Using ^{228}Th/^{228}Ra isotope pair to constrain POC export from the twilight zone, South China Sea

Pinghe Cai, Kuanbo Zhou, Minhan Dai, Dongwei Lv, Qing Li, Weifang Chen

In this study, we have attempted to utilize ^{228}Th/^{228}Ra isotope pair to quantify particulate organic carbon (POC) export from the twilight zone in the South China Sea. Four depth profiles of ^{228}Ra, size-fractionated ^{228}Th and nutrient were collected from the upper 500 m at Station A1, SEATS, TS1 during three cruises from 2004 to 2007. ^{228}Ra activities decreased from about 100 dpm m^{-3} at surface to about 5 dpm m^{-3} at 500 m. Using a 1-D diffusion-decay model, we have estimated the eddy diffusion coefficient to be 11.2, 4.5, 3.0, 6.6 m^2 d^{-1} at the three stations, respectively. ^{228}Ra-derived nutrient budget showed that there generally occurred a maximum of POC export at the subsurface in the South China Sea. Below the subsurface, POC flux gradually decreased. The average POC fluxes based on the ^{228}Ra-derived nutrient budget were 4.9, 2.7, 2.5, 1.1 mmolC m^{-2} d^{-1} at 100, 200, 300 and 500m, respectively. POC fluxes from the twilgiht zone (500m) estimated from ^{228}Th/^{228}Ra disequilibrium ranged between 0.5 and 1.7 mmolC m^{-2} d^{-1}. This estimate is in good agreement with that derived from the approach of ^{228}Ra-derived nutrient budget. This suggests that ^{228}Th/^{228}Ra disequilibrium may be a good tool to study POC export in the twilight zone.