Review of the paper entitle:

"Impact of the dense water flow over the sloping bottom on the open-sea circulation: Laboratory experiments and the Ionian Sea (Mediterranean) example"

by

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General comments.

The scientific matter of the manuscript isn't a really new; actually in the literature there are many example on this, either in the modelling field or in the analysis of the in situ observations and correctly in the manuscript there are a long list of key references. However, the manuscript tackle an important and new relevant scientific issue dealing with the analysis of the ocean processes related to the propagation, spreading and adjustment of the density anomaly in a complex topography like as it is the Ionian Mediterranean sub-basin.

This study, specifically the tank-experiment, reveals the important role of the n-layer stratification in the vortex rotation within the framework quasi-geostrophic model on an f-plane.

For all these reasons that the results of this paper are very interesting for the oceanographic communities and in particular for those scientists more implicated on the Mediterranean studies.

However the present version of the manuscript have a lot of a weak points and therefore is not ready to be published for the following reason.

Major revision:

Among the weak points the following ones is the most relevant:

- The manuscript encompassing a comprehensive introduction of the experimental apparatus and methodology followed by the authors and every thing is very well conducted, except the relative role (scale ratio) of the central part of the tank respect to the sloping part. In fact, looking the figure 7 in the manuscript seems that the dynamics driven by the slope domain dominates on those generate in the flat domain, making very difficult distinguishing the difference between the two dynamics. This isn't irrelevant to make more realistic the comparison with the northern Ionian Sea circulation in section 4.
- Moreover is very confusing the theoretical and modelling equations that are used to analyse the experimental results: the equation 1 is not the same used by the cited paper of Lee-Lueng, F. and Davidson, R. A. (A note on the barotropic response of sea level to time-dependent wind forcing. J. Geophys. Res., 100, C2, 24955-24963, 1995) that use a classical linear barotropic vorticity equation, may be the authors have to use a different reference.
- However, the most relevant matter is related to the stratification that, at the end, is the core problem of the manuscript. It is well know that a good representation of the ocean dynamics is a three-layer system and this is this is confirmed even in this case as is

well evident in the figure 2c (experiment 27), specifically around the 75th day in which we see the respond of the pressure to the injection of the density anomaly and subsequence stratification in three layer (or a continuously stratification see references), is very interesting the impact of the redistribution of density and pressure within the water column in the figure 3 (and also figure 5) experiment 27 at the same day (around the 75th). These figures are the most interesting of the manuscript and at the same time are those that demonstrate the weakness of the theory presented in this manuscript: actually can't demonstrate the opposite vorticity at the 75th day and the corresponding kinetic energy anomaly in the lower layers. However, despite this experimental evidence and the same recognition as the authors themselves that the dynamics follow at least a two-layers system, even so at the end the equation that the authors used is written in a one-layer formulation. This is not irrelevant for physical point of view. Is matter of fact that dealing with one, two or three layer formulation of the QG equation, produce a different vorticity relation between the several interfaces along the water column (see Sokolovskiy paper and all reference herein). This is true either in the flat or in the slope domain and finally on the comparison with the realistic example of the Ionian sea.

In conclusion the circular rotating tank experiment shows in an impressing way (this could be more impressing with a different scale ratio between the slope/flat domain), the adjustment of the vorticity along the continuously stratified water column (and its dependence from the layers-thickness distribution) when it is subjected to a density anomalies: first along the slope and afterwards during the spreading of the anomaly density flow along the flat bottom; finally is very arduous to do some comparison, in the present version of the manuscript, between the tank experiment and what was observed in the northern Ionian sea in 2012.

Minor revision:

- Line 326 "level 1" is referred to inclined laser sheet levels 1 of the Figure 1?
- Line 451 at which model is referred? Please give more details;
- figure 1 the word "cp3" is not clear;
- figure 2 in the color tab 0-15 means that the range of density is between 1000-1015?

References.

1. M. A. Sokolovskiy; Stability of an Axisymmetric Three-Layer Vortex, Izvestiya, Atmospheric and Oceanic Physics, Vol. 33, No. 1, 1997, pp. 16–26. Translated from Izvestiya AN. Fizika Atmosfery i Okeana, Vol. 33, No. 1, 1997, pp. 19–30. (and all references herein)