Response to the comments of the Ref. 1

Laboratory experiments are used to investigate the effects of injecting fluid at various flow rates and densities on a sloping boundary into a two-layer stratification in a rotating system. The aim is to examine the effect of overflow waters into the Ionian Sea, and in particular how changes in the density or flow rate can affect the overall circulation within the basin. This is a substantial experimental effort, conducted carefully, and the work is mostly described well, with an analysis of the partitioning between eddy and mean flow KE, the resulting flow within the basin, and comparisons with numerical model output for the Ionian Sea, assimilating in-situ data for 2012. Overall this is a valuable piece of work. There are some aspects of the presentation that should be improved before the paper is published.

1 While I realise details are included in other references, you need to give some more details about how the velocities are calculated from the laboratory experiments. An image showing a velocity field earlier in the paper, to help explain the main features of the laboratory flow, would also be useful.

In section "2. Data and methods" under the paragraph "2.1 Experimental design", we added the two following sentences describing the methods employed to calculate the velocity.

"Sequences of the images at each of the 12 levels were taken with a high-resolution Nikon Camera synchronized with a profiling laser system. It illuminated the Polyamide particles (Orgasol) with a mean diameter of 60 μm and a density of 1.020 kg m^{-3} dispersed in the tank and in the injected saline solutions to allow optical velocity measurements. Velocity fields were computed from the images using a cross-correlation particle image velocimetry (PIV) algorithm encoded with the software UVMAT developed at LEGI. "

In addition, the supplementary material S1 shows the main features of the laboratory flow.

2 You mention viscous bottom draining (line 313) but there was no mention of this before – something on this should appear in the Introduction.

We thank the referee for this observation. In the Introduction, after line 95 we added the following paragraph:

"On the slope area, the injected saline solution induces a gravity current whose body quickly reaches an almost geostrophic equilibrium due also to the particular injection method employed. The gravity current consists then of two parts: the first one is the proper 'vein', characterized by an almost along-slope velocity, and the second is a viscous bottom layer, also called Ekman leakage, showing an almost down-slope velocity. A detailed description of the structure of a rotating gravity current composed of a vein and an Ekman leakage is given in Wirth, 2009 (see also Cenedese et al., 2001)."

3 It would be useful to have a chart of the Ionian Sea sooner in the paper, and you should mark the locations of the main inflows and sketch the typical circulation(s).

We have inserted a new Fig. 1 in the paper showing the map of the Ionian Sea and the sketch of the laboratory tank:

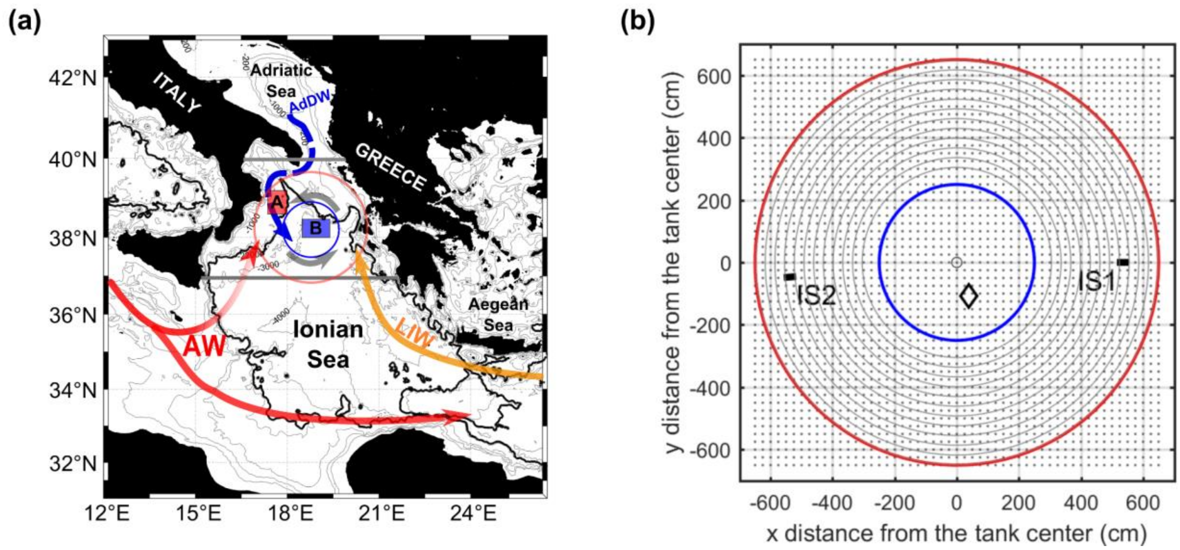

Figure 1: (a) Map of the study area in the Ionian basin with a simplified circulation scheme, which changes according to the BiOS regime. Gray horizontal lines indicate the geographical limits within which the mean vorticities above and below the 2200 m isobath were calculated. Rectangles A and B indicate the areas where density data (CMEMS reanalysis) were averaged. Concentric rings represent the simplified laboratory tank scheme. Acronyms: AW = Atlantic Water, LIW = Levantine Intermediate Water, AdDW = Adriatic Deep Water; (b) Top view of the tank: the slope area is between the red and blue circles, the deep flat-bottom area is inside the blue ring. Dense water injectors are placed at IS1 and IS2. A diamond near the center shows the location of the Cp3 profiler. Concentric gray rings indicate intersections of the laser sheet levels with the slope. Gray dots indicate regular x-y grid nodes for the tank velocity field (subsampled every 5 nodes for clarity). The map in (a) was created from the bathymetry data ETOPO2v2, NOAA, World Data Service for Geophysics, Boulder, June 2006, doi: 10.7289/V5J1012Q) using the MATLAB software.

4 You need to explain how you calculate MKE and EKE in more detail.

The explanation about the calculation of MKE and EKE was added in section "2.2 Data Analysis", as follows:

"Mean Kinetic Energy (MKE) and Eddy Kinetic Energy (EKE) are computed for the surface layer over the slope based on the time series of current velocity components v_x and v_y according to the system in tank coordinates (Fig. 1b). Specifically, we take v_x and v_y as the respective average from the levels 1, 2, 3, and 4 at each grid point. Hence, MKE=½ ($<v_x>^2+<v_y>^2$) and EKE= ½($<v_x'^2>+<v_y'^2>$), where the symbol <> means the temporal average in each grid point, $v_x'=v_x$-

$\langle v_x \rangle$, and $v_y' = v_y - \langle v_y \rangle$. This operation is performed for each measurement phase for which, finally, spatial averages of the MKE and EKE are obtained over the slope area."

5 The English needs some attention – below I list a few corrections from the Abstract and Introduction by line number, but there are others, and throughout you often write "the experiment 24" or "the phase II" where "the" should be deleted.

30 Density records show

56 as happened in

69 these studies maintain that

80 of dense water in the

82 with observations

83 with a duration of

87 circulation of the open sea

91 of vorticity generation

Fig 1 (not to scale)

Following these comments our paper underwent an English proofread.