夏季の南極海季節的海氷域表層のプランクトン生態系における炭素の動態

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Change in carbon mass with surface plankton ecosystem in Antarctic SIZ waters

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Elevated partial pressure of pCO_2 in the atmosphere leads to ocean acidification due to increased CO_2 in surface waters. Subsequently the calcium carbonate saturation horizon becomes to shoal in many regions, particularly in high latitudes. To predict the influence of ocean acidification to the Antarctic ecosystem, it is important to know the carbon cycling processes between atmosphere-seawater and seawater-biology in surface waters in biologically productive summer period. The present cooperative research project is one of the 8th stage Prioritized JARE Project “Responses of Antarctic marine ecosystems to global environmental changes with carbonate systems (RAMEEC)” and we have collected intensive data on the DIC variability, primary production with phytoplankton compositions, ecology of carbonate shelled plankton, particle fluxes of POC and PIC, and ecological model analyses to comprehend the present state of the Antarctic SIZ ecosystems.

The present study is to show the short-term change of carbon in terms of DIC (dissolved inorganic carbon including CO_2), PIC (particulate inorganic carbon) and POC (particulate organic carbon) in the upper 50 m water column around 60^{o}S, 110^{o}E in early summer (from 6 December to 1 January, 2010). The estimations were made using the data on DIC in surface water (Hashida et al., 2011; Yoshikawa et al., 2012), primary production (Takao et al., 2011; Sasaki et al., 2011; Konno et al., 2014), and PIC and POC fluxes (Akiha et al., 2012; Makabe et al., 2013; Narita et al., 2014). Based on the present preliminary estimations, net decrease of DIC in surface water for 25 days was approximately 2490 mg-DIC m^{-2} and 63 % of decreased DIC (1850 mg-POC m^{-2}) was transformed into POC as net phytoplankton increase (net primary production without respiration and heterotrophic utilization). The rest of the DIC (37%, 1090 mg-(DIC+PIC) m^{-2}) was removed in the form of downward sinking DIC and PIC, if DIC-derived DOC was almost unchanged. In the most productive summer period in the SIZ, the phytoplankton production is most influential factor to the decrease of surface water DIC. The dynamics of carbon associated with heterotrophic processes in surface waters will be also discussed.