

Authors Comments 2

_____ *Anonymous Referee comment*

_____ Authors comments

RC2: 'Comment on sp-2025-7', Anonymous Referee #2, 06 May 2026

Review of the manuscript “Long term trends and variability of the mixed layer depth in the Baltic Sea”.

General comments

This manuscript reports on studies of long-term trends in MLD in the Baltic Sea, and also discusses the implications for the ecosystem. It is a nice and fairly well-written manuscript that is easy to read. The figures are also well done, though I have a request for either an additional figure or a remake of one of the figures (the MLD trend; see my specific comments below). I recommend the paper to be published after minor corrections.

Specific comments

l. 9: “...reanalysis data set...”

Will be corrected

l. 20: “...more stratified which...”

Will be corrected

l. 49: “...Baltic proper...” (...and many other places in the manuscript. Many people write proper with Upper-case P, but grammatically it should be lower-case p, as proper is not part of the name.

Example: France proper means mainland France, i.e. not including French Guiana.

We thank the reviewer for this comment. We agree that “proper” is normally written in lower case when used as a general adjective referring to the central or mainland part of a geographical region, excluding peripheral regions, bays, or sea areas. However, in the present manuscript, “Baltic Proper” is used as a formal geographical name for a Baltic Sea subregion, not as a descriptive phrase. For example, Rolff et al. (2022) use “Baltic Sea proper” in the article title in the grammatical sense, while the term “Baltic Proper” is used consistently with a capital “P” within the main text when referring to the recognized Baltic Sea subregion.

The capitalized form “Baltic Proper” is used in established marine nomenclature, including the Marine Regions Geographic Identifier (MRGID), as suggested in FAO (2019), and is also widely used in Baltic Sea oceanographic literature. We therefore retain “Baltic Proper” with a capital “P” throughout the manuscript for consistency with accepted regional naming conventions.

MRGID: <https://marineregions.org/mrgid.php>, last accessed: 11 May 2026.

FAO. 2019. Aquatic Sciences and Fisheries Information System. Geographic Authority List. ASFIS-7 (Rev. 3). Rome. Licence: CC BY-NC-SA 3.0 IGO.

I. 87-89: Perhaps you could rewrite this paragraph a bit, to emphasize that the validation was done outside of this paper, and also comment on the result of the validation (e.g. that most validation stations are in open water and that the really deep MLD often seem to be underestimated by the model. The trends that you calculate could still be okay, as I see it.

Will be rewritten as suggested

I. 90: "The annual cycle..."

Will be corrected

I. 91: "...for the whole reanalysis period..."

Will be corrected

I. 94: "...10-20m during the period..."

Will be corrected

I. 95: "...80 m deep during the reanalysis period..."

Will be corrected

I. 96: "...until the end o summer..."

Will be corrected

I. 97: "...for the reanalysis period..."

Will be corrected

I. 98: "...comparison of the MLD product..."

Will be corrected

I. 104: "...more energy is required..."

Will be corrected

I. 107: As far as I can see, the variable names "SA" and "CT" are not used anywhere else, so I suggest to simply leave them out (but of course keep the words "Absolute Salinity" and "Conservative Temperature")

Will be corrected

I. 113: "where g is..." (lower-case "w")

Will be corrected

I. 117: What do you mean by "streaming statistics"?

We will clarify and rewrite.

I. 123: "...derived from the high-resolution..."

Will be corrected

I. 121-133: This figure caption is too long, in fact I think there has been a mistake here. Everything except the first sentence should be in the main text, referring to the figure.

We will correct the text according to the suggestion

I. 147: Error in figure heading for subplot "f)": Should be Total precipitation.

Will be corrected

I. 151-152: I think there is a mistake here. The areas shaded in red must be the regions with insignificant trends, right? And the areas shaded in green are the regions with significant trends?

Will be corrected

I.167: "...seasonal fluctuations..." ("s")

Will be corrected

I. 173-174: Judging from the figure I would say Oct-Mar and Jun-Aug, respectively.

Will be corrected

I. 255: How can you see a "trend toward stronger stratification" in figure 3? Which sub-panel?

The different (discrete) colormaps will be used and the sentence will be rewritten in revised manuscript.

I. 119: I would suggest changing the section heading to simply Results, and add a new section heading called Discussion between I. 229 and I. 230. Or keep it as it is; just a suggestion...

We considered separating the sections into distinct "Results" and "Discussion" chapters. However, we decided to retain the combined "Results and Discussion" format because the manuscript is strongly process-oriented, where the interpretation of the observed spatial and temporal MLD patterns is closely linked to the presented results themselves.

In particular, many of the findings require immediate physical interpretation in the context of Baltic Sea stratification, sea-ice decline, buoyancy forcing, and regional mixing processes with corresponding references. Separating the discussion into an independent section would lead to substantial repetition of the same patterns and mechanisms, making the manuscript more redundant and interrupting the continuity of the scientific narrative.

The current structure allows observational results and their mechanistic interpretation to be presented together in a coherent way, which we believe improves readability and helps maintain a clear connection between the identified trends and their underlying drivers. This format is also commonly used in

oceanographic and climate-related studies where interpretation is tightly coupled to spatial analysis and process understanding.

I. 266, 276, 279: You discuss a trend toward a shallower MLD during winter, but figure 3 a) shows the MLD trend for the year as a whole, as I understand it. If the winter trend is most important, perhaps fig 3 a) can be remade to show that instead of the annual trend? Or do you need both for the discussion?

We will add seasonal trends to revised manuscript and will rewrite text accordingly.

We thank the reviewer for the constructive suggestions.