

Referee #2

The authors thank the referee for careful reading of our manuscript, useful comments and suggestions.

Referee: The discussion falls quite in the short side. The role of horizontal resolution in submesoscale processes is not discussed (rather it is discussed the impact of submesoscale processes (upwelling/downwelling) in the UML structure). Being the lack of field data a problem, a deeper discussion on model results is required.

Authors: The discussion was revised and extended (see reply to the referee #1)

Referee: One of the paper's conerstone is the use of MODIS SST data to evaluate the performance of the different runs in reproducing the stratification. However, it is not enough justified in my opinion. This interesting approach demands more argumentation.

Authors: SST fields can be considered as integral of subsurface dynamic but for example we can not estimate directly a depth of the thermocline from them. Alternatively the comparison of the modeled frontal structure at the sea surface and MODIS data during an upwelling event (lifting water from under the UML) could indicate how well the model reproduces stratification.

This clarification will be placed in the paper P2406 L19 after the sentence "At the same time, the SST fields can be used as an indicator of vertical mixing processes".

Referee: I suggest adding a figure (the first one) with the geographical setting.

Authors: The figure was added (see reply to the referee #1)

Referee: P2396 L6 "were" instead of "where" L17 add "water" after "fresh"

Authors: It's accepted.

Referee: P2397 L3 delete "the" before "three", L15 difficult to assess "best existing", I would suggest "most advanced" L15 delete "scientific"

Authors: It's accepted.

Referee: L16 which mean temperatures are you referring to? Daily mean, monthly mean, ...?

Authors: "mean" refers to the difference. We rephrased the sentence: "For example, generally the hind-cast temperatures differ from observations by less than 1–2°C..."

Referee: P2398 L11 add "the" before "thermohaline" L13 "believe" does not sound scientific, I suggest "hypothesize" L15 add "that" before "submesoscale" L17 "contribute" instead of "act" L17 delete "ocean"

Authors: It's accepted.

Referee: L21 Which studies are you referring to? Cite, please. If they are Sokolov and Zhurbas change the place of the reference.

Authors: The reference is replaced by "Zhurbas et al., 2008; Sokolov, 2013".

Referee: P2399 L2 "estimating the contribution" instead of "learning how"... "contribute"
L7 "The traditional" instead of "Traditional" L15 delete "a" before "many" L17 "for"
instead of "on"

Authors: It's accepted.

Referee: P2400 L17 horizontal resolution better in degrees

Authors: We decided not to change the unit, because $0.0041(6)$ degrees = 0.25 min -
it's hard to grasp.

Referee: L22 "...salinity fields from the..." L23 "...the entire GOF with the open..."

Authors: It's accepted.

Referee: P2401 L10 Reword the sentence as "Convective mixing can be parameterized
in NEMO by (1)..." L11 Expand the meaning of TKE (first appearance) L13 Expand the
meaning of GLS L15 "for" instead of "to a model of"

Authors: It's accepted.

Referee: L24 and Eq (1) Is it the same l_c than l ?

Authors: l_c replaced on l_ϵ

Referee: P2402 L4 "specified" instead of "designed"

Authors: It's accepted.

Referee: L14 "additional condition" better than "extra assumption"

Authors: We have retained the original version "... adds an extra assumption" in order to
avoid repetition of the word.

Referee: L19 "displace" instead of "travel"

Authors: We have retained the original version because of the same meaning.

Referee: Eq (7) ", " before l_{dwn}

Authors: It's accepted.

Referee: Eq (7) Is it $e_3 = 1$ m for all k-levels?

Authors: It's right for all k-levels except for bottom layer.

Referee: P2403 Eq (9) ", " before l_{dwn} L8 delete "its"

Authors: It's accepted.

Referee: L11 Not very clear what authors pretend to say. Could it be better "...arbitrarily
increases...?"

Authors: Yes, it's right. "...arbitrary increase" replaced by "...arbitrarily increases".

Referee: P2404 L14 "was" instead of "were"; 1st and 31st L15 add "surface" before "heating"

Authors: It's accepted.

Referee: P2405 L4 delete "stated"

Authors: "stated" replaced by "started"

Referee: L6 Do you mean hypothetical?

Authors: Yes, it is changed.

Referee: Fig.1 Show the N-S or indicate Estonian and Finnish coasts.

Authors: It is south-north cross section. Clarifications will be added to the text and figure caption.

Referee: P2406 L25 "difference" instead of "gradient"

Authors: It's accepted.

Referee: P2407 L9 In page 2395 it was University, not Institute.

Authors: "Russian state hydrometeorological institute" replaced by "Russian State Hydrometeorological University"

Referee: L13-L14 I guess there are longitudes, not latitudes

Authors: "Lat" replaced by "Lon"

Referee: P2408 L25 "pattern" instead of "paten"

Authors: It's accepted.

Referee: P2409 L10-L11 "turbocline" a few times

Authors: "also maximum turbolcline and thermocline depths" replaced by "the same"

Referee: L12 Fig 6 captions indicate different dates

Authors: Fig 6 captions where corrected according to the main text.

Referee: P2410 L3 add "is" before "manifested"

Authors: It's accepted.

Referee: L16 Is it true annual cycle?

Authors: "over the annual cycle" replaced by "during the spring-summer season"

Referee: P2412 L4 units for viscosity and diffusivity values?

Authors: The units " m^2s^{-1} " have been inserted.

Referee: P2415 Umlauf and Burchard (2005) is likely to be Cont. Shelf Res.

Authors: Yes, you are right. The reference is changed.