Net Community Metabolism in the Luzon Strait and Northern South China Sea

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Abstract

This study aims to understand the seasonal and geographic variations of net community metabolism and their relations to air-sea fluxes of CO_2 in the northern South China Sea (NSCS) where the Kuroshio meets SCS waters. The study area may be predominantly influenced by Kuroshio Water, Zhujiang Diluted Water and southward China Coastal Water in different seasons. During the study period, the integrated gross production (IGP) ranged from 851 to 5032 mgC $m^{-2}d^{-1}$in the NSCS, and from 1740 to 7094 mgC $m^{-2}d^{-1}$ in the Luzon Strait. The integrated dark community respiration (IDCR) ranged from 435 to 10707 mgC $m^{-2}d^{-1}$ in the NSCS, and from 2628 to 8901 mgC $m^{-2}d^{-1}$ in the Luzon Strait. The higher IGP was found in summer than in winter in the NSCS, primarily due to greater input of freshwater and nutrients from the Pearl River. The higher IGP may be also ascribed to deeper euphotic layer in the central basin during the summer season. Positive correlations are significant between GP (DCR) and temperature, PAR and nutrients, and negative correlations are also significant between GP (DCR) and salinity in the NSCS, showing the significant impacts of freshwater inputs and climatic changes on GP (DCR). However, such relationships are not found in the Luzon Strait except for spring, largely due to typhoon's influence. The GP was determined largely by DCR, and DCR was attributed mainly to BR (bacteria respiration) in both the NSCS (~ 65%) and the Luzon Strait (52 ~ 79%). The ratio of IGP/IDCR is an indicator of net ecosystem production. The ratio was <1 for all but stations near the Pearl estuary during both summer and winter in the NSCS, and << 1 in the Luzon Strait, indicating a year-round heterotrophic around the Kuroshio influenced areas. However, this ratio was higher in winter than in summer in the NSCS, possibly resulted from higher GP in winter than in summer. Seasonal compensation and geographic difference explain largely the net community metabolism in productive and unproductive ecosystems. The ratio of IGP/IDCR may not be the solely factor in determining the air-sea fluxes of CO_2. The physical forcing such as temperature and wind velocity may be also important in determining the source or sink of CO_2 in the study areas.