Session: C37 Poster: TH74B

Vertical diffusivity at the upper boundary of the North Tropical Atlantic oxygen minimum zone

Donata Banyte[†]; Toste Tanhua; Martin Visbeck; Tim Fischer; Marcus Dengler; Douglas W. R. Wallace; Peter Brandt; Gerd Krahmann; Johannes Karstensen
[†] IFM-GEOMAR, Germany
Leading author: dbanyte@ifm-geomar.de

Subsurface oxygen minimum zones (OMZ) are located in the eastern part of the tropical Atlantic and Pacific oceans. They form as a consequence of eastern boundary upwelling, hence, high biological productivity, and low ventilation as a result of basin scale wind-driven circulation creating so-called 'shadow zones'. The low oxygen content in the OMZ is created by a balance of 1) high oxygen consumption resulting from biological decomposition of organic matter and 2) an oxygen supply resulting from lateral currents and eddy fluxes as well as vertical diapycnal mixing. Recently observed intensification and expansion of the OMZs over the last five decades raises the need to quantify the oxygen supply and consumption terms. In this study we focus on the vertical diffusivity at the upper boundary of the northern tropical Atlantic OMZ. During a tracer release experiment in the Guinea upwelling region (GUTRE), 470 moles of halocarbonic compound, SF5CF3, were released at the western and upper boundary of the northern tropical Atlantic oxygen minimum zone, at 8^{o}N, 23^{o}W and at density surface of 1026.88 kg/m3. Three surveys followed 7, 20 and 30 months after the injection, mapping the vertical and horizontal extent of the tracer patch. A high precision, time integrating, diapycnal diffusion coefficient was calculated from the widening vertical tracer distribution. Additionally, microstructure measurements and acoustic measurements using Acoustic Doppler Current Profiler(ADCP) were done in parallel, both of which give independent estimates of vertical diffusivity. This enabled us to verify the large scale mean diapycnal coefficient estimate from the less accurate methods with that of the tracer release experiment. The diapycnal diffusivity coefficient calculated in this study is (1.1 ± 0.2x◊10^-5 m^2/s and the associated vertical mean oxygen supply is (1.7 ± 0.2)x10^-3 mol/m^3/year. Regional differences in the vertical gradients of density and oxygen were observed corresponding to the regional bottom topography roughness. Their respective influence on the spatial differences in diapycnal diffusivity and vertical oxygen transport is discussed.