Strong biological uptake of carbon in a polynya of the Amundsen Sea, Antarctica

Doshik Hahm, Tae Siek Rhee, Young-Nam Kim, Hyun-Cheol Kim, Hyoung Chul Shin, and SangHoon Lee

We surveyed O_2/Ar in the surface waters of the Amundsen Sea during the austral summer to investigate the variability of net community production (NCP), a measure of the net carbon removed from the atmosphere via biological productivity. The biological O_2 saturation (ΔO_2/Ar) dropped as low as -10% in the sea-ice area, implying net consumption of O_2 over the winter as a result of respiration and limited production. In contrast, ΔO_2/Ar increased to 30% in the polynya, where ΔO_2/Ar, together with pCO_2 and chlorophyll-a, showed a strong correlation with sea surface temperature. This finding suggests that when the sea ice melts, causing radiative heating, the upper water column is stabilized, and this stabilization results in the high biological productivity and consequent O_2 supersaturation in the polynya. The NCP in the polynya was 90 - 170 mmol O_2 m^{-2} d^{-1}, making the Amundsen polynya one of the most effective carbon sinks in the world's oceans.