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Mesoscale eddies in the coastal upwelling region of the tropical northeast Atlantic Ocean

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The mesoscale variability in the tropical northeast Atlantic (between 12°N - 22°N and 15°W - 26°W) is examined and characterised. We applied two automated methods for eddy identification to 16 years of satellite altimetry measurements: the geometrical method, based on closed streamlines around eddy cores, and the Okubo-Weiß method, based on the relationship between vorticity and the strain tensors. In general, both methods agree well.
On average about 125 ($\pm$11) eddies per year were identified, separating in 52% cyclones and 48% anticylones. We found an average radius of about 50 ($\pm$20) km, a westward propagation speed of about 2.8 ($\pm$1.2) km/d and an average lifetime of about 40 days. Several eddies (more anticylones than cyclones) were detectable up to 300 days. Three main eddy formation regions in the coastal upwelling region that can be associated with headlands of the coast are detectable. This suggests that dynamic instability of the along-shore current is an important generation mechanism. We identified that cyclones are produced predominantly during boreal winter, especially in January, whereas anticyclones are generated predominantly during boreal summer. From the three eddy generation areas, almost all eddies propagate westward along distinct corridors with a small polarity depending meridional deflection (anticyclones – equatorward, cyclones - poleward).
Considering occupied area and number of eddies, about 17% of the tropical northeast Atlantic region under investigation was occupied by eddies in every moment in time. About 30 ($\pm$5) eddies per year originate from the upwelling region off Senegal and Mauretania.
Considering in-situ temperature and salinity observations (Argo, ship, mooring data) within and outside of eddies detected by the algorithms the mean vertical structure of the mesoscale eddies were determined. From together 2191 Profiles, 106 (144) profiles were within anticyclonic (cyclonic) mesoscale eddies. On average the maximum temperature and salinity anomalies are +1.6°C (-1.7°C) and +0.2 (-0.3) with positive (negative) values in the eddy core of an anticyclone (cyclone). The depth of the maximum density anomaly, which is related to the eddy core is on average $\sim$50m ($\sim$40m) for an anticyclone (cyclone).
Considering the amount of water isolated and trapped within the eddy core estimates of volume anomaly flux, heat and salt transport could be made.