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The formation of an anticyclonic mode water eddy within the Peru-Chile Undercurrent.

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Introduction

The near coastal ventilation of the Peruvian oxygen minimum zone is studied. This productive upwelling regime is characterized by pronounced mesoscale variability. The formation of an anticyclonic mode water eddy and its effects on the near coastal salinity and oxygen distribution is presented.

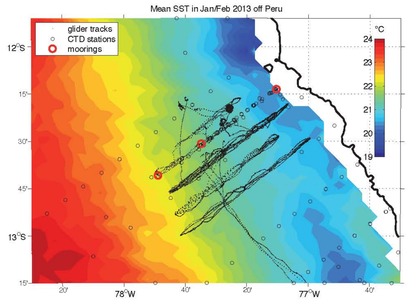

Figure 1 - Mean sea surface temperature off Peru in Jan/ Feb 2013 with CTD stations, glider tracks and mooring positions.

Experiment

A multi-platform observational study including a swarm experiment with seven gliders and ship based / moored measurements was conducted within the Peruvian upwelling regime in early 2013. The gliders measured >15.000 profiles of pressure, temperature, salinity, oxygen, chlorophyll and turbidity which translates into 65 high-resolution transects over a period of two months.

Eddy formation

A low oxygen anticyclonic mode water eddy is formed within the glider field resulting in large cross-shore velocities.

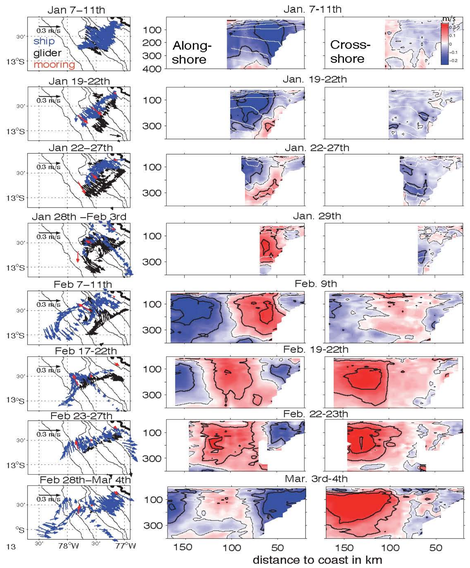

Figure 2 - Horizontal circulation off Peru (upper 400 m) at 8 different times (left). Along- (middle) and cross-shore (right) velocities observed by vessel mounted ADCP. Isopycnals in white.

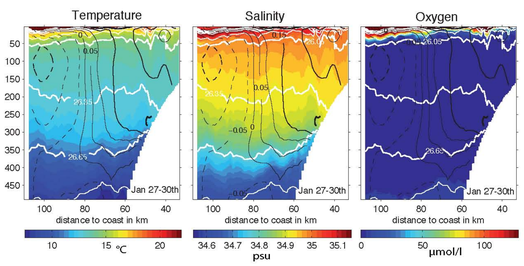

Figure 3 - Temperature, salinity and oxygen distribution within the mode water eddy. Isopycnals in white and geostrophic velocities in black contours.

Mesoscale stirring

Small scale density compensated salinity anomalies are formed at the eddy edge by mesoscale stirring. No oxygen is found below 70 m.

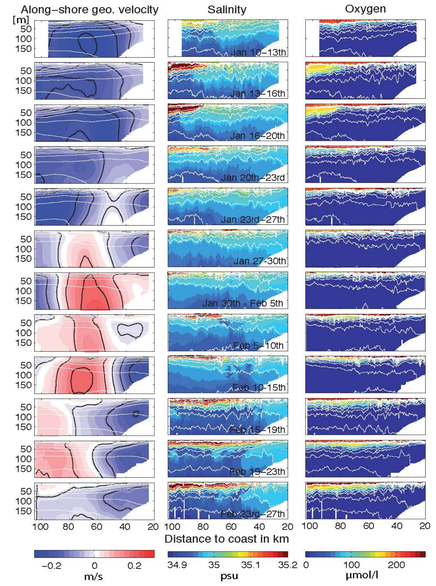

Figure 4 - Repeated transects of alongshore geostrophic velocities (left), salinity (middle) and oxygen (right).

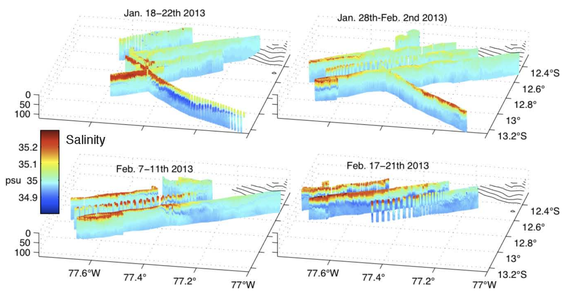

Figure 5 - 3D near surface salinity field at 4 different time periods observed by the glider fleet showing the formation of small scale salinity anomalies at the eddy edge.

Near-inertial oscillations

Enhanced near-inertial energy (NIE) is found at the eddy base possibly due to downwards propagation of NIE within the anticyclone and NIE accumulation at a critical layer below.

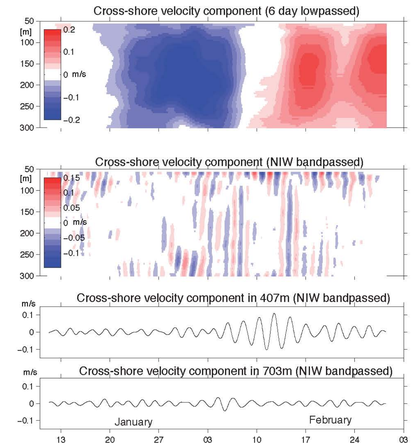

Figure 6 - Cross-shore velocity component from moored ADCP measurements between 50 - 300m (a) low passed (6 days), (b) NIW bandpassed (1.5-3 days) and RCM measurements at (c) 407 m and (d) 703m both NIW bandpassed.

Summary

The formation of a low oxygen mode water eddy within the upwelling regime off Peru in Jan/Feb 2013 is shown. The cross-shore velocity component results in a cross-shelf water mass exchange. At the eddy edge small scale density compensated salinity anomalies are formed by mesoscale stirring. The oxygen concentrations vanish below 70m. Enhanced NIE is found just below the eddy.