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Vertical and horizontal transport of particles in the coastal upwelling filament off Cape Blanc, Mauretania

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The coastal upwelling area off NW Africa is one of the most prominent Eastern Boundary Current systems with respect to total primary production. Highest upwelling occurs at capes such as Cape Blanc where a 'giant filament' persists almost year-round which exports material from the coast to the open ocean. Sediment traps were used to measure particle fluxes at a coastal eutrophic site ($CB_{coastal}$-1) and an open-ocean mesotrophic site (CB14) in the filamental zone. At $CB_{coastal}$-1, highest mass fluxes of 950 mg m^{-2} d^{-1} were found during the late winter-spring bloom, fairly lower values of 750 mg m^{-2} d^{-1} in mid-summer. Fluxes remained low in winter-spring offshore at site CB14, suggesting that the filament did not approach the trap position. There, peak fluxes of about 300 mg m^{-2} d^{-1} were determined for late summer to fall, about 60 days after the summer flux maximum at $CB_{coastal}$-1 about 120 miles to the east. Applying the alkenone unsaturation index of the sinking particles for the estimation of SST which were compared to measured values, we determined sinking velocities of 55 m d^{-1} for alkenone-associated particles in summer at the open-ocean site CB14. Using satellite chlorophyll$a$ and deep-ocean fluxes, Helmke et al. (2005) obtained sinking velocities around 75 m d^{-1} and suggested a source region of trapped particles about 120 km to the northeast. At $CB_{coastal}$-1, estimated sinking velocities based on alkenones were only around 25 m d^{-1} in summer, indicative for a significant

lateral displacement of particles. When comparing upper and lower trap flux patterns at the open-ocean site, particle sinking velocities of 65 m d^{-1} during enhanced opal sedimentation of the winter-spring bloom were found. Also, a two-fold increase in particle fluxes with depths was observed, characteristic for an additional onshore particle source. During the summer peak, however, when fluxes decreased with depth and carbonate sedimentation was high, particle sinking velocities were as high as 250 m d^{-1} and the vertical flux component was more pronounced. The observed regionally and seasonally different sinking behaviour of particles is consistent with the carbonate ballast theory.

References:

Helmke, P., Romero, O., Fischer, G. (2005) Northwest African upwelling and its effect on offshore organic carbon export to the deep sea. Global Biogeochemical Cycles, 19, doi:10.1029/2004GB002265, 2005.