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Title: Partitioning and Vertical Fluxes of Dissolved and Particulate Organic Carbon in the Northern South China Sea

Abstract:

The northern South China Sea (NSCS) is oligotrophic in most deep and mesotrophic in certain shelf zones with moderate to high partitioning ratios between DOC and POC. DOC was the major pool of total organic carbon (80-95 % TOC), ranging from 70 to 85 μM in the euphotic layer study area. The concentration of POC was relatively low, ranging from 4 μM in the euphotic layer. The partitioning ratios are generally correlated inversely with chlorophyll a distributions. DOC and POC distributions are more pronounced in spatial variability than in temporal variability. They are generally higher in shelf seas than in deep basins, and also slightly higher in summer than in other seasons. Both terrestrial inputs and in-situ production influence spatial and temporal distributions of DOC and POC in northern NSCS. Contribution of DOC oxidation to AOU (apparent oxygen utilization) by the mixed layer is fairly low ranging from 14 to 43% with an average $\sim 17\%$, implying that DOC is largely recycled in the upper layer. The degradation rate of DOC in the mixed layer is generally higher in the zone near the Pearl River (decay coefficient: -0.045 d^{-1}) than in the basin ($\sim -0.011 \text{ d}^{-1}$). The labile and semi-labile fractions of DOC are roughly $<50\%$ of total DOC in the mixed layer. Although the downward flux of DOC decreases with depth below the mixed layer, its magnitude is comparable with POC export through the base of 100m derived from sediment trap deployed in the NSCS basin. The contribution DOC flux to organic carbon exports appears to be significant in this tropical and oligotrophic marginal sea. The ratios of DOC/DON/DOP are much higher than the traditional Redfield Ratio, implying a significant release of nitrogen and phosphorus poor DOM during photosynthesis, as $\Delta\text{POC}/\Delta\text{PN}$ is close to Redfield Ratio (6.6) in the euphotic zone. The POC in the euphotic zone is largely biological origin, its distribution correlates significantly with the chlorophyll a. The overall POC-chl a ratio derived from regression relation is about 32 that is close to the typical ratio found in most open ocean. Dissolved organic matter appears to play important roles in cycling of carbon and nutrients in the upper layer of NSCS.

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