Dear Reviewer,

Thank you very much for dedicating time to review our manuscript, and for your clear and pertinent remarks. Please find our point-by-point response concerning both the major and minor comments. All modifications are given in blue in the revised manuscript.

Major comments:

1. Line 106 in page 5, the author mentions that all drifters were equipped with an anchor to allow them to drift with surface currents. However, it is not specified whether there were sensors to monitor the presence of the anchor or if there was an assessment of the anchor's stability in the marine environment.

Thank you for your comment. There were no sensors to monitor the presence of anchor on the buoys. All the buoys were recovered at the end of each campaign, which was limited to one or two days due to the high speed of currents in the eastern English Channel. No one drifter lost its anchor. We deployed our drifters for longer periods in other geographical areas. The anchor was present again after recovery. This proves that the equipment we used is of good quality.

Concerning the stability of the drogue at sea, we used professional equipment, anchors originally designed for sailing boats. Prior to the campaign, we monitored drifters with anchors at sea, and never noticed any problem with the anchors. It is worth noting that the Nomad drifters, manufactured by SouthTek (https://www.southteksl.com), are equipped with exactly the same anchors.

2. In the process of optimizing model evaluation, this study extensively utilized fused data sources to assess fusion outcomes. However, such an evaluation process may not objectively reflect the effectiveness of the fusion method and the characteristics of the real ocean current field. Given the scarcity of high-resolution observational data in the study area, buoy data can be partitioned into training and validation sets. The "cross validation" method mentioned at line 285 is an effective approach for dataset partitioning, which could be considered as a core method to extend across various stages of model evaluation, illustrated through figures and charts.

We thank the Reviewer for this comment which is in line with the comment 2 of the Reviewer 3. We agree that using fused data to assess the results of fusion may not always objectively reflect the effectiveness of the fusion method. However, "validation without exclusion" (see response below to major comment 3) enables to assess the quality of our results and the effectiveness of the fusion method objectively.

In addition, and again we agree with the Reviewer on this point, the "cross-validation" method is probably the best way to evaluate the performance of the data fusion technique. However, it requires larger amount of high-resolution observational data (more drifters, or remotely sensed data, for example) that we did not have. A paragraph has been added to the discussion in the revised version of the manuscript (lines 446-451) to address this issue.

3. Line 285 in page 12, the author mentioned the "cross validation experiment," where one drifter was used for model optimization and the others for validation. However, the cross-validation method imposes high requirements on the randomness and independence between the training and validation sets, often employing random sampling. Can simply selecting one drifter as the training set meet these requirements? For example, considering that drifters released during the same period exhibit highly similar and repetitive trajectories due to minimal differences in release times and geographic distances, would the cross-validation method remain effective in such scenarios?

We agree with the Reviewer on this point. We did not use a random set for training; therefore, the term "cross-validation" is not appropriate. To meet the Reviewer recommendation, we applied another technique of validation, which is "leave-one-out validation". It provides a much less biased measure of error compared to the previously used method of validation, because we repeatedly fit the model to a dataset that contains n-1 drifter trajectories. More specifically, the method involves using one drifter trajectory as a control data set and other trajectories for optimization. The control trajectory is repeatedly replaced during the validation exercise. At the end, the mean relative error of optimization was reduced by 22% for S1 and by 36% for S2. A new text describing the validation technique and the results has been added on page 14 (lines 327-333) of the revised manuscript.

Even if the drifters are released with minimal differences in time and geographic distances, their trajectories are different, in particular, in the Cap Griz Nez region, characterized by a complex current structure and large velocity (see Fig. 9b). This variability ensures that the leave-one-out validation method remains effective. The observational data set provide a solid basis for both optimization and validation, demonstrating that the model improvements are not simply coincidental but rather the result of effective capturing of the underlying physical processes.

Minor comments:

1. Line 103 in page 5, the construction of laboratory-made drifters was described. It would be beneficial to also introduce the construction of Nomad drifters and provide a comparison between these two types of drifters.

Thank you for your pertinent comment. The description of the coastal Nomad drifters manufactured by SouthTek was added line 106-107 of the revised manuscript. For this study, we assumed that differences between the two types of drifters were negligible, which was added line 111-112 of the revised manuscript.

2. Line 106 in page 5, the author mentioned that all drifters were equipped with an anchor of 0.5 m long positioned in the water layer between 0.8 and 1.3 m depth. Would it be feasible to calculate the overall center of buoyancy depth, including the anchor?

Thank you for this remark, the overall center of buoyancy depth has been estimated to 1 m and this has been modified in the revised manuscript.

3. Line 108 in page 5, the author mentions that observed surface current velocities were estimated from the drifter trajectories. Please describe the specific method used.

Thank you for your comment, this has been clarified in the revised manuscript lines 114-115.

4. In Figure 1, would it be better to align the display area of Figure 1b with the measurement area outlined in Figure 1a?

Thank you for your suggestion. We modified Figure 1b to show that it corresponds to the red rectangle in Figure 1a.

5. Issues with image consistency. For example, the image sizes and font sizes of axis labels in Figures 1a and 1b are inconsistent. Additionally, the positioning of subplot identifiers in Figures 1 and 9 is inconsistent.

This has been addressed in the revised manuscript, thank you for your pertinent remark.