

Interactive comment on “Transition to El Niño conditions in the eastern tropical Pacific in October 2015” by Lothar Stramma et al.

Anonymous Referee #1

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Review of the paper “Transition to El Niño conditions in the eastern tropical Pacific in October 2015” by Stramma et al.

This paper documents the changes in water masses and circulation patterns in the equatorial and eastern south pacific from an oceanographic cruise which took place in october 2015 during El Niño (EN). Profiles and sections for temperature, salinity, oxygen, nutrients and ADCP current measurements are compared with those from previous cruises under different neutral, EN-like and La Niña-like conditions. The results show that the eastern flow associated to the EUC along the equator has greatly diminished in october 2015, and that temperature and oxygen have increased, while salinity has decreased. Near the Peru shore, cross-shore sections along the northern coast (9° and 12°S) display typical EN conditions with the upwelling of warmer, more oxygenated waters, while the EN patterns are not evidenced at lower latitudes (14° and

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16°S).

General comment: Documenting EN conditions in this region of the Pacific is important particularly as there are not many measurements published in the literature during previous events. I found the paper well written and interesting to read. Most of my comments are minor.

Minor comments: Abstract: L23: transition to EN conditions west of the coastal sections is not well documented in the paper. Figures are not shown and it should be discussed how EN can be present offshore and not nearshore. What is the local process that could compensate the nearshore warming? Wind-driven upwelling? This should be investigated and discussed in more detail.

Introduction: P2L7: The denomination of Central EN or Modoki has been found in the literature previously to the publication of Dewitte et al., which is mainly a model study focused on the Peru region. I also think that other references (L10) should be cited to document the impact of EN off Chile (Ulloa et al., 2001 is an example but there must others more recent)

P2L19: "Climate modelling evidence": I would rather ponder this statement and write that climate models suggest that a doubling in the occurrence..

P3L20: "As a result of circulation changes" This is really vague. Could you be more specific?

P6L19: "The equatorial spreading of the thermocline" This spreading of the thermocline is unclear to me. Is it zonal, meridional? Could you rephrase?

P6L25: "...intensifies from 16 to 15..": is such a decrease of the mean oxygen concentration robust? This 1 micromole difference seems very small.

P7L10: The sentence is clumsy. I also do not understand the concluding sentence of the paragraph. Why should higher salinities be expected in the pycnocline during EN?

P8L6: What about local increase of precipitation and/or poleward displacement of the equatorial front (associated with the ITCZ) which separates fresh waters off Ecuador from more saline waters off Peru?

P8L21: higher PNM during EN. I understand the deepening of the peak due to the deeper pycnocline but not the more intense PNM. How can it be explained? could this be due to an increase in denitrification?

P9L6: A citation of EN years considered in Czeschel et al. 2012 would be useful here.

P9L16: I would rather say an "ocean model" than a climate model which refers more often to ocean-atmosphere coupled models.

P10L2: "in Nov 1982" is repeated twice in the sentences

P10L11: in Fig 6, could you add "positive eastward" for zonal velocities?

P11L18: "November minimum at 95°W". A reference is missing here and I do not see how this statement on the EUC at 95°W backs up the fact that it should be a reasonable estimate of the EUC in neutral EN conditions.

P12L5: the reference to Gutierrez et al. is misplaced. This sentence should be moved to L1 where SST are described. I am not sure Sydeman et al is really relevant here.

P12L16: I do not have a problem with citing Strub et al which is a review, but other papers should be cited as well (Halpern et al. 2001 , Enfield, 1981; Huyer et al., 1987)

P12L20: Here same remark as before, I think that Strub et al 1998 can be cited but other papers as well (which are cited by Strub in his review).

P12L26: "Reduction of the ODZ area": I do not understand how this area is computed. It seems more a vertical displacement of the OMZ than a reduction of its area. Could you clarify?

P13-16: I think there are too many figures in the supplementary here. Please reduce

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them and add some of them to the paper section, as it is very difficult to follow without looking at the figures in the supplementary.

P14L3: could the lower nutrient concentrations in october 2015 be due to the seasonal variations of the nutricline?

P14L14: I would conclude this sentence by saying explicitly that this process may produce more nitrate. I think that is important as one may think that all nutrient pools (phosphate, silicate AND nitrate) decrease during EN, which is not always the case from your observations.

P14L24: You suggest that diatom biomass may increase during EN due to the N:P increase. However both nitrate and phosphate concentration reduce strongly during EN, which should impact negatively phytoplankton growth more than the N:P increase. Previous studies have shown that the surface chlorophyll observed from satellite decreases during EN (Carr et al. 2002) and the ecosystem suffers dramatic changes during extreme EN (Barber and Chavez, 1983, Chavez et al. 2003).

P15L7: At 12°S, higher nitrate... how can higher nitrate indicate a developing EN? This sounds contradictory.

P16L14: I think you should also mention the strong intraseasonal signals in the equatorial pacific in neutral periods, with the passage of upwelling and downwelling waves at intraseasonal time scales (Cravatte et al., 2003; Echevin et al. 2013). during a cruise, if sampling is performed during the passage of a downwelling wave in a neutral EN period, this might have some similarity with EN conditions.

P17L15: I do not understand the sentence. Please rephrase.

P17L18: Measurements are carried out by CNRS, IRD and IMARPE . IFREMER is the owner of the glider, which is part of the french national glider pool. Here is a link with more precise information (in french): <https://www.ird.fr/toute-actualite/actualites/communiqués-et-dossiers-de-presse/cp-2015/lancement-de->

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References: Ulloa et al., 2001. Evolution and biological effects of the 1997-98 El Niño in the upwelling ecosystem off northern Chile, GEOPHYSICAL RESEARCH LETTERS, VOL. 28, NO. 8, PAGES 1591-1594, APRIL 15, 2001.

Halpern, 2002. Offshore Ekman transport and Ekman pumping off Peru during the 1997–1998 El Niño. GEOPHYSICAL RESEARCH LETTERS, VOL. 29, NO. 5, 10.1029/2001GL014097, 2002

Enfield, D. B. Thermally driven wind variability in the planetary boundary layer above Lima, Peru, J. Geophys. Res., 86, 2005 – 2016, 1981.

Huyer, A., R. L. Smith, and T. Paluszkiwicz. Coastal upwelling off Peru during normal and El Niño times, 1981 – 1984, J. Geophys. Res., 92, 14,297 – 14,307, 1987.

Carr, M.-E., P. T. Strub, A. C. Thomas, and J. L. Blanco, Evolution of 1996 – 1999 La Niña and El Niño conditions off the western coast of South America: A remote sensing perspective, J. Geophys. Res., 107(C12), 3236, doi:10.1029/2001JC001183, 2002.

Richard T. Barber and Francisco P. Chavez. Biological Consequences of El Niño, Science, New Series, Vol. 222, No. 4629 (Dec. 16, 1983), pp. 1203-1210, <http://www.jstor.org/stable/1691793>

Chavez et al. 2003. From Anchovies to Sardines and Back: Multidecadal Change in the Pacific Ocean, SCIENCE, VOL 299, 10 JANUARY 2003

Cravatte, S., Picaut, J., Eldin, G., 2003. Second and first baroclinic kelvin modes in the equatorial Pacific intraseasonal timescales. J. Geophys. Res. 108 (C8), 3266, <http://dx.doi.org/10.1029/2002JC001511>.

Echevin et al. 2013. Intraseasonal variability of nearshore productivity in the Northern Humboldt Current System: The role of coastal trapped waves, Continental Shelf

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