Harmful algal bloom monitoring using satellite remote sensing

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Abstract. The field observation was conducted in the coast of Bungo Channel where is a strait separating the Japanese island of Kyushu and Shikoku, Japan to understand the optical characteristics of harmful dinoflagellate bloom. Sub-surface harmful dinoflagellate *Cochlodinium polykrikoides* bloom was observed and this sub-surface bloom was detected by using red tide detection algorithm, which is a simpler new satellite remote sensing-based harmful algal blooms detection method for JAXA's GCOM-C/SGLI. The algorithm improvement to detect the harmful algal blooms in the optically complex water is required.

Keywords: Ocean color, Remote sensing, Harmful algal blooms, Dinoflagellate, GCOM-C/SGLI.

1. INTRODUCTION

A specific algal species grows immediately and change the color of the sea surface, which called "red tide", especially the red tide affect human health and fish aquaculture and economy, which called "harmful algal bloom". Global Change Observation Mission - Climate (GCOM -C) / Second-Generation Global Imager (SGLI) will be launched at JFY 2016 and GCOM-C is expected to use coastal area because that sensor has maximum 250m resolution. GCOM-C has a detection algorithm of red tide. If harmful algal bloom can be detected before becoming red tide, it is useful to decrease the fish mortality and economic loss.

2. FIELD OBSERVATION

Ocean color remote sensing is expected as a useful tool to reduce the financial damage of harmful algal blooms. Ocean color data is low accuracy in the coastal region because colored dissolved organic matter and suspended solid are dominant. More optical data of harmful algal blooms are required because there are few data in harmful algal bloomS. Bungo Channel where is a strait separating the Japanese island of Kyushu and Shikoku, Japan, is a richly fish aquaculture area. However, sometimes harmful algal blooms occur in this region, especially harmful dinoflagellates blooms, and cultured fish mortality occurs (Fig. 1). The field observation was conducted to understand the inherent optical property of harmful dinoflagellate bloom in the eastern coast of Oita prefecture on April and August.

3. RESULTS AND DISCUSSIONS

Maximum of chlorophyll-a concentration, which is the index of phytoplankton biomass, (>24 mg m^-3) was observed in the subsurface layer (2-3m) on April. The dominant phytoplankton species in this chlorophyll-a concentration maximum layer was dinoflagellate *Cochlodinium polykrikoides* (>300 cells ml^-1) and early stage of the bloom was formed. Peak of the remote sensing reflectance was near 565nm due to strong phytoplankton absorption within 400 ~ 500 nm domain from the subsurface bloom layer. Moreover, high phytoplankton absorption coefficient was observed at the shorter wavelength (< 400nm). This strong absorption might be due to mycosporine-like amino acids, which absorb the UV (Kahru and Mitchell, 1998). And this subsurface *Cochlodinium polykrikoides* bloom was detected by using dinoflagellate bloom detection algorithm, which is a simpler new satellite remote sensing-based harmful algal blooms detection method for JAXA's GCOM-C/SGLI (Siswanto et al., 2013). However, detection of the dinoflagellate *Karenia mikimotoi* bloom by using the algorithm on August was difficult as colored dissolved organic matter and detritus absorptions were high.

Figure 1 The color of harmful dinoflagellate *Karenia Mikimotoi* bloom (Picture from National Research Institute of Fisheries and Environment of Inland Sea).

4. CONCLUSIONS

Although the algorithm could detect the early stage of *Cochlodinium polykrikoides* bloom, the algorithm improvement to detect the harmful algal blooms in the case II water is thus highly required. This red tide detection algorithm of GCOM-C is believed to use not only coastal area but also fresh water area.

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