Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2019-58-RC2, 2019

Ocean Science
Discussions

Interactive comment on "Effect of Caribbean Water Incursion into the Gulf of Mexico derived from Absolute Dynamic Topography, Satellite Data, and Remotely – sensed Chlorophyll-*a*" *by* J. A. Delgado et al.

Anonymous Referee #2

Received and published: 23 August 2019

General comments:

In this manuscript (MS), the authors evaluate different long lime series dataset (ADT, Chl-a, wind stress, geostrophic and Ekman currents) to describe the seasonal cycle and interannual variability of the Loop Current. They also relate this variability with the Chl-a. The MS enhance the existence of an annual seasonal cycle of the Caribbean Water (CW) intrusion, or Loop Current (CL) extension, which has already been discussed with altimetry data in previous studies. However, the seasonal averages of the Chl-a and the climatological pattern observed before and after 2002 is an interesting

finding that deserves to be considered for publication, after mayor modifications of the MS.

There is a lack of discussion regarding previous studies, which referrer to the seasonal cycle of the LC, like Chang & Oey (2012, 2013), which expose a bimodal cycle obtained with model outputs; Hall & Leben (2016), which show an annual cycle with altimetry data; or Candela et al. (2019), which estimate the amplitude of the seasonal cycles of the transport at Yucatan Channel and at the Strait of Florida using mooring observations. Those works, among others, must be at least mention in the introduction and their findings should be discussed with what was found in this MS.

The conclusion regarding the decrease of Chl-a concentrations in the western Gulf of Mexico (GoM), where the authors state that there is a reduction due to a larger volume of waters coming from the Caribbean Sea toward the GoM, should be taken with caution and considers/discuss the limitations of the data series used for this conclusion. There are other sources that could contribute to a reduction in Chl-a in the western GoM. It is not obvious to me what the authors state with the footprint of the CW/LC path, in the Chl-a climatological patterns (Fig. 11).

The MS need to focused to highlight the relevant contributions. Additionally, statistical relevance of the seasonal cycle needs to be deeply discussed; it is necessary to specify how representative are the climatological averages (Fig. 1), obtained from the monthly averages of the individual years (using information from Fig. 4). Description of section 3.2 (lines 229 – 262 and lines 271 – 280) needs to be rewrite in order to guide the reader to the months of the year that the authors are talking about (maybe a Table will be useful); What is the main message given by all these numbers and description? Besides, there need to be an agreement between the months of the year with the LC extension/retraction throughout the MS.

Specific comments

The MS focus the discussion on the oligotrophic CW intruding the GoM owing to the

Loop Current. Therefore the description of the water masses that conform the GoM, must be introduced and supported by additional bibliography, aside from Nowlin & McLellan (1967), since the reference of Schmitz (2005) is not referred to water masses composition. Further Tanahara (2004), cannot be consulted.

I do not understand why the Loop Current track is called Caribbean Water. Discernment must be used throughout the MS when the authors refer to the Caribbean Water and the Loop Current; CW could be used to name the water intrusion from the Caribbean with specific biological and physical characteristics (maybe when they talk about Chl-a characteristics) and the LC when you refer to dynamic characteristics, i.e. current that enters the Yucatan Channel, loops at the eastern GoM and through the Florida Strait.

Lines 66-67: I do not consider that the MS shows a detailed analysis of the Loop Current Eddies, maybe the approach could be focus to the analysis of the LC and the LCE path footprint.

Line 77: Who is this acting as a primary forcing mechanism of the Loop Current? Yucatan Current? The term PFM is not clear and must be specified.

Line 100: "which move CW". . .. . ..where?

Lines 104-105: "In this work we reexamine the effect of . . .." Rephrase please.

Line 121: "we considered eddies in any state of formation, detaching. . ..", then they are Loop Current Eddies (LCE), not only eddies.

Lines 146-154: The first three points of the paragraph referring to data description are repetitive with the first paragraph of section 2; the description of the datasets is disordered, since they are described in two different places. I suggest to add additional information, such as the years of the data that you are using at the beginning of the section, before methods description. The calculation description of the mesoscale instabilities, as well as the AR can be described in the methods section, where they have already been described (without paragraph mark).

Line 164: Is repetitive with line 110.

Line 192: The contours from the ADT are not determined by the influence of the CW, please rephrase.

Please define which months of the year are described for each season (I guess winter (Jan, Feb, Mar), spring (Apr, May, Jun), etc.?). It is not clear to me, at least from Fig. 1, that the LC extension is retracted in autumn and extended in spring (lines 200-203), or the fact that the maximum penetration occurs in September, instead of August (see also your statement in line 232). I think it could be useful for the authors to discuss their results with previous work referring about the seasonality of the LC (see comment above).

Line 241 and Fig.3: Please specified if the ADT was spatially averaged. The steric signal included in the ADT data must be discussed, considering the high-energy observed in the annual period (see Hall & Leben, 2016).

Section 3.2 (Fig. 4): Why the STD contour of 15 cm was chosen as a reference for the regions of maximum variability? Lines 278-280: How this cycle of the monthly ratios compares with the results of Chang & Oey (2012, 2013)?

It makes not sense to me the discussion of the monthly averages of the wind stress, shown in Fig. 6 and described in section 3.4, it is not relevant for the main objective of this section, further this discussion do not reinforce de main idea exposed here; I suggest to delete this part or move this description elsewhere in the MS.

Lines 300-301: Please be more specific; Do you mean an upwelling? Is so where? Please use references.

The whole paragraph of section 3.5 is not linked with the rest of the MS, if you want to keep it, at least it go deeper in the implications and discussion of these calculations.

Statement of line 327-329: The difference between the mean life of the LCEs (6.8 vs 11.7) needs to be discussed with previous studies.

Lines 378-379: How these three periods were chosen? Why not using the same two periods of the ADT? Please explain.

Table 1 (lines 386-399), please specify what means the bold numbers in Table 1 and show the difference between Early and Contemporary periods at each row. Using the differences obtained here discuss the significance of the Chl-a averages between these two periods.

Second point mark of the conclusions (line 515). I do not see that in Fig. 10, or in Fig. 11.

Technical corrections:

Please avoid the double space throughout the manuscript (i.e., lines 58, 60, 144, 263, 267, 269, etc.).

Caribbean water is mentioned for the first time in the MS in line 68 as the acronym CW and in the line 75 as Caribbean Water. The acronyms must be defined for the first time as they are mentioned in the text and then they should be used throughout the MS as an acronym (the same for Loop Current as LC, which is even lowercase in line 99).

Line 119: Specifiy the years used for the 25 years climatologies.

Line 140: 'island' instead of Island.

Line 216 and 230: CWF instead of Caribbean water front, it is already defined in line 125.

Lines 294-295: Please specify that this is a supposition.

Line 314: Please use the accurate terms.

Line 324: 'extended to the west'. . .in summer and autumn?

Line 337: Avoid the use of acronyms in the title sections (especially if it has not been previously defined).

Line 360: Use CW.

Line 402: Add (see also Fig. 11).

Lines 413-415: Rephrase.

Line 432: Check the point marks.

Lines 446-450: Rephrase the way you mention the M-K work please.

Please avoid the use of 'we', instead use something like 'in this work. . .'

Line 470: R means correlation?

Line 480: Change 'begs' for a more appropriate word (needs, requires, etc.).

Lines 508 and 509: Please change the term 'lifespan'.

Line 513: Please rephrase the first point of the conclusions.

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