Present Status of Coastal Environmental Monitoring in Korean Waters Using Remote Sensing Data

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1. Introduction

Korean waters around the Korean Peninsula are connected in the eastern parts with East /Japan Sea (EJS), western parts with Yellow Sea (YS) and southern parts with the East China Sea (ECS) as shown in Fig. 1.

The water of the EJS is in communication with the ECS and YS to the south through the Tsushima (Korea) Strait, with Pacific Ocean to the east through the Tsugaru Strait, and with the Sea of Okhotsk to the north through the Soya and Tartar Straits. The ECS is bounded by the Izu Island Chain to the east, and includes the narrow the deep Okinawa Trough, which rises steeply to the northwest, onto a broad and shallow shelf bounded by China to the west and Korea to the north. The YS is bounded by the land in the north, west and east, connected in the south with the ECS, is a marginal sea of the western Pacific Ocean. The southern YS is located between the mainland China and the Korea Peninsula, representing a typical shallow epicontinental sea. The southern boundary between the YS and ECS runs from the mouth of the Yangtze River to Jeju Island.

NFRDI (National Fisheries Research and Development Institute) under the Ministry of Maritime Affairs and Fisheries of Korea has been receiving the satellite data since 1989 and operating five kinds of the earth observing satellites. The satellite ocean information are obtained the sea surface temperature (SST) data, which is related to the cold water mass, thermal front etc in Korean waters, from the NOAA satellite series and the MTSAT (Multi-functional Transport Satellite) satellite, and the ocean color data such as phytoplankton pigment (Chl-a), turbid water distributions from the SeaWiFS (Sea-viewing Wide Field of view Sensor), MODIS (MODerate resolution Imaging Spectroradiometer) and OCM (Ocean Color Monitor) satellites. The monitored data in Korean waters are distributed through the website of the NFRDI, the public PC communication network and a facsimile system on a daily base.

The objective of this presentation is to evaluate the usefulness of remote sensing techniques as a monitoring tool for the marine environment in Korean waters.

2. Method

In order to the coastal environmental monitoring in Korean waters, we used Chl-a and SST data. The Chl-a data set utilized in this study consists of the results in the global SeaWiFS processing project at NASA Goddard Space Flight Center (GSFC). The data products are monthly global composite images of Chl-a with 9 km x 9 km spatial resolution from 1998 to 2005.

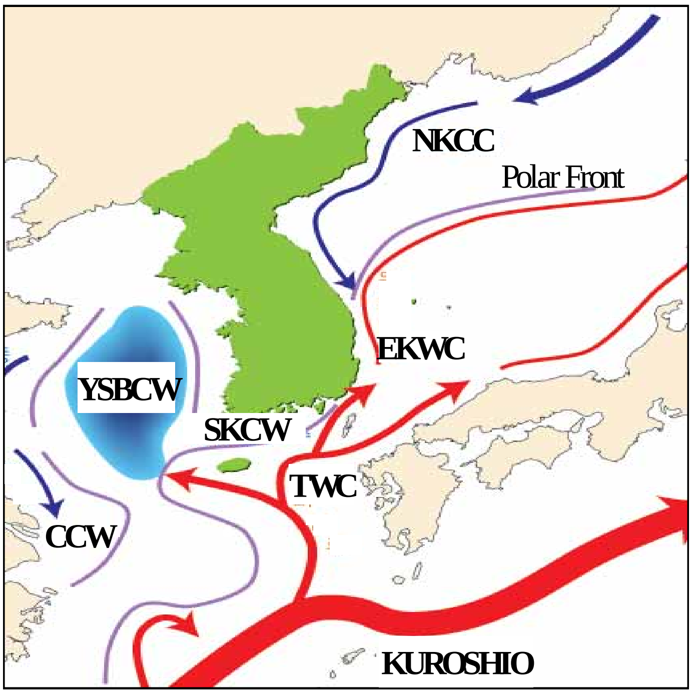

Fig. 1. Schematic diagram showing oceanic currents adjacent to the Korean Peninsula (Naganuma, 1973; Inoue, 1974).

Map projection is a linear latitude-longitude projection with a global dimension of 1024 x 2048. We also used the local area coverage images of Chl-a with 1 km x 1 km spatial resolution supported by KEOC (Korea Earth Observation Center). Map projection is a linear latitude-longitude projection with a dimension of 2000 x 2000. The data was processed based on the OC2 algorithm, which was developed by NASA.

SST data utilized the AVHRR data by the receiving of NFRDI. These data products are the daily data of SST with 1 km x 1 km (2000 x 2000 pixels) spatial resolution from 1990 to 2007. The QuikScat images used in order to get a wind data about the coastal upwelling in the southeast coast of Korea in summer.

3. Result

In order to evaluate the usefulness of remote sensing techniques as a monitoring tool for the marine environment including coastal area, a case study was conducted in the southern waters of the Korean Peninsula and northern part of the ECS. We also monitored cold water mass in the southeast of Korea.

The Chl-a concentrations around the bay in the South Sea of Korea are higher in summer and early fall (October) than those in the other seasons (Fig. 2). Two peaks of Chl-a concentration occurred, one was in spring (March, April and May) and the other was in fall (October and November).

The monthly average SeaWiFS Chl-a concentration images from 1998 to 2005 are as shown Fig. 3. The concentrations of indicates high Chl-a more than 5 mg/m^3 occurred in the coast water of China every year. In the northern part of the ECS, the Chl-a concentrations are higher in summer (July, August and September) than those in the other seasons.

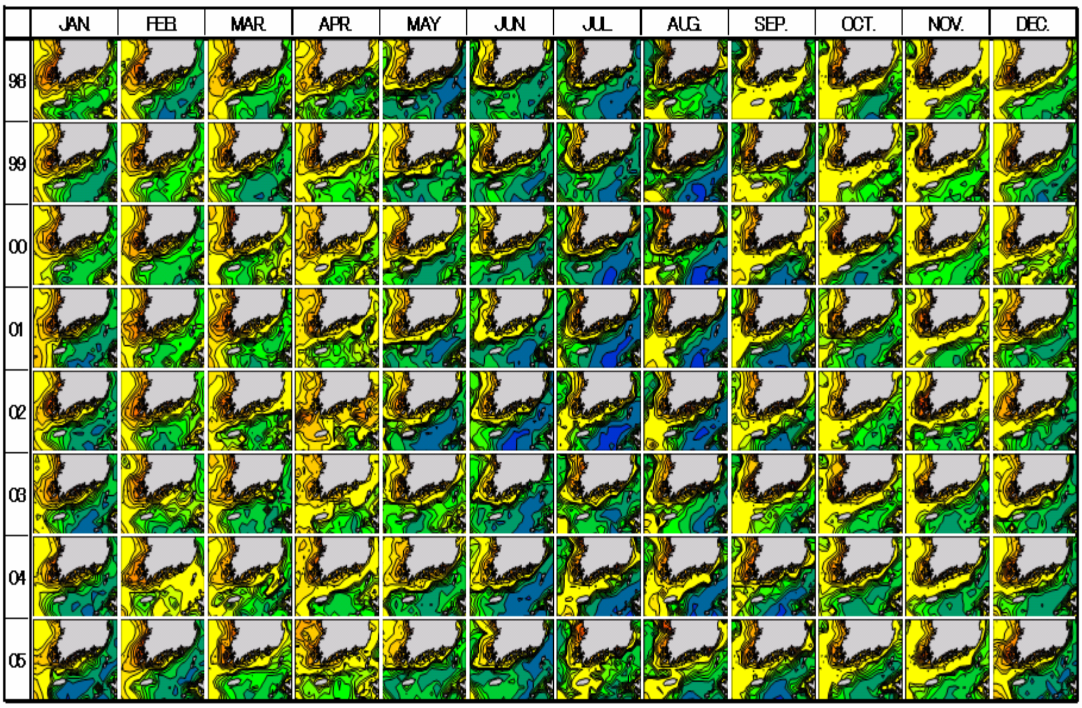

Fig. 2. Monthly average SeaWiFS Chl-a images in the South Sea of Korea from 1998 to 2005.

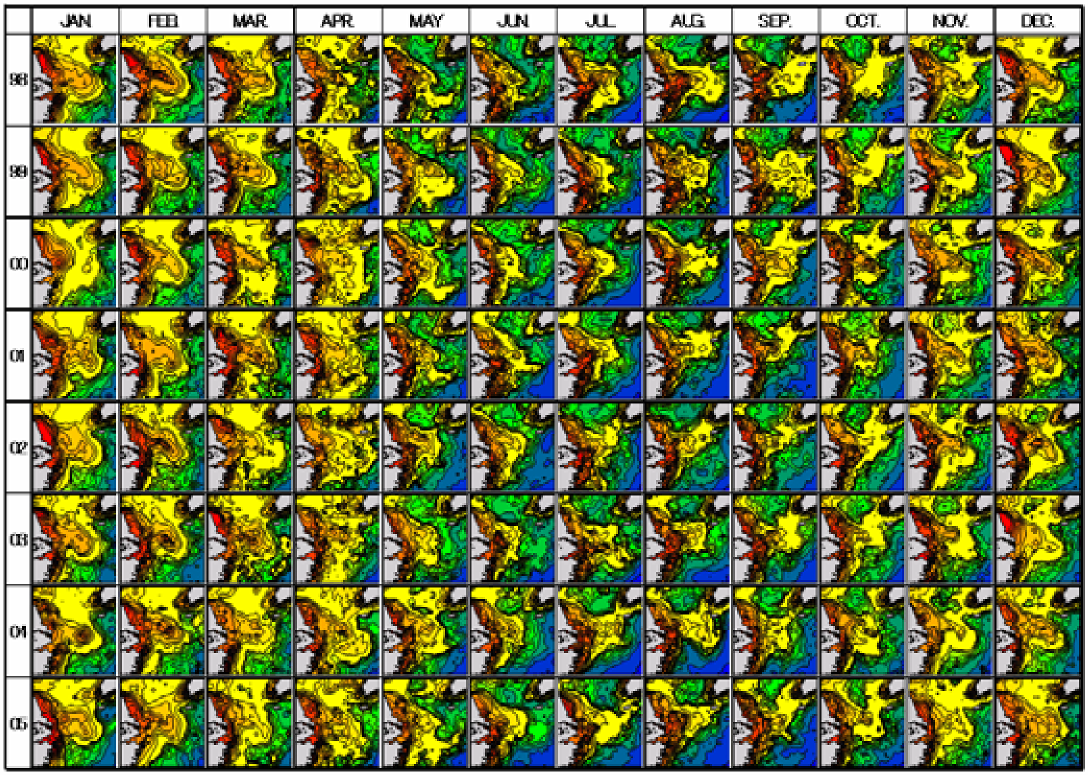

Fig. 3. Monthly average SeaWiFS Chl-a images in the East China Sea from 1998 to 2005.

It is well known that cold water mass appears off the southeast coast of Korea in summer. The prominent feature is that the appearance of cold water is quite localized. NFRDI has been monitoring the cold surface water using NOAA data in summer. Spatial distribution of SST and Chl-a in the southeast of Korea are described using SeaWiFS and AVHRR images on August 24, 2007. Spatial distribution of SST and Chl-a around East Korean Warm Current can be classified into four categories in the profile of SST and Chl-a images: (1) coastal cold water region, (2) cold water region of thermal front, (3) warm water region, (4) cold water of offshore region (Figs. 4-5). In the daily mean wind vector derived from QuikScat images, the winds occurs mostly southerly wind as shown in Fig. 4.

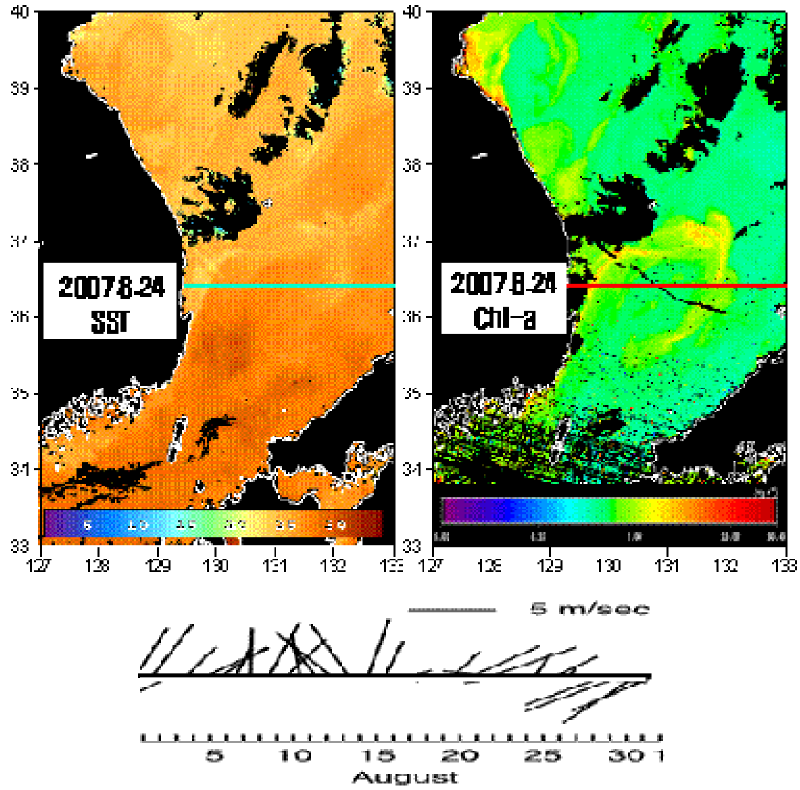

Fig. 4. The satellite image of the SST and Chl-a on August 24, 2007.

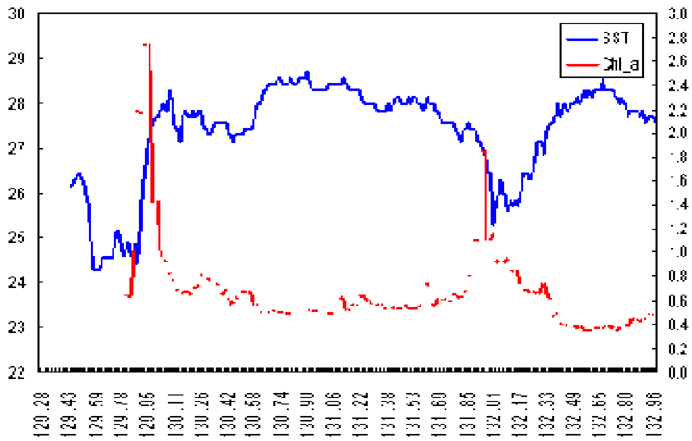

Fig. 5. Profile of SST and Chl-a along the 36.3°N on August 24, 2007.

4. Conclusion

In this report, we reviewed the present status of coastal environmental monitoring in Korean waters using remote sensing data. In future, we will share the information of coastal environmental monitoring for establishment of marine environmental assessment in the NOWPAP region using satellite remote sensing data. We will also contribute to development of NOWPAP coastal environmental assessment procedure.