Reply to reviewer 1

Summary

We thank reviewer 1 for the useful comments. We considered all comments and adjusted the manuscript. Line numbers correspond to the new manuscript.

Major comment

Previous studies suggested that enhancement of mesoscale anomalies in the Central Caribbean coincide with the presence of shallower bottom topography (p.e. Andrade and Barton, 2000) when reaching the Beata Ridge. Would the authors analyze that aspect and comment on that regard.

- Indeed, previous studies suggested several mechanisms that impact the life cycle of Caribbean anticyclones, among which topography. (Introduction: page 2, lines 6-10: *"They can be generated from the interaction of the flow with the topography (Molinari et al., 1981; Andrade and Barton, 2000), from the meandering current (Andrade and Barton, 2000), from instabilities due to the presence of the river plume (Chérubin and Richardson, 2007), and from perturbations caused by the interaction of North Brazil Current Rings (NBC Rings) with topography (e.g., Simmons and Nof, 2002; Goni and Johns, 2003; Jochumsen et al., 2010)").*

  While this is an interesting topic, it is not the main topic of study in this manuscript: here we analyse how the wind-driven upwelling affects the westward intensification. (Page 2, lines 32-33: *"In this study, we hypothesize that this intensification is steered by the offshore advection of cold upwelling filaments that cool the interior of the basin."*).

  We did not explicitly study the impact of topography. However, in the revised version of Section 4, we now also discuss the variations in westward intensification that occur with longitude (Fig. 8d). In this plot, we identify 3 longitudes at which the intensification peaks. Here, we discuss a possible connection to the local topography:

  Page 13, lines 6-7:
  "Although the third rapid increase is located eastward of the Beata Ridge at 73°W, it is possible that this topographic feature has some impact on the westward intensification, as was previously proposed by Andrade and Barton (2000)."

Minor comments

1. Page 2, line 19

"Here ~~There~~, model studies have shown that Caribbean anticyclones could influence eddy-shedding events of the Loop Current (Oey et al., 2003; Murphy et al., 1999; Carton and Chao, 1999; Candela, 2003; van 20 Westen et al., 2018)."

- Corrected (Page 2, line 19)

2. Page 5, line 1-2

"We will use this set of simulations ~~with the different~~ to study aspects of the seasonal and interannual variability of Caribbean anticyclones."

- Sentence removed.

3. Page 6, line 11

"*The considered region was limited to 1.5 × R_{eddy}. This restriction was applied to ensure that the advection of cold filaments and other mesoscale variability was excluded from the analysis.*"

Why excluded?

- The goal of this study is to analyse the westward intensification of Caribbean anticyclones. Therefore, we wanted to isolate this westward intensification from other processes that contribute to the eddy kinetic energy. We rewrote this paragraph to clarify:

  Page 6, lines 17-21:
  "Since the focus of this study is to analyze the westward intensification of the anticyclones, we not only calculate the EKE and strength of the horizontal density gradients over the full domain, but we also calculate their contribution associated with the anticyclones only. We estimate the latter by considering the EKE and density gradients around the core of an eddy at each 5-day averaged field over a spatial extend of 1.5 × R_{eddy}. This procedure allows us to study only the westward intensification of the anticyclones."

4. Page 6, lines 23, 25, 26 and 27
Modify Andrade (2003) for Andrade et al. (2003): Andrade, C.A., E.D. Barton and C.N.K. Mooers, Evidence for an Eastward Flow along the Central and South American Caribbean Coast, Journal of Geophysical Research, Vol. 108, C6-3185, June, 2003. EID:2-s2.0-0141501411.

- The reference was replaced.

5. Page 7, lines 8-11
"The Guajira upwelling region is located west of the Cariaco upwelling region, between 69°W and 74°W (Rueda-Roa and Muller-Karger, 2013). Here, the observed average SST is slightly higher (25.5°C) than in the Cariaco upwelling region (Rueda-Roa and Muller-Karger, 2013). The model displays a similar temperature difference between the two upwelling regions (26.1°C in Guajira, Fig. 3d)."
Consider compare these temperature values with those in Andrade and Barton (2005).

- We made a comparison with Andrade and Barton (2005) and added a sentence to the manuscript.

  Page 8, lines 2-3
  "Furthermore, the modeled temperatures are in line with Andrade and Barton (2005), who found surface temperatures varying between 25.6°C and 28°C in the Guajira upwelling region."

6. Page 8, lines 4-8
"In line with observations (Richardson, 2005; Carton and Chao, 1999), we find that the flow in the Caribbean Sea is highly variable (Fig. 4). In the eastern part of the basin, the surface EKE is relatively low (100-300 $cm^2\ s^{-2}$, Fig 4a). The EKE increases westward towards a maximum >900 $cm^2\ s^{-2}$ at 78°W."
Consider compare these EKE values with those in Andrade and Barton (2000) in this sentence and in the other parts where EKE was commented throughout the manuscript.

- We compared the average EKE in Venezuela Basin with Andrade and Barton (2000), and added a sentence about this.

  Page 8, lines 16-27

"In line with observations (Andrade and Barton, 2000; Richardson, 2005; Carton and Chao, 1999), we find that the flow in the Caribbean Sea is highly variable (Fig. 4). In the eastern part of the basin, the modeled surface EKE is relatively low (100-300 cm2 s−2, Fig 4a) and similar to observations of Andrade and Barton (2000). The EKE increases westward towards a maximum >900 cm^2 s^{-2} at 78°W. The modeled magnitude of EKE is higher than found in satellite altimetry (>600 cm^2 s^{-2}, Andrade and Barton, 2000; Jouanno et al., 2012), but it is more similar to estimates obtained from surface drifters (>900 cm^2 s^{-2}, Richardson, 2005). This is in line with other modeling studies (Jouanno et al., 2008, 2012), and this discrepancy is mainly attributed to the coarse resolution (0.25o) of the gridded altimetry data products (Jouanno et al., 2008). The modeled spatial variability of EKE matches analyses of to satellite altimetry well (Jouanno et al., 2012; Ducet et al., 2000). Corresponding to observations (Silander, 2005; van der Boog et al., 2019), we find that the eddy kinetic energy is surface intensified (Fig. 4b). In line with the modeling results of Jouanno et al. (2008), the magnitude of EKE at depth also increases towards the west (Fig. 4b)."

- Furthermore, we compared Fig. 11 of Andrade and Barton (2000) to the meridional increase of EKE in Ekman100.

Page 11, line 12; Page 12, lines 1-2
"Overall, the meridional maximum of EKE that is contained in the anticyclones increases from approximately 200 cm^2 s^{-2} at 65°W towards 530 cm^2 s^{-2} at 75°W (Fig. 8a). These values are similar to those observed in Andrade and Barton (2000)."

7. Page 9, line 13
"The cyclones are less energetic than the anticyclones."
This is not true in the southwest Caribbean where cyclonic circulation is almost permanent. Consider complete the sentence with a location reference

- We clarified the sentence by adding a location.

Page 10, lines 11-12
"In the central Caribbean Sea (65°W-75°W and 12.5°N-17.5°N), the cyclones are less energetic than the anticyclones, and have an average amplitude of $A_{eddy} = -0.16$ m and swirl velocity of $u_{swirl} = 0.50$ m s^{-1}."

8. Page 22, line 21
"...that ~~salinity was~~ observed salinity in the Cariaco Basin was anomalously low in these year:"

- Corrected (Page 23, line 25).

9. Page 22, line 33
"Together these two processes explain the mesoscale variability in the Caribbean Sea."
Clarify why the wind stress field is not included in this sentence.

- The wind stress field is similar in each simulation, only the magnitude differed. Therefore, the impact of the wind stress field (spatial variations) should not differ between the simulations, and these were not analysed. To highlight this, we clarified the first sentence of the paragraph.

Page 24, lines 1-2:
"Overall, in this study we showed how the strength of the zonal wind stress in the Caribbean Sea impact the eddy variability in this basin."

10. Page 22, line 26

“(Villamizar G. and Cervigón, 2017), it also impacts the mesoscale variability.”

no G.in the reference

- Corrected. (Page 23, line 31)

11. Page 23, line 31

Is Juan Manu~~a~~el Sayol, Y pma, is Ypma

- Corrected (Page 25, line 4).