Ocean Diurnal Variations Measured by the Korean Geostationary Ocean Color Imager

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COMS-1 – Communication, Ocean and Meteorological Satellite
GOCI Introduction

- 412nm: Yellow substance and turbidity
- 443nm: Chlorophyll absorption maximum
- 490nm: Chlorophyll and other pigments
- 555nm: Turbidity, suspended sediment
- 660nm: Baseline of fluorescence signal, Chlorophyll, suspended sediment
- 680nm: Atmospheric correction and fluorescence signal
- 745nm: Atmospheric correction and baseline of fluorescence signal
- 865nm: Aerosol optical thickness, vegetation, water vapor reference over the ocean
NOAA-MSL12 Processing for GOCI data

- Collaboration effort between NOAA/NESDIS/STAR and KIOST/KOSC.

- **NOAA-MSL12 data processing** (based on NASA SeaDAS) is improved for the GOCI data processing.

- Various parameters and **lookup tables** are generated, and a **new atmospheric correction algorithm** has been developed for GOCI data processing in the region (Wang et al., 2012; 2013).

- **New cloud masking method** has been recently developed for very turbid coastal waters (e.g., Yangtz River mouth, Korean Coastal areas).

- The GOCI atmospheric correction algorithm is recently improved using **new vicarious calibration**.

- GOCI Level-1B data (Mar. 2011–Feb. 2013) were obtained from the Korea Ocean Satellite Center and processed using the new atmospheric correction algorithm.

- In situ optical measurements (Mar.–Nov. 2011) are used to quantify and validate GOCI ocean color products with the new atmospheric correction algorithm for GOCI ocean color data processing.
Estimating NIR Contribution

- $nLw(748) = f(Kd(490))$, $f(x) = 0.465x - 0.385x^2 + 0.152x^3 - 0.0121x^4$
- $nLw(869) = g(nLw(748))$, $g(x) = 0.368x + 0.04x^2$
GOCI Coverage over Korean Peninsular and location of in-situ measurements

*. In-situ bio-optical measurements are provided by KIOST/KOSC
GOCI Matchup Comparison

Matchup between in-situ and GOCI NOAA-MSL12 using New Gain
## Mean Ratio of GOCI NOAA-MSL12 vs. In Situ

<table>
<thead>
<tr>
<th>Var</th>
<th>Old (Wang et al. 2013)</th>
<th>New Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avg (std)</td>
<td>No</td>
</tr>
<tr>
<td>$nL_w(413)$</td>
<td>1.2737 (0.599)</td>
<td>18</td>
</tr>
<tr>
<td>$nL_w(443)$</td>
<td>1.4182 (0.486)</td>
<td>18</td>
</tr>
<tr>
<td>$nL_w(490)$</td>
<td>1.2868 (0.357)</td>
<td>18</td>
</tr>
<tr>
<td>$nL_w(555)$</td>
<td>1.1506 (0.308)</td>
<td>18</td>
</tr>
<tr>
<td>$nL_w(660)$</td>
<td>1.3367 (0.531)</td>
<td>18</td>
</tr>
<tr>
<td>$nL_w(680)$</td>
<td>1.4092 (0.586)</td>
<td>17</td>
</tr>
</tbody>
</table>
Spectral shape of **in situ** and **GOCI**-derived $nL_w(\lambda)$ measurements.

Black-in situ, red-GOCI
GOCI Composite Images
(2011 Mar. – 2012 Oct.)
Climatology GOCI Images from Mar. 2011 to Oct. 2012 (at 12:00)
Monthly Composite Images of GOCI $K_d(490)$
(Mar. 2011 – Oct. 2012, at 12:00)
Time Series of GOCI $\text{Chl-a} \, & \, K_d(490)$ Monthly Mean
(Mar. 2011 – Oct. 2012, at 12:00)
GOCI Images for Diurnal Changes
GOCI Images in the East China Sea
Diurnal Changes

GOCI NOAA-MSL12 Chl-a (2012-04-26)
GOCI NOAA-MSL12 $K_d(490)$ (2012-04-26)
GOCI Images in 
Hangzhou Bay & Lake Taihu
GOCI NOAA-MSL12 $K_d(490)$ (2012-07-29)
GOCI Images in the Bohai Sea
GOCI NOAA-MSL12 $K_d(490)$ (2012-03-25)

Time: 09:00
GOCI NOAA-MSL12 $K_d(490)$ (2012-08-23)
GOCI Images in
Dump Site in the Yellow Sea
GOCI NOAA-MSL12 $K_d(490)$ (Jul. 19, 2011)
The GOCI ocean color products for the GOCI coverage region have been derived using an iterative NIR-corrected atmospheric correction algorithm.

Validation results show a reasonably good agreement between GOCI retrievals and in situ measurements.

This study demonstrates that GOCI ocean color products can be confidently used to characterize and quantify the ocean environments as well as the diurnal variability of the marine ecosystem in the western Pacific.

This unique capability from geostationary satellite sensor can complement the ocean color observations of other polar-orbiting satellites such as MODIS and VIIRS, which have a global coverage but lack the temporal resolution to monitor the dynamics of marine environments on an hourly basis.
Thank you!
GOCI NOAA-MSL12 $K_d(490)$ (2012-08-23)

Time: 09:00
Backup
Spectral shape of **in situ** and **GOCI**-derived $nL_w(\lambda)$ measurements

Black-in situ, red-GOCI
GOCI-MSL12 *Chl-a* (Oct. 2, 2012)
GOCI-MSL12 *Chl-a* (Oct. 18, 2012)
Diurnal Changes (Box2)
GOCI NOAA-MSL12 $K_d(490)$ (2012-08-23)
Diurnal Changes
GOCI NOAA-MSL12 Chl-a (2012-04-27)