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Oxygen variability in the eastern tropical North Atlantic oxygen minimum zone

ABSTRACT: Ocean observations taken in the oxygen minimum zone (OMZ) of the eastern tropical North Atlantic (ETNA) are analysed to study seasonal variability to long-term changes in the oxygen distribution and its causes. The dataset includes repeat shipboard hydrographic and velocity measurements along 23°W and multi-year moored observations at several locations between 11.5°N and 0°N. Below the mixed layer, the water column in the ETNA OMZ can be divided into two regimes: a ventilated upper layer (above 300 m depth) separated by a sharp oxycline from the core of the OMZ below. Within the upper layer in the proximity of the eastern boundary upwelling region, a secondary shallow oxygen minimum is present. Low oxygen eddies dominantly generated at the eastern boundary contribute to its establishment. The observations along 23°W show that the upper layer is dominantly ventilated by zonal advection, while the ventilation of the OMZ core is due to lateral eddy fluxes, vertical mixing, and advection. Both regimes differ in their oxygen variability on decadal time-scales. Oxygen changes during the last decade are characterized by a strong deoxygenation of the upper layer, while oxygen levels in the OMZ core increased. These differing decadal trends are superimposed on the multi-decadal oxygen decline observed since the 1960s. Spatial patterns of seasonal to decadal oxygen variability suggest a dominant role of the advective oxygen supply for the observed changes.