



Black carbon in seawater and its cycling in the Gulf of Maine

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The study of black carbon (BC) is becoming more important as new findings reveal its roles in diverse processes. In addition to being a potential sink in the global carbon cycle, BC is believed to be a factor in the Earth's radiative heat balance and an important carrier of organic and inorganic pollutants. However, our current knowledge of BC cycling prevents us from having a quantitative understanding. Additionally, the different techniques used to measure BC inhibit the combination of data from diverse fields.

To increase our understanding of BC cycling and reconcile atmospheric and sediment BC studies, we measured BC concentration in the Gulf of Maine (GoM), a representative coastal area downwind of BC sources, and inferred BC export fluxes out of the water column. Average BC concentrations of $8 \mu\text{g BC/L}$ in this coastal seawater suggest that BC can account for up to 50% of the uncharacterized particulate organic carbon (POC) and can explain the reported old ^{14}C ages of such POC. Additionally, these concentrations indicate that high molecular weight pollutants such as PAHs and PCDDs would be mainly sorbed to the solid phase, and therefore less bioavailable. Average fluxes out of the water column of $1.5 \text{ gBC/m}^2\text{yr}$ were consistent with observations of BC accumulation in the bed sediments of this area ($1\text{-}2 \text{ gBC/m}^2\text{yr}$)¹ and with our estimates of atmospheric deposition ($0.1\text{-}0.8 \text{ gBC/m}^2\text{yr}$) based on measured BC atmospheric concentrations². A mass balance in the GoM showed that atmospheric deposition ($20\text{-}140 \text{ Gg BC/yr}$) is the main input into the GoM and river sources were minimal at about (3 Gg BC/yr). Sedimentation ($70\text{-}400 \text{ Gg BC/yr}$) was the main out-

put. Our mass balance also showed that in this area, the residence time of BC was of the order of months (5-7 months) in the surface mixed layer and about a year in the GoM water column as a whole. The GoM captures 40- 80% of the atmospheric BC emanating from the northeastern coast of the USA.

References

1. Gustafsson, Ö., and Gschwend, P.M. (1998) *Geochem. et Cosmochim.*, **62**: 465-472.
2. Airmap: <http://airmap.unh.edu/>