Dear coauthors,

Your paper offers valuable insights into the drivers of Laptev Sea dynamics and interannual variability in salinity and temperature. It provides evidence that the salinity and temperature signatures agree in different reanalyses and satellite products under different wind regimes. Addressing the major comments proposed will improve the clarity and robustness of the research, enhancing its contribution to the scientific community.

We thank you for your positive and in depth review and agree that implementing suggested changes will strengthen the paper.

Major Comments:

The focus of the paper:

The stated objective of the paper is to determine the drivers of the interannual variability of the Laptev Sea dynamics. However, a significant portion of the paper is devoted to the validation/intercomparison of satellite Sea Surface Salinity (SSS) products. While the effort to validate and compare these products is commendable, it appears to dominate the narrative, diverting attention from the primary objective of identifying the drivers of Laptev Sea dynamics.

To address this concern, I see two options:

a) Dividing the current study into two separate papers, each with a distinct focus and stating clearly the objectives (Validation and Intercomparison of Satellite SSS Products / Drivers of Laptev Sea Interannual Variability in Salinity and Temperature).

b) Focus on the primary objective during the narrative and if you feel that the validation/intercomparison of satellite SSS products is an essential part of the methodology, it would be beneficial to include at least one example figure showcasing the different products. Additionally, providing information on the p-value of your correlations, bias, and spectral analysis to assess the effective resolution of the products will improve the methodological rigor and transparency of the study.

We agree that the validation distracts from the main objective. The abstract and introduction will be shortened to help more clearly highlight the focus of the paper. The section validating in-situ data will be moved to help better emphasize the main objective.

Methods:

1. In subsection 2.2.2, it is not clear why the analysis is not performed with all four satellite products. To ensure the robustness of the study, it would be beneficial to explain the reasons for the exclusion, if any, of certain products in the analysis.

The reasoning behind the omission of two products will be better justified earlier in the text. Primarily, the omission was based on the correlation and RMSD values calculated for each product, so moving much of the validation section out of results will allow earlier discussion of the choice of products used in the methods section.

2. The temporal resolution of satellite SSS products is a critical factor when studying the dynamics of a region like the Laptev Sea, where rapid changes can occur over short time scales. If you choose not to use 3-day or available 8-day satellite Sea Surface Salinity (SSS) products, providing a clear and well-justified argument for this decision is crucial.

The reasoning behind the choice of data will be clarified. The shift towards one main objective of understanding plume interannual variability, and the de-emphasis on validation should also help to clarify the choice of data.

3. The paper mentions a validation/intercomparison of satellite SSS products. To strengthen this aspect, I suggest including an example figure showing the different products for comparison. Additionally, information on the p-values of your correlations, bias, and spectral analysis to determine the effective resolution of the different products should be included.

If reference is made to all four products throughout the main body of text, a figure containing all four products will be included.

4. The decision to use the median of the products for analysis should be justified. It might be more appropriate to use the product that best aligns with in-situ information, has a higher spatiotemporal resolution, or realistically agrees with the expected dynamics of the area. If the median approach is retained, the reasoning behind this choice should be elaborated.

If the median product is still used, its use will be justified.

Results:

1. The results section lacks concrete analysis and tangible results to support the discussed relationships with the Arctic Oscillation Index, and river runoff.

Further analysis on the AOI and lagged correlations with river runoff will be conducted.

Discussion:

1. The discussion/conclusion emphasizes that wind is the dominant driver of offshore or onshore Lena River plume transport. To strengthen this claim, the study should include additional evidence from the analysis correlating composites and other drivers, for example, the river runoff, ice melting, etc.

A lagged correlation analysis will be conducted between eastward wind stress, river runoff, SSS, SST and sea ice concentration. This will help to justify that runoff is not a dominant driver of variability in SSS.

2. Line 415: your claim that because GLORYS12V1, which doesn't include interannually varying river runoff, replicates the SSS pattern well as compared to satellite SSS, suggests that variability in river runoff is not a significant contributor

to the interannual variability in GLORYS12V1 SSS. However, GLORYS12V1 utilizes in-situ SSS data, which is how it reproduces the SSS pattern. This does not negate the potential influence of river runoff on interannual SSS variability. The absence of river runoff does not imply that it has no impact on SSS dynamics. Moreover, the correlation between GLORYS12V1 and satellite SSS patterns does not necessarily indicate causation, river runoff could influence Laptev SSS variability, if you make this argument, the paper should conduct a more comprehensive analysis that explicitly investigates the impact of river runoff on interannual SSS variability.

Lagged correlations with river runoff will be conducted.

3. In Section 4.1, there is a discussion about correlating composites to river runoff, but no results are shown to support the argument. The analysis should be included to provide tangible evidence for the discussion. Additionally, the use of the BEC SSS should be addressed if you want to compare your results to the study of the product as in Umbert et al. 2021, who uses this product. The absence of BEC SSS figures and the correlation against river runoff data should be explained to ensure a coherent argument.

We will include a comparison figure of all four satellite products or at least ensure that the reasoning behind our choice of products is more clear earlier in the methods section. The expanded analysis of river runoff will be compared with reference to Umbert et al., 2021

Figures:

1. Figure 1, it is unclear why the wind over plots are not the mean for September, similar to the salinity over plots. Providing an explanation for this difference would enhance the figure's clarity and interpretation.

The choice of wind metric will be better explained in text. Results from the lagged temporal correlation analysis between eastward turbulent surface stress and salinity (see Figure 1 below) should help to explain this choice.

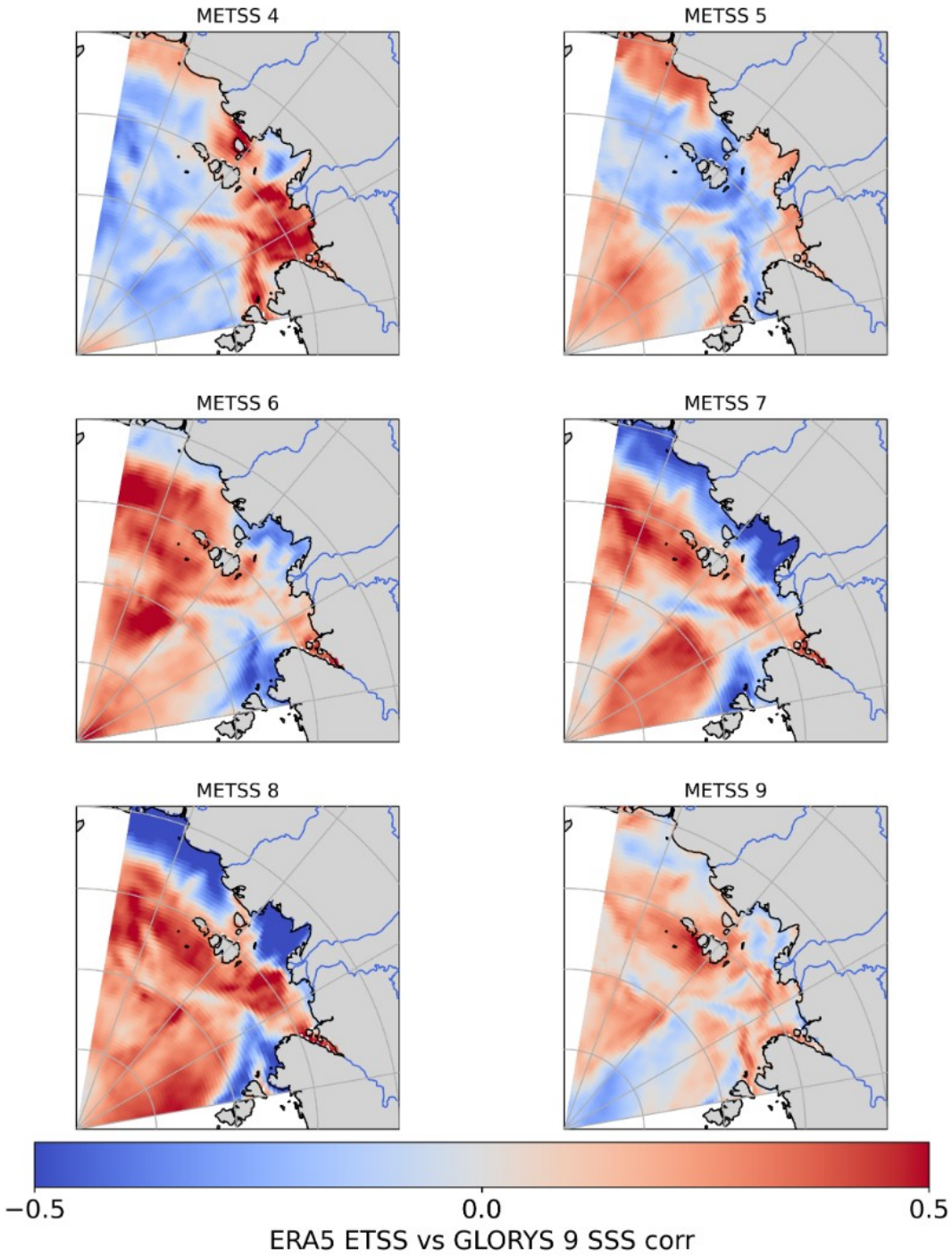

Figure 1: Lagged temporal correlation between ERA5 eastward turbulent surface stress in April-September (4-9) and GLORYS September SSS

2. In Figure 3, I strongly suggest to include the other two satellite SSS products

Including the other two products will be considered and balanced with wishing to not overcomplicate the figure. Including all four products in another figure (possibly figure 2) may help to illustrate why it is not beneficial to include all four products here.

Minor comments:

Introduction

I suggest including a reference to Umbert et al. 2021 as it also uses SMOS SSS to characterize the Lena River plume in the Laptev Sea, which could provide valuable context and potential links between the two studies.

Reference to the Umbert et al., 2021 paper will be made in the introduction as well as in the discussion.

Methods

In line 280, it is mentioned that the median product is generated using GLORYS12V1, LOCEAN SMOS, and both SMAP products. However, it seems there might be a discrepancy, as it was previously stated that there were four satellite products. This inconsistency needs clarification.

The median product is only calculated from the four satellite SSS products. It is then compared with GLORYS SSS. The wording in this line is unclear so will be altered for clarification.

Results

Section 3.3 is missing, but it is referred to in the text as "3.2 3". The authors should correct this discrepancy and make sure the section numbers are accurate.

The section will be correctly renamed to resolve this.

In Table 1, it is puzzling that the median product has more observations than any of the individual products. The authors should address this discrepancy and provide an explanation for the data variations to ensure the table's accuracy and consistency.

If we chose to keep the median, the reasoning behind this will be clarified.