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Isopycnal analysis of T-S anomalies in mesoscale eddies

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1- Introduction: In this study, we analyzed temperature and salinity anomalies (θ' and S') within new born mesoscale eddies along isopycnal surfaces in the tropical Atlantic ocean (TAO). We also infer the possible mechanisms at the origin of eddy potential vorticity (PV) anomaly generation.

2- Data and methods:

1- Mesoscale eddies were detected from the daily ADT from 2000 to 2017 and were co localized with Argo θ - S profiles

2- θ' were computed on density-coordinates by subtraction of the local climatological mean from θ .

3- θ' were classified into significant **positive** or **negative** and **non-significant** surface (above the pycnocline) and subsurface (below the pycnocline).

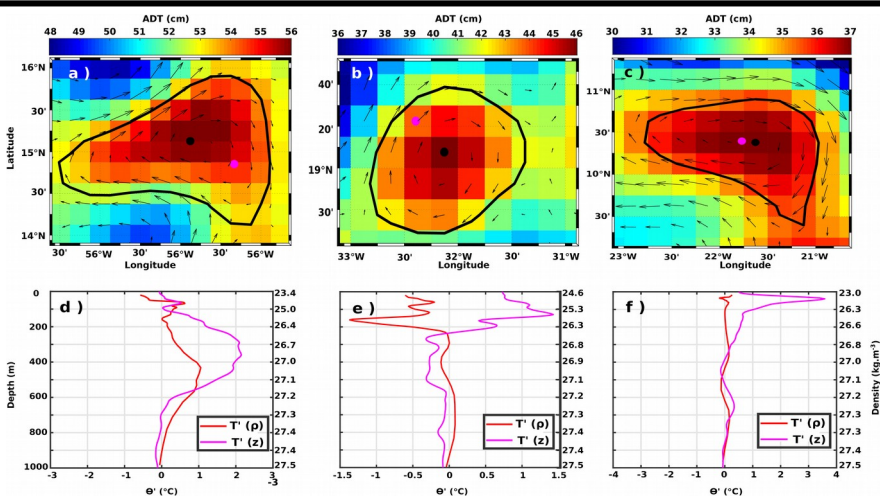


Figure 1. Case study of AEs. Top panel : eddy altimetric signals with Argo float (magenta dots) and eddy centers (black dots) location. Lower panel : θ' on depth (magenta) and density (red) coordinates.

3-Results

On depth coordinates, θ' are always positive for AEs, but on density coordinates, anomalies can be **positive**, **negative** or non significant for both anticyclonic and cyclonic eddies (AEs and CEs) (Fig1.)

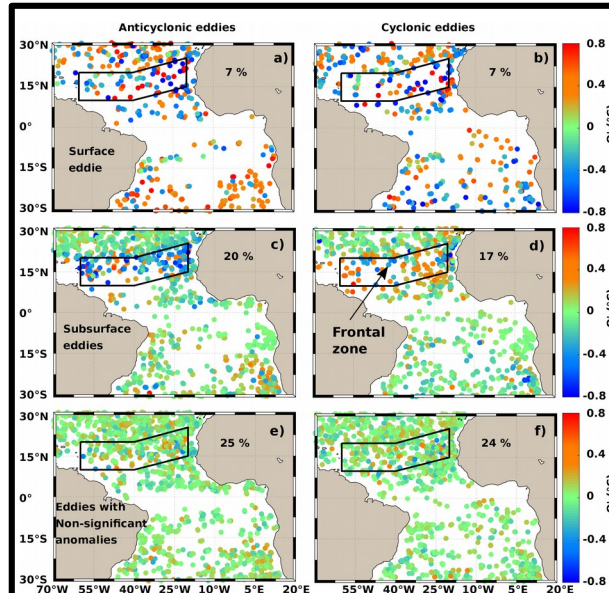


Figure 2. New-born eddy classification and spatial distribution

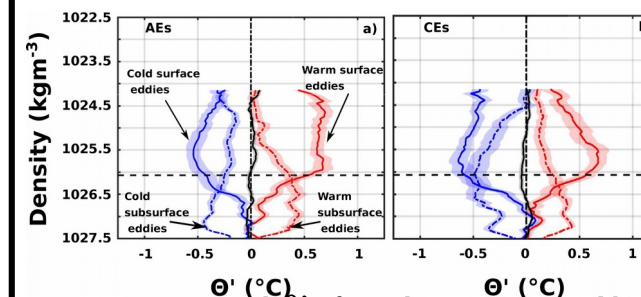


Figure 3. Isopycnal θ' of new-born a) AEs and b) CEs in the frontal zone.

Link with generated eddy PV

Eddy generation are necessarily associated with PV anomalies induced by frictional processes or by mixing (diapycnal or isopycnal advection). Mixing is always associated with θ' or S' anomaly, while friction do not create any anomaly. Thus, according to our results, we argue that both friction and mixing contribute equitably to the PV anomaly creation and therefore to the eddy generation in the TAO.

This study is currently under review in JGR

Classification of eddies

~ 50% of new-born eddies have non-significant θ' (fig. 2e-f). Among those with significant anomalies ~70% are of subsurface (Fig2c-d). In subsurface θ' tend to be negative (positive) for AEs (CEs) especially in the frontal zone (Fig.2 d)

Eddy vertical structure in the frontal zone

In the frontal zone (Fig. 2d), the mean θ' profiles are almost symmetrical for positive and negative anomalies (Fig3). Surface anomalies reach up to 0.6°C in average, while subsurface ones are slightly weaker (~0.4°C)