Ocean Science Discussions

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Comment on os-2021-13

Anonymous Referee #2

Referee comment on "Interannual variability in contributions of the Equatorial Undercurrent (EUC) to Peruvian upwelling source water" by Gandy Maria Rosales Quintana et al., Ocean Sci. Discuss., https://doi.org/10.5194/os-2021-13-RC2, 2021

Review of "Interannual variability in contributions of the equatorial undercurrent to Peruvian upwelling" by Quintana et al.

This study makes an attempt to link the interannual variability of the Equatorial Undercurrent (EUC) to that of the Peruvian upwelling, by back-tracking particles released in the Peruvian upwelling region to the equatorial Pacific. Particle tracking is an effective technique in tracing the origins of water masses. The application of the technique in this study, however, is insufficient. The authors estimated the contribution of the EUC to the Peruvian upwelling from just one release per year without demonstrating that this one release is representative of the oceanic condition of the corresponding year. For a fuller exploration of the connection between the EUC and the Peruvian upwelling, particles need to be released throughout of a year so that stable statistics can be obtained.

The analysis and interpretation of the results are also insufficient. Results from particle tracking show that the strongest influence of the EUC to the Peruvian upwelling is in 1997 (an El Niño year). The authors' explanation is flawed (e.g. flattening of thermocline, lines 201-203), or has no physical basis (e.g. lines 215-216). I suggest that the authors consider more carefully the timing of various events – the release time of particles, the transit time for particles to reach the equator, and the structure of the EUC near the eastern boundary at the time of particles' arrival so that a clearer view of particle dispersal can be obtained.

Some specific comments:

1. Introduction

Line 48: Are there available data for the total pelagic fish landings in 1997, 1998 and 1999?

2. Methodology

Line 85: Peruvian upwelling happens year-round with variability (your figures 3 and 4), what makes December 31 a good release time for particles to sample interannual variability?

3. Results and discussion

Lines 172-173: How did the authors determine from Fig. 8 that there was a flattening of the thermocline?

Lines 181-183: These lines state that the EUC disappeared from the central Pacific in December 1997 - January 1998, and that the EUC transport anomalies exceeded -20 Sv for much of 1997.

Lines 196-198: How do particles near 160°W in the EUC arrive at the Peruvian upwelling region in 1997 in large numbers if the EUC transport is reduced or absent (lines 181-183, above)?

Lines 200-203: Do the authors suggest that the EUC can persist when the thermocline (pycnocline) is flat?

Lines 203-218: Perhaps this is an issue with timing instead of specific types of El Niño or La Niña. For example, the transport at 160°W in late 1998 is unlikely making an impact on particles released in the Peruvian upwelling region on 31 December 1998. The coastal flow and the EUC in the vicinity of the eastern boundary are much more relevant for the initial dispersal of particles.

Line 229: Was there a La Niña event in November 1993 – March 1994? April - August 1998 was a transition period from El Niño to La Niña.

4. Conclusions

First sentence: The investigation is not systematic because only water that upwells in the Peruvian region in December each year is tracked. No evidence is provided that December is representative of the whole calendar year.

Lines 285-286: The EUC is driven by zonal pressure gradient. When the thermocline (pycnocline to be precise) is flattened at a certain longitude, does the EUC not weaken or disappear at that location.