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Estimation of austral summer net community production in the Amundsen Sea: Self-organizing map analysis approach

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Abstract:

The Amundsen Sea, Antarctica, has been known for one of the most susceptible region to the current climate change such as sea ice melting and sea surface temperature change. In the Southern Ocean, a predominant amount of primary production is occurring in the continental shelf region. Phytoplankton blooms take place during the austral summer due to the limited sunlit and sea ice cover. Thus, quantifying the variation of summer season net community production (NCP) in the Amundsen Sea is essential to analyze the influence of climate change to the variation of biogeochemical cycle in the Southern Ocean.

During the past three years of 2011, 2012 and 2014 in austral summer, we have conducted underway observations of $\Delta O_2/Ar$ and derived NCP of the Amundsen Sea. Despite the importance of NCP for understanding biological carbon cycle of the ocean, the observations are rather limited to see the spatio-temporal variation in the Amundsen Sea. Therefore, we applied self-organizing map (SOM) analysis to expand our observed data sets and estimate the NCP during the summer season.

SOM analysis, a type of artificial neural network, has been proved to be a useful method for extracting and classifying features in geoscience. In oceanography, SOM has applied for the analysis of various properties of the seawater such as sea surface temperature, chlorophyll concentration, pCO_2 , and NCP. Especially it is useful to expand a spatial coverage of direct measurements or to estimate properties whose satellite observations are technically or spatially limited.

In this study, we estimate summer season NCP and find a variables set which optimally delineates the NCP variation in the Amundsen Sea as well. Moreover, we attempt to analyze the interannual variation of the Amundsen Sea NCP by taking climatological factors into account for the SOM analysis.

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