Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2019-90-RC2, 2019

Ocean Science
Discussions

Interactive comment on "Rotation of floating particles in submesoscale cyclonic and anticyclonic eddies: a model study for the southeastern Baltic Sea" *by* Victor Zhurbas et al.

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Received and published: 5 September 2019

General comments

The work examines the spiral-shaped submesoscale eddies to the southeastern Baltic Sea. The authors set out to show that the overwhelming dominance of cyclonic spirals on satellite images of the sea surface are caused by some differences between rotary characteristics of the submesoscale cyclonic and anticyclonic eddies. Using the well-known three-dimensional circulation model GETM, an evolution of eddy structures in the southeastern Baltic Sea from April 1 to October 9, 2015 is reproduced on an ultra-high resolution grid (approximately 232 m). The results are in a good agreement

with Landsat-8 true color image of the southeastern Baltic Sea on the date 07/03/2015 which shows a prominent cyclonic spiral located at a distance of about 60 km to the north-northwest from the Cape Taran. Calculated trajectories of synthetic floating Lagrangian particles embedded in the above regional circulation model showed that: 1) the cyclonic spirals are formed both from a horizontally uniform initial distribution of floating particles and from the initially lined up particles during the advection time of the order of 1 day , 2) the spirals were formed only from the linear features embedded into the submesoscale cyclonic eddies, while the linear features in the anticyclonic eddies transformed to some curves of irregular shape. Statistical processing of the trajectories of the synthetic floating particles in order to calculate the kinematic characteristics of submesoscale eddies allowed to conclude that the submesoscale cyclonic eddies differ from the anticyclonic eddies in three ways favoring the formation of the spirals: the former can be characterized by a significantly higher angular velocity and a more pronounced differential rotation as well as by a negative helicity. These features of the kinematics of submesoscale eddies were revealed for the first time, the article is important and interesting. However, I have a few questions and small comments, the answers to which I would like to receive before finally recommending the article for publication.

Specific comments

1. Studying the eddy structures and features, the authors do not refer to the surface salinity fields anywhere. At the same time, salinity is a more conservative characteristic than temperature, especially far from river estuaries, and eddy structures will probably appear clearer in salinity fields. It would be nice if the authors showed salinity fields in Fig. 4,5,6 and commented on the results.

2. Lines 96-100. The depth field in the domain of the high-resolution model (0.125 nm) has a coarser resolution (0.5 nm). I would like to hear the authors' thoughts regarding the sensitivity of the calculation results to the accuracy of the representation of the field of sea depths, especially in the coastal zone.

3. Line 119. “The high-resolution model accounts only for rivers that flow into the sea within the model domain.” The meaning of the phrase is not clear. Indeed, in the high-resolution model, only rivers flowing into this area should and can be taken into account. And what else? The phrase can be deleted altogether.

4. Line 120. The procedure for obtaining the initial thermohaline fields on the coarse grid should be described in more detail. Please, indicate at least the duration of the run in which these fields were obtained.

5. In the part 2 "Material and methods", the material is not located in accordance with the order in which the results in part 3 are presented. It would be logical to isolate paragraphs Lines 179-183 and 184-185 and modify them in the new section "Synthetic floating particles approach", which is placed after section 2.1 Model setup (after line 130). In this case, the general numbering of sections will change as follows (the title of the last section was shortened): 2.1. Model setup 2.2. Synthetic floating particles approach 2.3. Rotary characteristics of submesoscale cyclones / anticyclones

6. Line 240. Why, when analyzing the results of numerical experiments in section 3.3, anticyclone marked as a17 in Fig. 6 missing?

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