# Temporal changes in export flux and physicochemical factors during sea ice melting season

Ayuko Kagesawa[1], Shintaro Takao[2], Ryosuke Makabe[1,3,5], Norio Kurosawa[4], Masato Moteki[3,5], Tsuneo Odate[1,3]

*[1]The Graduate University for Advanced Studies (SOKENDAI), [2] National Institute for Environmental Studies,*

*[3]National Institute of Polar Research, [4]Soka University, [5]Tokyo University of Marine Science and Technology*

Functions of ecosystem structure and biological carbon pump are deeply influenced by seasonal dynamics of sea ice in the Southern Ocean. Various materials such as sediment particles, phytoplankton, and nutrients are incorporated into sea ice during sea ice formation, which contribute to the ice edge bloom and serve as a prey item for pelagic consumers in the marginal ice zone. Mooring systems are useful for time series observations to reveal ecosystem dynamics, but not available in surface layer in the Southern Ocean because of a risk of the system to collision against iceberg. Drifting systems are more suitable for surface observation but is usually operated only a few days. The Japanese Antarctic program operates the ice breaker *Shirase* and the training vessel *Umitaka-maru* in the Southern Ocean every summer off Vincennes Bay, East Antarctica. Therefore, we conducted a long-term drifting experiment for more than one month in the seasonal sea ice zone. The aim of this study is to understand temporal changes in export flux related to the surface environment after sea ice melting by analyzing the sensor data and the phytoplankton composition in the sinking particle samples.

A drifter system attached with sea ice resistance GPS buoy, sensor array (CT, PAR and Chlorophyll fluorescence at 25 m depth) and a time-series sediment trap (at 50 m depth) was deployed at 63.5°S, 110°E on 9$^{th}$ December 2016 from *Shirase*, and retrieved by *Umitaka-maru* at 63.1°S, 106.1°E on 14$^{th}$ January 2017. At both locations, CTD cast, vertical stratified zooplankton sampling and water sampling for phytoplankton, particulate organic carbon (POC) and nitrogen (PON) were conducted. Sample cups of the sediment trap were filled with neutral Lugol' solution (final conc. 10%). Each sediment trap sample was divided into several aliquots after zooplankton swimmers were removed, then used for chemical and microscopic analyses.

The most dominant phytoplankton in sedimented particle flux and water column was *Phaeocystis antarctica*, which was consistent with a result of a previous work in the same area and season. Chlorophyll fluorescence was higher from 11$^{th}$ to 20$^{th}$ December than those in the later period of the present research. This is likely attributed to nutrient supplies by a mixing with the underlying Modified Circumpolar Deep Water (MCDW) during high chlorophyll periods (Fig. 1). POC flux exhibited the highest value (62.0 mg C m$^{-2}$ day$^{-1}$) during period from 15$^{th}$ to 19$^{th}$ December. There was a time lag between the highest chlorophyll and POC flux. This paper will discuss a relation between phytoplankton composition and physicochemical factors of water column.

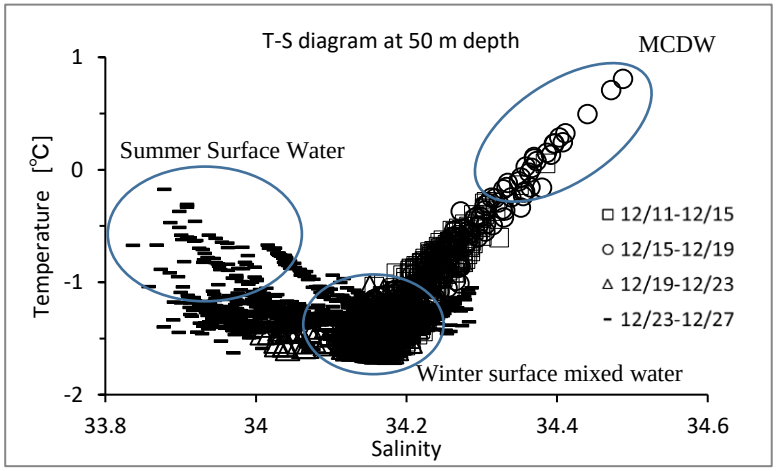


Fig. 1. A T-S diagram at 50 m depth during each