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Ocean Science Discussions

Interactive comment on "Influence of intraseasonal eastern boundary circulation variability on hydrography and biogeochemistry off Peru" *by* Jan Lüdke et al.

Anonymous Referee #2

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General comments: This research presents the shipboard currents, hydrographic and biogeochemical properties observation and satellite remote sensed sea surface temperature and sea level anomaly over the slope off the central Peru-Chile coasts. The authors used these data to investigate the possible scheme that determines shift of the upwelling system associated with the eastern boundary current in the southern hemisphere. Their most striking conclusion is that the southward propagating coastally-trapped waves (CTW), sourced from the equatorial current, played key (the authors used the word "likely" in the abstract) roles in determining those aforementioned variability in the upwelling system, or these CTW strengthened the southward transport of the sub-surface waters, which then "supersedes the simultaneous effect of down-

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welling in terms of nutrient response". In my opinion, this conclusion is interesting, but still questionable, since the authors didn't provide sufficient solid analyses to support the schematic they drew in the abstract and conclusion section. Before presenting more specific comments, I have to admit that the results from their field measurements are invaluable and comprehensive, and the author put a lot of effort on the quality control and demonstrating them by using nice figures, although it took me some time to link the caption of those figures will the contents presented. Another great point of this research is that the authors did this research in a very interdisciplinary way. The combined discussion based on theories of physical and biogeochemical oceanography is very enlightening. The general comments, if I correctly summarized those specific ones, are that "the posted evidences cannot sufficiently support the conclusions" and "you need more evidences about the changes in the currents, not only in nutrient responses".

Specific Comments: 1) It is worthy for the authors to further polish their writing. The meaning of majority of those sentences is not easy to extract, since some sentences are too long and composed by many elements. I noticed that there is another published comment on the details about writing, and skipped them then. 2) The authors listed too many details in the data processing section without paying sufficient attention to the interlinkages among these data. Yes, processing data is important, but it is more important for the authors to guide us towards the mainstream of their research flow by introducing the procedure of data processing. I can just get what did you do, this or that, but cannot understand why did you do that. There are too many subsections in the section 2. Please also make sure that tides are not important in determining the general characteristics of the general circulation in your study area. 3) The introduction section is not well written either. The only points I can get are that the eastern boundary current and upwelling system experience multiscale variabilities that were not well studied, and the anomaly in winds (actually not only winds) can stimulate southward propagating CTW along the coastline. The authors didn't extract enough information from those cited historic studies to persuade us that CTW was found to greatly alter

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the regional upwelling processes, for example, strong downwelling signal from historic studies was observed during upwelling-favorable forcing conditions. Those historic studies were just cited in and out without sufficient investigation. The novelty of this research is missing in this section, although it is much better summarized in the summary section. 4) I don't quite understand why did the authors link the effect of CTW to the intraseasonal variability of eastern boundary current, especially when they didn't do any analyses on the wind (stress and its curl) fields in the manuscript. Although they compared the observed currents with the climatological ones from, for example, numerical simulations, we still don't know whether the wind is comparable to is climatological conditions during the observation periods. Thereby, we cannot grantee that the variability is due to CTW, instead of migration of the wind system. Moreover, there were plenty of studies, for example, Zhang and Lentz [2017], have clearly showed that the response of shelf currents to the regional topography will also greatly modulate the domestic response of the current system. So, variability of the along-slope current itself is also worthy to be investigated. Talking about the time scale of intraseasonal, I also suggest the authors to investigate whether there are any meso-scale processes, for example, eddies, formed or detached from the main currents to generate the transition.

5) We knew that Kelvin waves or CTW will be continuously stimulated in its source region and propagate along the path you sketched. The authors used this process to explain the intraseasonal variability in the cold half year. Does that mean when the first CTW propagate through the system, the upwelling system will be shifted to a downwelling one and never switch back in the coming season? What will happen in, for example, December and January, when the downwelling system is switching back to an upwelling-dominant condition? It was also known that those CTW will be domestically arrested by irregularity of the along-slope topography to form standing waves and alter the regional cross-slope processes. The recent study of Kämpf [2018] also showed that there will be downstream propagation of topographic waves after the strong current passing through an irregular topography, for example, canyon or ridge. This is another possible process that determine the domestic response of the regional dynamics to the

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CTW or general disturbances in both barotrophic and baroclinic modes.

In summary, this study is a great try to advance our understandings on the transition of the eastern boundary currents, and they provided us invaluable observational evidences and detailed analyses. However, it is not easy for this single research (not their series of studies) to answer all those previous questions. I suggest the authors to investigate the spatial and temporal variation of winds (stress and curl) and variability of the currents from, for example, numerical simulations or some widely used global simulations (e.g. HYCOM and CMEMS) to expand the vision of this research and make sure that the variability is mostly determined by the southward propagating CTW, instead of the other processes, including, for example, migration of wind system, along-shore variability of slope current and response of slope currents to the domestic irregular topography. The authors didn't show us the general distribution of the regional topography, yet. The authors are also suggested to more explicitly define the timescale of intraseasonal variability in the manuscript. In my opinion, CTW may determine the synaptic variation of the current system, while migration of the wind system (and the associate variation in the eastern boundary currents) will determine the entire background characteristics of the flow condition (upwelling or downwelling pattern). This will possibly be clearer than the term "intraseasonal" in your manuscript. A three-dimensional schematic of the flow pattern, propagation of CTW and responses in biogeochemical processes will greatly elevate this research, too.

References: Kämpf, J. (2018), On the Dynamics of Canyon–Flow Interactions, Journal of Marine Science and Engineering, 6(4), 129. Zhang, W., and S. J. Lentz (2017), Wind-driven circulation in a shelf valley. Part I: Mechanism of the asymmetrical response to along-shelf winds in opposite directions, Journal of Physical Oceanography, 47(12), 2927-2947.

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