Oxygen and nitrous oxide fluxes in the oxygen minimum zone off West Africa

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Oxygen minimum zone (OMZ) off West Africa

\[ \Phi = K \cdot \nabla c \]

**K** from microscale velocity fluctuations
**K** from ADCP acoustic survey of internal wave field, a proxy for mixing intensity

\( \Phi = 6.2 \pm 0.7 \text{ mmol/m}^2/\text{s} \)
\( \nabla \Phi = 1.7 \pm 0.2 \text{ umol/kg/a} \)


\( K : \) diapycnal diffusivity
\( \nabla c : \) vertical concentration gradient

**\( \Phi \)**: Ozone downward flux into upper OMZ

Enhanced flux at and south of Sierra Leone Rise

\( \Phi = 6.2 \pm 0.7 \text{ mmol/m}^2/\text{s} \)
\( \nabla \Phi = 1.7 \pm 0.2 \text{ umol/kg/a} \)

**\( \Phi \)**: Oxygen distribution at 400 m level

**\( \Phi \)**: Oxygen along 23 W meridional section

Diapycnal fluxes to the upper half of the OMZ. The existence of a shallow oxygen minimum / N2O maximum in large parts of the OMZ decouples diapycnal fluxes at the OMZ upper border from the local mixed layer and atmosphere.

Diapycnal fluxes and flux divergences of oxygen and nitrous oxide as part of the OMZ budget

O2 downward flux into upper OMZ

Inferences on oxygen budget of OMZ’s upper part

Our estimated diapycnal supply is 20-50% of estimated consumption. Brandt et al. (2013) estimate 15-40% from a conceptual model.

N2O upward flux from upper OMZ

\( \Phi = 1.0 \times 10^{-5} \pm 0.4 \times 10^{-5} \text{ mmol/m}^2/\text{s} \)

\( \nabla \Phi = 250 \pm 100 \text{ pmol/kg/a} \)

References


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