Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2019-131-SC1, 2020

Ocean Science
Discussions

Interactive comment on "Are tidal predictions a good guide to future extremes? – a critique of the Witness King Tides Project" *by* John Hunter

Ben Hague

ben.hague@bom.gov.au

Received and published: 9 March 2020

Overall, I believe that this study contains many useful insights into the causes of high sea levels and associated coastal inundation and their spatial variability around the world. In particular, the spatial distribution of where annual maximum sea levels is tide-dominated compared to surge-dominated helps to explain spatial variability in extreme sea level drivers and projections around the world. These are important findings and make this paper an important contribution to the coastal inundation literature. However, I feel that the definition of 'success' of Witness King Tides has been too narrowly defined, especially when viewed from the perspective as a mechanism to generate coastal inundation impact information.

This study has largely ignored one of the key motivations of Witness King Tides – to document coastal inundation impacts that will occur increasingly frequently with sea-level rise. Rather, it has rather narrowly considered the single question of whether high sea levels coincided with high predicted tides on some of the days that images were taken during the project. For example, the appropriateness of using a single 'WKT day' per year (as opposed to once-a-month or once-a-decade, for example) in the metrics defined has not been discussed. The existence or value of coastal assets that are impacted by king tides (e.g. Hanslow et al. 2018) also not been considered in the assessment of the suitability of sites for WKT locations. These are both important factors to consider when assessing the success of a coastal monitoring program. For example, recent research by Hague et al. (2019) used WKT and other sources (e.g. social media, online news) to show that there is large spatial variability in coastal inundation frequency across Australia. In some places coastal inundation was reported many times per year and in others it occurred less frequently than one year. The reasons for these spatial differences are likely many, but a lack of coastal infrastructure built close to the high tide marks was noted at some locations where coastal inundation occurred infrequently.

This leads into my key point – that just because the highest annual sea level didn't coincide with the highest predicted tide it doesn't make WKT 'not successful'. WKT is one of few coastal change monitoring programs – two other notable cases from Australia are Fluker Posts (Augar and Fluker 2015) and CoastSnap (Harley et al. 2019). The reduction in activity in WKT in the last 5 years has resulted in a large reduction of reports of coastal inundation impacts (e.g. refer Witness King Tides' Flickr page: https://www.flickr.com/photos/witnesskingtides/). To my knowledge this has not been replaced by an alternative publicly-available source – impact reports are now primarily confined to private or institutional repositories, portions of which are occasionally published in reports or research studies (e.g. Maddox 2018, Hague et al. 2019). Unlocking, collating, or generating, these sources of impacts information is vital to understand the physical impacts of coastal inundation and how the frequency and nature

of these will change as sea-level rise continues and accelerates. The continuation and enhancements of programs such as WKT are of great scientific importance. Concerningly, the results of this study could be (mis)interpreted to suggest that we only need to monitor coastal impacts at locations where inundation is tide-dominated. This is a dangerous proposition when coastal inundation impact information is simultaneously becoming rarer but also more important as scientists consider the impacts of sea-level rise on coastal communities happening now and in the future.

The 'attractive alternative' offered by the author – to photograph every high tide and pick the ones associated with the highest sea level – is effectively advocating for CoastSnap or Fluker Posts to be extended to, or expanded in, areas where coastal inundation occurs. (CoastSnap is currently confined to open ocean environments where coastal erosion is being monitored.) This is an excellent idea, and one that would likely be successful, with enough financial or community support for the project. However, other new technologies such as flying of drones (Klemas 2015) or use of social media analytics (Hino et al. 2019) could also provide opportunities for citizen science coastal monitoring projects and should also be considered as alternatives. I would however suggest that the aim of future programs is to capture any day where coastal inundation occurs, rather than the highest annual sea level. This will ensure a focus on coastal inundation impacts, rather than simply extreme sea levels.

Finally, regarding the results discussed in Section 3.5 and shown in Figure 10 – that the ratio of variances of observed sea levels and predicted tides may be a simpler but suitable metric for assessing the relative proportions of tide-dominated and surge-dominated extreme sea level regimes. It would have been interesting to further explore whether tidal range is a key factor in this analysis. For example, are low ratios due to infrequent storm surges or because tidal range is large? This could be useful to investigate due to its implications in the changing predictability of coastal inundation and potentially highlight locations where increases in tide-dominated inundation are most pronounced, and hence help identify candidate locations for future monitoring

efforts.

References

Augar, N. and Fluker, M. (2015) Towards Understanding User Perceptions of a Tourist-based Environmental Monitoring System: An Exploratory Case Study, Asia Pacific Journal of Tourism Research, 20, 10, 1081-1093, DOI: 10.1080/10941665.2014.962554

Hague, B. S, Murphy, B. F., Jones, D. A. and Taylor, A. J. (2019) Developing impact-based thresholds for coastal inundation from tide gauge observations. Journal of Southern Hemisphere Earth System Science. DOI: 10.22499/3.6902.006 [accepted: http://www.bom.gov.au/jshess/docs/2019/Hague2_early.pdf]

Hanslow, D. J., Morris, B. D., Foulsham, E. and Kinsela, M. A. (2018) A Regional Scale Approach to Assessing Current and Potential Future Exposure to Tidal Inundation in Different Types of Estuaries. Sci. Rep., 8, DOI:10.1038/s41598-018-25410-y.

Harley, M.D., Kinsela, M.A., Sanchez-Garcia, E. and Vos, K. (2019) Shoreline change mapping using crowd-sourced smartphone images, Coastal Engineering, 150, 175-189.

Hino, M., Belanger, S. T., Field, C. B., Davies, A. R. and Mach, K. J. (2019) High-tide flooding disrupts local economic activity. Sci. Adv., 5, DOI:eaau2736.

Klemas, V. V. (2015) Coastal and Environmental Remote Sensing from Unmanned Aerial Vehicles: An Overview. Journal of Coastal Research, 31, 5, 1260 – 1267.

Maddox, S. (2018) NSW Ocean and River Entrance Tidal Levels Annual Summary 2017-2018. Manly Hydraulics Laboratory Report MHL2618, State of New South Wales, Sydney.

Interactive comment on Ocean Sci. Discuss., https://doi.org/10.5194/os-2019-131, 2020.