

Review of “Analytical model captures intratidal variation of salinity in a convergent, well-mixed estuary” by Xu et al.

In this manuscript, an unsteady analytical solution was presented to simulate the spatial-temporal variation of salinity in convergent estuaries and applied to the Humen estuary of the Pearl River Delta. There are a lot of issues which should be addressed.

Major points:

1. This manuscript is about the unsteady state analytical model for salt intrusion, but in the introduction section there is no anything about unsteady state analytical model. Nobody else did the unsteady state analytical model?
2. What differences are there between your model and previous models? What are the advantages of your model? Authors should compare your model results with other model results, to prove that your model is better.
3. In the methods section, which are input parameters, and how to determine them? These should be presented clearly.
4. In the application of the model to the Humen estuary, the first location of measurements (Dahu, figure 1) was set as the mouth of the estuary, and authors only calculated the results between station 1 and station 6 (figure 4). Actually, the real mouth is far downstream from station 1.
5. In figure 2, cross-sectional area of the Humen estuary was only shown for the reach between 0 km to 60 km. However, the Humen channel has a total length of 128 km (page 7, line 4). I think that the mouth in figure 2 should be the same as that in figure 4. If only part topography data was used, the area convergence length you obtained may be not correct. It is an important parameter in the model.
6. Section 4.1 (Application to the Humen Estuary) is about calibration of model. Authors only discussed the calibration of parameters. The calibration results of model were shown in section 4.2 (model validation). In other words, model calibration and model validation used the same data. Although in figure 4 the results between 29 January and 3 February were shown, the conditions were similar.
7. Section 6 Conclusions. In this manuscript, the main work is application of the model to the Humen estuary, showing calibration results. The first paragraph is

enough. In the second paragraph, part is about results instead of conclusions, and the other part is already in the first paragraph. In addition, “predictive”, “predicating”, and “predictable” used in conclusions are not proper.

Minor points:

1. Page 1, lines 16-17: “Compared with steady-state solutions, it can directly reflect the influence of the tide and the interaction between the tide and runoff”. Salt intrusion is the result of interaction between tide and runoff. The steady-state solution cannot reflect the influence of tide and interaction of tide and runoff? And authors did not compare their solution with steady-state solutions.
2. Page 1, line 31 and page 2, line 1: “Hence, the effects of human activities on salt intrusion are of major interest to engineers and scientists”. This sentence is not related to the topic of this manuscript. Authors did not do anything about the influence of human activities.
3. Page 3, lines 2-5. The sentences about paper organization are not necessary.
4. Page 6. What is e in equations 17 and 18?
5. Page 6, line 20. Here the citation of a reference is not necessary. Particularly the reference is from a foreigner. Is a foreigner more familiar with a Chinese estuary?
6. Page 7, line 6. What does the ES mean?
7. Page 7, lines 16-17: “The Humen waterway is well-mixed in the dry seasons (Luo et al., 2010)”. The mixing condition can be seen directly from the vertical distribution of salinity, which should be shown in section 3.1 (overview of the study area).
8. Page 7, section 3.2 data. What data about the tide was used in this study? In line 12, it is tidal flow. But in line 19, it is tidal level.
9. The title of section 4.1 can be changed into “Model calibration”, corresponding with section 4.2 Model validation.
10. Page 9, lines 18-19. Why did you use the daily maximum and minimum salinity in figure 4?
11. Page 9, the last paragraph. I did not understand what authors wanted to express except for the first sentence. In the first sentence, the “downstream” is relative to the 40 km reach in figure 4 or the whole channel? It can be seen from figure 4 that the main overestimates occur at station 3 and station 5.
12. Page 10, line 16: “salinity variation is more symmetrical further away from the study site”. What does this sentence mean? It is difficult to understand.

13. Page 10, lines 29-30. Authors used this sentence to explain the nonperiodic variation of salinity at Machong station in figure 5. It seems that only in the second tidal cycle, the variation is abnormal.

14. Page 16, table 2. All parameters used in the model should be shown.

15. Page 17, figure 1.

(1) The Pearl River estuary is too complicated, and Humen is only one of eight branches. The figure caption is map of Humen estuary. But where is Humen? Only six gauging stations can be seen. The Humen estuary should be enlarged and shown clearly.

(2) River names "Beijiang River and Xijiang River" are different from the names "the North river and West river" in the text.

(3) East River and the Shiziyang channel in Page 10, line 23 were not shown in figure 1.

16. Page 19, caption of figure 3: "The linear relationship between these quantities predicted by Eq. (12) has been confirmed for all surveys, and the figures here show the linear line fitting results from Jan. 29th to Feb. 3rd". Page 22, caption of figure 6: "The subtidal discharge switches from seaward to landward between Machong and Dasheng stations, which will have an impact on salinity dynamics." These sentences should not be in the figure caption.

17. The legends should be inside or outside figures, instead of covering the curves or words, such as figure 4, figure 6, and figure 7.

18. Is Humen a waterway or estuary? In some figure and table captions waterway was used, but in others estuary was used. It is the same in the text.

19. English writing should be improved. For examples:

(1) Page 7, line 19, "salinity was obtained by using a salimeter". "by" or "using" is enough.

(2) Page 9 and page 10. "Analysis of " in the titles of section 4.2.1 and 4.2.2 can be deleted. They are not necessary.

(3) Page 12, line 8, "the predicted result obtained by this model". "predicted" or "obtained" is enough.

(4) Page 16, caption of table 2: "Values of the parameters of salt intrusion in Humen estuary". "Values of the" can be deleted, "parameters" is enough.

These are only examples. Authors should check every sentence to make them standard, concise, and fluency.