

Interactive comment on “Extremes floods of Venice: characteristics, dynamics, past and future evolution” by Piero Lionello et al.

Anonymous Referee #1

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The paper touches an interesting and relevant topic because of the recent flooding events in Venice and the start of the operation of the Mose barriers. In general terms I think the paper would convey a stronger message provided that:

- a. It emphasizes what is actually new in the paper and the advances with respect to previous publications and the state of the art.
- b. It discusses the various contributions to sea level in Venice, distinguishing between internal and external variability.
- c. The same regarding the non-linear and non-stationary effects in the different sea level components.

More specifically, I include some remarks to strengthen the message of the paper:

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1. When talking about the timing of the surges with respect to the astronomical tide and free oscillations, some further discussion on the possibility to lower high sea level by modifying the resonance period could be interesting. As a matter of fact, part of the literature on how to avoid harbour long wave resonance could be applied in here.
2. When presenting (section 2.1) the astronomic tides and other components, it would be nice to relate the maximum tidal amplitudes at the Northern shore of the basin to antinodes.
3. When presenting (section 2.2) the different contributions to relative extreme sea level the paper would benefit from a more in depth discussion regarding the non-linear feeding between the different components. In particular discussing the cases of constructive versus distractive interference.
4. When presenting (section 2.2) the RSL peaks with at least 1.40m that occurred in November 2019 on 12, 13, 15, 17 I think this deserves a further discussion on the possibility of a 2-day resonance period.
5. When discussing the propagation of the sea level signal into the interior of the lagoon (section 2.3) it appears that the surge signal propagates nearly without damping while other sea level components appear to experience significant damping. This should be discussed more in depth and explained in “physical” terms.
6. When presenting the evolution of mean sea level pressure fields during intense surge events (section 3.1) further discussion on the cause-effect relationship between the position of the low pressure centre and the pressure gradient could provide an alternative to numerical model predictions and also advance the understanding on these phenomena.
7. When discussing the future evolution of extreme sea levels (section 4.2) some further discussion on the projection of surges should be included. In fact, in a former section, mention is made on the possibility that surges will get smaller while here the

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possibility of non-significant changes or significant reduction are presented on an equal basis. This evolution of surges should also be related to the projections of storm trajectories and peak intensities in this part of the Mediterranean, since both are expectedly related.

8. When discussing (section 5) the limited consideration of wave set up so far I think it would be worthwhile to add the role of infra gravity waves both cross shore and edge waves since they can also contribute small variations to mean sea level which may be critical for the resulting flooding damages.

9. When presenting (lines 430 and following) the projected attenuation of storm surges again it should be discussed whether the projection represents a decreasing trend and relating that to the projected wave conditions.

10. Finally there are some “typos” that should be corrected (e.g. line 36 or line 265).

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