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Oxygen depleted eddies at low latitudes in the eastern tropical North Atlantic

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Oxygen depleted eddies have become a well-studied phenomenon in the shallow (50 to 200m) oxygen minimum zone (OMZ) of the eastern tropical North Atlantic (ETNA) north of 12°N. The eddies are associated with anticyclonic mode water eddies and cyclonic eddies, which enhance vertical mixing at the eddy peripheries and lead to an upward doming of isopycnals in the upper part of the water column. Both processes induce an upward flux of nutrients which locally increases productivity at the base of the mixed layer implicating enhanced respiration and a reduction of oxygen beneath the mixed layer in the isolated eddy core.

Recent moored and shipboard observations in the ETNA, revealed episodic events of anomalously low oxygen in the upper 300 m also south of 12°N. The low oxygen concentrations, lasting for around a month, may result from (i) enclosed water which is transported from a region of low oxygen to oxygen-rich waters (i.e. from east to west) (dynamic effect) or (ii) an open ocean upward nutrient flux regime with high productivity (production effect). Both processes would require a long-lasting isolation of the water by a coherent mesoscale eddy. This contrasts theoretical considerations of low-latitude dynamics that predict short life times of mesoscale eddies.

In order to shed light on this conflict between theory and observations, we use a large observational data set consisting of moored, shipboard and satellite observations as well as an actively eddying ocean-biogeochemistry model to study the characteristics, life spans and generation of these low oxygen events south of 12°N. Their potential origin is discussed, which might be related to the presence of strong instabilities either in the open ocean or at the eastern boundary.