Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

ACG06-30 Room:315 Time:April 29 16:45-17:00

Ocean primary production algorithm for the GCOM-C1/SGLI

HIRAWAKE, Toru[1*] ; FUTSUKI, Ryosuke[1] ; SHINMYO, Katuhito[1] ; TAKAO, Shintaro[2] ; FUJIWARA, Amane[3] ; SAITOH, Sei-ichi[1]

[1]Faculty/Graduate School of Fisheries Sciences, Hokkaido University, [2]Faculty of Environmental Earth Science, Hokkaido University, [3]National Institute of Polar Research

One of the objectives of second-generation global imager (SGLI) on the earth observation satellite, Global Change Observation Mission 1st-Climate (GCOM-C1) is to understand the global carbon cycle. Therefore, estimation of column integrated daily net primary production (PP_{eu}) as carbon assimilation by photosynthesis of phytoplankton in the ocean is essential for the objective of SGLI/GCOM-C1 project. Most of the algorithms developed in the past used chlorophyll *a* (chl *a*) concentration. However, estimation of chl *a* concentration from satellite data has uncertainty due to the effect of pigment packaging that leads to underestimation, and the interference of colored dissolved organic matter (CDOM) which leads to overestimation. Another uncertainty is derivation of photosynthetic rate of phytoplankton. Although the vertically generalized productivity model (VGPM) which is one of the frequently used algorithms expressed the maximal photosynthetic rate (${P^B}_{opt}$) as a function of sea surface temperature (SST), the SST derived ${P^B}_{opt}$ had large error, particularly in the polar waters. Furthermore, discussion on the effect of global warming to primary productivity in the ocean using satellite data is facilitated, if the photosynthetic rate is an independent parameter on the SST.

To reduce these issues, light absorption coefficient of phytoplankton (a_{ph}) was used in the algorithm for SGLI/GCOM-C1; product of ${P^B}_{opt}$ and chl *a* in the VGPM, which means productivity at the depth with the maximal photosynthetic rate within a water column, was expressed by photosynthetic available radiation (PAR) absorbed in phytoplankton. In situ primary production and optical data to develop the algorithm were measured in the North Pacific, Japan Sea, East China Sea, Southern Ocean, Chukchi Sea (Arctic Ocean), Bering Sea. Additional datasets of the Bermuda Atlantic Time-series Study (BATS), Hawaii Ocean Time-series (HOT) and The California Cooperative Oceanic Fisheries Investigations (CalCOFI) were also obtained for the development and validation of the algorithm. Accuracy in the estimation of product of ${P^B}_{opt}$ and chl *a* (P_{opt}) and PP_{eu} were fairly well and estimated values from the new algorithms almost satisfied a factor of 2 of the values measured in situ. If accurate value of aph is derived from SGLI data, global estimation of PP_{eu} without the issues of pigments packaging, CDOM and SST are expected.

Keywords: primary production, phytoplankton, absorption coefficient, GCOM-C, SGLI