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Interactive comment on "Climate change overtakes coastal engineering as the dominant driver of hydrologic change in a large shallow lagoon" *by* Peisheng Huang et al.

Anonymous Referee #2

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General comments

In this manuscript, titled "Climate change overtakes coastal engineering as the dominant driver of hydrologic change in a large shallow lagoon", the authors describe the application of an unstructured modelling system to investigate hydrodynamics in the Peel-Harvey Estuary-Lagoon. Even if some may modelling studies dealing with lagoon's hydrodynamics have been already published, I particularly enjoyed reading this paper, which is clear, to the point and most interesting. The applied numerical model was properly applied and model results correctly presented and discussed. I particularly appreciate the multi-year investigation to separate the effects of climate change

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and engineering interventions. I recommend publication, subject to the authors addressing the major comments made below.

Specific concerns

- Even the model has been validated, the authors did not carry out any calibration of the model parameters. The authors adopt bottom drag coefficient values based on the area type and the estimated biomass of aquatic vegetation within the cell. The selected values are probably retrieved from previous studies and not calibrated for the specific site. To my opinion every model application need a calibration phase were the most important model parameters are properly tuned (as also highlighted by the sensitivity tests). Therefore, I suggest to perform a model calibration. As the
- I suggest including some general information about tide characteristics, average freshwater discharge and main wind regimes in PHE in the site description section (2.1).
- A detailed description of the open sea boundary conditions used in the simulations is needed.
- Please provide a more detailed description of the retention time computation (number of replicas per year, boundary conditions, initial conditions, treatment of the tail of the concentration decay when the simulation is shorted than the retention time, ...). The work of Li et al. (2019) is not present in the reference list.
- Since the author is already computing the water retention time and the bulk flushing time, I strongly suggest to investigate the variation of the mixing efficiency of

the lagoon. This will allow the author to investigate the effect of climate change and cut-opening not only on the sea-lagoon exchange (flushing), but also on the internal mixing processes. As far as I understood, the retention time computed by the author is similar to the water renewal time estimated by Umgiesser et al. (2014). According to Umgiesser et al (2014), the ratio between the bulk flushing time and the mean renewal time can be interpreted as an index of the mixing behaviour of the basin (i.e. mixing efficiency, ME). ME ranges between 0 and 1 and is equal to 1 in case of a fully mixed system (renewal time becomes equal to flushing time). In the theoretical case of ME = 0, the water masses entering the lagoon do not mix at all with the inner waters, and the renewal time goes to infinity.

- In commenting the possible future changes in PHE hydrodynamics, please consider also that these coastal environments can act as sentinel systems for observation of global change (see ad example Ferrarin et al., 2014).

Minor comments

- Change hydrologic to hydrological.
- Line 13-15: I suggest to remove this statement since is not valid in general.
- For the water inflow rate and fluxes I would suggest to use m3 instead of GL.
- I suggest to remove Figure 11, because the results are clearly explained in the text.

References

Ferrarin, C., M. Bajo, D. Bellafiore, A. Cucco, F. De Pascalis, M. Ghezzo, and G. Umgiesser (2014a), Toward homogenization of Mediterranean lagoons and their loss of hydrodiversity, Geophys. Res. Lett., 41(16), 5935–5941, doi: 10.1002/2014GL060843.

Umgiesser, G., C. Ferrarin, A. Cucco, F. De Pascalis, D. Bellafiore, M. Ghezzo, and M. Bajo (2014), Comparative hydrodynamics of 10 Mediterranean lagoons by means of numerical modeling, J. Geophys. Res. Oceans, 119(4), 2212–2226, doi: 10.1002/2013JC009512.

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