PHYTOPLANKTON PRIMARY PRODUCTION AND RESPIRATION BALANCE IN THE UPWELLING-CANARY COASTAL TRANSITION ZONE REGION

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The region of the Canary Islands intersects the boundary between eutrophic African upwelling waters and oligotrophic oceanic waters. This transition zone constitutes an area of high spatial and temporal variability. Together with the seasonal fluctuations of the coastal upwelling and the variability of the open ocean processes, the islands introduce large spatial variability in the region by disrupting the flow of the Canary Current.

Average primary production values measured in the region range from >2 gC m-2 day-1 in the coastal upwelling to <0.1 gC m-2 day-1 in open ocean waters (although values up to 1 gC m-2 day-1 are observed associated with mesoscale features, like eddies or fronts). Primary production computed from the monthly mean near-surface chlorophyll fields otained by the CZCS radiometer and from constant photosynthetic parameters from PI curves yield similar results.

Seasonal mean values of community respiration integrated in the upper 150 m of the Canary region range from 1.5 to 2.9 gC m-2 day-1. Although the balance between primary production and respiration varies in relation to different factors like seasonality and distance to the coastal upwelling, in general, integrated respiration is several times higher than the integrated primary production.

Two main mechanisms are proposed to explain the high respiration in this region. First, filaments of cold, chlorophyll-rich water extend several hundreds of kms from the upwelling into the Canary archipelago, transporting particulate and dissolved organic matter, which is respired by the heterotrophic microbial community. Second, recurrent cyclonic eddies formed downstream the archipelago, and with lifespans of several months, represent regions of strong vertical nutrient flux and enhanced primary production. Estimations of vertical velocities in the eddy centers indicate that cyclonic eddies may be responsible of a major component of the nutrient flux in the region, as important potentially as the coastal upwelling.Their vertical flux is estimated at 29 mol N m-2 yr-1, a hundred times the oceanic mean. New organic matter produced in eddies would be spread into surrounding, more oligotrophic, waters supporting additional microbial respiration. The latter hypothesis is supported by the observation of respiration rates 1.5 times higher south than north of the archipelago. A third mechanism which may be responsible of a high loading of organic carbon on surface waters during some periods is aeolian transport from the vecine African continent, although its influence on primary production and respiration has not been quantified yet.

Overall, the Canary region seems to represent a heterotrophic system (allocthonous input of organic matter > autocthonous production), strongly afected by the lateral input of organic matter from the African coastal upwelling and, presumably, aeolian dust. Nevertheless, the integrated primary production might be spatially and temporally underestimated, leading to an unreal plankton metabolic balance.