# Effect of sea ice melting processes on phytoplankton physiology in the northern Chukchi Sea

Eunho Ko, Jisoo Park, Maxim Y Gorbunov, Edaward Keunuk Shin, Jinyoung jung , Eunjin Yang ,Kyung-ho Cho, Sung-ho Kang

University of Science and Technology, Korea

Korea Polar Research Institute, Korea

Department of marine and Coastal Sciences, Rutgers University, New Jersey, USA

We investigated phytoplankton physiology in the northern Chukchi Sea in the late summer of 2015 and 2016 during cruises of icebreaker R/V Araon. We used a novel ultra-sensitive Fluorescence Induction & Relaxation system, called a mini-FIRe, to measure a set of parameters that characterize photosynthetic light-harvesting processes, photochemistry in Photosystem II (PSII), and the photosynthetic electron transport rate. The amount of sea ice was greater in the late summer of 2016 than in 2015. Due to difference in sea ice extent, the thickness of the surface low-salinity layer was larger in 2015 than in 2016. The influence of fresh water content enhanced the stratification in the upper ocean. The stratification index calculated by the density profile was larger in 2015 than in 2016. Previous studies reported that the thickness of freshwater layer may also affect the depth of nitracline, which was closely related to depth of subsurface chlorophyll maximum (SCM), because nitrate is usually the main limiting nutrients in the Arctic Ocean. As a result, depths of nitracline and SCM in 2015 were 39±10 m and 53±6 m, which were deeper than the depths of 30±11 m and 45±10 m in 2016. There was a statistically significant correlation between freshwater content and the depth of nitracline ($r=0.78$, $p<0.01$, $n=28$). In physiological parameters of phytoplankton, the quantum efficiency of photochemistry in PSII ($Fv/Fm = 0.43\pm0.09$) in MLD was about 20% lower than that ($0.55\pm0.03$) in SCM, because of nitrate depletion in the surface layer. The functional absorption cross section of PSII ($\sigma_{PSII}$) in SCM depth were higher than those in MLD indicating that the phytoplankton improved its light-harvesting capability of the photosynthetic pigments under low light condition in depth of SCM. We will discuss how the difference in thickness of fresh water from melting sea ice influences the physiological status of phytoplankton.

**Keyword**: phytoplankton, sea ice, photochemical efficiency, the Chukchi Sea