Hydrology and
Earth System
Sciences
Discussions

Interactive comment on "Linking biogeochemistry to hydro-geometrical variability in tidal estuaries: a generic modeling approach" *by* C. Volta et al.

Anonymous Referee #2

This manuscript presented an interesting idea and intention of using an extensive and comprehensive literature data to develop a universal tool to simulate the estuarine bio-chemical dynamics for the current and future condition by coupling the biochemistry with the hydro-geometrical variability in estuaries. The authors' effort to compile the comparative studies on biochemical dynamics covering wide range of estuaries is motivating. However, I have several concerns that I would like to get some explanations and attention from the authors, which are:

1. In the beginning of the manuscript (abstract and introduction), the authors mention that their study covers three-idealized end-member systems of estuary, but there is no clear definition of what exactly is the three-idealized end-member systems.

2. Then, the authors indicate that the hydro-geometrical variability is categorized into

three: marine, mixed and riverine. I presumed this three types are the three-idealized end-member systems. However, in Section 2.1, the authors claimed that an estuary is divided into only TWO zones: marine-dominated and riverine-dominated, followed by a statement "This dynamic interplay between hydrodynamics and morphology results in a continuum of estuarine shapes that cover the entire spectrum between two end-member cases: systems with rapidly converging banks and channels with parallel banks, which are rarely found in nature and are typically man-made (Savenije, 1992)." These statements are conflicting with the previous mentioned in the abstract and introduction.

3. In the manuscript, Equations (3) and (5) are referring to the estuary shape number. These equations are applied to estimate the bankfull discharge. However, there is a new paper published in WRR which is the updated version of this equation. The authors may download the paper from this link: onlinelibrary.wiley.com/doi/10.1002/2014WR016227

4. In line 13 page 6357, I suggest the authors to include the equation to calculate the tidal excursion E, and indicate what is the purpose to calculate E, is it to get the value of velocity?

5. In line 15 page 6357, I could not find the statement that the coastal plain estuaries have an average depth of 7 m in Savenije (1992, 2005, and 2012). I hope the authors can clarify on this.

6. According to the authors (line 26 page 6357 onwards), the definitions of the hydro-geometrical estuarine types given in the manuscript is according to Savenije (2005, 2012). However, I find that the definitions from Savenije (2005, 2012) are different from those claimed in the manuscript. In Savenije (2005, 2012-Section 1.2), there is NO mixed-type estuaries. So, please check on this. If the authors are suggesting a new classification, then please include a clear indication.

7. Referring to Table 1, it is not mentioned clearly in the manuscript how the total tidally-

averaged volume V is calculated. Is it the A0 x EL? If that's the case the values given in the table are incorrect. In this table, the authors also did not explain how to obtain Bx = 30m. If it is an assumption, it is based on what criteria? Moreover, the classification is based on how many estuaries? I suggest the author to include a list of the estuaries. There is an article in HESS "Revised predictive equations for salt intrusion modelling in estuaries" which contains a list of 31 hydro-geometrical data for 31 surveyed estuaries in the world. Maybe it may help to expand the database in this manuscript. Link: www.hydrol-earth-syst-sci.net/19/2791/2015/hess-19-2791-2015.html

8. In equation 6, it is indicated that the discharge Q is the product of the cross-sectional area A and flow velocity v, but there is no information on how to calculate the velocity. Furthermore, if the Q is the product of A and v, then in which part does equation (5) applies?

9. In Section 4.1, the authors discuss about the tidal amplitude and salinity simulation. But, there are no explanations on how they are simulated and with what equations?

10. In the conclusion, there are 51 total modelling applications have been carried out in which 49 of them are from temperate latitudes. I suggest the authors to plot a map/google satellite image showing the boundaries of the hemisphere for temperate region, as well as the location of the estuaries considered in this study.

Technical error:

1. Page 6352, lines 23 – 27, It is recommended to rephrase the sentence "Simulation for the year 2050...".

2. Page 6354, line 12, please replace "purposes" with "objectives".

3. Page 6355, line 22, please replace "estuarine shapes" with "estuaries shape".

4. Page 6355, line 23, please rephrase the sentence "system with rapid converging...".

5. Equations (2) and (3), is it possible to use the same symbol for depth as the one

used in Savenije (1992) to avoid confusion. Savenije used the symbol h and h0 for average depth and H and H0 for tidal range.

6. Page 6358, line 21, is the word "proprieties" means "properties"?