Geophysical Research Abstracts
Vol. 15, EGU2013-6136, 2013
EGU General Assembly 2013

Oxygen variability and meridional oxygen supply in the tropical North East Atlantic oxygen minimum zone

Johannes Hahn, Peter Brandt, Richard J. Greatbatch, Gerd Krahmann, and Arne Körtzinger
GEOMAR Helmholtz Centre for Ocean Research Kiel, Physical Oceanography, Kiel, Germany (jhahn@geomar.de)

The oxygen minimum zone (OMZ) of the tropical North East Atlantic (TNEA) is located between the oxygen-rich equatorial region and the Cape Verde Frontal Zone at about 20°N in a depth range of 300 – 700 m. Its horizontal extent is predominantly defined by the North Equatorial Current and by the equatorial zonal current system ventilating the region to the north and south of the OMZ, respectively. The interior of the OMZ is characterized by a sluggish flow regime, where mesoscale eddies play a major role in the ventilation. In this study we focus on the oxygen variability in the TNEA as well as the eddy driven lateral ventilation of the TNEA OMZ across its southern boundary.
During recent years an intense measurement program was executed along 23°W cutting meridionally through the TNEA OMZ. Hydrographic and velocity data has been acquired from ship sections and moorings, together covering the latitude range between 6°S and 14°N with particularly high meridional resolution of shipboard and high temporal resolution of moored observations.
Based on shipboard data we derived a meridional section of oxygen variance, which reveals numerous local maxima of oxygen variability. Exemplary, strong oxygen variability is observed at the upper (300m, 5° - 12°N) and the southern boundary (400m - 700m, 5°N - 8°N) of the OMZ, whereas the interior of the OMZ is characterized by weak variability. An application of the extended Osborn-Cox model shows that the strong oxygen variability at the southern boundary is mainly generated by mesoscale eddies. The strong variability at the upper boundary is generated by mesoscale eddies as well as microscale turbulence.
We apply two methods to estimate the meridional oxygen flux: 1) a flux gradient parameterization and 2) a correlation of oxygen and velocity mooring time series. From the analysis of the 5°N mooring data we find a northward oxygen flux directed towards the OMZ at its core depth, that is mainly due to variability of mesoscale eddy motions (10 - 50 days). The magnitude of the oxygen flux is well represented by the flux gradient parameterization, which moreover reveals an overall northward oxygen flux from the southern boundary to the centre of the OMZ. We further estimate the oxygen supply (divergence of oxygen flux) by mesoscale eddies and discuss its contribution to the oxygen budget of the TNEA OMZ.