Geophysical Research Abstracts
Vol. 18, EGU2016-6662, 2016
EGU General Assembly 2016

Interplay of oxygen and hydrography in the eastern tropical North Atlantic on decadal to multi-decadal time scales

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Ocean observations in the oxygen minimum zone (OMZ) of the eastern tropical North Atlantic (ETNA) are analyzed to study decadal oxygen variability. Corresponding changes in hydrography are discussed and associated with changes in the circulation and ventilation. The data set consists of repeat shipboard hydrographic, oxygen and velocity observations along 23°W as well as of three multi-year long moored observations both acquired during the last decade. It is examined in comparison to historic hydrographic data on a decadal to multi-decadal time scale perspective.

During the last decade, a strong deoxygenation was observed at depth of the deep oxycline representing a shallowing of the ETNA OMZ, while oxygen increased below in the OMZ core. Both trends are superimposed with a moderate multi-decadal oxygen decrease over the whole depth range. Water mass analysis indicates that this dipole pattern in the decadal oxygen variability is associated with a shift in the ventilation pathways having their origin either in the northern or southern hemisphere.

The decadal and multi-decadal oxygen trend is implemented in the oxygen budget for the ETNA OMZ, which is based on recent estimates of oxygen consumption as well as lateral and diapycnal diffusive oxygen supply. The change in the residual of this oxygen budget derived from multi-decadal and decadal oxygen trend patterns indicates a shallower wind-driven near-surface circulation during the last decade compared to the period before. In contrast, the latitudinally alternating zonal jets that were suggested to generally weaken since the 70ies might have intensified during the last decade providing the enhanced oxygen supply at the core depth of the OMZ.