

1. Introduction

To investigate marine environmental information using remote sensing technology from artificial satellites, the radiant brightness of the upper atmosphere is generally employed. Since only 5 to 10% of this radiant brightness originates from the sea surface, estimating physical quantities at the sea surface via remote sensing is known to be highly susceptible to the influence of atmospheric aerosols. Coastal areas, in particular, present optically complex environments. They contain not only atmospheric aerosols but also suspended matter and colored dissolved organic matter entering the water via rivers from land. Consequently, physical quantities estimated from satellite sensors are prone to error, necessitating verification of their accuracy.

Therefore, CEARAC has developed Satellite Data Match UP Tool called “SMAT” to verify the accuracy of physical quantities estimated from satellite sensors by uploading field observation data to the Marine Environmental Watch Platform. The SMAT is publicly available at the following URL: <https://ocean.nowpap3.go.jp/smat/>. Previously, performing this comparative verification required downloading large volumes of satellite data and locating the data corresponding to the field observation data. The SMAT allows downloading only the minimum satellite data necessary for accuracy assessment of satellite derived values.

2. Usage Instructions

2.1. Preparing and Loading Field Observation Data

First, prepare the in-situ observation data for verification. This data should be prepared in comma-separated CSV file format. Time information must be entered in Coordinated Universal Time (UTC). Table 1 below shows an example data format for chlorophyll-a concentration. If comparing other physical quantities, change the column name from “chla”. Next, load the prepared in-situ observation data from the “List of in-situ data points” section and enter your name and email address in the “Contact Information” field.

Table 1. Example of data format. Chlorophyll a concentration (chla) is used here.

station	date	time	lat	lon	chla
6	5/24/2004	3:18	36.794	137.164	3.4
3	5/23/2004	3:38	36.795	137.252	6.9
1	5/22/2004	3:57	36.792	137.3331	12

2.2. Setting Selection Criteria

From the Selection Criteria, choose the Sensor (Instrument), Data Type, Physical Quantity (Products), and Validation Criteria.

The following explains the selection of each item.

- **Sensor (Instrument)**

The Instrument options are listed by sensor/satellite name (Table 2).

Table 2: Selectable Sensor/Satellite Names

Instruments name	Sensor / Satellite
sgli	SGLI / GCOM-C
MODIS-A	MODIS / Aqua
VIIRSN	VIIRS / Suomi NPP
VIIRS	VIIRS / JPSS
GOCI	GOCI / COMS
MERIS	MERIS / ENVISAT
czcs	CZCS / Nimbus 7
OCTS	OCTS / ADEOS
seawifs	SeaWiFS / Orbview 2

- **Data Type**

The following four data types are available for selection (Table 3). The available data types vary depending on the sensor.

Table 3 Selectable Data Types

Ocean Color	Ocean Color Data
Inherent Optical Properties (IOP)	Sea Water Optical Properties
Sea Surface Temperature (SST)	Sea Surface Temperature Data
Remote Sensing Reflectance	Remote Sensing Reflectance

- **Physical Quantities (Products)**

The SMAT searches for physical quantities within the Level 2 data provided by space agencies for each sensor and retrieves the stored physical quantity names. For details on each physical quantity, please contact the Level 2 data provider. The available physical quantity options vary depending on the selected data type.

- **Validation Criteria**

The validation criteria locate corresponding satellite data based on the time and location information of the field physical quantity data. Pixel Window Size represents the range of pixels centered on the field data location. Min Valid Pixels is the minimum number of valid data pixels within the search range. Max Time Difference is the upper limit for the time difference from the field data observation

time. SST Quality Level is a 5-level quality indicator ranging from 0 to 4: 0 () is highest quality, 1 is good, 2 is questionable, 3 is poor, and 4 is unusable. For ocean color data, seawater optical property data, and remote sensing reflectance data, search conditions can be set by referencing the quality information in l2_flags. If you check the box next to Level-2 flag name, the SMAT will not find the matching data. For details on l2_flags, please refer to [the User Guide for the Sea of Japan Ocean Environment Watch Product](#).

2.3. Downloading Corresponding Satellite Data

After completing the field observation data import in Section 2.1 and setting the search criteria in Section 2.2, finally click the Submit button at the bottom of the screen. After the message "Now Working, please wait a moment" appears, the processing will complete and change to "The matchup is completed." Subsequently, an email will be sent from matchup@ocean.nowpap3.go.jp to the email address entered in Section 2.1.

Download the corresponding satellite data from the link in the email body, which will have the subject line "The Matchup is completed".

The downloaded data will display the corresponding satellite data filename, product name, observation scene start and end times, number of valid data pixels, minimum value, maximum value, standard deviation, median, center pixel value, and the value of each pixel.