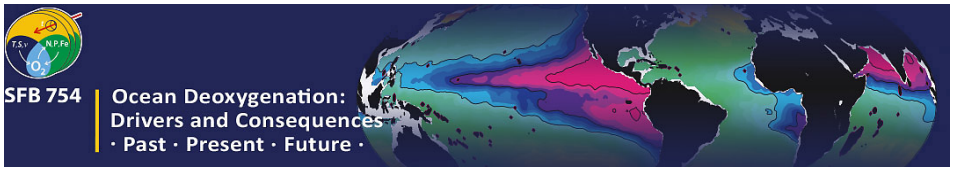


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# Variability of the Atlantic North Equatorial Undercurrent and its impact on oceanic oxygen distribution

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In the Oxygen Minimum Zone (OMZ) of the Eastern Tropical North Atlantic (ETNA) oxygen values vary on daily to multidecadal time scales. The OMZ is ventilated by weak eastward flowing zonal currents, among them the North Equatorial Undercurrent (NEUC). It is located between $4°$N and $6°$N in a depth range of $50\,$m to $400\,$m and its core velocity varies between $0.1\,\mathrm{ms}^{-1}$ and $0.3\,\mathrm{ms}^{-1}$. It has been suggested that the NEUC is an important oxygen supply pathway to the ETNA OMZ. Here we investigate the variability of the NEUC on interannual time scales and its impact on oxygen levels in the ETNA OMZ.
The variability and driving mechanisms of the NEUC are not well understood. Obtaining reliable transport estimates of the NEUC from observations and models is difficult, mainly because the cores of the NEUC and the North Equatorial Countercurrent (NECC) above cannot be clearly distinguished over most of the year. For our analysis we are using observational data from 20 ship sections along $23°$W from 2002 to 2016 and the output of a high-resolution ocean model in which a $1/10°$ nest of the tropical Atlantic is embedded into a global $1/2°$ model. The model captures the zonal current field of the tropical Atlantic reasonably well although the NEUC tends to be too strong compared to observations. Utilizing a new, path-following algorithm to investigate its location and intensity, we find that about $20\%$ of the NEUC variability on interannual time scales can be explained by wind variability in the tropical Atlantic. These large-scale wind changes are related to the Atlantic Meridional Mode (AMM), a climate mode that represents an interhemispheric SST gradient in the tropical Atlantic. Interannual variations in both the position and the intensity of the NEUC are significantly correlated with the AMM index. Composites further show a weakening and a southward shift of the NEUC during positive AMM phases and vice versa. Positive AMM phases are thus associated with reduced oxygen concentrations in the NEUC and decreasing oxygen levels in the ETNA OMZ region.

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