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Comment on hess-2022-247

Anonymous Referee #3

Referee comment on "Effect of tides on river water behavior over the eastern shelf seas of China" by Lei Lin et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-247-RC3, 2022

In this paper, the authors use POM with an offline particle-tracking model to reveal the behaviors of the fluvial fresh water discharged from three major rivers in the eastern shelf seas of China. This is an important study that may serve to better understand influences of tides on transit time, water ages, and pathways of the fluvial fresh water on the shelf seas, and could further help in calibration/validation of the tidal parameterizations for the Earth system models. The results of the particle-tracking model clearly demonstrate that the tides change the behaviors of river water. But I struggled to interpret some of these behaviors shown with different types of tracers. With additional clarifications in the hydrodynamic processes on which the spatial distributions of tracers rely, and more details in model setups and methodology, the readability of this paper could be largely improved. For this reason, I would recommend returning this manuscript to the authors for revision.

The following are detailed comments:

Line 77: "… from the perspectives of transport pathways, transport timescales, and water concentration distribution". This is a general comment about these river water behaviors. The authors represent details in each behavior with tracer results, but do not explain well what oceanographic processes or properties they are presented. For example, as RC1 commented, why the water ages are high in the Yellow Sea, but the emerging probabilities are low? It may help to have an extra paragraph to explain oceanographic processes or properties that different types of tracer represent, such as the water age reflects the residence time, emerging probability depends probably on both buoyancy and atmospheric forcings, and the tracer concentrations could show the effects in salinity field, etc. Then the effects of tides can be rooted through differences in tracer fields for physical reasons.

Line 91: In general, it would improve the readability with some level of detail in model

setups. The authors provide a list of references containing very detailed information about the model they used, but I must stop reading and search for them.

Line 94: What are these tidal constituents?

Line 95: How many vertical layers does POM have?

Line 96: What forcings are used in the POM; are wind, radiation, and evaporation considered?

Line 125-126: "… by dividing the number of particles emerging in the grid cell by the total number of particles released." Is the denominator the total tracer released per day, or for the entire simulation of 30 years?

Line 148: Does reenter account on the shelf boundary, or is t1 accounted for the first leave?

Line 152-153: This should be mentioned earlier in 2.1, and emphasize the tracer model is decoupled from the hydrodynamic model, as I thought the tracer module was running with POM. Are three years long enough for POM to get equilibrium of the water exchanges along the shelf boundary? If the hydrodynamic fields are not in a steady state, would it affect the results of particle-tracking model? Which outputs of POM are used to force the particle-tracking model? Does POM consider evaporation? Does tracer-tracking model consider surface sink?

Line 170: "Figure 2 …" Is the emerging probability calculated only for surface layer, or integrated vertically? Why is the spatial pattern of emerging probability discontinued at Yellow Sea trough for Changjiang River?

Line 199: "Figure 3 …" It would be helpful to show the annual mean vertically averaged velocities, and to explain why the water ages are high in Yellow Sea, but the emerging probability is low.

Line 213: Consider replacing Figure 4 with Figure 9, as both contain the transit time for "control" and "no-tide" cases.

Line 225: “Figure 5 …” Why the tracer concentrations are low in Cheju Strait for all rivers, but their emerging probabilities are high?

Line 297: “Figure 10 …” Please consider changing the color scheme to increase readability. As all tracer fields are shown in annual mean, what are the net effects of these seasonal differences in shelf currents? Generally, a set of annual mean vertically integrated plots of velocities and/or tidal current ellipses would greatly help better understand the tracer patterns.

Line 309-310: The seasonal velocities (Figure 10) also show differences in mesoscale eddies. Would they affect the river water behaviors?