General comments

This paper applies the ROMS ocean model to study the impact of downwelling favorable winds on canyons of different shelf bathymetries typical of Eastern Boundary systems and their influence on nearby flows and on offshore and downward transport. This study confirms and extends previous studies on downwellings in canyons using idealized modelling (in particular Spurgin and Allen, 2014). Interesting results are provided on the time-varying response of canyons to the forcing or on the ability of the canyons to trap a significant amount of particles under downwelling conditions. However, the results section is rather long and the novel results could be emphasized.
In terms of form, the paper is well written and clear. It includes extensive reference to the literature, which will be very useful to future research on the subject. I would therefore recommend this paper for publication if the following points are addressed.

Specific comments

Methodology:

l.74: Do you use sigma coordinates or generalized sigma-coordinates? The latests would be best suited to represent air-sea interactions, hence the wind forcing, and would allow for a better representation of the physical processes at the bottom of the canyon.

l.85: The bathymetries (and the following model description) are largely inspired by the work done by Saldias and Allen. Please add "Three types of bathymetric configurations**, already described by Saldias and Allen (2020)** were used".

l.122: please specify why you need to compute the topographic Burger number S.

Results:

l.149: "downward velocities occur upstream of the canyon". Please add on Figure 2d the upstream and downstream areas you are referring to. At the upstream corner, the velocity is upward. If your definition of upstream refers to y=-6 km to y=0 km as defined latter in the paper at l.253, one would find upward velocities on Figure 2d at the upstream canyon wall (red color) depending on the depth. This should be clarified as this statement is repeated several times in the manuscript.

l.165: Locating the downwelling front on the plot would help.

l.177: "Along the canyon axis (Y = 0 km), offshore and onshore velocities occur within the canyon". This seems obvious, do you mean velocity changes?

l.187: "values tend to diminish" and at l.189 "the numbers". Which values? Which numbers? These sentences may be reformulated.

l.269 and 272 : Please add "not shown" as the figure of dispersion of particles in the case NO-CANYON is not in the manuscript. I suggest this part to be shortened.

l.290: "the vertical velocities induced by the submarine canyon not significantly affecting the vertical particle movements". Can you explain this sentence please? I guess that particles follow

the water masses as they are passive tracers. At line l. 292 you mention an aggregation of particles. It should be mentioned if the particles behavior is taken into account with processes such as flocculation, else you should use another word like “accumulate”.

l.296: What do you mean by “outside this range”?

Discussion:

l.318-322: The improvement in the wind forcing in this experiment compared with previous studies on downwelling canyons is emphasized in different parts of the manuscript, but it is not straightforward. Finally, what are the additional forcing terms in the equation? It is also not very clear to the reader what the novel results are in the study of downwelling canyons. What are the differences between the results of the present study compared to the previous ones?

Conclusions:

The conclusions part draws a clear picture of the downwelling canyon functioning, however it mixes original results emerging from this study with previous results that can be found in the literature. The novel results should be emphasized.

Figures:

Figure 2, Figure 6 nd Figure 7 (e,f): Please add the number of days after the start of the simulation when the plots were calculated.

Figure 3: “Cross-shore sections of velocity **field** (color) and **isopycnes** (gray lines) **at**”. You should add the values of isopycnes on the plots or in the text.

Figure 4: “Cross-shore sections of velocity **field** (color) and **isopycnes** (gray lines) **at** 15 km (a-f) **downstream**, 0 km (g-l) **in the canyon** and -15 km (m-r) **upstream** for the no-canyon simulations at day 25.”. You should add the values of isopycnes on the plots or in the text. For the plots at 0 km, the added canyon bathymetry should be represented using dotted lines and explained in the text.

Figure 5: Replace “density (gray lines)” with “isopycnes (gray lines)”, and add the associated values. The location of the alongshore sections could be added on Figure 2 to help the reading of the paper. Note that in some of the plots in the manuscript, grey lines appear black rather than grey after printing, which is the case for this figure.

Figure 8: Upstream and downstream areas should be defined, either on Figure 2 as previously suggested, or here.

Figure 9: I guess that the red dotted lines are the isobaths, you should add it to the legend.

<u>Typos</u>

l.25: Something is missing in the sentence “for downwelling favorable flow (right/left-bounded in the Northern/South- ern Hemisphere) promote an anti-symmetrical circulation”.

l.37: “focused **on** upwelling”

l.52: ”is to **enhance** the downwelling” and “**These** biological characteristics”

Figure 2: “with (lower panels) **and** without”

l.137: ”exten**d**”

l.147: ”**at** the location”

l. 187: ”In terms **of** stratification”

l.195:” Depending on **the** location”

l.215: “**at** x=-13”

l.219: “**due** to”?

Figure 7: A dot is missing at the end of the legend.

Figure 8: “(e-f) at z = -20 **m**”

l.271: There is a problem with this sentence, do you mean “Particles released in the presence of a canyon”?

l.281: “**Figure** 1”

l.296: “The percentage of **trapped** particles appeared to **increase**”

l.375: “**be trapped** by the anticyclonic circulation”

l.400: “increased cross-shore transport” or “an increase in the cross-shore transport”

l.408: “to be **studied**”