Ocean Sci. Discuss., 11, C832–C836, 2014
www.ocean-sci-discuss.net/11/C832/2014/

Ocean Science
Discussions
Open Access

Interactive comment on "Influence of frontal cyclones evolution on the 2009 (Ekman) and 2010 (Franklin) Loop Current Eddy detachment events" *by* Y. S. Androulidakis et al.

Y. S. Androulidakis et al.

iandroul@civil.auth.gr

Received and published: 23 September 2014

General Remarks

We would like to thank Referee #2 for the useful suggestions and for finding our manuscript well written and suitable with the scope of Ocean Sciences. We have accommodated his/her comments and suggestions and we believe that the new version addresses all concerns.

Revision Points

This is a detailed manuscript describing the evolution of the Loop Current (Gulf of Mex-

ico) during two summer events of eddy detachment. The authors use an operational simulation (that assimilates satellite data) in combination with in situ (mooring) and satellite records. After an evaluation of the model against observations, the evolution of the Loop current is analysed from model outputs. The authors also investigate the role played by slope processes based on the associated Potential Vorticity field. The article is well written although the large number of acronyms used difficult sometimes the reading. The organization could be slightly modified, as in my opinion most of the material that is included in the Discussion section could be in fact part of the Results section. I consider this manuscript fits well within the scope of Ocean Sciences and that it can be published after minor review.

My specific comments are presented below:

1) Title: This is a quite long title. I suggest removing the Ekman and Franklin names from the title.

Answer: The detachments of Loop Current Eddies are important events for the GoM, and the associated records have historical significance, hence they are given "official" names (similar practice with the naming of hurricanes, for instance). Eddy Franklin has received wide spread attention, as related to the 2010 DwH incident. Although we agree with the reviewer that the title is long, we decided to keep it unchanged.

2) Abstract: again I am not very convinced in the utility of giving a name to the two shedding events studied in this study.

Answer: We would like to clarify this aspect regarding the Loop Current Eddy (LCE) names. We did not name these ocean features ourselves. LCEs are such major events in the GoM that they are given names, which are then used by the whole GoM scientific community. Hence, both of the events have already been referred to with these names in previous publications, as the ones cited in the manuscript (Walker et al., 2011; Hamilton et al., 2011).

3) Abstract: The Campeche Bank is mentioned in the abstract, although many of the readers may not know where it is,: : : I recommend not being so detailed in the abstract.

Answer: We agree with the reviewer that some readers may not be familiar with the GoM geography. However, the Campeche Bank and the related dynamics (eddies and shelf processes) are a prominent feature in our article and have previously extensively appeared in the literature, including on manuscript titles (Zavala-Hidalgo et al., JPO 2003). To satisfy the Reviewer request, we will add "Campeche Bank (Southwest GoM shelf)" in the Abstract and the text.

4) Abstract: 'positive vorticity', replace by 'positive potential vorticity'

Answer: This will be changed

5) Objectives: To facilitate the reading of the paper, I would try to avoid acronyms in the description of the objectives (same holds for the titles of sections).

Answer: We agree with the reviewer that avoiding acronyms in the description of the objectives may facilitate reading and therefore we will modify accordingly Section 2 (Study Objectives.). We will change title of Section 4.1 to "Model evaluation during Eddy Ekman and Eddy Franklin shedding sequences", of Section 4.3 to "Tracks of frontal cyclones during Eddy Ekman and Eddy Franklin events of, Section 5.1 to "Structure and migration of northern gulf frontal cyclones", of Section 5.2 to "Campeche Bank Loop Current Frontal Eddies evolution and growth", and of Section 5.2.2 to "Contribution of slope processes to Campeche Bank cyclones evolution and growth".

6) Model evaluation: The authors show the temporal evolution of temperature at different depths given by the moorings in comparison with the simulation. What about salinity? Is it a relevant variable? Are the T-S diagram from model and observations similar?

Answer: We agree with the reviewer that salinity would be an interesting variable for comparison between the model and observations. However, the focus of our work is

in the description and discussion of dynamical processes, in which salinity has only a minor role. The scope of Section 4.1 (new Section 4) is first to provide a general validation to the already well-known GoM-HYCOM simulation, and then to show that it efficiently simulated LC, LCE, LCFEs and the respective shedding events during the summers of 2009 and 2010. We believe that showing temperature and sea surface heights during the events is enough to cover these objectives.

7) Figure 3: I suggest including here a sequence of SSH from model and altimetry in order to illustrate the detachment events. It is shown in Figure 5 but only for the model.

Answer: The available AVISO maps, used in the study, have weekly time step and therefore do not coincide with the dates presented in Figure 5. We believe that showing two characteristic dates of the shedding events (Figure 3) is enough to show the shedding event captured by the satellites. Expanding to more comparisons would violate the suggestion from Referee #1, who suggests putting less focus on the model validation.

8) Discussion: as stated above, I would merge the Results and Discussion sections in one single section entitle Results and Discussion

Answer: Following the suggestion by both Referee#1 and Referee#2 we modified Sections 4 and 5 and we separated the evaluation of the model from the main results. We separated Section 4.1 from the Results Section by producing a new smaller section dedicated to the model evaluation during the two events (4. Model evaluation during LCE Ekman and LCE Franklin shedding sequences). We will merge Results and Discussion sections in one single section entitle "5. Results and Discussion", including "5.1 Loop Current evolution in summers of 2009 and 2010", "5.2 LCFE tracks during Eddy Ekman and Eddy Franklin events", "5.3 Northern GoM LCFE structure and migration" and "5.4 Campeche Bank LCFE evolution and growth", following the reviewer's suggestion.

9) Section 5.1: 'The cyclonic LFCEs drive colder waters to upper layers through up-

welling'. This is a too simplistic view, as this process takes place only during the formation of a cyclone. Once it is formed, dipoles of upwelling/downwelling will be usually located on the edges of the eddy, according to QG theory (see for example Pollard and Regier, 1992).

Answer: We will modify this phrase, following the reviewer's comment.

10) Section 5.2.2: I found very interesting this section on the use of PV for the examination of slope processes. However, I think it should be better justified. It is not very clear why the authors choose this analysis of PV. Maybe a slightly longer introduction of the section referring to previous publications would help.

Answer: We agree that the introduction of this section was a little abrupt. We will modify the text at the beginning of Part 5.2.2 in order to better justify the use of the PV diagnostics.

11) Appendix A: this appendix is useful as it explains well the potential vorticity analysis (although the justification of the application needs to be expanded, as mentioned above). How are the errors estimated (lines 20-35)?

Answer: We are pleased that the Reviewer found the Appendix useful and we will be happy to clarify the error estimation in the revised text. The errors in total currents mentioned in the Appendix are errors in depth-averaged currents. We estimated these errors by comparing the depth-averaged currents from the reference Hycom model outputs, where the current is defined in hybrid layers, and the depth-averaged currents interpolated on purely isopycnal layers.

Interactive comment on Ocean Sci. Discuss., 11, 1949, 2014.