HCS072 - A Lagrangian study of the PCUC source waters

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Key words: Lagrangian, undercurrent, upwelling, model, source water

The ROMS (Regional Ocean Modeling System) sigma-coordinate model was run in a configuration from 5°N to 35°S, including both Peru and Chile basins to 99°W, to study the origins of the PCUC (Peru-Chile UnderCurrent) and coastal upwelling waters. To allow computation on that large spatial domain, resolution was limited to 1/6° and time period to 2000 - 2004. The model was forced with daily QuikSCAT winds and boundary conditions prescribed by ECCO (Estimating the Circulation and Climate of the Ocean) model results.
To compute trajectories, an offline algorithm allowing backward calculation [Blanke and Raynaud, 1997] was used on the mean state and climatology derived from that interannual simulation. Particles were initially located along the Peru and Chile coasts in the core of the PCUC and at the surface. A backward integration then permitted to evaluate the particles origins. 3 sources were identified: the SSCC (South Subsurface Counter Current or Tsuchiya jet), the lower part of the EUC (Equatorial Under-Current) below 100 meters, and a subsurface current coming from the south of the region. This current is probably part of the south-east gyre return branch and is characterized by an extremely low salinity. This water mass has the properties of the Eastern South Pacific Intermediate Water (ESPIW) [Schneider et al, 2003]. Transport was computed to quantify the relative contribution of each source. The EUC brings about 1.8 Sv of water which mainly upwells along the Peru coast. The Southern branch brings around 0.4 Sv; only along the Chilean coast at about 30°S. The SSCC is the main source of water with more than 3 Sv. Part of this water upwells along the Peru coast but another part (0.7 Sv) flows south of 18°S in the Peru Chile undercurrent. Moreover, 2 distinct cores were identified in the SSCC, (around 4°S and 8°S at the western boundary of the model) in agreement with previous observations [Rowe et al 1999]. The first core (4°S) mainly feeds the Peru upwelling whereas the seconds (8°S) also feeds the Chile undercurrents and upwelling.

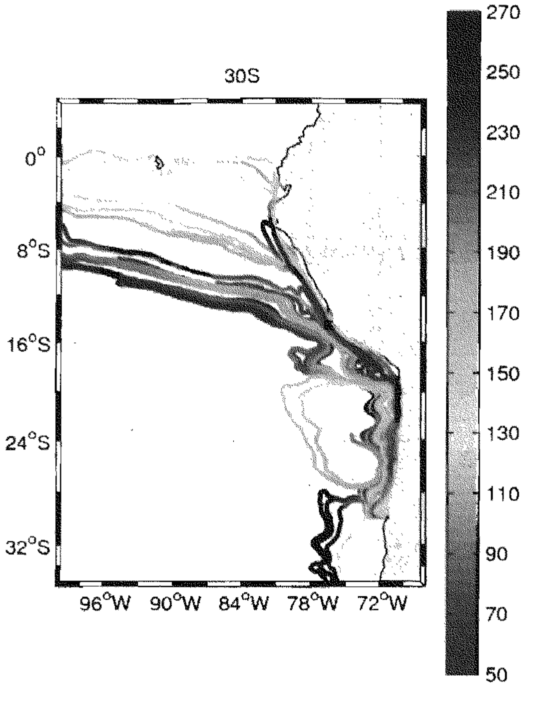

Figure 1: Backward trajectories of particles initially positioned in the PCUC core at 30°S. Colours represent depth.

HCS095 - Statistical study of mesoscale characteristics in the Eastern-South Pacific. A review based on different approaches

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Keywords: Eastern South Pacific; Mesoscale characteristics; Satellite altimetry; Lagrangian drifters; Spatio-temporal variability.

Based on nearly 15 years of satellite altimetry measurements and 25 years of Lagrangian surface drifters data, this study investigates the mesoscale characteristics of the Eastern South Pacific (ESP). Three different vortex identification techniques (sea level anomaly contours, Okubo-Weiss parameter based on satellite surface geostropic current fields, and surface drifter loops) are used to provide the mean kinematics properties of the ESP eddies and their main characteristics (length scales, rotation period, swirl and translation velocities).

The "Chile-Peru Current eddies" have a typical diameter of order of 30 km, smaller than the typical Rossby radii observed in the region. They are principally formed near the South American coast and propagate seaward with a translation velocity varying from 3 cm s^{-1} at 40°S to 6 cm s^{-1} north of 15°S. Long-lived anticyclonic eddies propagate northwestward (Figure 1a), whereas cyclonic vortices propagate westward (Figure 1b), consistent with the vortices propagation theory on a β-plane. The radial distribution of the swirl velocity shows that the Chile-Peru Current eddies have a maximum diameter of order of around 200 km with a swirl velocity of around 14 cm s^{-1} and a rotation period of 50 days. No significant difference is observed between the tangential velocities of cyclonic and anticyclonic eddies.

The good temporal coverage of satellite altimetry observations also allows investigating the seasonal and interannual variations of eddy generation, in particular along the Peruvian coasts. The number of coastal eddy centers is 35-45% higher during autumn than during spring (Figure 1c), probably associated with the seasonal variation of the thermal upwelling front. Eddy activity strongly increased during the 1997-1998 El Niño period but also throughout the study period with an increase of 60% between 1992 and 2004 (Figure 1d). Off-shore mesoscale activity being associated to the upwelling rate at the coast, the data collected during the IMARPE cruises of 1992-2005 are also interpretated in the light of the above analysis.

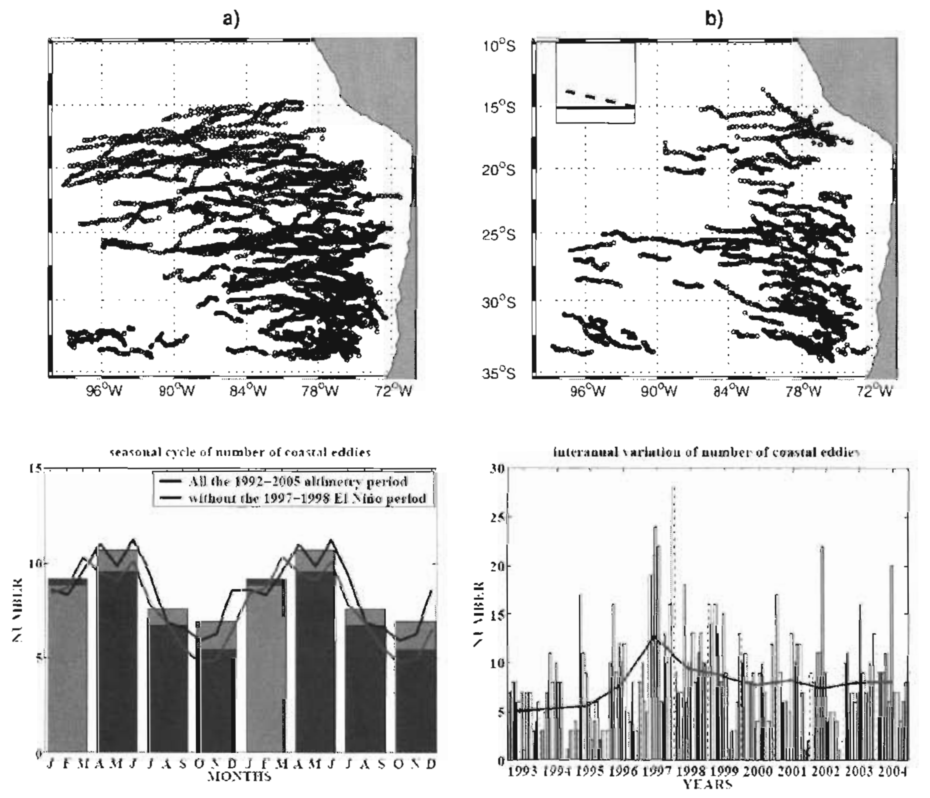

Figure 1. Propagation pathways for (a) cyclonic and (b) anticyclonic eddies tracked with altimetry data for more than 3 months. The inset in Figure 3b shows the mean propagation direction of the cyclonic (solid line) and anticyclonic (dashed line) eddies. Seasonal cycle (c) and interannual variations (d) of the number of coastal eddies in the Peruvian region [5°S-20°S; between the coast and 4° offshore

HCS193 - Some evidences of physical-biological coupling between jack mackerel larvae and mesoscale structures off central Chile

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Chaigneau Alexis, Grados C., Pizarro O., Dewitte Boris, Vasquez L. (2006)

Stastistical study of mesoscale characteristics in the eastern-south Pacific : a review based on different approaches

In : *Climate ocean dynamics, ecosystem processes and fisheries : the Humbolt current system : book of extended abstracts*

La Paz (BOL) ; La Paz : IMARPE ; IRD, p. 41-42

International Conference on The Humboldt Current System : Climate, Ocean Dynamics, Ecosystem Processes and Fisheries, Lima (PER), 27/11/2006-01/12/2006.