Dear editor (John Huthnance):

We are very grateful for your detailed comments and keen insights, which improve our manuscript greatly. We address these comments in a point-to-point way as follows:

Detailed comments

Comment:

Throughout, you still have salinity units psu not g/kg. For me personally this is OK but you did respond to the referee that you would change it. The referee comment will be available with your final version, so I think you should change it.

Response:

We change "psu" back into "g/kg". Actually, we think this is rather strange, as "psu" or "ppt" is more widely used in the literature now than "g/kg".

Comment:

Lines 158-165. This paragraph is generally confusing. Line 158: "The river discharge". What river? – obviously not the total river discharge. Do you mean the East River? Or do you mean that ¾ of the Pearl River flows into the other estuaries, not the PRE? Line 161: ". . at the head of the PRE takes up . .". The head of the Pearl River is its source and there is almost no flow. Lines 162-163: This is not clear. "total river discharge of the Pearl River is about 6000 m3/s in the dry season"; discharge to where? "upstream river discharge of the PRE"; the PRE does not discharge upstream; I think you mean "upstream river discharge into the PRE"

Response:

We agree, this paragraph is rewritten now. 3/4 of the Pearl River flows into other estuaries. "The river discharge dumping into the PRE is about 1/4 of the total river flow from the Pearl River. The total annual flow of the Pearl River is 3260×10^8 m^3, in which the river flow experiences distinct seasonal variations. During the dry season (from November to March), the river flow takes up only about 30% of the total annual flow , which is about 6000 m^3/s, and the river discharge into the PRE is 1500 m^3/s (1/4 of the Pearl River flow). Under extremely dry conditions, the river discharge into the PRE can be less than 1000 m^3/s."

Comment:

Lines 271-273. "The width of the sub-estuary is mildly convergent, with a width of 10 km at the confluence and decreasing to 600 m at the head, with an e-folding decrease scale (Lb) of 90 km." These values are inconsistent with a length 75 km.

Response:

Sorry. We change "90 km" into "26.7 km" and delete "mildly".

Comment:

Line 288. You can omit "the reference of".

Response:

We delete "the reference of".

Comment:
Lines 330-332. “The internal time scale . . was estimated to be longer than 30 days.” On what basis (e.g. sub-estuary volume / 200 m3/s)? It might be better to omit the two sentences lines 330-334 because they have less basis than (4) and I don’t think you use 30 days.
Response:
The internal timescale of the sub-estuary for a river discharge of 200 m^3/s was estimated to be longer than 30 days, which is the timescale for a particle to travel through the sub-estuary by the river-induced flow.
We delete these sentences as you suggested.

Comment
Line 335. I think you mean “sub-estuary’s response timescale”
Response:
We correct it.

Comment:
Lines 339-340. I disagree with this sentence. If you force an oscillator with (spring-neap) period slightly short than its intrinsic period (16.22 days or 16.22 days x 2π ?) then it tends to be 180° out of phase (if no friction, or dispersion in this case). In practice, however, your sub-estuary salinity appears to be somewhat in phase with the forcing, especially at spring tides. and this seems to be attributable to increased dispersion (introducing a shorter effective timescale to the problem). An item for “Discussion”?
Response:
This is a great comment. We agree that the system should be out of phase with the forcing when the external timescale is comparable to the internal one. Maybe the large dispersion would shorten the internal timescale. A timescale of L^2/K_x can be an approximation at hand, where L is the salt intrusion length, and K_x is the horizontal dispersion. This timescale is about 60 days during spring tides, even longer than the 16.22 days. Probably we can take another perspective that neap tides should correspond to greater salt intrusion, and spring tides correspond to lesser salt intrusion. This scenario is common for a partially mixed estuary and holds true in the main estuary and at the sub-estuary’s mouth. Due to the time lag (180° out of phase) in the sub-estuary, neap tides become to correspond to weaker salt intrusion, and spring tides coincide with stronger salt intrusion. Anyway, we are not much clear how to address this shorter effective timescale and have to leave it for future work.

Comment”
Line 345. “be proceeded” –> “proceed”
Response:
We correct it

Comment:
Lines 368-369. 25 hours is a reasonable period to average over but I would not call it

"subtidal"; the O1 period is longer.

Response:

We agree, subtidal is generally obtained by using a low-pass filter with a cut-off period of longer than 30 hours. We now rename "subtidal" as "tidally-averaged" in the text.

Comment:

Line 374. "a subtidal timescale" could be anything > 25 hours. Please be precise.

Response:

We change it into "a tidal period"

Comment:

Figure 3 caption. "the river discharges in 2022 are comparable to those of 2009 but the effect on salinities are dramatically higher". Referee 1 asked if there is a reason; what is different between 2009 and 2022 to give greater effects in 2022? [You might better discuss this in the main text, not the figure caption.]

Response:

We move the caption words into the main text. "Note that the river discharges in 2022 are comparable to those of 2009, but the effect on salinities are dramatically higher. The reasons behind such a difference is not clear right now, but could be due to the increased water depth along the sub-estuary in 2022 by sand mining, and/or the elevated water level outside the sub-estuary due to wind effects."

Comment:

Figure 5 caption. As suggested you now "note that it takes about 7-8 days after the storm for the salinity to recover to its pre-storm levels in the main estuary and almost a month in the sub-estuary." Can you explain these different recovery times; what differs between the main estuary and the sub-estuary to give the different recovery times?

Response:

We move the caption into the main text. The recovery time is mostly determined by the landward salt flux, as pointed out by Du and Park (2019). The landward salt flux is larger in the main estuary as it is more stratified and the estuarine circulation is more developed, which generate a larger steady shear transport. Meanwhile the width and the cross-sectional area of the main estuary are larger, favorable for the salt import from the ocean. Moreover, the station at the main estuary is located downstream of the confluence between the main estuary and the sub-estuary. After the salinity recovery at the station in the main estuary, the elevated salinity then propagate from the confluence to the upstream of the sub-estuary, where the station at the sub-estuary is located. As the cross-section at the confluence is small, the landward salt flux is limited, further increasing the recovery time for the station at the sub-estuary.

Reference

Du, J., Park, K., 2019. Estuarine salinity recovery from an extreme precipitation event: Hurricane Harvey in Galveston Bay. Science of the Total Environment 670, 1049-1059.

Comment:
Line 491. “at the late of” is unclear. Maybe you want “. . intrusions occur ?? days before neap tides . .” (you replace ?? by the number of days).
Response:
We replace it by “1-2 days before neap tides.”

Comment:
I agree with a referee that results should be in section 4 and discussion in section 5. Headings and content should correspond. Balance of section length is less important. Anyway, some comments above should increase the “Discussion”.
Response:
We do not agree this comment. Section 5.2 is actually a sensitivity study. It deals with the issue how the changes in the river discharge and the associated salinity dynamics in the main estuary affect the salt intrusion in the sub-estuary. We prefer to place it in the discussion part.

Comment:
Line 737. “. . salinity and tidal range in the upstream region . .”
Response:
We correct it.

Comment:
Lines 919, 924. You need the additions to figure captions made in the main text.
Response:
As we now move the words in the captions into the main text, it is not needed anymore.