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Physical mechanisms driving the global ocean breathe

Esther Portela Rodriguez, Nicolas kolodziejczyk, and Virginie Thierry
CNRS, LOPS, Plouzane, France (eportelanh@gmail.com)

The physical transport of dissolved oxygen across the mixed layer base is the main process to oxygenate the interior ocean. This ventilation mechanism is suspected to play a dominant role in the predicted ocean deoxygenation over the 21st century, however, it has not yet been properly quantified or described at global scale. Here we show the mean distribution of the mechanisms driving the oxygen exchanges between the mixed layer and the ocean interior and their relation with water-mass formation. Most of the oxygen uptake occurs in well-defined hot-spots located in the subpolar North Atlantic (30%) which provide oxygen to deep and waters and in the Southern Ocean (37$%) that oxygenates intermediate and bottom waters. The oxygen release is concentrated within the ACC belt (37%), in the subtropical-subpolar North Atlantic (22%) and within the equatorial strip (13%). Globally, the mode waters account for about 72% of the subducted oxygen during their formation process. The oxygen uptake by the Subantarctic and Subpolar Mode Water is driven by strong currents flowing through large mixed layer depth gradients at localized hot-spots while the spatial continuity of the wind-driven vertical velocity over broad areas in the Subtropical gyres accounts for most of the oxygen subduction during the Subtropical Mode Water formation.