

Response letter to Reviewer#2

We thank Reviewer#2 for the careful consideration of our work. We agree with his/her constructive and thoughtful comments and suggestions, which led to a much improved and complete manuscript. In this response letter, we have replied (in blue) to all the comments formulated by the Reviewer (in black).

Comments:

The manuscript by Garel et al. is a very focused piece of research on the fortnightly variability in mean water level along a tide-dominated estuary with low river inflow. They apply an analytical model to determine the physical processes involved, validating their results against observations in the Guadiana estuary. The presentation of the research is well structured, has a good coverage of supporting literature to define existing knowledge - identifying the gaps to address, and has good use of figures to illustrate key points.

Our reply: Thanks a lot for the positive assessment of our manuscript. We very much appreciate all the comments raised by the Reviewer. In the revised manuscript, we shall completely address all the comments.

1. I have a few minor comments, with the main one focusing on the implications of the research. Section 5.2 answers the initial research question posed, but it is not until this point (near to the end of the manuscript) that the reader has a good understanding of the importance of this research in terms of application to present-day management issues. More detail is required earlier in the manuscript, for example L19 in the abstract more information about the impacts could be stated. On L56/57 more information is given but this could be summarized in the abstract. "Impacts on the estuarine environment" is very general and could be a positive or negative impact and may relate to the natural system and/or human influence on the system. While ecosystems are mentioned in the conclusions, flood hazard is not.

Our reply: We very much appreciate the Reviewer's comments. In this study, the potential impacts on the estuarine environment is mainly due to the changes in terms of upstream mass transport and inundation regime rather than the flood hazard, since we mainly focus on a tide-dominated estuary with negligible river discharge. In the abstract part, we shall explicitly mention that:

"This has significant potential impacts on the estuarine environment in terms of ecosystem management."

In the conclusions part, we shall explicitly mention that:

"Impacts on the ecosystem may arise from the induced modification of the inundation regime (through changes of the MWL and LWL) and of the upstream mass transport, in particular in macrotidal regions."

2. In the paragraph starting at L131, the influence of atmospheric pressure has been

considered and removed. Could you comment on the influence that wind and waves may have on the water levels. I appreciate winds are mentioned later in the manuscript but a comment to acknowledge the limitations of not removing all meteorological (and wave) forcing on the water level would be of value.

Our reply: Indeed, the other meteorological forcing (e.g., wind and wave) may also exert on a considerable impact during a storm surge event. In the revised manuscript, we shall explicitly mention that:

“It should be noted that the potential impacts induced by wind and waves on the water level dynamics during storms are not addressed since the study focuses on normal (fair) meteorological conditions.”

3. I have a few other minor suggestions:

■ L34, “metric order”, I suggest providing a value the change in elevations may reach.
Our reply: In the revised manuscript, we shall replace “metric order” with “of order 1 m”.

■ L35, “flood control” I would have thought flood hazard was related to the changes in mean high water rather than mean water levels. This point isn’t discussed later in 5.2. Are you really referring to inundation of the intertidal and the impacts on ecosystems as discussed later in section 5.2 or potential changes in saltmarsh that protect the coast from flooding? Please ensure the points in the introduction are directly linked to the discussion points in section 5.2 and vice versa.

Our reply: You are right! Here, we would like to emphasis the “tidal inundation” of the intertidal area at high tide rather than the “flood hazard” related to the high water levels and high river discharges. In the revised manuscript, we shall replace “flood control” with “tidal inundation”.

■ L206 & L244, “species” is an unusual choice of term. I would have used component.

Our reply: We would prefer to keep “tidal species”. The CWT is not able to distinguish tidal constituents (such as M_2), but groups of constituents with similar frequencies (such as semi-diurnal, D_2). A group of tidal constituents with similar frequencies is commonly denoted as a tidal species (see for example Buschman et al., 2009, Hoitink and Jay, 2016, Jay, 1991, Jay and Flinchem, 1997, Sassi et al., 2012).

■ L209, Z_f remains at a similar level but it is not perfectly constant.

Our reply: We agree with this comment. In the revised manuscript, we shall modify the sentence as:

“It is also obvious in Fig. 2b that Z_f remains at a similar level along the upper estuary half.”

■ L210, it would be better to focus on the period where there are quality results

stating the initial data are removed due to artefacts of the filtering techniques.

Our reply: We shall follow this recommendation. In the manuscript, we shall explicitly mention that:

“The initial 4 days of the time-series were discarded due to artefacts produced by the filtering process”.

The axes of Figures 2, 5 and 8 were updated accordingly.

■ L235, both lines have a clear signal. One is larger than the other rather than clearer.

Our reply: In the revised manuscript, we shall modify the sentence as:

“By contrast, the relative difference in LWL between St3 and St0 (ΔLWL , red line in Fig. 5) was larger than ΔHWL (> 15 cm in range between the 24 and 31 August), and clearly features fortnightly variations in phase with ΔZ_f .”

■ L272, how realistic is the use of a flat non-rippled sandy bed. How could the results vary for different conditions?

Our reply: We have not considered a flat non-rippled sandy bed to obtain the K parameter. Typically, K was obtained by comparing the model results with observations. In this paragraph, we intend to check if our K value is realistic or not. Calculations based on equations 8 and 9 indicate that the calibrated K corresponds to a drag coefficient (C_d) which is in the range of typical values applicable to depth averaged currents in estuaries.

■ L396, clarify the study is numerical using a case study for validation. I suggest you start the conclusion saying, “in a numerical representation of tide-dominated estuaries”. Otherwise, it could be misinterpreted that the results are only applicable to the study site.

Our reply: Many thanks for the suggestion. In the revised manuscript, we shall modify the sentence as:

“Using analytical solutions, this study has examined the fortnightly water level variations due to tidal motions alone in tide-dominated estuaries with negligible river discharge.”

4. There are a few typos to correct including:

■ L16 and L46 need rewording for clarity.

Our reply: We sincerely thank for pointing these out. In the revised manuscript, we shall modify the sentences as:

“Observations of a flat mean water level along a significant portion of an upper estuary suggest a standing wave character and thus indicate significant reflection of the propagating semi-diurnal wave at the head.”

“The friction-induced modulation in subtidal water levels allows transporting, for any tidal amplitude, the same volume of riverine water seaward over the neap-spring cycle (Guo et al., 2015).”

■ L34, check punctuation.

Our reply: We shall modify the sentence as:

“Subtidal changes in water elevation at these systems can be of order 1 m at the upper reaches and may have as such significant effects on navigability and tidal inundation (e.g., Aubrey and Speer, 1985; Godin, 1999; Guo et al., 2015; Jay et al., 2015; Matte et al., 2014).”

■ L46, check grammar.

Our reply: We shall modify the sentence as:

“The friction-induced modulation in subtidal water levels allows transporting, for any tidal amplitude, the same volume of riverine water seaward over the neap-spring cycle (Guo et al., 2015).”

■ P6/P7, there is an unexpected break in the sentence across the pages.

Our reply: Corrected as suggested.

■ L205, insert a space between “is 0.8”

Our reply: Corrected as suggested.

■ L208, depends on.

Our reply: Corrected as suggested.

■ L250, nearly constant.

Our reply: Corrected as suggested.

■ L403, in the upper estuary.

Our reply: In the revised manuscript, we shall replace “at the upper estuary” with “in the upper estuary”.

■ In the Conclusion both abbreviations (e.g. LWL) and full names (e.g. mean water level) are used. Be consistent.

Our reply: Thanks a lot for pointing this out. In the revised manuscript, we shall modify the full name (e.g. mean water level) into abbreviations for the whole manuscript.

References:

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