

Interactive comment on “The impact of shoreline change on the salinity distribution in the wetlands of Liao River Estuary, China” by Mingliang Zhang et al.

Anonymous Referee #2

Received and published: 15 September 2020

General comments

This paper applies the FVCOM unstructured mesh model to the Liao River Estuary. The aim of the study is to understand how the construction of the Panjin Port impacts the flow and salt intrusion in the estuary. FVCOM is used to simulate hydrodynamics and salinity, under different river discharge scenarios. The model is validated using recent observations in intertidal areas. Results show that the construction of the port has a large impact on salinity transport in the Liao River Estuary. The Pink Beach wetland is the most affected area with a rise in water salinity due to modification of the water flow. This results from the construction of the port that prevents fresh water from

C1

the Daliao River to be transported up to the lower reaches of the Pink Beach wetland. This is an important result as this increase in salinity has an impact on vegetation growth in the area.

The paper is well written on the whole, and provides readers with useful information about wetland hydrodynamics. However, some parts of the manuscript should be improved prior to publication. In particular, there is not enough information about the hydrodynamics of the study area and reference to previous studies in the introduction, the model is poorly described and figure 15 has to be reworked.

Specific comments

Introduction:

Information about the main circulation features and tidal dynamics of the coastal Liaodong Bay from the literature would be nice (for example the tide is semi-diurnal close to the coast according to Hao et al., 2005).

But my main concern is that there is nearly no mention to the paper by Qiao et al. (2018), entitled “Numerical study of hydrodynamic and salinity transport process in Pink Beach wetlands of Liao River Estuary, China”, which shares co-authors with this paper. In their paper, Qiao et al. apply the Mike unstructured mesh model to the Liao River Estuary. They focus on the hydrodynamic characteristics and salinity transport processes in Pink Beach wetland of the Liao River Estuary, considering the effect of wetland plant on tidal flow. In the present paper, the authors should emphasize what is new in their study (scenarios with and without the port). Why do they use FVCOM instead of MIKE, is there a reason? In their conclusion, the authors of the present paper mention (Page 19) that runoff increases can decrease salinity in estuary waters due to the dilution of freshwater. Is this result really new? In Qiao et al., Figure 20 shows contour maps of salinity in the LRE under different runoffs during the period of highest saltwater intrusion, and the authors conclude that “the larger the river discharge, the stronger the runoff diluting effect”, and “when the river discharge is low, less freshwater

C2

is mixed into the system and salinity is higher". Page 4 Line 20 : Sources of data and where they can be downloaded should not be in the introduction but in the Method part.

Model description:

It would be nice to have more details about the model equations and how they are solved. At least mention that it is a 3D primitive equation model.

Page 6 Line 17: please add details about the vertical coordinates (sigma?) and provide reference.

Page 7 Line 1: "other existing models". As many other models use terrain following (sigma) coordinates, what do you mean? Is it models that use z coordinates? You should be more precise here.

Model configuration:

Model initialization and forcing need to be more detailed. Please give the model initial condition and the boundary conditions for the tides, or add a reference. Also, explain your choices for open boundary salinity of 34 PSU, initial temperature of 15°C, and river discharge scenarios (are values chosen from observation, literature?).

Page 7 Line 11: Please provide a reference for surface water model system. As you do not use the acronym SMS after, do not use it here.

Page 7 Line 18: A reference for the Bohai Sea Parent Model validation would be nice.

Model validation:

Page 9 Line 4: You could add "by taking into account the bias and correlation between model and observation" to the description of skill sentence.

Page 9 Line 11: you claim that "significant errors are observed between the simulated high and low tide levels and observed values". If this is from figure 4, it is not very clear to me. Also, T1 and T2 are very close to the boundary, what is the tidal forcing

C3

at the boundary? You explain the poorer fitting results at spring tide by the choice of open boundary conditions, so you may definitely give them in the model description/configuration part. It would be great to have this kind of comparison close to the LR, can we assume that there is no data there?

Results and discussion:

Page 12 Line 6: Why did you choose 50 hours for averaging?

Page 17 Line 13-19: Figure 15 is not clear and should be reworked, as this part is not very clear for the moment.

Page 18 Line 1-4: As this part deals with the effect of shoreline change on tidal flow, all the text beginning by "In summary" could be moved to the conclusion, or the link with salinity could be added in the subtitle.

Conclusions:

Page 18 Line 10: what is a well-validated model? Maybe you could use a term that refers to the robustness of the model ("proven model"?).

Figures:

Figures 1 and 2 could be merged to give the location of the area at first, and the names of big cities could be added (at least Dalian) to facilitate the reading by foreign scientists.

Figure 2: Blue triangles are not visible on the plot. Please add a Table with the coordinates of the stations.

Figure 4: It would be nice to have the amplitude and phase for the main tidal components for the comparison in an additional Table or in the text.

Figure 6: Why did you choose the scale 18-24 PSU? Is it possible to zoom in?

Figures 8 and 9: Is it necessary to show both surface and bottom maps, as they look

C4

very similar? You do not comment the differences in the text so I suggest to remove bottom plots.

Figure 15: This figure has to be reworked, as it is very hard to see anything, especially the direction of arrows. Perhaps reducing the number of arrows and zooming in areas of interest could help?

Minor comments

Page 3 Line 14: What are ELCIRC and COAWST? Models?

Page 7 Line 11: Please write “digital elevation model” instead of DEM.

Page 7 Line 12: “elements were respectively”

Page 8 Line 11-12: Delete “A comprehensive model validation was performed using the observation data”, as it has already been said at Line 8.

Page 12 Line 23: Please write “Liaodong Bay” instead of LDB.

Page 15 Line 5: I suggest to replace “above” with “upstream”.

Page 15 Line 5: Replace “Figure 12” by “Figure 13”.

Page 17 Line 15: By “its”, do you mean “the port”?

Page 17 Line 19: Add “(not shown)” for the comparison of results at neap and spring tides.

Typos:

Page 2 Line 21: “to understand”

Page 8 Line 7: “In order to”

Page 9 Line 14: “Figure 5 and Figure 6”

Page 12 Line 7: “Figures”

C5

Page 12 Line 9: “decreases”

Interactive comment on Ocean Sci. Discuss., <https://doi.org/10.5194/os-2020-36>, 2020.

C6