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What can we learn from observed temperature and salinity isopycnal anomalies at eddy generation sites? Application in the Tropical Atlantic Ocean.

Habib Micaël Aguedjou[1,2], Alexis Chaigneau[1,2,3], Isabelle Dadou[1], Yves Morel[1], Cori Pegliasco[4], Casimir Y. Da-Allada[3,5], and Ezinvi Baloïtcha[2]
[1]CNRS, CNRS/ LEGOS, 31, TOULOUSE, France
[2]CIPMA/UAC, Cotonou, Bénin
[3]IRHOB, Cotonou, Benin
[4]CLS, Ramonville Saint-Agne
[5]UNSTB, Abomey, Benin

Potential vorticity (PV) is a key parameter to analyze the generation and dynamics of mesoscale eddies. Numerical studies have shown how adiabatic (displacement of particles within a background gradient of PV) and diabatic (diapycnal mixing and friction) processes can be involved in the generation of localized PV anomalies and vortices. Such processes are however difficult to evaluate in the ocean because PV is difficult to evaluate at mesoscale. In this study, we argue that qualitative analysis can be done, based on the link between PV anomalies and isopycnal temperature/salinity anomalies (*θ'/S'*). Indeed, in the ocean, eddies created by diapycnal mixing or isopycnal advection of water-masses, are associated with PV anomalies and significant isopycnal *θ'/S'*. In contrast, eddies created by friction are associated with PV anomalies but without isopycnal *θ'/S'*. In this study, based on 18 years of satellite altimetry data and vertical *θ/S* profiles acquired by Argo floats, we analyze the isopycnal *θ'/S'* within new-born eddies in the tropical Atlantic Ocean (TAO) and discuss the possible mechanisms involved in their generation. Our results show that on density-coordinates system, both anticyclonic (AEs) and cyclonic (CEs) eddies can exhibit positive, negative, or non-significant *θ'/S'*. Almost half of the sampled eddies do not have significant *θ'/S'* at their generation site, indicating that frictional effects probably play a significant role in the generation of their PV anomalies. The other half of eddies, likely generated by diapycnal mixing or isopycnal advection, exhibits significant positive or negative anomalies with typical θ' of ±0.5°C. More than 70% of these significant eddies are subsurface-intensified, having their cores below the seasonal pycnocline. Refined analyses of the vertical structure of new-born eddies in three selected subregions of the TAO where the strongest anomalies were observed, show the dominance of cold (warm, respectively) subsurface AEs (CEs) likely due to isopycnal advection of large scale PV and temperature.