CURRENT STATUS OF GEOSTATIONARY OCEAN COLOR IMAGER

Communication, Ocean and Meteorological Satellite (COMS) is the first Korean geostationary multi-mission satellite launched in June 2010 with a design lifetime of 7 years. For the ocean observation, Geostationary Ocean Color Imager(GOCI), a payload of COMS is developed by KARI(Korea Aerospace Research Institute) and EADS Astrium according to the user requirements assigned by KORDI(Korea Ocean Research & Development Institute). GOCI has a unique capability to observe the ocean and coastal waters with high spatial resolution (500m) and very high temporal resolution (re-acquisition rate: 1 hour), thanks to the state-of-the-art optical design and satellite location in geostationary orbit. Korea Ocean Satellite Center (KOSC) has the competence for GOCI operation and data distribution. GOCI data can be accessed on website and the data policy is free costs for public/research purposes.

GOCI calibration and validation activities are conducting radiometric calibration and geometric correction, vicarious calibrations comparing satellite products with field measurements, and improving the data processing algorithm. In order to coordinate the Cal/Val activities, the KOSC is organizing the GOCI Cal/Val Advisory Group, comprised of both domestic and international experts. Application research of high quality GOCI data is being conducted in a diverse range of areas.

This paper presents the status of GOCI and the instruction of distribution service. GOCI Cal/Val and application is described also.

1. Introduction

Communication, Ocean and Meteorological Satellite (COMS) is the first Korean geostationary multi-mission satellite launched in June 2010 with a design lifetime of 7 years. COMS have three dedicated payloads for three missions, ocean observation, meteorological observation, and experiments of Ka band antenna system. For the ocean observation, Geostationary Ocean Color Imager(GOCI), a payload of COMS is developed by KARI(Korea Aerospace Research Institute) and EADS Astrium according to the user requirements assigned by KORDI(Korea Ocean Research & Development Institute) supported by Ministry of Land, Transport and Maritime Affairs (MLTM).

In order to detect, monitor and predict short term and regional oceanic phenomena such as red tides, yellow dust, fishing ground information, and etc, high spatial and temporal resolutions are required to ocean color remote sensing satellites. Unlike other ocean color satellites, GOCI has a unique capability to observe the ocean and coastal waters with high spatial resolution (500m) and very high temporal resolution (re-acquisition rate: 1 hour), thanks to the state-of-the-art optical design and satellite location in geostationary orbit.

2. THE MISSIONS AND OVERVIEW

The GOCI can detect the ocean phenomena, monitor its changes and respond to any changes in the ocean environment resulting from natural and/or man-made disasters, such as marine resource exhaustion, marine pollution, red tides, oil spills, tsunamis, and earthquakes. This sensor makes possible to predict short term biophysical phenomena and noxious or toxic algal blooms of notable extension.

2.1 Technical Specifications

The GOCI has 500m×500m pixel resolution (GSD) and a coverage area of 2500km×2500km centered at 36˚N and 130˚E. GOCI can acquire 16 slot images and compose one complete image of the GOCI coverage area. Each slot image consists of 8 spectral band images and 2 dark images for instrument dark current correction and monitoring. GOCI measures upwelling visible radiance with 6 spectral bands for ocean observation and near infra-red(NIR) radiance with 2 spectral bands for atmospheric correction, as described below Table 1. The temporal resolution is 1 hour and image

acquisitions are 8 times for a day.

Band	Centre wavelengths	Band width	Nominal Radiance	Maximum Radiance	Saturation Radiance in High gain	Saturation Radiance in Low gain	Type
B1	412 nm	20 nm	100	150.0	152.0	601.6	Visible
B2	443 nm	20 nm	92.5	145.8	148.0	679.1	Visible
B3	490 nm	20 nm	72.2	115.5	116.0	682.1	Visible
B4	555 nm	20 nm	55.3	85.2	87.0	649.7	Visible
B5	660 nm	20 nm	32.0	58.3	61.0	589.0	Visible
B6	680 nm	10 nm	27.1	46.2	47.0	549.3	Visible
B7	745 nm	20 nm	17.7	33.0	33.0	429.8	NIR
B8	865 nm	40 nm	12.0	23.4	24.0	343.8	NIR

Table 1. GOCI spectral performance specification (Spectral radiance values are in $Wm^2um^{-1}sr^{-1}$**)**

2.2 GOCI Ground System and Data Processing

The Korea Ocean Satellite Center (KOSC), a department of KORDI, has the competence for GOCI operation and data distribution. KOSC has several systems to perform data acquisition, data processing, data archiving and distribution.

KOSC makes the daily mission schedule for GOCI image acquisition and the schedule should be provided to KARI Satellite Operations Center (SOC) in proper time for COMS operation. KOSC and SOC have collaborated for successful operation of GOCI/COMS with the sharing of operating status of each center and the data receiving backup activity.

KOSC receives and stores the ocean observing data and processes the products in near-real-time using the Image Preprocessing System (IMPS) and the GOCI Data Processing System (GDPS). The products are going to be available to partners and users. It takes within 3 hours after observation that KOSC prepare it distributable. The GOCI products are listed as following: Water Leaving Radiance (Lw), Normalized Water Leaving Radiance (nLw), Optical Properties of ocean water (absorption coeff. & backscattering coeff., diffuse attenuation coeff.), Chlorophyll, Total Suspended Sediment(TSS), Colored Dissolved Organic Matter (CDOM), Red tide index(RI), Fishing Ground Information(FGI), Underwater Visibility, Water Current Vector, Atmosphere & Earth Environment Monitoring like yellow dust concentration and vegetation index, Water Quality Level, Primary Productivity

2.3 GOCI Data Distribution

The MLTM issued the GOCI data distribution policy as the Minister's

instruction. In the instruction, GOCI data can be distributed free of charge only for public/research purposes. But it takes payments for special request and commercial use. The intellectual property of both GOCI and GOCI data is belonged to the MLTM and the re-distribution to third parties of distributed data is limited. The standard products passed the calibration and validation is only distributable on website or on the file transfer service. A distribution is based on this instruction.

This GOCI data has been provided as HDF-EOS 5(He5) format using the orthographic map projection. For a stable distribution service of GOCI data, various systems were installed in KOSC. KOSC developed GOCI Data Distribution System (GDDS) and a website (http://kosc.kordi.re.kr) to distribute geo-corrected satellite data and browsing image. GDDS has been distributed GOCI data to the users since April 2011 on this website restrictively. Recently, Some of GOCI level 2 data (Chl, TSS, CDOM, Lw, nLw) are available from 01 September 2011. Also, GDPS for user can be downloaded in the web site.

All what users to do is to access to web server for the data searching. User can search data as specified date and sensor. Basic selected options are including sensor name, time, date1, date2 and amount of clouds, searching area and each products of each sensor in advanced selections. The function of cart and saving condition is added for user's convenience. User can download the searched/requested data from the data server through download component.

Data distribution for dedicated institution is performed by FTP push method. There are 16 domestic institutions which are getting the GOCI data through the FTP service from KOSC. Interested in using the FTP service, an institution, who wants to receive the satellite data in near-real time, can fill out an application and send it to KOSC. But the institution should prepare the FTP system for receiving the data. It is just to minimize inconvenience of users by avoiding overloading the KOSC system. If there is no problem on the application through the review, KOSC will announce the start date to you by e-mail. Then the data will be sent from KOSC FTP to your system and the report on the transmission also sent you every day by e-mail. The report includes the result and information of the provided data. If there is any missed data, re-transmission can be required.

3. GOCI research activies

3.1 Calibration/Validation Activities

The KOSC is actively engaged in a range of calibration/validation activities, conducting radiometric calibration and geometric correction, comparing satellite

products with field measurements, and improving the data processing algorithm.

For radiometric calibration and geometric correction, there are activities like derivation of radiometric calibration coefficient, trace of sensor sensitivity change, geometrical matching between satellite data and reference data, enhancement of geometrical correction performance.

For atmospheric correction & water-leaving signal validation, KOSC has engaged to the estimation of radiance from atmospheric molecules & aerosols, correction of the bi-directional effects of water-leaving radiance and validation of atmospheric properties using the Aeronet-OC network (be expected on September 2011)

For water property validation, KOSC has the opportunities to comparison of satellite products with in-situ data, acquisition of match-up data using ships and ocean stations, inter-satellite Cal/Val and improvement of bio-optical algorithms.

In order to coordinate the Cal/Val activities, the KOSC is organizing the GOCI Cal/Val Advisory Group, comprised of both domestic and international experts (Figure 1).
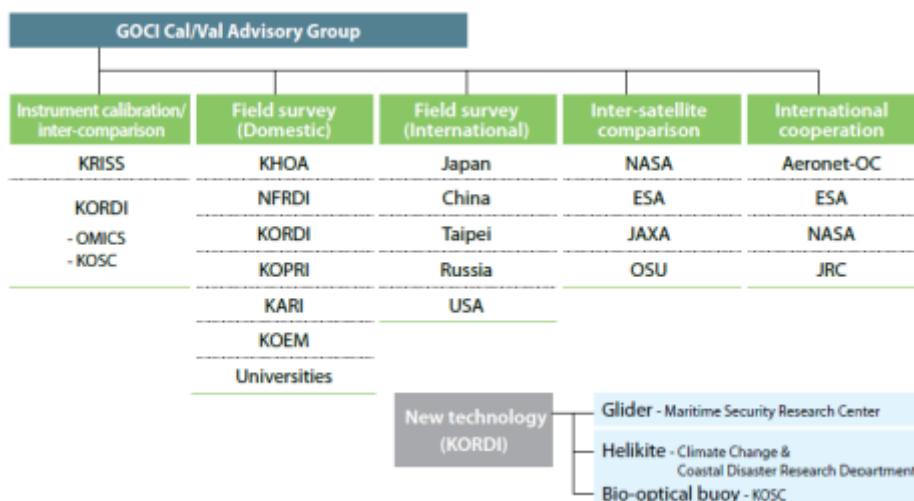

Figure 1. Cal/Val Network

Through these activities, for the development of core technologies for atmospheric correction and the verification of ocean color algorithm, 14 internal and external research subjects are supported by KOSC. Also, the ocean environment algorithm for GOCI has been verified/improved using ocean surface optical data, water depth profile data and ocean environment observation data which acquired at 150 points in 12 ship cruises from May 2010 to December 2010.

3.2 The Application Research

Application research of high quality GOCI data is being conducted in a diverse range of areas, such as climate change, coastal environment and disaster monitoring, the management of territorial waters, the fields of weather, atmosphere and land (red tide, turbid water, chlorophyll, typhoon, yellow dust, forest fire). How to apply the GOCI products is shown below (Figure 2).
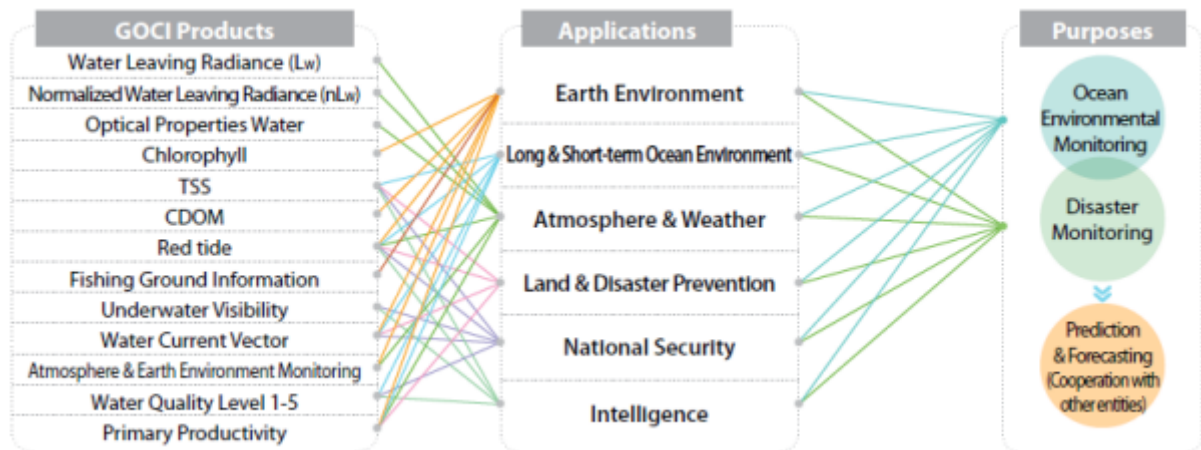

Figure 2. Applications of GOCI products

4. CONCLUSIONS

GOCI has been operated since June 2010 and its data has been processed and distributed by KOSC. Only calibrated and validated standard product of GOCI can be distributed to users. User can find the data on website but should join the website for downloading the data. An institution who needs to get the data in near-real time ftp services can find the application form on website.

The GOCI Cal/Val Advisory Group have been organized and managed for quality control at the national and international level. Application research of GOCI data with high quality is being conducted in a diverse range of areas.

The data quality improvements and the reliability enhancement are expected through Cal/Val activities for GOCI data. It make possible to extend fields of application of GOCI.