

Fig 7 - Longitude would be best as East Longitude, it has a larger font than Latitude, and the lat/lons are too small

180 - harbor –> harbour

Shown with –> shown by

Drop 'The axes ..'

Table 2. Sampling frequency. Could you add a column for Manufacturer/Technology e.g. are they radar or pressure gauges

193 ... means with each record offset for ..

Fig 8 - harbour. This is a nice plot

198 ... gauges, ... harbour .. have been offset ..

Table 3 - say somewhere that these correlations are between monthly means (if so)

I guess another way to gap-fill would be to make an average of the three, or an EOF, rather than simply look for the one with the highest correlation. In this case it probably doesn't matter much.

Fig 9 - harbour

219 - harbour

221 - should not be expected to deviate .. other to any great extent ..

223 - .. change of behaviour could be considered as an anomaly ..

228 - .. gauges, namely ... harbour ... (in red)

235 - were the regressions made using annual or monthly means? And did the estimation of the errors take into account serial correlation. In the extreme situation of a strong seasonal cycle you would under-estimate errors on a trend by sqrt(12) when using monthlies.

Fig 11 - harbour. The names are too small font. Anyway, would not a little table be better for these numbers than this figure?

244 to those

248 As has

250 exclude

254 - what does 'more regular patterns' mean? More linear?

255 in which the overall ..

259 - .. since 1980, interannual sea .. increased significantly.

Figure 12 - what is this figure of anyway. MSL or MTL or both? If MSL then presumably you have adjusted the earlier MTL values? The text doesn't say.

266 Better would be: Standard deviation of annual sea level [presumably] in each decade at Dublin Port

271 - drop 'which is ..'. This is not the point to try inject some discussion.

Fig 14 - the y-axis would better say Rate of Sea Level Change than SLR. There are decades when it is not rising. Then in the caption 'Rate of sea level change in each decade at Dublin'.

278 To estimate instantaneous ..

280 behaviour - this is a European journal so please use UK English

282 during the 1980s

The spline is a low-pass filter/smoother, so what was the smoothing timescale imposed?

Fig 15, y-axis - SLC should be Rate

continuous –> instantaneous

297 - 1991, 1991

300 - harbour

overall negative trends

302 in regions of uplift due to Glacial Isostatic Adjustment (GIA)

A reference for GIA would be Tamisiea and Mitrovica (Oceanography, 2011)

303 Adjustment

309 - second 'found' –> observed

311 - this is an obvious sentence

312 such as the Atlantic Multidecadal Oscillation (AMO) ..

325-332 I would drop this para which is not much use. 9 years is not enough to check changing tides.

But for the record: phases should be phase lags. it's –> its. I don't have Table S1

334-340 On the other hand, you do need to mention land movements here and GNSS (not GPS) but this para as it stands is useless. You assertt an accuracy which is not meaningful, that there is uplift but provide no data or reference. It is just woffle. And GNSS does take tidal loading into account, but that is irrelevant for long-term trends anway.

Best would be to simply say that you are aware that the land could move vertically, due to GIA or local submergence, but that Dublin does not have the infrastructure as yet to monitor it properly. And give a general reference to Woppelmann and Marcos (Rev Geophys, 2016) or to a chapter in the Pugh and Woodworth (2014) book.

342 - Conclusions

345 harbour

346 .. Port, at a maximum distance of 60 km, and their ... variation in ..

347 variation in

349 at the end of 2016

351 period of time (i.e. little rise in total earlier)

353 event,

354 period,

the reader will not know where Clontarf is - say ? km NW of Dublin or whatever

363 (O'Connell, 2019).

emission

define RCP

370 reached at the

in the References

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The references are a mess. Please see the OSD instructions. Titles do not have quotes. the year comes at the end. There are no volume and page numbers. Some authors have first names and some have initials. Some could not barely be called references at all.

I am sorry for so many comments. I would be happy to chat about any of them privately if the authors wish.

Phil Woodworth