Dear Reviewer #4,

Thank you very much for your comprehensive review of our manuscript. Please find below our replies to your comments. Note that below your comments are written in italic.

The authors use an ocean model with a very high resolution that evidently is able to resolve a number of fine (sub)mesoscale features. The simulated pattern of eddies fairly well matches the outcome of satellite remote sensing. Most likely this match partially reflects the high probability of having synoptic eddies in certain more or less fixed locations of the Baltic Sea because of the specific geometry of the sea and its shores. Even though this remark is just an observation and not critics, still I recommend making the claim on lines 220-221 a little bit weaker.

In view of this remark the claim on lines 220-221 will be re-written in a weaker formulation as

"The fact that a vortex pair of almost the same size and orientation was modelled in almost the same place and at the same time as the observed vortex pair can be considered as a validation of the model."

To my eyes, the use of words "linear features" (lines 57, 63 and in several occasions below) is misleading; mostly because in hydrodynamics the adjective "linear" is usually associated with properties of the underlying equations and their solutions. Thus, for many readers "linear surface features" would automatically connote "sinusoidal wave trains" even if Walter Munk used this expression in a different meaning of substances aligned into elongated patches or stripes (like mentioned on line 239).

Since at the beginning of the manuscript a quote from Munk (1990) with words "linear feature" was given, it would seem inappropriate to completely refuse this term further in the text.

To avoid misleading, we will supplement words "linear features" by "in a tracer field" or "of a tracer concentration".

I recommend to mention that a "sister" phenomenon of the quick regrouping of particles to cyclonic spirals (lines 302–304; Väli et al., 2018) occurs in the periphery of intense marine eddies. The associated almost explosive increase in the particle concentration in in was first explored in detail in (Samuelson et al., 2012). The increase in the local concentration occurs in the rim of an anticyclonic eddy differently from that in cyclonic ones. It happens basically because of the interaction of outward motions of particles with the field of particles outside the eddy. A little bit outside of the scope of the manuscript is an attempt to quantify the associated systematic changes to the density of particles, with much lower resolution than the simulations in this manuscript, for a subbasin of the Baltic Sea (the Gulf of Finland) in terms of so-called finite-time compressibility (Kalda et al., 2014).

In view of this remark, we will add to the Introduction a short mentioning of (Samuelson et al., 2012) and (Kalda et al., 2014) results as follows.

"Aggregation of simulated floating particles at the edges of anticyclonic eddies as applied to biomass redistribution was explored in (Samuelson et al., 2012). An attempt to quantify the associated systematic changes to the density of particles in terms of so-called finite-time compressibility was made in (Kalda et al., 2014)."

The entire study, in essence, signals that the well-known asymmetry of atmospheric cyclonic and anticyclonic eddies (all strong storms are cyclonic) becomes evident also in the field of ocean eddies. I guess that the reader would enjoy some comments on whether the established strong

asymmetry of the rotation rates of eddies of different sign is a local property (of densely packed eddies?) or reflects a generic property of marine eddies. This asymmetry may affect more widely the statistical parameters of surface flows (Heinloo and Toompuu, 2012) as in such occasions the average curvature of trajectories of water parcels is predominantly of one sign.

A conspicuous asymmetry of the relative vertical vorticity distribution with a tail of enhanced positive (cyclonic) vorticity values is a generic property of oceanic submesoscale flows (Thomas et al., 2008; McWilliams, 2016) – we pointed it out in the Introduction.

In view of this remark we will add to Discussion and Conclusions chapter a "semi-intuitive" explanation for strong asymmetry of the rotation rates of eddies of different sign as follows.

"The physical intuition for faster spinning of cyclonic eddies vs anticyclonic eddies can be gained from conservation of potential vorticity in a fluid parcel (e.g., Väli et al. (2017): $(\zeta + f)\rho_z = const$, where ρ_z is the vertical gradient of density. If the parcel undergoes ultimate vertical stretching ($\rho_z/\rho_z(0) \to 0$, where $\rho_z(0)$ is the initial value of ρ_z) given that it does not spin initially ($\zeta(0) = 0$), it will acquire unlimited cyclonic rotation: $\Omega = \zeta/f = \rho_z(0)/\rho_z - 1 \to \infty$. On the contrary, if the parcel undergoes ultimate vertical squeezing ($\rho_z/\rho_z(0) \to \infty$), it will acquire anticyclonic rotation limited from above: $\Omega \to -1 + 0$. The above considerations make it clear why in Fig. 8 in all cyclonic eddies $\Omega_0 > 1$, while in all anticyclonic eddies except one the rotation speed is within $-1 < \Omega_0 < 0$."

However, the asymmetry of the rotation rates of eddies towards fast spinning cyclonic eddies, to our mind, does not guarantee that the mean vertical vorticity and/or the average curvature of trajectories of water parcels is predominantly positive (cyclonic). This issue deserves a separate study.

The use of English is clear and appropriate but may need at places minor corrections (e.g. on line 286 it should probably by "the radial distance" but simply "submesoscale cyclones" would do on line 292).

Thanks, we will made the corrections and check the English once again.

Minor comments
I recommend to be careful with the use of "rotation" of particles and to clearly distinguish rotation of particles around their own centre and (rotary) motion of particles along curved or circular trajectories. For example, the words "floating particles rotation" (line 66) could easily be misinterpreted. Similarly, "the rotation of a particle /—/ is accompanied /—/ by a shift" is ambiguous.

Ok, we will change "particles rotation" for "rotary motion of particles around the centre of eddy" or at least for "rotary motion of particles".

Some parts of the manuscript contain too long paragraphs that make it complicated to follow the line of thinking. The first paragraph of Introduction covers 27 lines that is far too much. Also, in several occasions the sentences could be split into parts for clarity.

Ok, we will split the first paragraph of Introduction and some long sentences.

Equation (4): it is not clear how w(0) is calculated; also there is no need for square brackets in the first expression.

To explain how $\omega(0)$ is calculated, we will add the following paragraph.

"The modelled velocities were bilinearly interpolated to the current position of the particle within the grid cell. Therefore if the initial position of the particle was taken close enough to the exact centre of the eddy, the radius of the loop r would be sufficiently small, e.g. smaller than

the grid cell size $dx, dy = 232$ m. The frequency of particle's rotary motion at $r \approx 0.5dx \approx 100$ m was taken for $\omega(0)$."

The square brackets in Eq. (4) will be dropped.

Line 106: n.m. obviously stands for nautical mile but it is better to explain the abbreviation.

We will change n.m. for nautical mile.

Line 169: perhaps it would be more exact to speak about divergence/convergence of the surface velocity field.

Ok, we will change divergence(convergence), positive(negative) etc. for divergence/convergence, positive/negative, etc.

Line 219: use the Polish ´n in Gda´nsk.

Ok, we will change Gdansk for Gdańsk.

The claim on line 232/233 is just a repetition of the same claim on lines 224-225.

Ok, we will drop the claim on line 232/233.

Table 1 could be better placed in Appendix

Ok, Table 1 will be moved to Appendix.

Line 261: "The statistics : : :" contains, to my eyes, too much jargon and simply "mean" (line 267) would do the same job as "ensemble mean" (but "ensemble mean curve" on line 282 has clear meaning).

Ok, we will drop unnecessary "ensemble" throughout the Line 261 paragraph and in the Fig. 8 caption.