This is an excellent data set with great potential as a valuable contribution to the river plume community. My general comment is there is a lot going on in this manuscript: the figures are busy, and there are many redundancies. I find myself often losing track of what is important and what is extra “fluff”. It think the results, discussion, and associated figures can be streamlined and the story made clearer. I am generally fine with the analysis, but some relatively significant restructuring and rewriting is needed. I tried to specify my individual concerns below.

-Preston Spicer, PNNL

Major Comments:

1. Introduction: there are not clear knowledge gaps outlined, so it is not clear if this data set and study are novel. Other folks have studied turbulence and mixing around plume fronts…what is new here? Make it clearer.
2. The tidal dynamics section (3.5) needs more clarifying information.
3. Restructuring associated with explaining results is needed. There are simply too many figures / too much text that are often redundant. It is very easy to get lost when reading from the amount of data.
4. Similarly, there are lots of turbulence/mixing parameters presented but it is not clear if they are all contributing to the story. Mixing is probably the most important part to this paper, but I feel the authors’ do not guide the reader properly through their train of thought. Some variables appear, are not really discussed, or simply don’t matter. I think there is also a major lack of discussion on dynamics/processes with too much focus on describing patterns in turbulence. Look through the figures and text and only present what is needed for your story. Repackage it.
5. The elevated currents and turbulence at depth after plume front passage is very interesting, but I don’t think the dynamics associated with this are ever addressed. Why do the currents speed up so much at depth after the front passes? Is bottom boundary mixing (Spicer et al., 2021 JPO; Whitney et al., 2024 JGR) important? This has **not been observed** in many systems and would be very impactful/novel to quantify here.

References:

Spicer et al., 2021: The Effect of Bottom-Generated Tidal Mixing on Tidally Pulsed River Plumes, Journal of Physical Oceanography, https://doi.org/10.1175/JPO-D-20-0228.1

Whitney et al., 2024: Mixing of the Connecticut River Plume During Ambient Flood Tides: Spatial Heterogeneity and Contributions of Bottom-Generated and Interfacial Mixing, JGR: Oceans, https://doi.org/10.1029/2023JC020423

Minor Comments (by line number):

53	Says “near surface mixing” here but bottom layer mixing is mentioned in the abstract.
Fig. 1	Do you have bathymetry contours that could be added to Fig. 1a? This would be very helpful to the reader…. particularly if bottom boundary mixing is discussed in the paper.

99 How far away, exactly, was the vessel?

108-121 We did a very similar upriser-mode MicroCTD sampling scheme in the Merrimack River plume (Spicer et al., 2022): https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2022GL099633. It may be useful for you to cross-reference our paper for differences in turbulence estimation parameters. Also, did you take multiple profiles are average them together? Or just use singular profiles?

144-146 I do not understand this logic. Why such a difference in discharge estimates? How far away is the USGS gauge?

146 Why not show the tides? Seems important for a plume front that forms with the tide.

148 Is this low water in reference to low water at the NOAA gauge or at Winyah Bay?

151 Can you use nearby NOAA wave buoys to back this up?

Fig. 2 I think it would be good to show river discharge and tidal elevations as well so we can see how the sampling day conditions fall in to the broader period.

173 You should mention the number of casts and when they were taken (i.e., a group before the front, a group in the front, a group after the front) in the methods section above.

180 Label the groups in Fig. 3b. Perhaps color the vertical lines marking the profiles the same colors as those in Fig. 4.

Fig. 4, 5 Why is group A warmer and fresher than group B?

Fig. 6 Why not make contour plots with time on x-axis, depth on y-axis, and velocities colored? If the ADCP was in a fixed position, this makes the most sense. That would explicitly show time variation and be a little easier to interpret/align with Fig. 3 time variation.

After reading through this section more, I feel strongly this should be a contour plot. Although the current profiles show an obvious increase in plume layer velocities, it is very hard to distinguish what velocities are positive and negative here particularly in the sub-plume layers. Contour plots with a red-blue colormap would be ideal and helpful.

206-208 Mark the front arrival time on the velocity plot/contours.

227 A map of where these stations are located should be given in an appendix or supplemental material. What are these 80 stations? 80 ADCPs set up at the same time? This seems excessive and unlikely. More information is needed.

230 Why 4.5 m? It would appear the plume influences currents below that depth in Fig. 6.

231 Why only these two harmonics?

Fig. 7	The velocity jumps evident at hour 0 in the inset would indicate there is plume influence here and the 4.5 m threshold is not the best to use. You refer to these jumps being a result of plume influence near bottom. Was the total depth at T2 ever mentioned? If the average includes plume velocities near 4.5 m, then I wouldn't call this near bottom. What do these scatter points look like if the threshold is deepened to 5 or 6 m? How deep is the water column at all the stations used here? Does it vary? By how much?
242	If the current changes direction exactly when the plume front passes, I don't think you can call this the tidal current…going back to my comments above. This is some combination of tide and plume. At all the other stations used to predict the tidal current, are they within or outside the plume? Why do we not see these jumps elsewhere? What accounts for the outliers in Fig. 7a and b which deviate significantly from the predicted tidal curve?
Fig. 8	You probably don't need the TKE dissipation rate colorbar going as low as 10^-12…. this is essentially unimportant noise. I would constrain to 10^-10 or even 10^-8 to better emphasize where the strong turbulence is. Also, the MSPE panel is probably not necessary as long as you explain in the text why data is missing, which you have. Going back to my comment on making contours of the current velocities, you should add them to this figure (after removing MSPE) and moving this to Fig. 6. Then you can describe currents and associated turbulence together. Alternatively, you can replace MSPE with contours of shear squared (S^2 = du/dz^2+dv/dz^2) to check how vertical velocity shear aligns with turbulence. Lastly, make the colormap of the vertical velocities red-blue so we can easily identify what is upward and downward moving velocity.
263-270	If this is true, please add an appendix or supplemental material to confirm to the reader. Typically, MicroCTD estimates are more reliable than those from an ADCP. It is strange to throw out those profiles here. Further, the thesis being referred to sharing this information has a link that does not work.
Fig. 10	Panel (a) should be at the top with succeeding panels beneath. I see now the shear squared which is good. I still think shear should be shown with turbulence, as they are linked. I don't think the current vectors are helpful on this map (as it is not oriented with the cardinal directions) and are better shown as red-blue colormaps as I described previously. Also, showing u and v here again is redundant to Fig. 6. Combine like-things rather than describe them twice in two different places.
305-325	Haven't current speeds and direction already been discussed? This sections is quite redundant and should be integrated into the results where velocities were already discussed.

330-332	This delta U_L1-L2 variable is not clear. Is it the difference in U_L1 and U_L2….it doesn't seem that way considering it remains well above 0 in Fig. 10.
337	Can you describe why the frontal Reynolds number is being calculated. What is the relevance to your story.
Table 1	If this information is presented in Fig. 10, then it seems redundant to include in a table as well.
357	Equation for buoyancy frequency?
358	Interpolation should be from the finer resolution to coarser: i.e., N^2 interpolated onto S^2 depth vectors.
Fig. 12	You already showed S^2 in Fig. 10. These are more unnecessary redundancies which take up figure space.
370-378	Ri can be greater than 0.25 and still have intense mixing. This is particularly true for convective instability driven mixing, where often Ri >1, and we would expect to be happening in the front (see Ivey et al., 2020: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020GL089455). I think your Ri profiles need to be smoothed more to get helpful info. By interpolating onto the coarser ADCP depth vectors rather than the finer CTD depths, this should help.
Eq. 3-5	Kind of an odd order to presenting these equations. Equation 3 uses Equation 5, so it makes more sense to have Equation 5 come before 3.
Fig. 13	This is too much to look at. Can you average by group and not show every single profile? This would be helpful here and in other figures. Where are the depth labels on the bottom panel?
420-425	I am interested how your cleaned up Ri profiles compare to this metric. Ri can indicate where convective or shear mixing is expected as well. It would be valuable to present the two parameters together and discuss alignment or lack thereof.
420-430	Again….is 10 m "near-bed"? I don't think total depth was ever mentioned.
Fig. 14	ADCP TKE dissipation estimates were already presented way before this in Fig. 8….where it makes sense to show comparisons with the other TKE dissipation estimation methods. Combine or remove to eliminate more redundancy.
433	Elaborate on why these mixing efficiency values are notable. This would imply convective mixing, correct?
439-458	This whole backscatter section feels very abrupt and I am not sure why these results are being presented here. The figure is nice, but is it necessary? Cant this be incorporated into a previous figure/section?
Table 3	Is this the same information presented in Fig. 16? Eliminate if so.

482-486 These conclusions were never clear to me in the main text. I think they get lost in a sea of other information presented.