# Authors responses to reviewer #1 comments

**Characteristics of ocean mesoscale eddies in the Canadian Basin from a high resolution pan-Arctic model**

Noémie Planat, Carolina O. Dufour, Camille Lique, Jan K. Rieck, Claude Talandier, L. Bruno Tremblay

**Manuscript Reference Number: 2025-3527**

Date: January 22nd, 2026

In the following, all page numbers refer to the revised manuscript.

## General comments

**Reviewer:** The authors have done a good job revising their manuscript. At this point, I just have some minor revisions to suggest, mainly related to expanding the discussion of the study's limitations in the paper's summary.
**Authors:** We thank the reviewer for their positive appreciation of the revised manuscript and for their suggestions which we address below.

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## Minor comments

**Reviewer:** In the abstract when the authors mention the eddy numbers, it might be good to clearly indicate that the majority of them are short lived.
**Authors:** The recommendation has been followed (lines 10-11):
*On average, eddies travel* 11 *km, have a radius of* 12.1 *km, and last* 10 *days, although the majority of eddies are short-lived (*50% *of eddies last less than* 4 *days).*

**Reviewer:** Line 80: In the vertical. **Authors:** Done, thank you.
**Reviewer:** Line 113: On the other hand. **Authors:** Done, thank you.
**Reviewer:** Line 180: Mars sais en Francais :-) – March. **Authors:** Done, thank you !

**Reviewer:** Line 486 – Are the authors sure that there is a climate signal for the eddies, or might it also be related to the model being better able to resolve eddies as the Rossby radius increases.
**Authors:** We agree with the Reviewer that the change in the Rossby radius over the course of the simulation may impact the reported increase in the eddy population density. However, we believe that this impact is small. Indeed, in the Beaufort Box (previously referred to as the Canada Basin; see response to the Editor), and more generally around the Beaufort Gyre area, the increase in the Rossby radius between the first and last decades of the simulation remains relatively small ($<$ 1km, Fig. I, II). Only along the Canadian Archipelago and in the Nansen Basin does the Rossby radius increase by $1-3$ km, but these regions correspond to areas where the density of eddies detected is small. To put these increases in perspective, an increase of radius for a circular vortex from 10 km to 11 km increases its area by 5 units of grid cell area approximately. In addition, the number of eddies increases at all levels despite contrasted changes in stratification across the water column (e.g, in the Beaufort Box, the stratification increases in the pycnocline layer but decreases in the surface layer ). Finally, if we look at eddies whose sizes fall above the detection threshold (i.e., above the Rossby

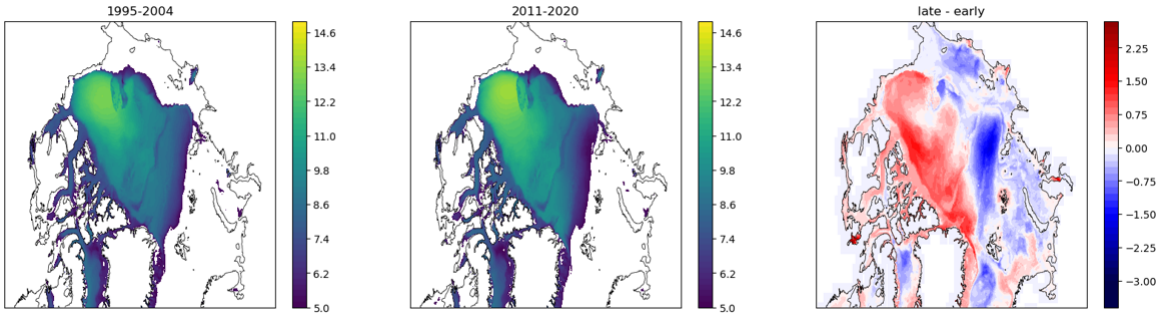


Figure I: Rossby radius for the first decade (left) and last decade (middle), and the difference between the two (right) computed following the simplified equation introduced by Chelton et al. (1998) and compared with the exact formulation in the Arctic Ocean by Nurser and Bacon (2013).

radius) at all times during the simulation (e.g., eddies with radii between 15 and 20 km or those between 20 and 30 km), their density increases throughout the simulation. We have added a comment to elaborate on this result that appears on lines 549-553:
*Along with the increase in the eddy population, between the first and last 5 years of the simulation, eddies become bigger (+0.7 km), travel further (+2.2 km) and carry relatively warmer waters (+0.0027°C; Table 2). These changes are in line with an increased stratification, which increases the Rossby radius. We estimate a change of +0.5 km for the Rossby radius in the BB between the first and last decade of the simulation. This increase in the Rossby radius enhances the effective resolution of the model, potentially leading to a higher number of eddies detected. Yet, the change of effective resolution, defined as $R_0/ds$ (where ds is the maximal grid spacing), is only significant in the northeastern side of the domain (not shown), a region where we detect overall very few vortices (for instance, see Fig. 7)*

**Reviewer:** Need to end with a more detailed discussion on model limitations and the likely need to look at question at higher resolution to confirm results.
**Authors:** We have added a more detailed discussion that appears in the second-to-last paragraph of the section (lines 721-740):

*This study is a first attempt to perform a systematic and quantitative characterization of mesoscale eddy properties in the Canadian Basin. Yet, an evaluation of the modelled eddy characteristics against observations is hampered by the incomplete resolution of the mesoscale spectrum in our 1/12° model at these high latitudes, given that most features identified with moorings, ITPs or satellite fall between the meso- and the submeso-scales [Cassianides et al., 2023, Kozlov et al., 2019]. Therefore, these results should be reproduced by a model with*

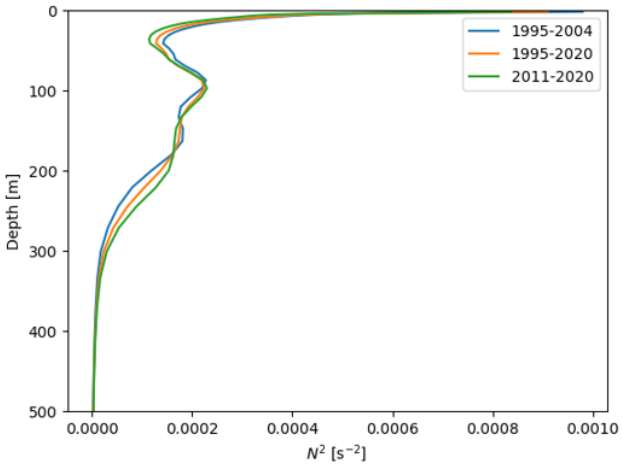


Figure II: Brunt-Väisälä frequency squared ($N^2$) averaged over the Beaufort Box (BB).

*higher resolution to be confirmed and compared with observations. The increase in horizontal resolution should be accompanied by an increase in vertical resolution that would not only improve the representation of the (sub)meso-scale features, but also improve the representation of some of the processes sourcing these eddies, especially in the ML, and therefore more accurately represent the variety of features found in the Canadian Basin [e.g., Manucharyan and Timmermans, 2013]. A comparison of eddy characteristics between model and observations should account for the typical sampling biases in observations, such as the spatial distribution of the ITPs and the seasonality of the satellite acquisition of ocean surface properties due to the sea ice cover [Kozlov et al., 2019]. This comparison could be undertaken with an Observing System Simulation Experiment and would help further our current understanding of eddies from observations and quantify the biases and uncertainties associated with the available observations. Finally, the other important limitation of our study lies in the approach used for the detection of eddies, which lacks a vertical dimension. We believe implementing a 3D reconstruction of eddies could form a substantial improvement of the present work, and would allow us to tackle additional questions regarding the formation mechanisms of the mesoscale eddies. In particular, one would be able to investigate the transport of the mesoscale eddies along isopycnals and their subduction at depth, as suggested in Fig. 11 and in the literature [Manucharyan and Timmermans, 2013], or the links between isopycnal displacements and eddy generation [Cassianides et al., 2023].*

# References

*Angélina Cassianides, Camille Lique, Anne-Marie Tréguier, Gianluca Meneghello, and Charly De Marez. Observed Spatio-Temporal Variability of the Eddy-Sea Ice Interactions in the Arctic Basin.* Journal of Geophysical Research: Oceans*, 128(6): e2022JC019469, June 2023. ISSN 2169-9275, 2169-9291. doi: 10.1029/2022JC019469. URL* https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022JC019469*.*

*Igor E. Kozlov, Anastasia V. Artamonova, Georgy E. Manucharyan, and Arseny A. Kubryakov. Eddies in the Western Arctic Ocean From Spaceborne SAR Observations Over Open Ocean and Marginal Ice Zones.* Journal of Geophysical Research: Oceans*, 124(9): 6601–6616, September 2019. ISSN 2169-9275, 2169-9291. doi: 10.1029/2019JC015113. URL* https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2019JC015113*.*

*Georgy E. Manucharyan and Mary-Louise Timmermans. Generation and Separation of Mesoscale Eddies from Surface Ocean Fronts.* Journal of Physical Oceanography*, 43(12): 2545–2562, December 2013. ISSN 0022-3670, 1520-0485. doi: 10.1175/JPO-D-13-094.1. URL* http://journals.ametsoc.org/doi/10.1175/JPO-D-13-094.1*.*

# Authors responses to the editor's comments

**Characteristics of ocean mesoscale eddies in the Canadian Basin from a high resolution pan-Arctic model**

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## General comments

**Reviewer:** The article has been substantially re-written, which makes the points a bit clearer (although I still don't think it goes far enough). The re-writing however introduces quite a few internal inconsistencies that I caught on a not entirely careful read, to be point where in my opinion it ends up being worse the initial submission... (so in that regard I disagree with the referee). Some of these are noted below; the authors probably do want to go through it a few more times, as I make no promises I have caught everything (since I didn't do a very careful read). The line numbers refer to the line numbers in the tracked manuscript version.
**Authors:** We thank the editor for the detailed review of the paper. We have addressed all comments below and have carefully proofread the manuscript.

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## Major comments

**Reviewer:** It's a minor decision so it will just come back to me. The science points that need addressing for me are the Lagrangian vs Eulerian usage, and baroclinic eddies having no/little buoyancy signature. The framing could be adjusted somewhat (see suggestion), but that is not the deal breaker for me (the above are though).
**Authors:** We have adjusted the framing following the editor's suggestions, and hope the clarification of Eulerian vs Lagrangian usage, as well as the discussion regarding the temperature and salinity anomalies, will address the remaining scientific questions. These modifications are detailed below.

**Reviewer:** line 190: "Lagrangian framework" is misleading, because Okubo-Weiss is an Eulerian measure. What is being done here is a detection by an Eulerian framework, but some quantities that are Lagrangian in nature such as implied eddy centre (of mass? area/volume?) are provided. It is also contradictory with what is written in line 298 later in the article.
**Authors:** To address this comment, we have removed the mention of "Lagrangian framework" in the introduction. It is now only mentioned in the Method section when opposing Lagrangian and Eulerian detection methods.

**Reviewer:** line 737: The lack of buoyancy signature seems suspicious/contradictory, since baroclinic eddies (by the definition of "baroclinic") requires them to have a buoyancy signature right (baroclinic torque would be $\nabla p \times \nabla \rho$, but no buoyancy anomaly means $\nabla \rho = 0$ so there is no baroclinic torque...)? This either implies they are not in fact baroclinic (e.g. horizontal shear instabilities), the detection is not really detecting geostrophic eddies that

this paper is supposed to be centred around, or some other thing. This one needs a serious attempt at commenting now that it has been mentioned...

**Authors:** We thank the editor for pointing out this issue. Indeed, potential density anomalies should be non-zero for all detected vortices that form through baroclinic instability. However, these anomalies are possibly very small, especially in the centre of the basin, where weak gradients of temperature and salinity are expected to generate the vortices. Quantifying the anomaly itself is not trivial, as it depends on what one considers to be the eddy "environment". Therefore, we have designed the metric used to quantify "significant anomalies" to robustly detect and report the strongest anomalies. This metric is therefore restrictive as it does not quantify the weakest anomalies. We believe the use of this metric is the reason why we do not find a density anomaly for each eddy.

We have added a few lines in the methodology (lines 333-339):

*The properties of the eddy environment are defined by spatially averaging over a box that we take to be $n = 3$ times larger than the eddy dimensions in $x$ and $y$ directions (thus not of identical size along both directions) and from which we remove the eddy area. We note $\Delta X = X_i^{eddy} - X_i^{env}$ the anomaly of property $X$ at the time of eddy generation $i$. If two eddies develop next to each other, they will become each other's environment as we do not use a 2D eddy mask. In the interior of the basin, the gradients of density that may generate eddies are generally small, and so is the density anomaly of each eddy. To increase the robustness of the quantification of these anomalies, we choose to report only on the strongest anomalies.*

The abstract has been reformulated as (lines 20-23) :

*The vast majority of eddies have a weak temperature and salinity signature with respect to their environment, although a significant portion of the long-lived eddies, located along the Chukchi shelf break, have a relatively large temperature anomaly and penetrate into the Beaufort Gyre, thus suggesting a mechanism for the penetration of heat into the gyre.*

We also have modified the wording of the discussion section to recall this limitation (lines 624-625):

*In addition, the majority of eddies do not have a significant temperature nor salinity anomaly relative to their environment, where significant only accounts for the strong anomalies. Nevertheless, some non-negligible anomalies are visible along the shelf in the surface layer (Fig. 6e,f)*

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## Minor comments

**Reviewer:** general formatting: Copernicus now only offer reduced copy-editing. There is still type-setting available, but I am not sure various formattings, spellings, bibliography entries etc. are checked for, and there are a whole load of things I spotted below that the authors should fix themselves.

**Authors:** We thank the editor for spotting the various editorial issues left in the manuscript. We have corrected them all, as well as read the paper carefully to remove remaining spelling and formatting errors.

**Reviewer:** general framing and the detection per level: As a dynamicist I still think the eddy detection per level is a misleading thing to do, but I note from this second reading that from the second paragraph in the introduction that there might not be an alternative choice as such with e.g. Ice-Tethered Profilers. Then I wonder if a better way of justifying the present choice taken in the article as something like

- ITPs detect and attribute eddy signals per depth
- since this work may want to compare with observational data, the present article takes the choice of comparing things per depth following established convention
- comment that it is known that geostrophic eddies can and do have a vertical structure/coherency, the present attribution probably over-estimates numbers, but that is just not an aspect considered in this work

I don't think it is a very good convention but it is a convention, which allows some deflection of the criticism. I just think rather than not saying anything and let other people pick at holes, it's probably better to highlight the issues, shut down that discussion and move on. This should/could be done at the introduction.

**Authors:** We agree that the detection per model level might be misleading. However, we believe it is the most robust way to detect eddies over the whole basin, and over the 26 years. Following the recommendations of the editor and reviewers during the first round of review, a comment on the vertical structure and coherency of the eddies was added to the introduction and at the beginning of the result section, as this vertical coherency is used to justify the analysis per layer. The choice of 2D vs 3D is clarified in the method section, where the detection is introduced. Finally, we removed from the paper most mentions of comparisons with observations, at the exception of an opening in the discussion. We thus believe that the approach of an eddy detection per level is clearly justified now. The 3D detection approach

is now mentioned at the end of the paper as a way forward to improve the characterization of eddies and the investigation of their generation and dissipation (lines 734-740) : *Finally, the other important limitation of our study lies in the approach used for the detection of eddies, which lacks a vertical dimension. We believe implementing a 3D reconstruction of eddies could form a substantial improvement of the present work, and would allow us to tackle additional questions regarding the formation mechanisms of the mesoscale eddies. In particular, one would be able to investigate the transport of the mesoscale eddies along isopycnals and their subduction at depth, as suggested in Fig. 11 and in the literature [Manucharyan and Timmermans, 2013], or the links between isopycnal displacements and eddy generation [Cassianides et al., 2023].*

**Reviewer:** sentence of line 145: Changing the sea-ice also changes the "generation" mechanism and instability characteristic at least from a linear point of view (because of changing the boundary condition), which is not discussed. This is also in one of Gianluca's papers (don't remember if it is the one cited here).
**Authors:** We agree with the reviewer and have modified the text to mention these changes in the second-to-last paragraph of the introduction (lines 136-137): *Likewise, changes in stratification and sea ice cover may have affected the eddy activity, characteristics, generation, and dissipation mechanisms. Notably, stronger baroclinic instabilities result from a less concentrated ice cover [Meneghello et al., 2021].*

**Reviewer:** sentence of line 147: Unnecessary leap-frogging sentence (and elsewhere). Why not just do something like "Eddies may persist beyond months at subsurface since they are shielded..." or similar?
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 166: "ALONG the same line..."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 162 and 154: "ON THE one hand..." and "ON the other hand..."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 177: comma after "Canadian Basin" to separate the two clauses.
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 179: Sentence beginning "In this paper..." defines what "eddy" is being re-

ferred to but should be much further up surely (although probably not right at the beginning of the introduction section). A ton of talk so far about "eddies" and only now are "eddies" being defined, which is out of order.

**Authors:** We now specify at the beginning of the introduction what we call eddy in the rest of the paper (lines 46-48):

*In the literature, the term eddy encompasses a broad range of definitions. Observations of eddies in the Arctic Ocean have, however, mostly reported on coherent structures identified as anomalies with respect to their environment. Thus, from now onwards, we will focus on these coherent structures.*

**Reviewer:** line 185: Remove "Besides" (don't need it) We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 195 and elsewhere: The paper uses "Canada basin" and "Canadian Basin (CB)", which seems more confusing than necessary (and annoyed me to no end actually particularly later on in the article when it seems to be used inconsistently). See later...

**Authors:** We understand the confusion around these two terms. To clarify, we have changed throughout the whole manuscript "Canada Basin (abbreviated CB in the manuscript)", which corresponds to an area within the Beaufort Gyre that we use for our analyses, into "Beaufort Box (BB)". The area is defined at the beginning of Sect. 2.1.2, lines 195-197:

*In the rest of this paper, the Canadian Basin is defined as the region between* $69-85°N$ *and* $108-180°W$*, thus fully encompassing the BG and its surrounding area. For analysis purposes, we define the Beaufort Box (BB), a region in the BG between* $73-77°N$ *and* $135-152°W$ *(see Fig. 1).*

**Reviewer:** line 204: Want mathfont for z**Reviewer:** (as "$z^*$")

**Authors:** We have modified the font accordingly.

**Reviewer:** line 208: Floating comma after "Fig. S1"

**Authors:** The comma has been removed.

**Reviewer:** line 211: "..., WITH AN ASSOCIATED COMPUTATIONAL cost that allows for decadal integradtionS."

**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 213: "...viscosity AND diffusivity..."

**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 215: Reference should be "de Lavergne" (lower case "d"). In bibtex this would be done with author = de Lavergne, C. and ...., or author = "de Lavergne, C. and ..."
**Authors:** We have modified the bibtex file following the recommendations of the editor.

**Reviewer:** line 222: Inconsistent unit formatting even within the same sentence (change to W m-1 K-1 or N / m2, choose one and stick with it).
**Authors:** Units have been adjusted to "m-1" formatting through the whole paper.

**Reviewer:** line 227: "At THE Bering strait..."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 237: comma after "observations"
**Authors:** We have added the comma following the recommendation of the editor.

**Reviewer:** line 238: "Across the Arctic... by AROUND -7% in September and -16% in March ON AVERAGE."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 240: French spelling floating around, "Mars" → "March"
**Authors:** We thank the editor for spotting this spelling mistake, it has been corrected.

**Reviewer:** (Elsewhere in the article some of the sentences have a French syntax style to it. That is not a big issue as such, but it sticks out at the moment at least to me.)
**Authors:** We have carefully read the paper before resubmission and hope that we corrected all the French syntax that might have been remaining.

**Reviewer:** line 242: "sea ice" what? (cover? thickness? volume?)
**Authors:** This has been modified to sea ice concentration.

**Reviewer:** line 242: comma after "model"
**Authors:** We have added the comma following the recommendation of the editor.

**Reviewer:** line 245: "...in THE supplementary MATERIAL"
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 248: "...successfully REpresents..."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 253: remove ", that allows and sustains this vertical temperature structure,", don't think that's needed.
**Authors:** The sentence has been removed following the recommendation of the editor.

**Reviewer:** line 254: comma after "BG"
**Authors:** We have added the comma following the recommendation of the editor.

**Reviewer:** line 255: I thought the preferred way nowadays is to not use "psu" as a unit (since concentration is dimensionless). Consider "g kg-1" or "g / kg", just be consistent with choices made elsewhere.
**Authors:** We thank the editor for this precision, which has been corrected to g kg-1 following the chosen unit format.

**Reviewer:** Eq. 1: Inconsistent forcing of "x" and "y" to e.g. line 289 and 290 (don't use , or whatever is being used here).
**Authors:** We thank the editor for spotting this formatting issue. We have modified the character style for $x$, $y$ in Eq. (1) and (2) (but not u, v that are kept as "roman").

**Reviewer:** line 292: "Eddies have to meet the following condition TO BE RETAINED IN THE CENSUS:..."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** Eq. 2: Inconsistent mathfont as above.
**Authors:** Adressed, see above

**Reviewer:** below eq. 2: $\alpha$ used but not defined here any more. Move some relevant text from below to be closer to eq. 2 (it's just some empirical user-specified parameter right, so just say it).
**Authors:** We have added after Eq. (2) the following sentence (line 267):
*where $\alpha$ is a threshold value typically chosen between 0.2 and 0.5 [Isern-Fontanet et al., 2003, Chelton et al., 2007, Pasquero et al., 2001].*

**Reviewer:** line 298: "Eulerian over Lagrangian approach" is currently internally inconsistent

with what is written in the introduction with "Lagrangian framework".
**Authors:** To clarify this point, we have modified the introduction to remove any mention of "Lagrangian framework". It is now only used when discussing the Eulerian and Lagrangian eddy detection methods.

**Reviewer:** line 308-309: If framing as "we take current approach to be consistent with what ITPs do" mentioned above, sentence here should probably be moved or repeated in the introduction also.
**Authors:** The paper is not an attempt to compare the eddy population of the model with that detected by ITPs. We are well aware of fundamental differences in the two populations, due to the model resolution, the lack of representation of mixed-layer instabilities by the model, etc. However, the 2D detection and tracking of eddies across coherent water layers is consistent with the model itself and bears similarities to the observations.

**Reviewer:** line 314: "have an elliptic shape" → "be elliptical in shape"
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 316: "...an eddy of ABOUT 7.5 to 10km..."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 321: suggest "...metrics investigated (THE mean eddy radius...) are robust to..." and remove an internal bracket, because the bracketed content is the subject of the sentence ("metrics") being expanded, and sentence makes sense without the bracketed content in principle.
**Authors:** We have modified the sentence which now reads (lines 292-294): *Sensitivity tests for $\alpha$ show that the vertical distribution of the metrics investigated (the mean eddy radius, duration, polarity $r_{C/T}$ i.e. ratio of cyclones to total number of eddies, and a proxy for the vorticity $|\Omega|$, see Sect. 2.2.3), are robust to changes of $\alpha$ from 0.1 to 0.5.*

**Reviewer:** line 328: "Similarly" → "Similar"
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 331: Comma after "eddies"
**Authors:** We have added the comma following the recommendation of the editor.

**Reviewer:** line 373: Either "...is said TO BE significant" or "...is significant" (remove "said")

**Authors:** The sentence now reads (line 345):
*Then, the anomaly $\Delta X$ is said to be significant if ..*

**Reviewer:** line 380 and later: Since the authors took the trouble to define "CB" why isn't it used here? Easy fix would be to have "Across the Canadian Basin (CB)" as a reminder, and then use CB throughout.
**Authors:** The confusion between Canada and Canadian has been solved as we now call Beaufort Box (BB) the area used for the analysis of the centre of the Beaufort Gyre (and previously named Canada Basin).

**Reviewer:** Table 1: Above point about "psu" as a unit (also Fig. 4 and elsewhere)
**Authors:** Addressed, see above.

**Reviewer:** Table 1: Do use "th" here probably, and elsewhere (e.g. line 396, Fig. 4)
**Authors:** We have modified the character style following the recommendation of the editor in Table 1 and the rest of the paper.
**Reviewer:** line 408: Probably "The vertical structure is CLOSE to the vertical structure..."
**Authors:** We have modified the sentence, it now reads (line 376):
*This vertical structure is similar to the vertical structure obtained from observations*

**Reviewer:** line 417: "...ARE FOUND, forming together the pycnocline layer."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 428: "follows" → "follow" (because "properties" is the relevant subject)
**Authors:** We have modified the sentence which now reads (lines 693-694):
*Within the top 85 m, about 6,000 eddies are detected every year. The properties of these eddies show a marked seasonal cycle (Fig. 6), mainly following the seasonal cycle of the sea ice cover.*

**Reviewer:** line 437: "barely changes" makes "comparatively" redundant
**Authors:** We have removed "comparatively" following the recommendation of the editor.

**Reviewer:** Fig. 6 caption: Missing a comma between "5,000" and "10,000"
**Authors:** We have added the comma following the recommendation of the editor.

**Reviewer:** line 570: Pretty sure the acronym "PV" is no longer defined, so acronym used before definition.

**Authors:** We thank the editor for pointing out this inconsistency, which we have corrected by removing the acronym PV.

**Reviewer:** line 594: Comma in "9000" (e.g. inconsistent with "5,500" in the same sentence)
**Authors:** We thank the editor for pointing out this inconsistency, we have added the comma.

**Reviewer:** line 596: Confusing use of sign, is it a "decrease of 20%" (so no need for "reduced"), "decreased to 20%", "reduced to -20%", or some theme and variations thereof? Offending article is probably that minus sign.
**Authors:** We thank the editor for pointing out the redundancy, which we have now removed throughout the whole manuscript. +/- sign are only kept when no information on increase/decrease in previously given by the sentence.

**Reviewer:** line 599: inconsistent formatting on "s" (probably do want it roman)
**Authors:** We thank the editor for pointing out this inconsistency, we have modified the character style.

**Reviewer:** line 633: "...associated WITH the generation..."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 638 and later: Similarly for CB here.
**Authors:** As mentioned above, we have modified CB in BB throughout the whole manuscript and clarified the wording when needed.

**Reviewer:** line 643, 645 and elsewhere: "decreases by -55%" means an increase of 55%, which I assume is not what is meant. Similarly for later and in the next paragraph.
**Authors:** This has been corrected throughout the whole manuscript, see above.

**Reviewer:** line 666: "fastened" means to "lock in" (e.g. "please fasten your seat belt", like "fast ice" is "locked in/anchored ice"), presumably "faster" is meant here?
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 674: the "in particular" at the end is floating, either something like "...and IN PARTICULAR to changes in atmospheric forcing" and elsewhere, or just remove it (don't need it).
**Authors:** "In particular" has been moved following the recommendation of the editor.

**Reviewer:** line 678: "...the EDDY POPULATION density..." to mirror that in line 680
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 685: "...and in the MIZ DUE to..."?
**Authors:** This sentence has been removed for clarity.

**Reviewer:** line 691: Another confusing bit where "Canadian Basin" was defined to be "CB" (but not used in the first case)...
**Authors:** Addressed, see above.

**Reviewer:** line 696: ...but also we have "the CB" and "THE whole Canadian Basin" in the same sentence! What is going on? (I am going to guess the latter one is "THE whole Canada basin", noting the missing "the" and lower case "basin" consistent with somewhere around section 2 when it was defined).
**Authors:** Addressed, see above.

**Reviewer:** line 704: Previously was "Northwind" but now it's "NorthWind", why?
**Authors:** We thank the reviewer for pointing out this inconsistency that has now been corrected throughout the manuscript.

**Reviewer:** line 708: "...a WEAKER increase in the number..."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** line 714: "...interpret THE OBSERVED changes."
**Authors:** We have modified the sentence following the recommendation of the editor.

**Reviewer:** Fig. 10: Again, we have "Canadian Basin", "CB" and "Canada Basin" (with the capitalisation when it was introduced without). Please do something about this, because it's either confusing or annoying at present, and neither is a good option when it can be avoided with some internal consistency check...
**Authors:** Addressed, see above.

**Reviewer:** section 4: So now I no longer have faith in whether "Canadian Basin" here really means "Canada basin" or "CB". Please go through this again and make things internally consistent. I am going to guess it's actually "Canada basin" that is being referred to? Because

"Canada basin" as used here encompasses the "BG" and "CB", but honestly who knows anymore...

**Authors:** We hope the chosen new convention and the adapted wording are clearer and prevent possible confusion.

**Reviewer:** line 778: Same point above regarding sea-ice and changing generation mechanism.

**Authors:** We have added a sentence in the discussion to point to the increased baroclinic instability with reduced ice cover, as is demonstrated in Meneghello et al., 2021 (lines 652-654):

*The 1995−2020 period is marked by an overall increase in eddy density at all depths (35−45%), in line with Meneghello et al. [2021] findings of enhanced baroclinic instabilities with reduced ice cover, leading to enhanced eddy generation.*

**Reviewer:** line 891: Please consider acknowledging the referees/editor if the authors think the comments have actually helped (even if the authors may not have enjoyed reading the comments...)

**Authors:** It now appears at the end of the acknowledgment paragraph (lines 774-775):

*We finally thank two anonymous reviewers and the editor J. Mak for their constructive and insightful input that we believe greatly improved the paper.*

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