Response to Referee #3

Dear Reviewer:

Thank you very much for your careful review and valuable comments. We have studied your comments carefully and tried our best to revise the manuscript. The point to point responses to your comments are listed as following:

Introduction:

Question 1: The model setup section is in need of an overhaul to better describe what has been done here (details below), and more broadly the manuscript should receive some reorganization to get all of the right content into the right sections. For example the start of section 4.1 has introduction material (pg 12, lines 1-5), and section 4.2 also has introduction material (pg 14, lines 8-18), while at pg 14, lines 18-21 look like they belong in a methods section..

Response 1: Thank you for your kind suggestion, we have revised the related questions in the manuscript.

Question 2: Despite the organizational issues, the manuscript starts off with a focused goal of investigating salinity distribution sensitivity and demonstrates/quantifies the effects of adjusting the domain geometry. In that regard it is successful. Surface forcing is absent so there is a lack of completeless for the model, but this is noted for future work, and presumably explains why specific forecasts about the fate of the salt-tolerant plants is not made.

Response 2: Thanks to the reviewers for their valuable comments. The influences of wind stress on the spatial-temporal distribution of salinity in the Liao River Estuary will be the focus of future work. In fact, there are many factors affecting the degradation of *Suaeda Heteroptera* in the wetlands of the Liao River Estuary, such as runoff, rainfall and water pollution. In this paper, we show that the construction of the port will have an potential impact on its salinity environment (*Suaeda Heteroptera*), and it is difficult for us to forecast clearly the fate of the *Suaeda Heteroptera* plant in the tidal wetlands of the Liao River Estuary.

Specific comments

Question 1: pg 7, lines 17-18: What is the "validated Bohai Sea Parent Model"? Definitely we need some sort of citation here, and some rationale for using it's water level as OBC in the present study. Does this model provide tides only or does it also include non-tidal sea-level variability?

Response 1: Thank you for your advice, we have added more accurate description about the model and open boundary conditions in this manuscript. The model was driven by water level derived from the Bohai Sea tidal model using the MIKE 21 hydrodynamic model Model at the open boundary. The Bohai model has been validated using available data as well.

Question 2: pg 7, lines 18-19: "The open boundary for salinity was set to 34 PSU at the sea surface and interpolated along the sigma layers." I don't follow; more than one number is needed to conduct an interpolation. Does this mean the salinity OBC was set to 34 PSU at all depths along the entire open boundary? Is the 34 PSU isohaline known to coincide with the model open

boundary? How does that reconcile with estuarine flow characterised by salty inflow at depth and fresher outflow in upper layers?

Response 2: Thank you for your questions, we have revised our statement in the manuscript. The open boundary condition for salinity was set to 34 PSU at the sea surface and interpolated between 34 and 32 PSU along the sigma layers, the value was based on data from an unpublished document.

Question 3: pg 7, lines 19-20: "Temperature was set to 15◦ C across the whole domain." This sounds like the temperature initial condition. What was done for the temperature OBC? Was temperature an active or inactive tracer in the model? Is water temp mostly uniform in the area justifying setting it to inactive in the model?

Response 3: Considering that the average water depth of the LRE is relatively small, variation of temperature in horizontal and vertical directions is negligible, the open boundary condition for temperature was set to uniform 15℃ from the surface to the bottom and the initial temperature field was set to a uniform value 15℃ across the whole domain accordingly.

Question 4: pg 7, lines 20-21: "The initial condition for salinity was based on the steady results derived by running the model for approximately four months." This reads as if the final conditions were used to initialize the model! Presumably the model was started with a different set of conditions (perhaps uniform salinity?) and then the four month run used (perhaps with average runoff?) to produce quasi steady salinity field for initializing the four cases. Please clarify this.

Response 4: The initial condition for salinity was based on the quasi-steady results derived by running the model with initially uniform salinity and average runoff for approximately four months.

Question 5: pg 7: No information provided about velocity boundary conditions.

Response 5: Initial condition: velocity is zero everyhere. In order to calculate the flux at the open boundary, the ghost cells are added at the open boundary in which the velocity is specified as the same value and direction in the open boundary cell.

Question 6: pg 7: No justification for not including surface forcing.

Response 6: Surface forcing are not considered in this study, we have added this statement in the manuscript.

Question 7: pg 7, lines 21-23: How were these numbers selected? Are there discharge records that were used? Pg 6 line 3 mentions low average and high averages of 101 & 285 m^3/s for LR but a value of 25 is used for cases 1 & 2. Some rationale for the choices would help here.

Response 7: Thank you for your suggestion, we have added supplementary specification in the manuscript.

Question 8: pg 8, lines 12-15: It is typical to evaluate water level by splitting into tidal and residual/sub-tidal components, this would help in understanding if mismatches are due to poorly tuned tides or due to poor non-tidal ssh from the forcing model.

Response 8: that is a good idea, in this paper, the simulation accuracy of tidal level is acceptable

for us. Thank you for your advice, we will carry out the related assessment work in future work.

Question 9: pg 9, lines 10-11: How was 30 minutes of phase lag measured? Is this associated with a particular tidal constituent?
Response 9: The description about phase lag in the manuscript was not rigorous in the entire simulated period, but in individual moments.
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Question 10: pg 9, lines 13-23 and Figures 5, 6: Terminology switches between flow speeds and tidal flow. Suggest to be precise here, tidal currents are typically extracted via tidal analysis and there is no mention of such analysis.
Response 10: We have revised this statement in the manuscript, tidal analysis has been removed in this study, we mainly focus on residual flow analysis.

Question 11: pg 17: How was the residual circulation calculated? Through an average or through a detiding procedure?
Response 11: We obtained the residual velocities by an average calculation.

Question 12: Figure 15: vectors are very dense, consider replotting with fewer vectors so the current field is more visible.
Response 12: We have redrawn this figure in this manuscript.

Question 13: Figure 15: there is a gap in vectors along the Daliao River; is that a plotting artifact?
Response 13: We utilized the Tecplot software to do the post-prosessing work, the vector plot was not obtained by regular grid interpolation, but was drawn directly by data on unstructured grid center for sparse processing. A gap appeared because of the coarse resolution of the Daliao River grid.

Question 14: pg 19, line 14: "The ecological degradation of wetlands in the LRE has become more and more severe in the past decade." This line difficult to reconcile with the first line of the abstract ("The wetland of Liao River Estuary in northeast China is one of the best-preserved wetlands across the globe")
Response 14: The total area of the Liao River Estuary wetland is about 1200 km^2, part of the wetland in Liao River Estuary has undergone serious degradation. We have revised description in the manuscript.

Question 15: pg 19, line 6,7: The salinity appears to vary considerably between dry and wet season at PBW, is a 4 PSU increase in the wet season enough to affect the species here?
Response 15: The main factor limiting the growth of *S. heteroptera* is water salinity, and the most suitable salinity for its growth is about 15 psu. If salinity is lower or higher than 15 psu, its growth will be degraded or inhibited. We think that the change of salinity caused by port construction has a potential effect lead to the degradation of estuarine wetland communities.

Technical corrections

Question 1: pg 7, line 11: which DEMs were used?
Response 1: We have revised this part in this manuscript.

Question 2: pg 7, line 16-17: are internal and external switched here?
Response 2: We have revised this part in this manuscript.

Question 3: pg 8: Which simulation was validated? Presumably it was case 1 or 3?
Response 3: To validate the model, we adopted grid 2019 with river runoff to perform the simulation of the tidal dynamics and salt transport in LRE in 2018.

Thank you for your evaluation of the manuscript.

The authors would like to revise this manuscript if reviewers have any other questions.
Sincerely
authors