Ocean Sci. Discuss., 11, C417–C421, 2014
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Ocean Science Discussions
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Interactive comment on "One plausible reason for the change in ENSO characteristics in the 2000s" *by* V. N. Stepanov

Anonymous Referee #3

Received and published: 27 May 2014

This manuscript is long and extremely hard to follow. From what i can gather there is no new results presented until 11 pages into the manuscript. Given that there are only 6 pages discussing the results, an 11 page introduction is clearly too long. In this introductory material, there is a lot of discussion of the authors previous results, some relevant and some not so much along with a lot of literature that is not really relevant to the current study. Further to this, and probably directly related, this extremely long introductory section is very hard to follow with no clear logical flow. There are also places where it seems, it may simply be the incorrect usage of grammar, that author may not totally understand the current status of our understanding of ENSO. There are also times, however, where the author appears to have a good grasp on the literature.

From what I understand of the authors previous work, it suggests that the Southern

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Ocean can influence the tropical Pacific. An interesting hypothesis. However, the question of whether these tropical Pacific changes are big enough to affect ENSO is not addressed here or in the previous work. The Nino 4 temp anomalies presented in Figure 2 are scaled, by how much is not mentioned. Are they tiny? Given that three recent westerly wind bursts on the equator have generated subsurface temperature anomalies that are up to 6oC, the subsurface temperature changes shown in Figure 3 are very small (+/- 0.5oC). Thus, it is not clear whether these anomalies would even impact the energetic tropical Pacific ocean-atmosphere system.

This work focuses on trying to link ENSO with SLP west of the Drake Passage. This link appears tenuous and the one plot that shows SLP in the region plotted against Nino3.4 SSTA, shows that SLP appears to lag Nino3.4 in many cases. Regarding the increased role of these SLP changes on ENSO since 2000, the correlation between the two indices is actually lower for this period than for the period prior to the 2000s. Again this does not appear to support the authors conclusions.

The EOF analysis used further decomposes these pressure signals, and the fact that the 5th EOF which accounts for 5% of the variability is being discussed does not add value and even highlights how tenuous this link is.

In my opinion, ff the author really wants to identify the affect these Drake passage (or EOF5) winds can have, I suggest using partially coupled CGCM simulations. These simulations could be coupled in the tropical Pacific, thus ensure they have ENSO variability, while forcing with some form of idealised forcing in the Drake Passage region.

Major comments

page 946: Oscillator model paradigm for ENSO are now widely accepted, which is generally true. However, three different Oscillator models are presented and the differences between these oscillator models is not described and the explicit mentioning of Kelvin waves makes me think that maybe the author does not understand the recharge oscillator.

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Following this, it is also mentioned that Kelvin waves may initiate events. This is pretty widely accepted, and relates to the role of westerly wind bursts triggering events.

page 947: My understanding of the propagation of SSTs during ENSO events, is that all La Nina and most small-moderate magnitude El Nino events propagate from east to west (e.g., see McPaden and Zhang 2009). The two big El Nino events of 1982/93 and 1997/98 are those which propagate from west to east. Interestingly, and in direct contrast to what you are stating here, these two events are widely considered conventional and they have there maximum SST anomalies in the nino 3 regions.

The lead lag relationship between nino 3 and nino4 region SSTA is simply indicative of SSTA propagation, so i would expect this lead-lag relation to reverse if the big El Nino events of 1982/83 and 1997/98 could be removed from this analysis.

page 953: it is mentioned that two different equatorial Kelvin waves are triggered by the Southern Ocean forcing, one at the western boundary and one of the opposite sign in the central Pacific. Is this consistent with the wave mechanism reported? Given it fundamental role in the hypothesis presented here, these waves and there pathways really needs to be better described. There are many other components of this introduction which can be removed to facilitate this, in my opinion, so the length need not be increased. Infact, really think the intro needs to be shortened significantly.

Page 955, how can a high atmospheric pressure located upstrean of the Drake passage "lock" the Drake Passage?

Bottom of page 955. Figure 5 does not confirm this hypothesis. Only two events are shown, why not show this pressure pattern for all El Nino and La Nina events? Even then, if all of these composite members display the upstream Drake passage pressure signal (as well as the composite mean) it does not imply cause. It is suggestive of a relationship but could be an affect, or even simply luck...

First paragraph, page 956: The last sentence suggests that the pressure anomalies in

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the upstream Drake passage region is the cause for all observed ENSO events since the 1990s. If this is true, shouldnt an index of pressure in this upstream region show a strong correlation with ENSO if this is the case? This would be much easier way to present this idea.

Second paragraph, page 956: You spend the whole page trying to say that the pressure signals upstream of the Drake Passage precede El Nino events, then in this paragraph you say this same region is crucial for the dynamics of the whole ACC. How did this huge leap come about? No analysis of the ACC has been presented that i can see.

Third paragraph, page 956: There is no evidence presented for defining this line at 48oS. It is stated that it separates cyclones and anticyclones, but some evidence of this is needed.

Figure 6: The pressure index has been shifted forward by 4-months (caption) but it appears to lag N34 SSTA in many instances. From my understanding of the mechanism, this shifted index should line up the peaks. This fact makes me think that an affect of ENSO is being identified, not a cause.

page 958: How is the affect of tropical cyclones excluded?

Hasn't the standard deviation of Nino3 or Nino3.4 SSTA also decreased since the 2000s consistent with this decrease in SLP variability? Given that it is a tightly coupled system, what role does this SST standard deviation decrease play in the decrease in tropical pacific SLP variability?

Are these changes in SLP variability significant? A Montecarlo test, or something similar, should be carried out to see whether any 10yr (or even 4yr as in Fig. 7f) period in the pre-2000 data displays changes in SLP variability that are as big as the highlighted post-2000 (or post 2008) period.

regarding: SLP variability in the Drake Passage region hasnt changed. Looking at Figure 7a and b, i would say that the variability of the tropical Pacific had not changed

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significantly either. What happens if you extend c and d so that you can see the southern ocean.

Minor comments:

page 946: "Under these conditions" sentence is repeated.

Figure 2: why plot the transport of the drake passage, it apparently has no relationship with the other two time series. What is the magnitude of

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