DEVELOPMENT OF GOCI/COMS DATA PROCESSING SYSTEM

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ABSTRACT: The first Geostationary Ocean Color Imager (GOCI) onboard its Communication Ocean and Meteorological Satellite (COMS) is scheduled for launch in 2008. GOCI includes the eight visible-to-near-infrared (NIR) bands, 0.5km pixel resolution, and a coverage region of 2500 × 2500km centered at 36N and 130E. GOCI has had the scope of its objectives broadened to understand the role of the oceans and ocean productivity in the climate system, biogeochemical variables, geological and biological response to physical dynamics and to detect and monitor toxic algal blooms of notable extension through observations of ocean color. The special feature with GOCI is that like MODIS, MERIS and GLI, it will include the band triplets 660-680-745 for the measurements of sun-induced chlorophyll-a fluorescence signal from the ocean. The GOCI will provide SeaWiFS quality observations with frequencies of image acquisition 8 times during daytime and 2 times during nighttime. With all the above features, GOCI is considered to be a remote sensing tool with great potential to contribute to better understanding of coastal oceanic ecosystem dynamics and processes by addressing environmental features in a multidisciplinary way. To achieve the objectives of the GOCI mission, we develop the GOCI Data Processing System (GDPS) which integrates all necessary basic and advanced techniques to process the GOCI data and deliver the desired biological and geophysical products to its user community. Several useful ocean parameters estimated by in-water and other optical algorithms included in the GDPS will be used for monitoring the ocean environment of Korea and neighbouring countries and input into the models for climate change prediction.

KEY WORDS: GDPS, GOCI, COMS, Korea

1. INTRODUCTION

Measurements from space-borne satellite sensors since the last two and half decades have demonstrated that ocean color remote sensing is a powerful tool for understanding ocean biology and marine ecosystem processes. Much of this information has been gained from, for example, NASA's CZCS (Nimbus-7 Coastal Zone color scanner) and Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and ESA's Medium Resolution Imaging Spectrometer (MERIS).

These are Low Earth Orbit (LEO) (polar orbiting) satellite ocean color sensors and provide nearly daily coverage. To provide important new capability for imaging the coastal zone (also open ocean waters), Korea is now developing the first Geostationary Ocean Color Imager (GOCI) which will be operated in a staring-frame capture mode onboard its Communication Ocean and Meteorological Satellite (COMS) and tentatively scheduled for launch in 2008. Tables 1 and 2 show the payload characteristics of GOCI and comparison with other LEO sensors such as SeaWiFS and MERIS.

Table 1. GOCI requirements and specifications

No of Channel	8 channels (6-Visible and 2-NIR)
Spatial resolution (IFOV)	500m × 500m
Coverage	2500 × 2500 Km
Spectral coverage	400 – 865nm (for 8 bands)
Temporal resolution	8 images at daytime and 2 images at nighttime
Digitization	12 bits
Data integration, readout and download rate	< 30 minutes
Image capturing	Staring method (frame capture)
Scheduled for launch	2008

Table 2. Comparison of GOCI with the polar orbiting SeaWiFS and MERIS sensors

Centre Wavelength ± Bandwidth (nm)			Application/mission objectives
SeaWiFS	MERIS	GOCI	
412 ±20	412.5 ±10	412 ±20	Yellow substance and detrital matter
443 ±20	442.5 ±10	443 ±20	Chlorophyll absorption maximum
490 ±20	490 ±10	490 ±20	Chlorophyll and other pigments
510 ±20	510 ±10		Suspended sediment, red tides
555 ±20	560 ±10	555 ±20	Chlorophyll reference, suspended sediments
	620 ±10		Suspended sediments
670 ±20	665 ±10	660 ±10	Chlorophyll absorption and fluorescence base 1
	681.25 ±7.5	680 ±10	Chlorophyll fluorescence peak
	708.7 5±10		Atmospheric correction, fluorescence base 2
	753.75 ±7.5		Vegetation, cloud
765 ±40	760.625 ±3.75	745 ±20	Chlorophyll fluorescence base 2, Oxygen absorption (in case of MERIS)
	778.75 ±15		Atmospheric correction, vegetation
865 ±40	865 ±20	865 ±40	Water vapour reference, vegetation
	885 ±10		Atmospheric correction
	900 ±10		Water vapour, land

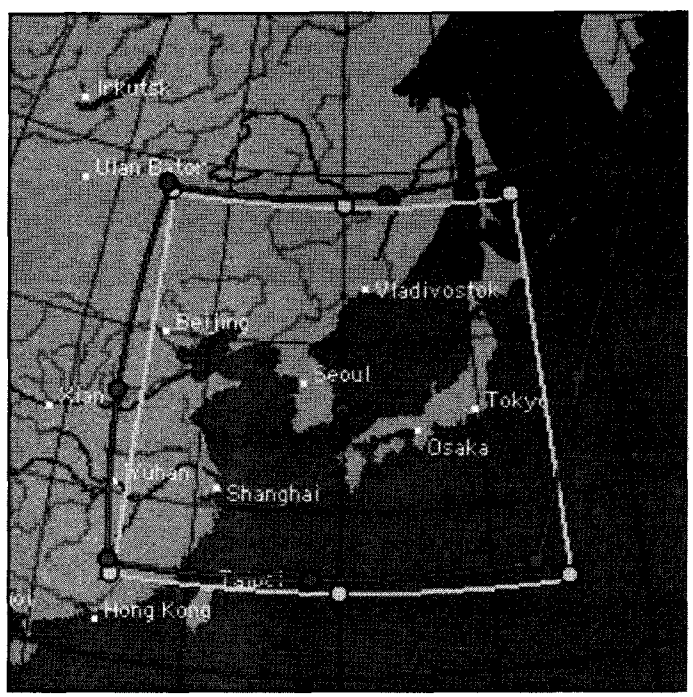


Fig. 1 The coverage area of the GOCI

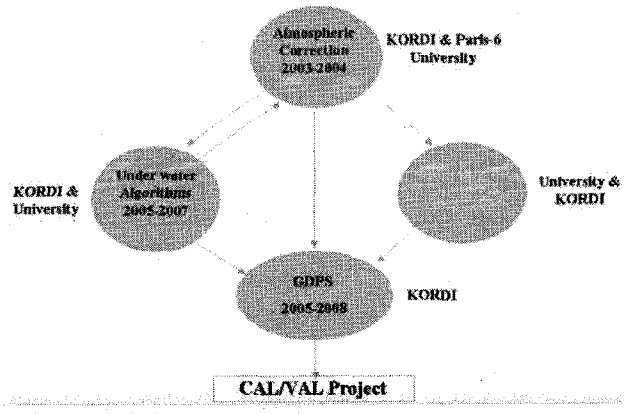
2. SCENE COVERAGE AREA

Fig. 1 shows the scene observation and coverage area. The nominal instrument Field of View (FOV) centered at Korean Seas: 36°N and 130°E. The coverage area depends on the satellite location: 116 E & 127 E.

3. GOCI MISSION OBJECTIVES

The following are the main objectives of the GOCI.

- Detecting, monitoring and predicting short term physical and biological phenomena
- Studies on biogeochemical variables and cycle
- Detecting, monitoring and predicting noxious or toxic algal blooms of notable extension
- Monitoring health of the marine ecosystem
- Assessing geological and biological response to physical dynamics
- Coastal zone and resource management
- Producing an improved marine fisheries information to the fisherman communities



1st phase / Atmospheric correction (2003-2004)
Sun-glint estimation
Atmospheric Signal Modeling
Optical properties of Korean atmosphere
Atmospheric correction technique development

2nd phase / Under water algorithms & GDPS (2005-2006)
Chl, TSS, CDOM algorithm
Water quality classification algorithm
Red-tide detection
Under water Visibility
Ocean current vector
Optical properties of waters
Fishing ground information
Improvement of SST algorithm for NOAA
GDPS design review

3nd phase / Atmosphere and Land application & GDPS (2007-2008)
Development of image processing techniques for,
-Yellow dust monitoring
- Forest fire monitoring
- Inland flood monitoring
- Heavy Snowfall monitoring
- Plant community & Vegetation index
Development of integrated GDPS SW
Simulation of GOCI data using RT model and OC satellite data
GDPS test using simulated data
Integration of GDPS to GOSI ground system

Post Launch (2009 ~)
Radiometric calibration of GOCI /Ground station
In-situ Validation of GOCI products

Fig. 2. Plan of GDPS development

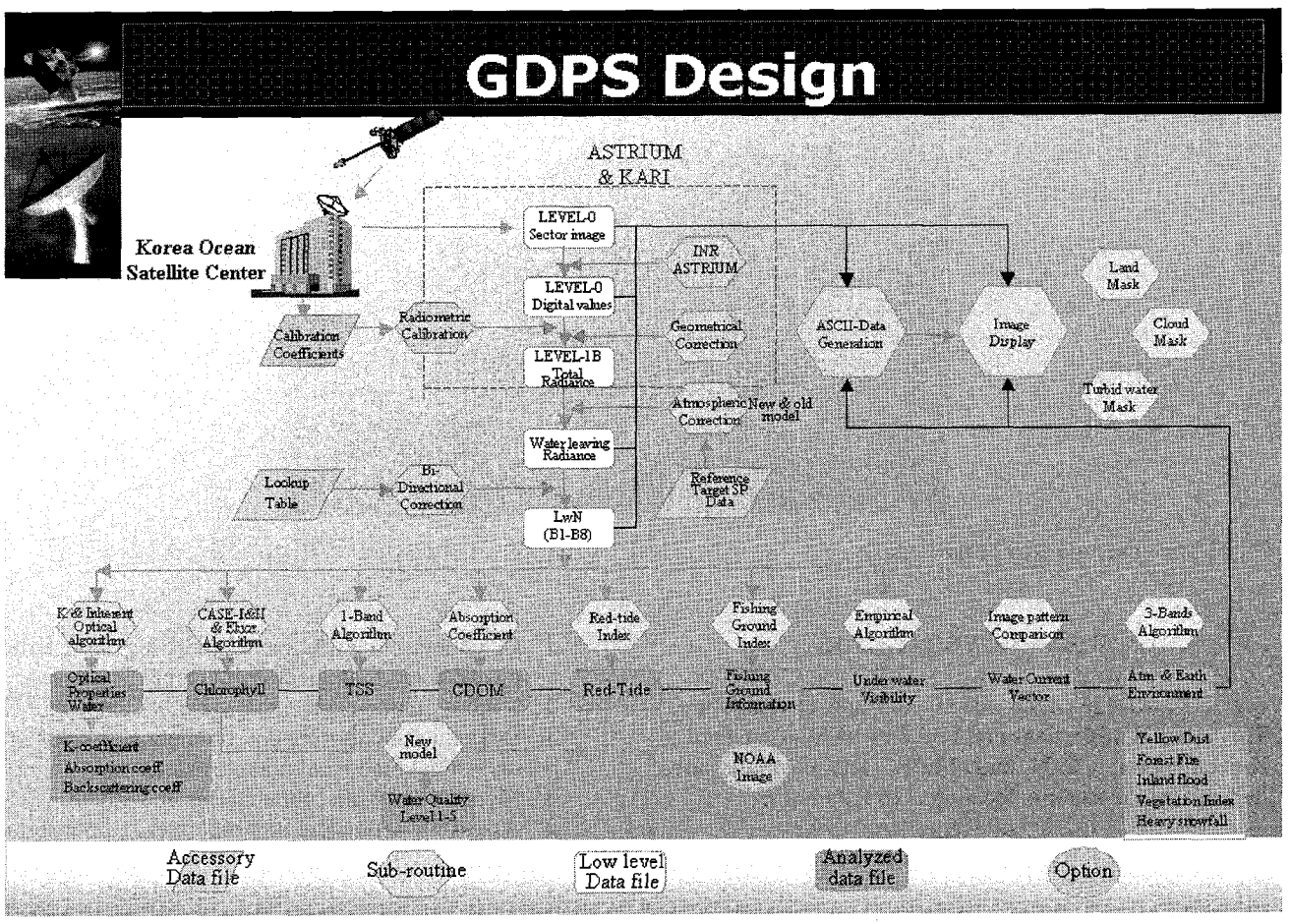


Fig. 3. Details of the GDPS and the necessary ocean parameters achieved.

4. DEVELOPMENT OF TECHNIQUES

To process the GOCI data several techniques are developed by Korea Ocean Research and Development Institute (KORDI) in collaboration with universities and other national institutes. There are also existing problems related to atmospheric correction, bi-directional factor and water-leaving radiance retrieval to be solved and the desired ocean parameters need to be estimated. Fig. 2 illustrates the plan of GDPS development in difference phases for different techniques and Fig. 3 shows the flowchart of the GDPS design and various parameters to be achieved for environmental monitoring. GDPS will be operated by the Korea Ocean Satellite Centre.

5. CONCLUSION

GOCI is expected to provide a remote sensing capability for observing oceanic biology and marine water quality through observations of water color. As it stands, the GOCI belongs to a new generation geostationary ocean color imager which will provide a major improvement in our knowledge of ocean environmental processes and their role in climate change. GOCI will be a role model for the future ocean color sensors to provide high temporal, spatial, spectral and radiometric quality of data that are necessary for monitoring the coastal and ocean processes. Fig. 4 is the description of various stages of the GOCI and GDPS development. It is expected that all the development processes will be completed by 2008.

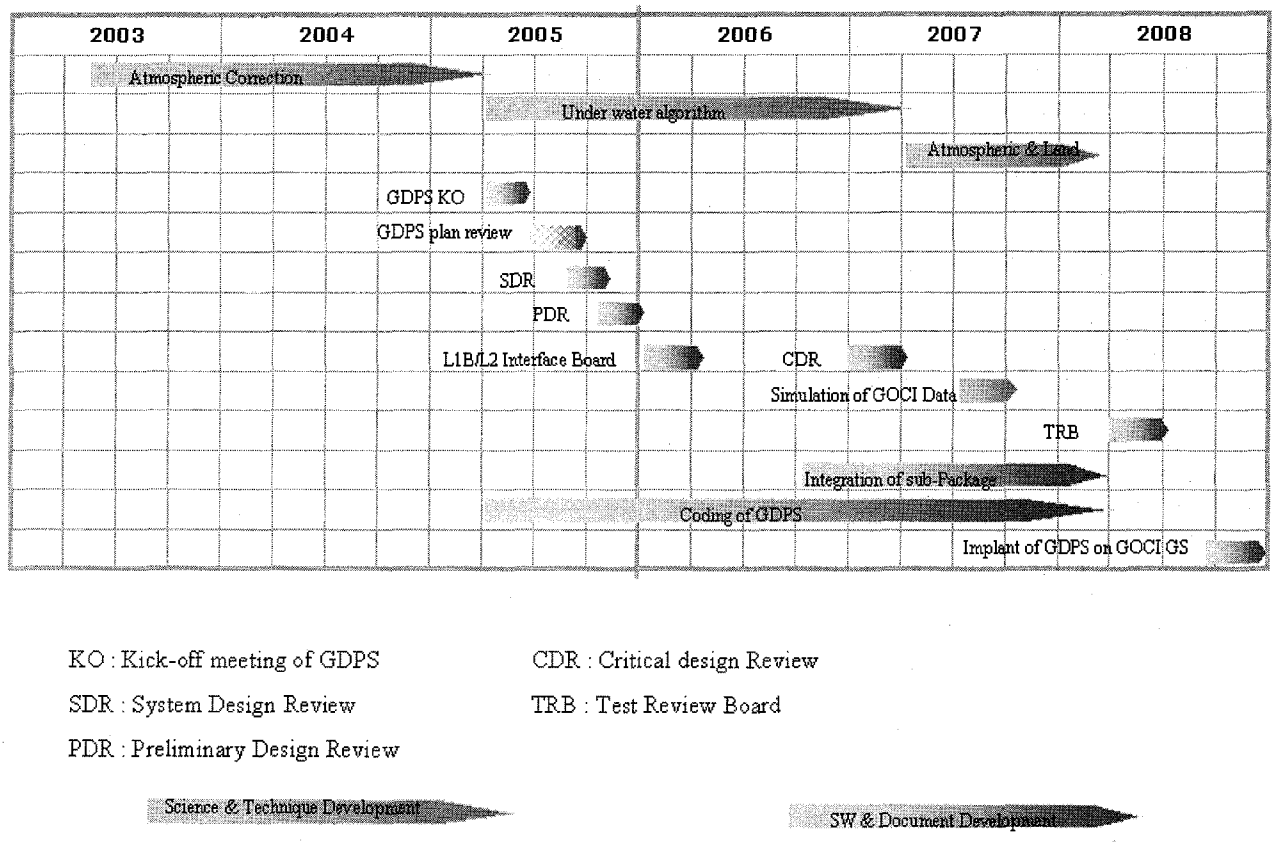


Fig. 4. Milestone of GOCI and GDPS development