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Ventilation of the equatorial Atlantic

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The equatorial oxygen maximum at intermediate depth (300m-700m) is a characteristic feature of the observed water mass distribution of the tropical Atlantic, but it is not well reproduced in biogeochemical models. Here we analyze long-term moored velocity and oxygen observations as well as shipboard hydrographic and current sections acquired along 23°W, which cover the depth range of the oxygen minimum zones of the eastern tropical North and South Atlantic. The mean flow field from shipboard observations shows the presence of the equatorial intermediate current system (EICS) with strongest eastward flow at 2°N/S and westward flow in between. The moored zonal velocity data show high-baroclinic mode equatorial deep jet (EDJ) oscillations at a period of about 4.5 years. Equatorial oxygen observations which do not resolve or cover a full 4.5-yr EDJ cycle nevertheless reveal large variability, with oxygen concentrations locally spanning a range of more than 60 μmol/kg. We study the effect of the EICS and EDJs on the equatorial oxygen concentration by forcing an advection-diffusion model with the velocity field of the gravest equatorial basin mode corresponding to the observed EDJ cycle superimposed on the mean EICS. The advection-diffusion model includes an oxygen source at the western boundary and oxygen consumption elsewhere. The respective role of mean advection, EDJs, and other possible processes in shaping the mean oxygen distribution of the equatorial Atlantic at intermediate depth is discussed.