

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.

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General Comments:

This study uses a 3D hydrodynamic model to investigate the impacts on salinity distribution in the wetlands of the Liao River Estuary (LRE) due to the construction of Panjin Port under wet and dry river discharge conditions. The study shows that the port construction prevents fresh water from the Daliao River discharge being transported up the coastline to Pink Beach Wetland, thus increasing the salinity. The implication being that this increasing salinity could be detrimental to the growth of vegetation (*Suaeda heteroptera* (S.h.) and *Phragmites australis* (P.a.)) in the LRE wetlands.

I think that the results are fairly well presented and make sense scientifically, and the study broadly achieves the principle aims that are clearly stated in the introduction. So, I think it should be considered for publication after addressing my comments to follow.

The authors could be more careful and precise about the current state-of-the-art knowledge on the effects of salinity on S.h. and P.a. vegetation. Do we know the levels of salinity that might be expected to be troublesome? i.e., does the increase to salinity from the port construction actually make the salinity levels reach a point that is expected to affect S.h. and P.a.? I also think it would help to show a satellite image (or any other image) that illustrates the degradation of the LRE wetlands seen over the past decade that is described by the authors.

The method section contains some inaccurate statements and many parts are poorly described, so it needs careful attention to improve it. The authors can refer to my specific comments for details. Nevertheless, the model validation results appear acceptable to me.

Lastly, the results sections start by including details that really should be in the introduction and the methods section (and are in the past tense). I think it would help to move all these details from the results sections to bolster the introduction and methods sections.

Specific Comments:

1. The authors are very liberal with their use of acronyms making some parts hard to follow. Only need to use acronym if the word is repeated many times and is long. I recommend to just use an acronym for the Liao River Estuary (LRE) and the vegetation (P.a. and S.h.), and spell everything else out.
2. Page 3, Line 14: What types of models are “ELCIRC and COAWST”?
3. Page 4, Lines 5-8: “Estuarine salinity has a significant effect on the growth of coastal wetland plants plays an important role in maintaining the ecological health of estuarine

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wetlands. Despite this, studies on the spatial and temporal distribution of salinity in estuarine wetlands are limited, with most work generally focusing on salinity transport and saltwater intrusion mechanisms along the estuaries". These two sentences seem to come out of nowhere and do not have any references to back up the statements. Please expand on these sentences and provide details of the previous studies and their limitations.

4. Page 4, Lines 11-12: "According to satellite images and on-site surveys, the wetlands in the LRE have experienced severe degradation over the past decade". What surveys and satellite images are these? Are these from the authors' own studies? Provide more details.

5. Page 4, Lines 14-15: "Studies have revealed that salinity increases in water and soil can result in the death of S.h. vegetation." What studies are these? Please provide references. Furthermore, what about P.a. vegetation? No details on P.a. are provided in this paragraph.

6. Page 5, Line 4: "(2) explore the internal mechanisms of these effects". What does internal mechanisms mean here exactly?

7. Page 6, Lines 16-17: "The application of terrain-following coordinates results in an improved capacity to solve complex bathymetric conditions compared to other existing models." This is not a correct statement. Many other models use terrain-following coordinates (e.g., ADCIRC, SELFE/SCHISM, ROMS) and they have a well-known issue associated the computation of the pressure gradient term in high gradient regions (Haney, 1990) that other researchers have attempted to alleviate (e.g., SELFE/SCHISM uses hybrid coordinates (Zhang et al., 2015)).

8. Page 7, Lines 6-10. How did the coastlines from Google Earth differ from the coastlines from Landsat Images? Please explain in more detail about the coastline extraction process (what tools?). Where were the Landsat images used and where were the Google Earth images used?

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9. Page 7, Lines 10-11. “available DEM datasets” does not explain anything. Provide the source.

10. Page 7, Lines 14-15. Does the spatial resolution model grid vary only with distance between the open boundary and the wetland? Or is there some bathymetry depth function involved as well?

11. Page 7, Lines 16-17. Says the internal mode time step is 2 s and external mode time step is 10 s. I think this should be reversed. (the external mode is the fast barotropic mode and should have a smaller time step).

12. Page 7, Line 18. What is the “validated Bohai Sea Parent Model grid”? Any reference? Explain in more detail please.

13. Page 7, lines 18-19. What do you mean by “salinity was set to 34 PSU at the sea surface and interpolated along the sigma layers”? Interpolated between 34 PSU and what other value?

14. Page 8, Lines 12-13 & Line 16. Are the open boundary water level conditions inaccurate? Why open boundary conditions may be inaccurate for certain periods? You should be able to quantify this from the “validated Bohai Sea Parent Model grid”.

15. Page 12, Lines 11-12. I don’t really see that much evidence in Figures 8 and 9 that “during the spring tide period, saltwater intrusion distance in the estuary increases compared to that during the neap tide period.” Can you be more specific about where you see that? Including a panel showing the differences may help.

16. Page 12, Line 24 – Page 13 Lines 1-2. It’s unclear to me how the Popescu et al. (2015) reference relates to this sentence. I searched for keywords “salinity” and “salt” in their article and nothing comes up. Furthermore, this sentence implies that increasing salinity definitely inhibits growth of S.h. and P.a. vegetation, but the introduction on Page 4 lines 10-11 says that the “S.h and P.a. are the most common pioneer salt-tolerant plant in the LRE wetlands”. Of course this does not mean that a very high level

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of salinity can't inhibit their growth, but this ties back to my earlier specific comment 5) where I think you need to be more clear and careful about the statements relating to how both S.h. and P.a. are thought to be influenced by salinity, and make the correct citations.

17. Most of the beginning of Section 4.2 (page 14) should be in the introduction and methods section. The first ~5 lines of Section 4.1 and 4.3 are the same. Please only focus on including results in Section 4.

18. Page 15 Line 7: "This indicates the intensification of the shoreline change with the intrusion of salt water". This needs to be reworded, do you mean that the shoreline change increases the intrusion of salt water onto the wetlands?

19. Page 17, Line 10: says both tidal flow and residual flow were analyzed but only results for the residual flow are presented.

20. It would be nice to use colormaps that are more physically intuitive and unbiased instead of the rainbow ones adopted; refer to Thyng et al. (2016) for colors design to be used for salinity and depths etc.

Technical Corrections:

1. Page 15 Line 5: Figure 12 should be Figure 13.

2. Page 15, Line 14: Fig. 13 should be Fig. 14.

References

Haney, R.L., 1990. On the Pressure Gradient Force over Steep Topography in Sigma Coordinate Ocean Models. *J. Phys. Oceanogr.* 21, 610–619.

Thyng, K.M., Greene, C.A., Hetland, R.D., Zimmerle, H.M., DiMarco, S.F., 2016. True colors of oceanography: Guidelines for effective and accurate colormap selection. *Oceanography* 29, 9–13. doi:10.5670/oceanog.2016.66

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Zhang, Y.J., Ateljevich, E., Yu, H.C., Wu, C.H., Yu, J.C.S., 2015. A new vertical coordinate system for a 3D unstructured-grid model. *Ocean Model.* 85, 16–31. doi:10.1016/j.ocemod.2014.10.003

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