Vertical structure of mesoscale eddies in the four Eastern Boundary Upwelling Systems

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1. Introduction

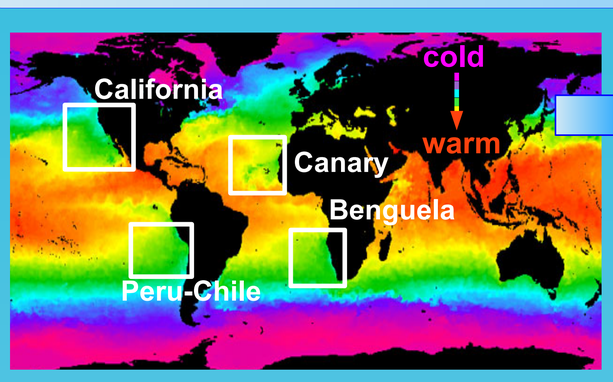


Fig 1 : Sea surface temperature and the major Eastern Boundary Upwelling Systems (EBUS) [NOAA image]

Similar dynamics :
- Surface equatorward current
- Subsurface poleward current

→ strong vertical shear

Mesoscale eddies:
- Generated near the coast
- Trap water in their cores
- Westward propagation

Important role for the transfer of physical and biochemical properties from the coastal to the open ocean

Do eddies share similar vertical structure in the four EBUS ?

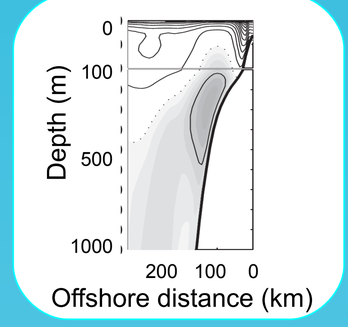


Fig 2 : Alongshore averaged velocity between 20-23°S, off Namibia (Benguela). Gray shading corresponds to poleward currents. [Veich, 2010]

2. Data & Methods

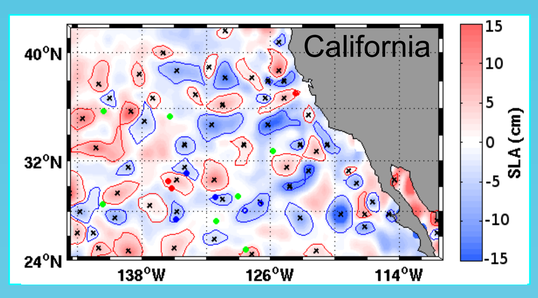


Fig 3 : Detection of AEs (red contours) and CEs (blue contours) on a given Sea Level Anomaly map. Black crosses are the eddy centers. Dots correspond to the position of Argo floats surfacing in AEs (red), CEs (blue) or outside eddies (green).

Weekly altimetry maps + Argo floats

Eddy detection algorithm **[Chaigneau et al., 2008; 2009]**

Mesoscale eddies (Amplitude ≥ 2 cm)

Temperature & Salinity vertical profiles

COLOCALISATION

Temperature & Salinity profiles in Anticyclonic Eddies (AEs), Cyclonic Eddies (CEs), and Outside eddies (Out)

Removing a local mean computed from profiles at +/- 200 km & +/- 1 month

Temperature & Salinity Anomalies

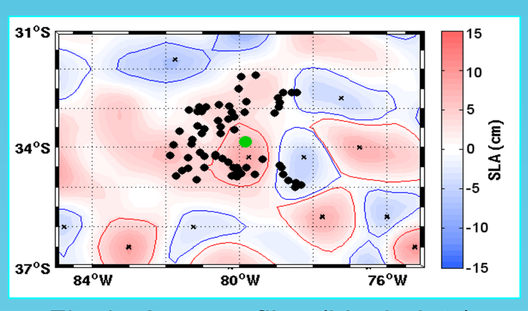


Fig 4 : Argo profiles (black dots) used to compute the local mean removed from the green profile to obtain T/S anomaly profiles

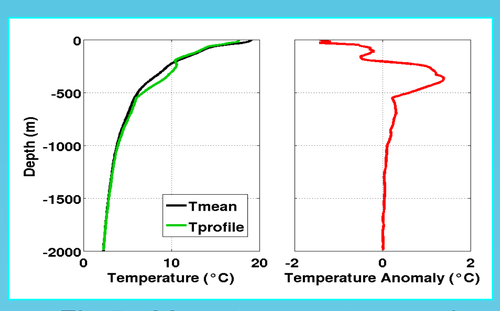


Fig 5 : Mean temperature and temperature anomaly profiles showing the subsurface signature of an AE.

3. Results

1. Mean vertical characteristics in each Eastern Boundary Upwelling System

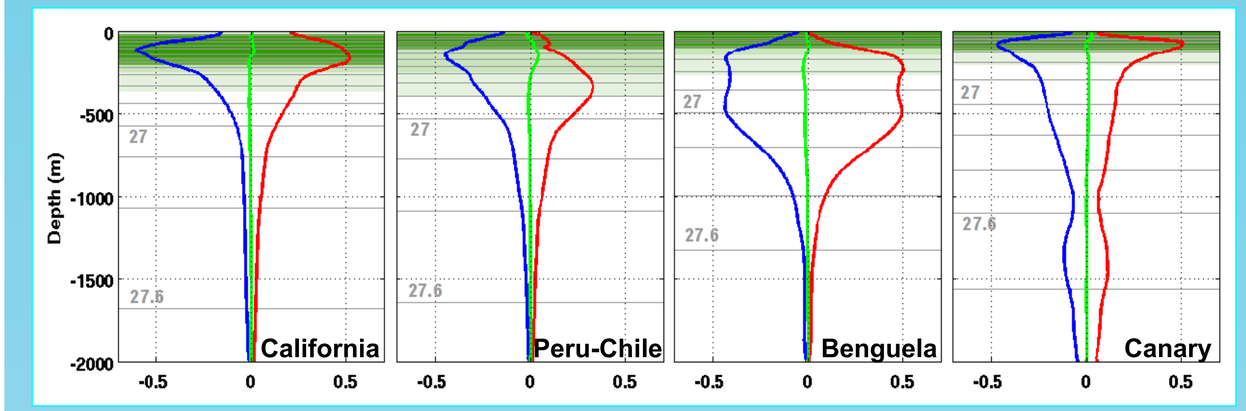


Fig 6 : Mean Temperature Anomaly profiles (°C)

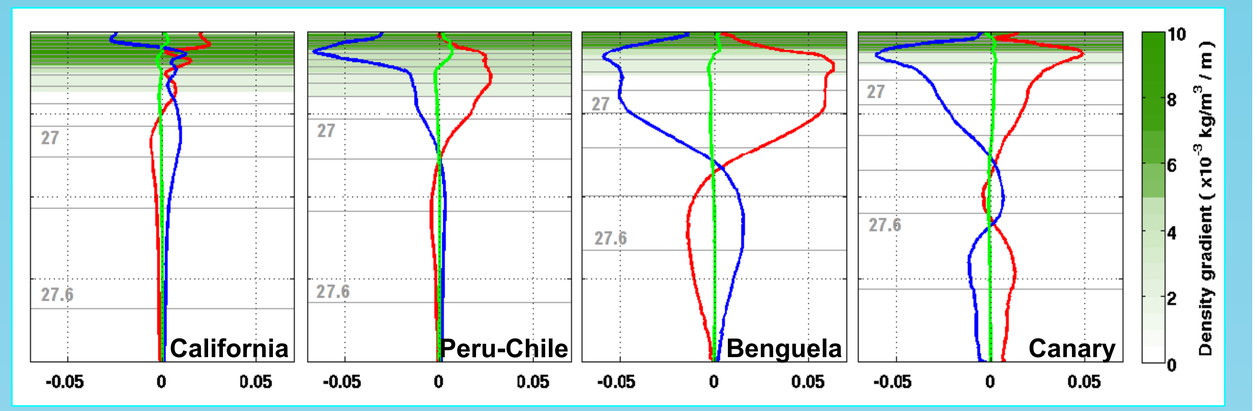
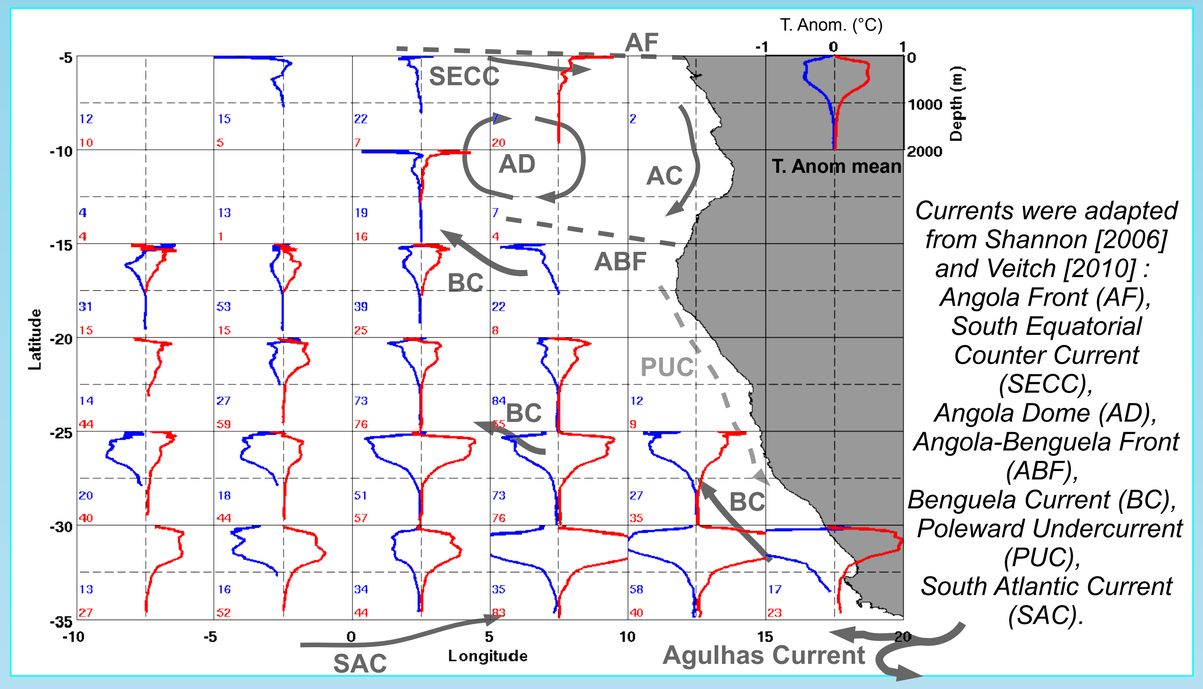
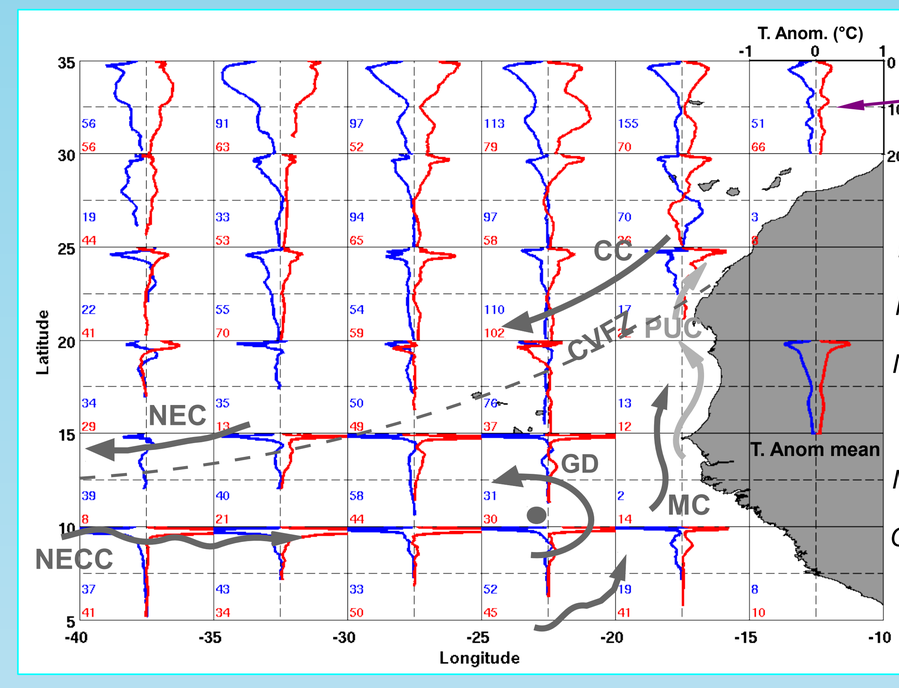


Fig 7 : Mean Salinity Anomaly profiles

2. Temperature anomaly profiles within mesoscale eddies in the Benguela (left panel) and Canary (right panel) Upwelling Systems



Currents were adapted from Shannon [2006] and Veitch [2010] : Angola Front (AF), South Equatorial Counter Current (SECC), Angola Dome (AD), Angola-Benguela Front (ABF), Benguela Current (BC), Poleward Undercurrent (PUC), South Atlantic Current (SAC).



Currents come from Pena Izquierdo [2012] : Canary Current (CC), North Equatorial Current (NEC), North Equatorial Counter Current (NECC), Poleward Undercurrent (PUC), Mauritania Current (MC), Guinea Dome (GD), Cape Verde Frontal Zone (CVFZ).

4. Conclusions

- **Altimetry + Argo floats → efficient tool to reconstruct the eddy vertical structure**
- **Strong differences between each EBUS**
- **Strong heterogeneity within each EBUS**

5. Perspectives

- **Track eddies in time and space to depict the evolution of their vertical structure**
- **Classify the main eddy types using cluster analysis in each EBUS**
- **Determine the main forcing mechanisms involved in their formation**

Ocean Surface Topography Science Team (OSTST) Meeting
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This study is part of the OSTST project entitled "Merging of satellite and in situ observations for the analysis of meso and submesocale dynamics"