# Sea surface floating matter observation by GCOM-C/SGLI

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## Introduction

Second-generation GLobal Imager (SGLI) on GCOM-C satellite is a middle-resolution (250-1000m), wide-swath (>1000km), multi-channel (19 channels in visible-thermal infrared) optical imagers. The 250-m spatial resolution is not enough to observe individual floating matter on the sea surface (*e.g.*, floating algae, seagrass, pumice raft, debris from the river discharge etc.); however, it can contribute to monitoring and prediction of their movement using the frequent observation and multiple channels. Some examples of the SGLI observations of sea-surface floating matters are introduced here.

## (1) floating algae

Large scale floating algae and seagrass can be observed by the middle-resolution imagers using characteristics of higher reflectance compared to nearly zero reflectance of surrounding seawater at near-infrared (NIR) wavelength (e.g., [1][2][3]). SGLI has observed distribution and movement of floating algae every spring around Japan using the 250-m resolution NIR and other wavelength channels (Fig. 1), and reported to the public including fishery communities.

## (2) pumice rafts

Pumice rafts were created by a submarine volcano, Fukutoku-Oka-no-Ba (24.29°N, 141.48°E) erupted on 13 August 2021 (Fig. 2). SGLI captured the part of the pumice rafts around the north of the volcano on 14 August 2021 (Fig. 2 A), and most of the pumice areas were revealed on 17 August (A'). The aggregated large rafts moved slowly to the west-northwest, reached 135°E within 40 days (corresponding to about 0.2 m/s), and divided into several clusters (B). Then the clusters moved to the west at about 0.3 m/s and neared the Okinawa islands 22 days later as thinner textures (C). After 20 days, the textures assumed as the pumice rafts were found in the path of Kuroshio as a small patch (D) seemed to be carried by the fast current of Kuroshio [4][5][6][7].

The reflectance of the pumice rafts ($r_p$) was estimated as the difference between reflectance of the target pixels and surrounding clear water pixels (Fig. 3). By assuming the SGLI 250-m pixel was 100% covered by the pumice rafts on 17 August (A), the cover ratio of the pumice rafts of (B), (C), and (D) were estimated to (B) 100 %, (C) 20 %, and (D) 2 % when we use $r_p$ at 865 nm, for which the influence of the background ocean colour is negligible (Murakami, 2023). The pumice raft locations captured by SGLI and other satellites such as Sentinel-3/OLCI, and Sentinel-2/MSI had been reported to ocean model researchers within 1-2 days (https://earth.jaxa.jp/karuishi/), and the weekly prediction of the pumice raft locations had been provided for the coastal environment measures [8].

## (3) Sea surface current vector

Estimation of the sea surface current by the ocean physical model is a key for the real-time monitoring and prediction of the floating matter migration. In addition to assimilating satellite ocean altimetry and sea surface temperature (e.g., [10][11]), multiple ocean colour images have a potential to give the ocean current information by the maximum cross-correlation (MCC) between two images of short-term observation difference (e.g., several tens of minutes to an hour) (e.g., [12][13][14]). Fig. 4 is an example of estimated ocean surface current vector by using SGLI and Sentinel-3/OLCI images. They could show small scale current structure and the accuracy was about 0.2m/s comparing NOAA drifting buoy (Fig. 5). We expect the information will contribute to the assimilation ocean physical models and improve their prediction of sea surface floating matter distribution including marine debris in the future.

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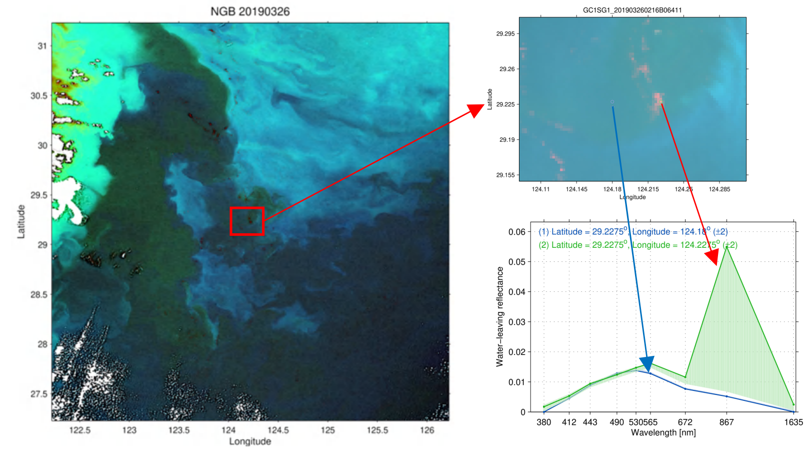



**Fig. 1 RGB image (RGB: 867, 565, 490nm) and water-leaving reflectance spectra of floating algae (Sargassum horneri) in the East China Sea observed by GCOM-C/SGLI on 26 March 2019.**

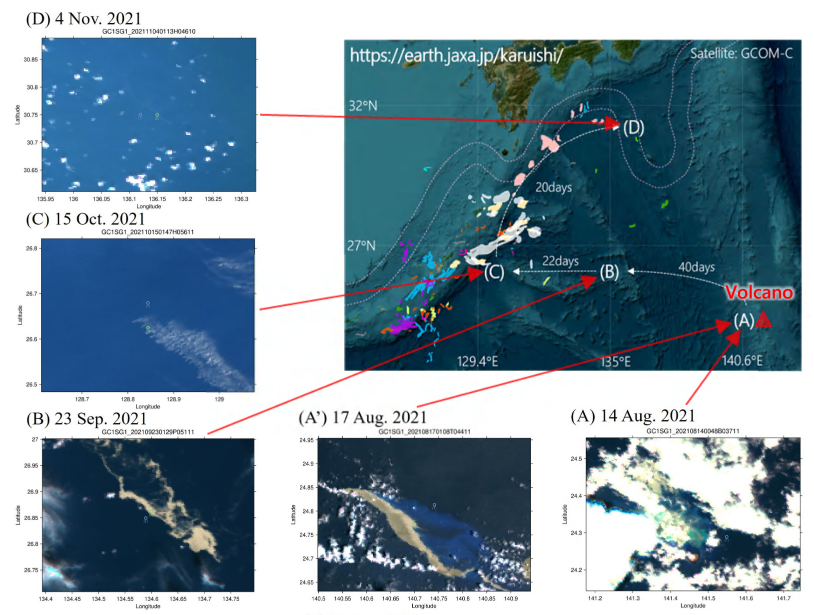
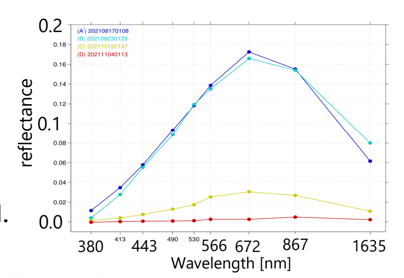



**Fig. 2 Locations of the pumice rafts (color polygons) detected by GCOM-C in 2021 (upper left). Panels (A)-(D) show SGLI RGB images around position of the spectra of Fig. 3**

**Fig. 3 Reflectance of pumice rafts estimated by the SGLI water-leaving reflectance, $\rho_W$. Blue, light-blue, yellow, and red lines indicate the reflectance on Aug. 17 (A'), Sep. 23 (B), Oct. 15 (C) and Nov. 4 (D) in 2021.**



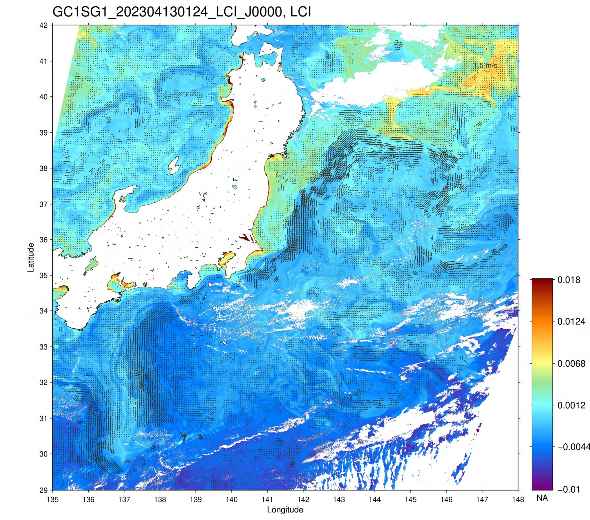




**Fig. 4 Ocean surface current vectors by SGLI and OLCI [14] on 13 April 2023. Background colour shows linear combination index of SGLI water-leaving reflectance.**

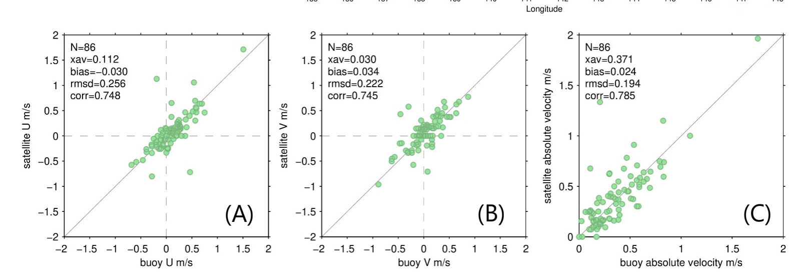



**Fig. 5 Comparison of the ocean surface current by SGLI-OLCI MCC and NOAA drifting buoys in 2018-2023 (zonal (A), meridional (B) and absolute velocity (C)).**