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Comment on essd-2021-165

Anonymous Referee #1

Referee comment on "Estimating population and urban areas at risk of coastal hazards, 1990–2015: how data choices matter" by Kytt MacManus et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2021-165-RC1, 2021

Review of MacManus et al "Estimating Population and Urban Areas at Risk of Coastal Hazards, 1990-2015: How data choices matter"

This is a good and timely paper which I have enjoyed reviewing. It aims to address the wide range of estimates of coastal population presented in the literature and understand why these arise. Hence, it defines the uncertainties of population estimates in the coastal zone, and equally defining what we do know about the problem. It builds on a large body of work by the authors and many others, and cites a comprehensive literature. In particular, it considers many of the difficulties of working with broad-scale coastal data and the authors show great knowledge and deep thinking about these problems, including practical recommendations for taking this work forward. The results emphasises that growing concentrations of people occur in the low-elevation coastal zone, often in urban locations and the coastal zone is more urban than the global average. This has important implications for coastal policy and management as well as sea-level rise and its impacts and risks.

I have the following queries:

- What is the purpose of defining the Low Elevation Coastal Zone (LECZ)? As far as I understand to define the broad areas and population threatened by sea-level rise. So the main goal is to define the exposure to sea-level rise (following IPCC) or the receptors following the SPRC (source-pathway-receptor-consequence) framework (http://www.floodsite.net/html/faq2.htm). Hence we are defining the areas that might be affected by sea-level rise. Am I understanding the goal correctly? It would be good if this purpose was explicitly defined.
- This raises questions about how to appropriately define the landward limit of the LECZ. For example, in the TanDEM-X elevation model the treatment of the raised roadways in

the analysis reduces the area of the LECZ. But this misses the point of defining exposure as the lower areas landward of the roadways would still be threatened by sea-level rise. In effect, the analysis is treating the elevated areas as defences, when measuring exposure should be based on elevation only and not consider defences. This raise the key point that the treatment of the landward boundary of the LECZ could be rigorous and this should be discussed in more detail.

- Can anything be said about land area and populations situated below mean sea level (0 m)? Globally there are many millions of people in this situation – but how many?
- Subsidence is affecting many coastal cities causing large losses of elevation which is relevant to these methods (e.g. Kaneko & Toyota, 2011). There is some discussion of subsidence but this could be expanded, especially for coastal cities.
- What about the new paper by Hooijer and Vernimmen (2021) on coastal elevation and population?

I have the following minor queries:

- Line 22 -- McGranahan et al., 2007b here and through the manuscript – why 2007b – we haven't seen 2007a yet?
- Line 40 -- Oppenheimer and Hinkel, 2019 – should be Oppenheimer et al, 2019
- Line 238 – Table 2 – why is this not structured as the text – population datasets appear in a different order – harmonisation of order makes for an easier read.
- Line 449 – Figure 4 – hard to read -- needs to be reproduced at a larger font size.
- Line 480 – no global standards for coastlines – a very good point that all those working on coastal data at broad scales appreciate but is often not explicit to the user.
- Line 652 – the change from 1990 to 2015 is 200,000 to 400,000 people? – this seems far too small a global change over 25 years – 0.25% to 0.49% is about 20 to 40 million people in 2015 alone – this needs to be corrected.
- Line 677 – English of the sentence – change "the land area is about 40% more in CoastalDEM ≤5m LECZ than in the others" to "the land area ≤5m LECZ is about 40% more in CoastalDEM than in the others"
- Line 685 – Figure 10 and the caption does not make sense to me – the main text needs to be taken into the caption so it can be read standalone ––– does not show all of China and the caption should say this.
- Line 801 "under 5" – units are needed
- Line 1025 – what about rapid subsidence of coastal cities? Similar issue to deltas.
- Line 1048 – "4.2 Can these data be used to observe changes over time?" – again what about subsidence in deltas and cities which is quite rapid in some populated locations?
- Line 1224-1225 – McGranahan et al 2007a or 2007b?
- Line 1238 – mention that CoastDEM uses population in the elevation model?
- Line 1333-1342 – is coastal city subsidence an additional issue here??
- Literature cited: There is a very large and good literature cited. However, I note many of the references are missing journals – such as Balk (2009) – there seem to be other cases. A thorough review of the references to make sure that they are all correct and complete is essential.

References

Hooijer, A., Vernimmen, R. (2021) Global LiDAR land elevation data reveal greatest sea-level rise vulnerability in the tropics. Nat Commun 12, 3592. https://doi.org/10.1038/s41467-021-23810-9

Kaneko, S. & Toyota, T. (2011). Long-Term Urbanization and Land Subsidence in Asian Megacities: An Indicators System Approach. Groundwater and Subsurface Environments: Human Impacts in Asian Coastal Cities. 249-270. 10.1007/978-4-431-53904-9_13.