Preliminary results on vertical flux of particulate organic carbon at the SEATS time-series site

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Abstract

Along with the "South East Asia Time-series study (SEATS)" project, vertical fluxes of particulate organic carbon (POC) were investigated using the sinking particles collected by sediment traps at three depths (531m, 1030m, and 3497m) near the SEATS hydrographic site (115°44'E, 18º20'N) from August 8, 2004 to February 15, 2005. In addition to each trap, three current meters were attached onto mooring string at about 5m below each trap. Upon return to the lab, the pressure readings measured by the current meters revealed unexpectedly that the actual depths were shallower than the designated depths by 410m, 411m, and 46m for the upper, middle, and lower traps, respectively. The discrepancy between the designated and actual depths is due to extension of mooring string.

POC fluxes at the upper trap (121m), progressively increasing from summer to winter, appear to be predominantly controlled by monsoon-related processes. The strong NE monsoon-induced wind stress and surface cooling are combined to enhance vertical mixing in the winter. Since the nutricline is relatively shallow at the SEATS site, the enhanced vertical mixing would entrain nutrient-rich subsurface waters onto the surface photosynthetic zone, leading to the high primary production observed in winter. The cool and weakly stratified surface waters also render a favorable hydrographic condition for the development of the short and efficient food web, via which more POC is exported from the euphotic zone. Additionally, the low temperature may lead to a decrease in community heterotrophic respiration, which tends to cause a reduction in POC consumption. As a consequence, the combined effect of high production and low consumption of POC gives rise to the highest POC flux observed in winter. On the contrary, the hydrographic condition is reversed in summer, i.e. warm and strongly stratified, resulting in the low production and high consumption of POC, and consequently leads to the lowest POC flux in summer. The POC fluxes at the middle (619m) and lower (3451m) traps, however, do not show any seasonality, implying a decoupling between monsoonal forcing and POC flux to the deep sea.

In terms of vertical variations, POC flux is constantly higher at the upper trap than the middle trap indicating a rapid decomposition of organic matter in the upper thermocline. On average, ~92.5% of POC export at 121m was remineralized before reaching 619m during the collection period. In contrast, POC flux at the bottom trap is larger than that at the middle trap, suggesting a potential lateral input of POC by a benthic nepheloid layer. Taking the POC flux at the middle trap as a reference and applying the algorithm of Pace et al. (1987), the average lateral flux of POC at the bottom trap is estimated to be ~2.3 mgC m^{-2} day^{-1}, which represents a significant source of organic carbon to the deep South China Sea.

Reference

Pace, M.L., G.A. Knauer, D.M. Karl and J.H. Martin, 1987: Primary production, new production and vertical flux in the eastern Pacific, *Nature*, **325**, 803-804.