Application of KOMPSAT/OSMI Data for Fisheries Oceanography in the East China Sea

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Abstract : A comparison was made between chlorophyll *a* from OSMI and SeaWiFS determined with the standard method during the NFRDI's research cruises. The simple algorithm for calibrating and validating of OSMI chlorophyll *a* as level 2 data in the East China Sea in specially winter season was made by relationship between the estimated chlorophyll *a* and the measured chlorophyll *a* in the field. We compared the distributions of OSMI chlorophyll *a*, sea surface temperature and zooplankton biomass, catch amounts of the Pacific mackerel in the East China Sea.

Key Words : OSMI, SeaWiFS, Calibration and Validation of Satellite data.

1. Introduction

The Ocean Scanning Multi-Spectral Imager (OSMI) is the first Korean ocean monitoring space-borne instrument on the Korean Multi-Purpose Satellite (KOMPSAT-1) satellite developed by the Korean Aerospace Research Institute (Cho et al., 1998). The visible bands of OSMI are very similar to the bands of SeaWiFS on Orbview-2 satellite. Quantification of concentration is usually achieved by the development of empirical or semi-empirical models correlating the radiance (or reflectance), as measured by remote sensor, with the 'ground truth' data (Yacobi et al., 1995).

Suh et al. (2001) studied the relationship between *in situ* chlorophyll measurements onboard the Korean NFRDI's ship and the estimated chlorophyll from the SeaWiFS satellite data using the ocean color chlorophyll 2 algorithm (OC2; O'Reilly et al., 1998) in the region of the northern East China Sea. Suh et al. (2002) determined the total suspended solid mass, and compared it with SeaWiFS (OSMI) spectral band ration (nLw 490nm/ nLw 555 nm). The development of the regional algorithms to quantify chlorophyll a and suspended solid in the

Korean waters was carried out by Suh et al. (2002).

The purpose of this study is to develop simple calibration and validation methods using OSMI level 2 data, and to apply the information of chlorophyll *a* derived from OSMI satellite to the Korean fisheries.

2. Chlorophyll Measuring in Field

We filtered appropriate amount of volume of seawater sample on GF/F filter. We filtered the sea water sample enough so that green color can be seen on the filter as possible as. Also we prepared a blank, which was a GF/F filter filtered with 0.45㎛ filtered sea water. We placed the filter on a histoprep, wrapped in aluminum foil, and stored in LN2 Dewar/Dryshipper. The samples stored in LN2 Dewar, placed the filter in a 1ml test tube, filled with 10ml 90% acetone, seal top with parafilm, wrapped the entire test tube with aluminum foil and stored in refrigerator for approximately 24 hours. Samples should be read between 24-36 hours for best results.

After extraction, brought samples out and let tubes equilibrate to room temperature. We turned on the Fluorometer and let it warm up for about 20-30 minutes. There should be a standard chlorophyll that should be measured on the Fluorometer at the beginning of every chlorophyll sample reading to test the integrity of the Fluoromter.

We took each sample and wiped the tube with Kimwipes and inserted in the sampled compartment. We read and recorded reading under Rb value. We placed ~3 drops of 10% HCl in the test tube, seal top with parafilm, inverted several times gently, and placed test tube with sample back into the sample compartment (Strickland and Parsons, 1968).

3. Simple Calibration and Validation Method for Chlorophyll a

We studied the relationship between the measured ocean color in the fields of the East China Sea and the estimated ocean color data of level 2 from the satellite. The relationship between the measured chlorophyll and the SeaWiFS (OSMI) chlorophyll can be expressed by the following equations (1) and (2) in the northern part of the East China Sea.

$$Chl = 0.1802\exp(0.5884(X_{SeaWiFS})),\ R^2 = 0.57 \quad (n=140) \quad (1)$$

$$Chl = 0.6069(X_{OSMI}) - 0.061,\ R^2 = 0.72 \quad (n=33) \quad (2)$$

where, $X_{SeaWiFS}$ is the estimated chlorophyll a from SeaWiFS satellite data. X_{OSMI} is the estimated chlorophyll *a* from OSMI satellite data using the OC 2 algorithm (Fig. 1).

To compare between the corrected chlorophyll *a* using (1) the simple calibration/validation(CAL/VAL) method of SeaWiFS and the estimated chlorophyll a data are shown in Fig. 2. The chlorophyll *a* values derived from the simple CAL/VAL method of OSMI are very similar to those of the simple CAL/VAL of SeaWiFS (Fig. 3).

4. Application of the Estimated Chlorophyll a derived from OSMI

The northern East China Sea is regarded as an important fisheries ground around the Korean waters. To understand the seasonal variation of chlorophyll *a* related to the density of phytoplankton in the northern East China Sea, we processed the OSMI data in 2003 and 2004. The distributions of chlorophyll densities derived from OSMI data in the East China Sea were 0.2-1.6 mg/m^3 in Oct., 0.3-1.6 mg/m^3 in Dec., 2003 and 0.2-2.4 mg/m^3 in Feb., 0.2-1.1mg/m^3 in Jun., 0.2-0.8mg/m^3 in Aug., 2004. We compared the distributions of OSMI chlorophyll *a* (mg/m^3), sea surface temperature(℃) and zooplankton biomass (mg/m^3), monthly total catch amounts (ton) of Pacific mackerel in the East China Sea in Feb., 2002 and 2004 (Fig. 4-1, 4-2).

5. Conclusions

The ocean color of the northern East China Sea is optically complicated due to the contributions not only from concentration of phytoplanktons, but also from suspended solids (Suh et al., 2002). We set up the simple and empirical algorithm for calibrating and validating of OSMI chlorophyll *a* as level 2 data in the East China Sea in specially winter season. In order to validate satellite ocean color retrievals and to develop simple CAL/VAL method for complex case 2 regions require continuous routine ship-based studies. In case of relationships between distributions of chlorophyll *a* derived from OSMI ocean color data, sea surface temperature (SST) derived from NOAA infrared data and amounts of zooplankton, Pacific mackerel in the winter seasons of 2002 and 2004, the plankton and the fish were depended on the distribution of SST.

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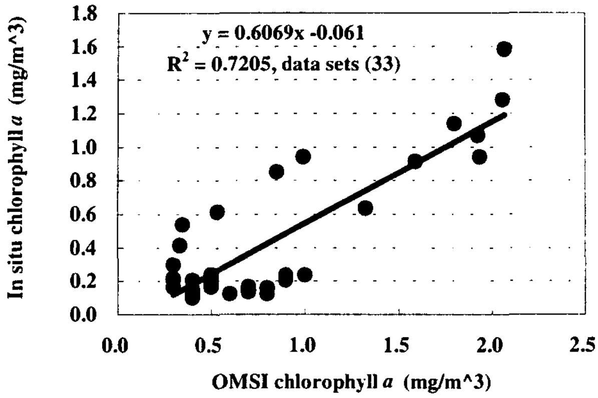

Fig. 1. Relationship between the field chlorophyll *a* (mg/m^3) and the estimated chlorophyll *a* derived from OSMI satellite in the southern part of the Korean waters in February 15, 2004.

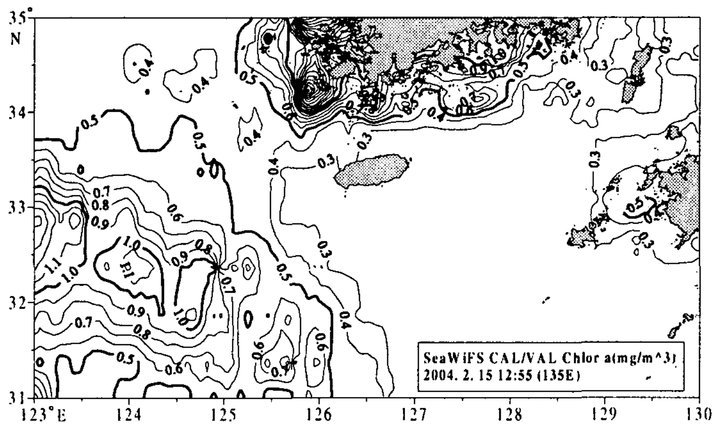

Fig. 2. Distribution of estimated chlorophyll *a* (mg/m^ 3) derived from SeaWiFS-CAL/VAL empirical equation on 15th February, 2004.

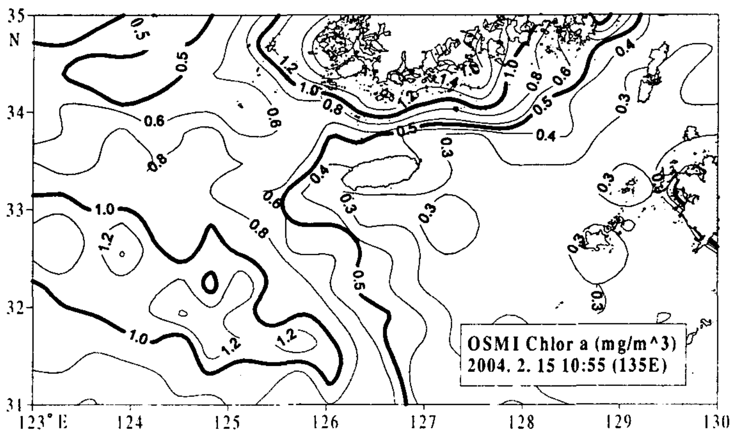

Fig. 3. Distribution of estimated chlorophyll *a* (mg/m^ 3) derived from OSMI on 15th February 2004.

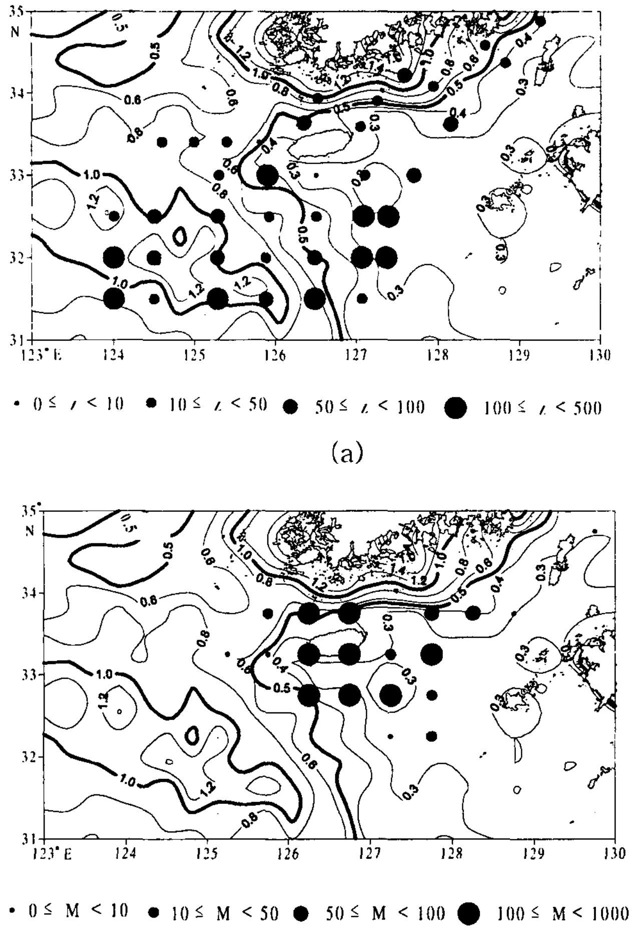

Fig. 4-1. Relationship between horizontal distribution of (a) zooplankton biomass (mg/m^ 3), (b) monthly total catch amounts (ton) of Pacific mackerel and the estimated chlorophyll *a* derived from OSMI data in February, 2004.

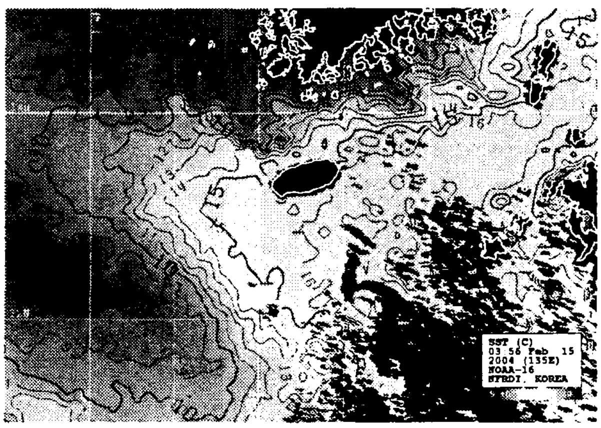

Fig. 4-2. Sea surface temperature (℃) derived from NOAA-16 satellite around the southern part of the Korean waters on 15th February, 2004.