Reply to the comments of Reviewer2 dated 23 November 2021

Comments of Reviewer2 are blue.
Authors' replies are black.

This paper describes the evolution of a submesoscale spiraling eddy as simulated by a multiple nesting configuration of a ROMS numerical model set up for the Baltic Sea. The paper provides exhaustive analyses of the simulation, proposing interesting dynamical interpretations of the vortex oscillations and specific investigations on their impact in terms of vertical transport (carried out through Lagrangian approaches). The paper is written clearly, but it is quite long and the organization of the sections not always optimal. As an example, the model set-up is both described in section 2 and discussed again in section 5, which leads to repetitions and makes the reading much less pleasant.

Section 2 describes the technical details of the model setup, the downscaling procedure, and a rough description of the formation of the spiral in R100 and R33. In contrast, subsection 5.1 justifies the model setup and subsection 5.2 evaluates the impact of downscaling.

In subsection 5.1 (P37L12-P38L6), we justify the turning-off of atmospheric forcing, both in R100 and R33. This leads to adiabatic conditions and allows to interpret the model results under the assumption that isopycnic potential vorticity is conserved. In the last paragraph (P38L7-16), we discuss the fact that the Lagrangian floats in ROMS follow neutral surfaces, while our analyses re based on the assumption that the floats move along potential density surfaces. By comparing subsection 5.1 with section 2, we do not see any repetitions.

In subsection 5.2, there are indeed repetitions.

Suggested action:

The repetitions in 5.2 will be removed. Moreover, subsections 5.1 and 5.2 may be merged in a subsection entitled "Impacts of the model setup and downscaling".

I really suggest to significantly shorten it focusing on the most relevant findings and eventually removing at least some of the many details (and sometimes repetitions),

Agreed.

Suggested action:

Manuscript will be shortened.

also eventually moving some of the text to the figure captions (e.g.:"[…]The images are centered at the density maximum of the spiral, their meridional width is 2 arc minutes (=2 nautical miles ≈ 3704 m),[…]").

Agreed.

Suggested action:

We will check what pieces of text may be moved to the figure captions.

In many cases, instead of providing punctual descriptions of each figure within the text, it would be much more effective to directly focus on the relevant information the figure is giving, which would otherwise be missed by the reader.

Agreed.

Suggested action:

We will try to make the descriptions of the figures more concise.

My only concern about the scientific findings/discussion is related to the way eddy perturbations are identified as VRW. While I do agree that this is an absolutely plausible mechanism, some more comments would help to clarify how VRW can be distinguished by other vortex wave processes (e.g. inertial-gravity waves) and in case complemented by additional analyses that can reinforce the interpretation (e.g. by looking at propagation speeds predicted by VRW dispersion relation).
We are not experts on VRWs. We just detected the eddy perturbations in our animations of the spiral and conjectured that they are VRWs, mainly because of the similarities with observed phenomena in hurricanes.
Suggested action:
We will try to compute the radial and azimuthal phase velocities using equations (15) and (16) in Montgomery and Kallenbach (1997) or equations (3) and (4) in Chen and Yau (2000). These will compared with the corresponding quantities of inertial-gravita waves.

I would thus suggest a revision that could be classified between minor and major, but surely believe that the paper should be accepted for publication.