International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 12 Issue: 2
Article Received: *25 November 2023* ***Revised:*** *12 December 2023* ***Accepted:*** *30 January 2024*

Low-Salt Water Flow Monitoring in Jeju Coastal Area Using Coms Satellite Data

[1]Jae-Won Kim, [2]Hong-Joo Yoon, [3]Ye-Been Do, [4]Se-Yun Oh, [5]Gyeong-Hyu Seok †
[1]Marine RS GIS Laboratory Pukyong National University Busan, Republic of Korea rktwlql@pukyong.ac.kr
[2]Marine RS GIS Laboratory Pukyong National University Busan, Republic of Korea yoonhj@pknu.ac.kr
[3]Marine RS GIS Laboratory Pukyong National University Busan, Republic of Korea microcoms1@pukyong.ac.kr
[4]Marine RS GIS Laboratory Pukyong National University Busan, Republic of Korea sierra6747@pukyong.ac.kr
[5]Donggang University Gwangju, Republic of Korea dol27@naver.com

Abstract— Recently, as low-salt fountains flowing from the Yangtze River region of China have caused damage to fishermen near the south coast, west coast, and Jeju Island, the importance of detecting and preparing for them in advance is increasing. Until now, monitoring of low-salt fractions has remained in the stage of monitoring by sending probes or predicting through ocean currents, and only recently, methods of monitoring low-salt fractions using chlorophyll concentration analysis through sea color and machine learning have been studied. However, these two methods have their own limitations, and this study aimed to develop a low-salt fountain monitoring method suitable for the Korean Peninsula by predicting the direction of movement of low-salt fractions using data different from previous satellite data.

Keywords- Low Salt Water, Monitoring, Satellite

I. INTRODUCTION (HEADING 1)

The Korean Peninsula is a sea on three sides, and is greatly affected by ocean currents flowing from other regions. In the past 20 years, low-salt fountain chunks originating from the lower Yangtze River in China have flowed into the southwest of the Korean Peninsula through ocean currents, causing damage to low-salt fountain. Low salt fraction refers to seawater having a salt concentration of 30 psu or less [1]. Among them, fresh water from China's Yangtze River meets coastal water to form a high-temperature low-salt fountain mass, flows into Jeju coast, south coast, and west coast through ocean currents, arrives on the Korean Peninsula about 30 to 45 days after departing from the lower Yangtze River, and moves or disappears after staying for about 7 days. During this stay, it will have a fatal impact on nearby ecosystems and fish and shellfish that are sensitive to salt changes, causing damage to fishing and aquaculture. Intensive heavy rain near the Yangtze River, the biggest cause of low-salt fountain inflow, is irregular in its degree and cannot be monitored at all times, so it is difficult to prepare, but recent studies have made it possible to detect in advance. If this can be detected more quickly and accurately, low-salt fountain damage can be reduced. This study aims to develop a means of monitoring low-salt fractions and increase accuracy through marine indicators obtained from satellites.

Damage from low-salt fountains is a major target of monitoring because great damage can occur in countries that encounter the ocean, and there are many related studies. As an example of an overseas study, there is a study on the correlation between sea color and marine salt in the Banda Sea in eastern Indonesia [2]. In this study, based on the fact that marine salts can be estimated through the investigation of seawater temperature and chlorophyll-a [3], an SSS dataset using color data different from the existing SSS (Sea Surface Salinity) dataset was established, and marine salts were estimated. This showed high accuracy, but the accuracy in a narrow area was excellent, but the accuracy tended to decrease as the target area widened. In addition, since it is a study targeting overseas regions, it is difficult to apply it to the case of the Korean Peninsula because it does not consider changes according to the characteristics of the Korean Peninsula[Figure 1].

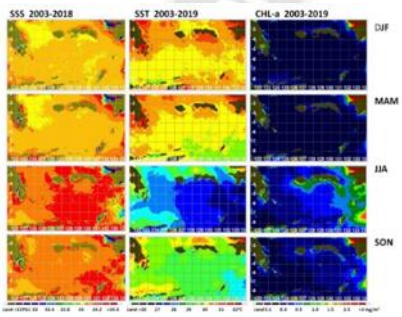

Figure 1 Image of changes in salt, seawater temperature, and chlorophyll-a in the Vanda Sea

As a domestic research example, "high-resolution surface salt estimation using various satellite data and machine learning" [4] estimated high-resolution SSS from geostationary color sensor images based on machine learning-based SMAP SSS detection. In this study, the LGBM machine learning model was adopted to present the possibility of calculating high-resolution SSS using optical satellite signals in the remote region as well as low-salt fractions in the coastal region, and proved that SST (Sea Surface Temperature) acts as an effective environmental variable in estimating

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 12 Issue: 2
Article Received: *25 November 2023* ***Revised:*** *12 December 2023* ***Accepted:*** *30 January 2024*

SSS[Figure 2].

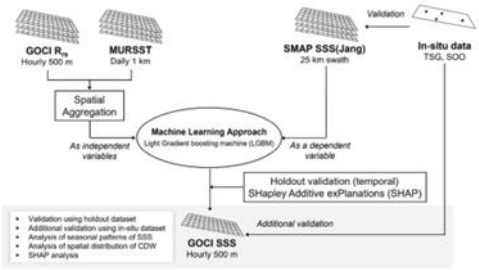

Figure 2 Estimation of SSS through satellite data and machine learning

However, instead of obtaining high accuracy near the Korean Peninsula, the overall accuracy including the source tended to decrease due to a lack of data on the source area, and the validity of the content was reduced due to the low frequency of data collection[Figure 3].

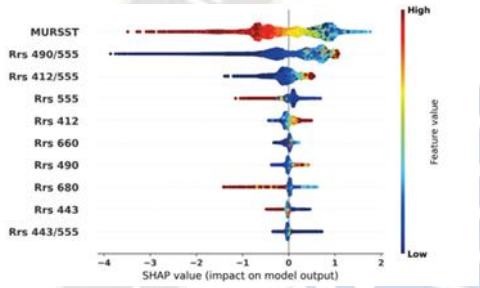

Figure 3 SST estimation by resolution

II. Main Body of Research

1. How to research

The flow of research is largely carried out in the stages of data collection and data processing, monitoring system development, system testing using verification data, and accuracy evaluation after system performance. It is determined that satellite data capable of collecting data from a wide range of regions are needed for data collection, and data are collected from other satellites such as the Chollian satellite's GOCI-II sensor data [Figure 4] and the overseas satellite Topex-Poseidon.

Figure 4 COMS-2B Satellite with GOCI-II Sensor

The sensor mounted on the Chollian satellite has a high spatial resolution and a wide observation band, which can be expected to improve the quality of the collected image. Since it is a domestic satellite, it is easy to obtain data and has a high frequency of shooting[Table 1]. The Topex-Poseidon satellite, an overseas satellite, was selected as a comparison target because it is a high-resolution satellite with excellent accessibility while filming the Korean Peninsula.

The sensor mounted on the Chollian satellite has a high spatial resolution and a wide observation band, which can be expected to improve the quality of the collected image. Since it is a domestic satellite, it is easy to obtain data and has a high frequency of shooting[Table 1]. The Topex-Poseidon satellite, an overseas satellite, was selected as a comparison target because it is a high-resolution satellite with excellent accessibility while filming the Korean Peninsula.

Table 1 GOCI-II Performance

Category	GOCI-II
Spectral Resolution	13 Bands
Spatial Resolution	250m
Number of Observation	10 times per day
Marine Factor Output	26
Observation Area	Regional and Global

2. Research area and period

In the past 20 years, it has been confirmed that the southern coast of the Korean Peninsula, the west coast, and the Jeju coast have been damaged by the Yangtze River's low-salt fountain in the past 20 years [5]. Among them, the coastal area of Jeju Island is the most frequently damaged area and the largest damage status is reported, so the coastal area of Jeju Island was selected as the main research area in this study[Figure 5].

Figure 5 Current Status of Low Salt Fountain Observation in Jeju Coast Area

The occurrence and inflow cycles of low-salt fountain damage are irregular, and as a result of the survey, there was no consistency such as 2003, 2004, 2010, 2016, 2017, and 2020. Based on the most recent data, low-salt fountain status data for 2022, additional low-salt fountain data for 2003 and 2010 will be collected and compared.

III. Future Plan

It is currently in the research planning stage of the research phase, and is working on collecting relevant research data, investigating available data collection means, and adjusting the scope and duration of the research. The

goal is to collect data based on data studied and collected by domestic/foreign journals and satellite data centers, and to establish a database for research by selecting data similar to or consistent with the characteristics of the Korean Peninsula.

After establishing a database, it is necessary to extract, refine, and process data necessary for research, and design and develop methods to monitor marine salts, which are research goals. The direction is to establish a system for refining and processing related marine indicator data such as salt data and seawater color data based on satellite images.

IV. SUGGESTIONS AND REMARKING

Monitoring of the ocean is also important on the Korean Peninsula, where three sides are the sea, but it is a very important task in all regions facing the sea. This study aims to monitor marine salts, but it is also possible to monitor other marine indicators, and in the end, it is expected to be effective in preserving the environment and preventing marine-related damage by developing a monitoring method to minimize human and time resource consumption.

References

[1] K. Park and Y. Park, "Characteristics of Temperature and Salinity observed at the Ieodo Ocean Research Station", *J.* Korean Society for Marine Enviromental Engineering Vol. 9, No. 4, pp. 225-234, Nov 2006

[2] Sam Wouthuyzen, "Ocean color as a proxy to perdict sea surface salinity in th Banda Sea", *IOP Conference Series: Earth and Environmental Science*, Volume 618, The 2nd Maritime Science and Advanced Technology; Marine Science and Technology in Framework of The Sustainable Development Goals 7-8 August 2019, Makassar, South Sulawesi, Indonesia

[3] Fischer, J. and U. Kronfeld, "Sun-simulated chlorophyll fluorescence: Influence of oceanic properties", Int. *J.* Remote Sensing, 1990, 11(12):2125–2147.

[4] T. Sung, S. Sim, E. Jang, J. Im, "Estimation of High Resolution Sea Surface Salinity Using Multi Satellite Data and Machine Learning", Korean *J.* Remote Sensing, Vol.38, No.5-2, 2022, pp. 747~763

[5] Beardsley, R., R. Limeburner, H. Yu, and G. Cannon, "Discharge of the Changjiang (Yangtze river) into the East China sea", Continental Shelf Research, 1985, 4(1-2): 57-76.