Improvement of GCOM-C chlorophyll-*a* concentration product by in-situ optical measurements

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Global Change Observation Mission for Climate (GCOM-C) which carries Second-generation Global Imager (SGLI) is planned to be launched in Japanese Fiscal Year (JFY) 2016 (from April 2016 to March 2017). SGLI has middle spatial resolution (250 m to 1000 m), wide swath (1150 km to 1400 km), 19 bands from near-UV (380 nm) to thermal infrared (12 um) wavelengths, and two-channel (red and near infrared) slant view polarization observations. SGLI will provide several ocean color products including normalized water-leaving radiance (*NWLR*) (or remote sensing reflectance (R_{rs})), photosynthetically available radiation (*PAR*), chlorophyll-*a* concentration (*Chla*), colored dissolved organic matter (*CDOM*), total suspended matter concentration (*TSM*), which will contribute to coastal environment monitoring and climate researches by the SGLI 250m resolution and wide swath. *Chla* is a key parameter to know phytoplankton distribution and the ocean primary production. Traditionally, it was estimated by an empirical regression between *Chla* and blue/green ratio of Rrs (e.g., OC4 algorithm (O'Reilly et al., 2000)). The regression is basing on a global in-situ dataset (e.g., NASA bio-Optical Marine Algorithm Data set, NOMAD (Werdell and Bailey, 2005)). However, the relationship can be deviated due to anomalous condition of inherent optical properties (IOPs), phytoplankton absorption, a_{ph}, CDOM + detritus absorption, a_{dg}, and particle back-scattering, b_{bp}, especially in the coastal areas.
This study showed improvement of the *Chla* estimation by considering the IOP deviation through a simple IOP models (Gordon et al., 1988 and Lee et al., 2002). We tested the scheme for in-situ Rrs and *Chla* data observed by Seikai National Fisheries Research Institute (SNFRI) in the East China Sea, which is independent of the NOMAD dataset. Firstly, we calculated $Chla^{1st}$ by the traditional OC4 algorithm and a_{ph} by the linear matrix inversion scheme (Hoge and Lyon, 1996, 1999) from the observed R_{rs}. Then, R_{rs} is modified by the IOP model with the estimated a_{ph}, which is assumed to be strongly related to *Chla*, and average state of a_{dg} and b_{bp} at condition of the *Chla* value. The average state of a_{dg} and b_{bp} was modeled by regression with *Chla* basing on the NOMAD dataset in advance. Finally we recalculated $Chla^{re}$ by the OC4 algorithm applied to the modified R_{rs}. Mean absolute difference (MAD) compared to the in-situ observed *Chla* was improved from 50% ($Chla^{1st}$) to 40% ($Chla^{re}$).
This scheme assumed spectral shape of a_{ph}, a_{dg} and b_{bp}, however they can change in various coastal environment. Collection of the in-situ bio-optical measurements in the various coastal areas is required to develop more robust GCOM-C algorithms and methodology to estimate coastal *Chla*.

Keywords: GCOM, GCOM-C, SGLI, ocean color, chlorophyll-a concentration

