



Oxygen variability over the southern Senegalese shelf

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Abstract

The shelf of the southern part of the Canary upwelling system along Senegal and Mauritania is bordered by an oxygen minimum zone whose center is located at about 400m depth above which is superimposed another minimum shallower than 200m. As a consequence, dynamic upwelling bring hypoxic waters (60 $\mu\text{mol/l}$ or 1.34 ml/l; 15°C) over the shelf during the upwelling season from December to May. An oceanographic survey was conducted in the heart of the upwelling season (7th-17th March 2012) over the southern Senegalese coast. Integrated physical and biogeochemical measurements were acquired and allowed us to measure for the first time to our knowledge an anoxic event in Senegalese waters with dissolved oxygen concentrations falling to zero. Very high concentrations of nitrite (11 mmol/m³) mirroring nitrate reduction and nitrate/nitrite deficit to phosphate highlight intense denitrification taking place in this oxygen-depleted water body. The record of this event by 30m depth occurs after a relaxation phase of the upwelling associated with a surface northward advection of warm waters from the south of the plateau. A subsurface north-westward advection of water consistent with wind relaxation was recorded near the anoxia event but inertial wave can not be dismissed for driving this northward flow. A diatom biomass was measured at 18 mgChl/m³ along the shore two days earlier. Apparent Oxygen Utilization and oxygen concentrations support the decay of phytoplankton biomass at the end of the survey. Whether the anoxia is due to the local decay of fast sinking dead diatoms or to a specific



3D history of the water body is difficult to establish. However, recently upwelled waters south of Cape Verde peninsula are advected southward and cover the entire shelf with undersaturated waters. Frequent occurrence of high phytoplankton biomass along the coast suggests that anoxia and denitrification could occur recurrently in this region during the degradation of organic matter. These observations take place in a long term monitoring of bottom oxygen concentrations in this very productive coastal region of the world.

Keywords: oxygen minimum zone, hypoxic waters, nitrate/nitrite, diatom, undersaturated waters Canary upwelling system, Senegal, Mauritania.



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