2.2 Water Quality Analysis

The raw imagery datum for water quality analysis was taken on August 13, 2000, as a rainy-season image, and on November 1, 2000, as a dry-season image. Using the original data of Landsat-7/ETM+, spatial distribution maps, the following parameters of water quality were drawn up.

1) Surface water temperature
2) Suspended Solids (SS)
3) Phytoplankton (Chlorophyll-a)

(1) Methodology

The data processing was based on the Lambert projection method with a spatial resolution of 50 m after applying geometrical correction using 'affine' transformation.

To obtain spatial distribution maps of the three parameters mentioned above, correlation analysis was conducted between *in situ* values obtained by the survey and the brightness in the satellite image.

Following are formulae that are used to calculate the parameters, with adequate correlation that were established by this analysis.

1) **Chlorophyll-a** **log (chl-a) = K x band 4 – L x band 1 + M**
2) **Suspended Solid (SS)** **SS = P x band 3 + Q**
3) **Surface Water Temperature** **T = R x band 6H + S**

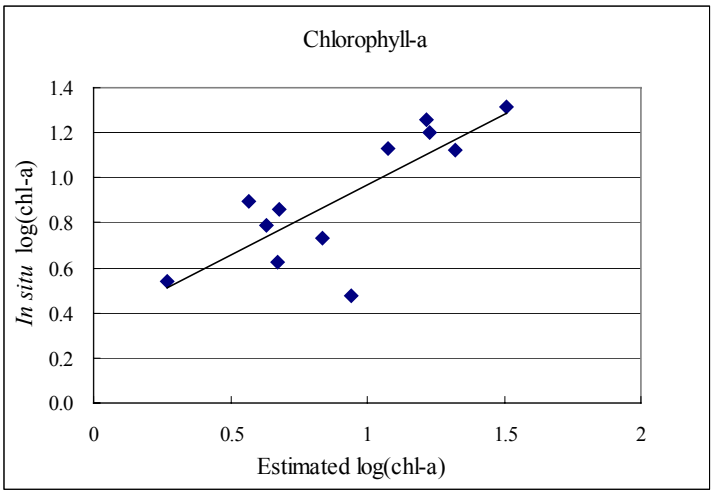
where

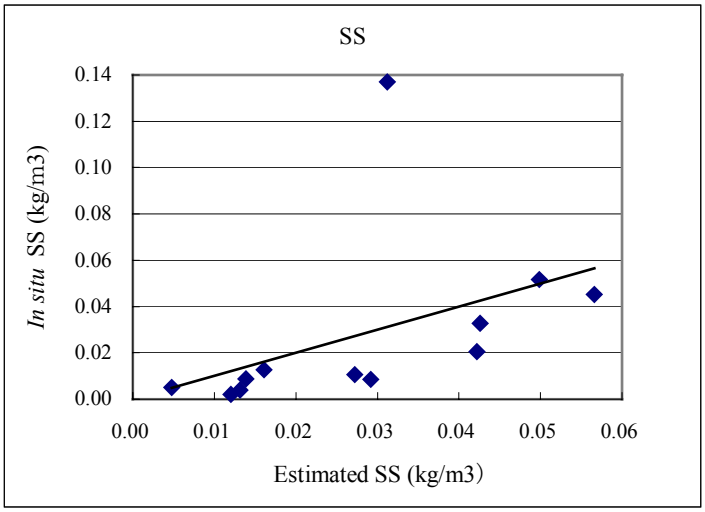
chl-a: Chlorophyll-a (mg/m^3), SS: SS (kg/m^3), T: Temperature (℃)
K, L, M, P, Q, R, S : Coefficients

(2) Correlation Analysis

The relationship between the estimated and *in-situ* values is shown in Figure 2.2.1. In this figure, chlorophyll-a and SS had a good correlation except for one or two points, but the relationship of surface temperature is not so good. Based on the correlation analysis, the coefficients were fixed as below.

K	:	0.003196
L	:	0.02435
M	:	3.549
P	:	0.0009753
Q	:	0.04863
R	:	0.1202
S	:	10.93





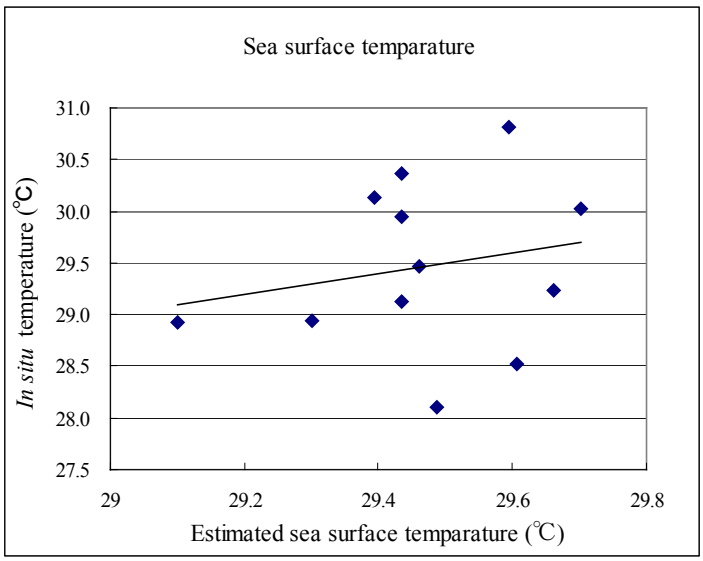


Figure 2.2.1. Correlation between Estimated values and *In situ* Values for Chlorophyll-a, Suspended Solids and Surface Water Temperature

(3) Special Distribution Maps

Spatial distribution maps for three parameters were drawn as Figures 2.2.2 - 2.2.7, and were compared with the results of the first and second field survey (Figures 2.2.8 - 2.2.10).

An effort was made to take the images of the analysis just during the each field survey. In practice, the images were taken the closest day before the each survey when the weather was suitable for the shooting.

Consequently, the values could not be directly compared in detail, but distribution pattern of the images for each parameter and the monitoring results could be compared, as discussed below.

(4) Surface water temperature

The images of surface water temperature are shown in Figure 2.2.2 (rainy season) and Figure 2.2.3 (dry season), and the monitoring results are shown in Figure 2.2.8.

In the rainy season, the image of surface water temperature did not coincide well with the results of the first monitoring. In the image, high temperature water extended at the mouth of the estuary, whereas in the first monitoring, the warm water spread into the middle of the estuary.

In the dry season, the image of surface water temperature was similar to the results from the second monitoring. Surface water temperature was distributed similarly in the estuary.

(5) Suspended Solid (SS)

The images of SS are shown in Figure 2.2.4 (rainy season) and Figure 2.2.5 (dry season) and the monitoring results are shown in Figure 2.2.9.

The SS image in the rainy season was different from the results of the first monitoring. A water mass with high SS existed around the upper bay in the satellite image, but in the first monitoring, high values were obtained in transient area between Dongguan and Shenzhen.

In the dry season, the SS image was fairly consistent with the results obtained during the neap tide of the second monitoring. High levels of SS were distributed from the coastal area of Zhongshan to the outer bay zone, in the western part of the estuary.

(6) Phytoplankton (Chlorophyll-a)

The images of chlorophyll-a are shown in Figure 2.2.6 (rainy season) and Figure 2.2.7 (dry season) and the monitoring results are shown in Figure 2.2.10.

The image of chlorophyll-a in the rainy season was not similar to the spring tide results of the first monitoring. In the image, high levels of chlorophyll-a extended

throughout the western part of the estuary, whereas Shenzhen bay had high levels in the first monitoring.

In the dry season, the chlorophyll-a image was similar to the results of the second monitoring. High levels of chlorophyll-a were found in the western part of the estuary, especially at the river mouths of Hengmen and Hongquimen.

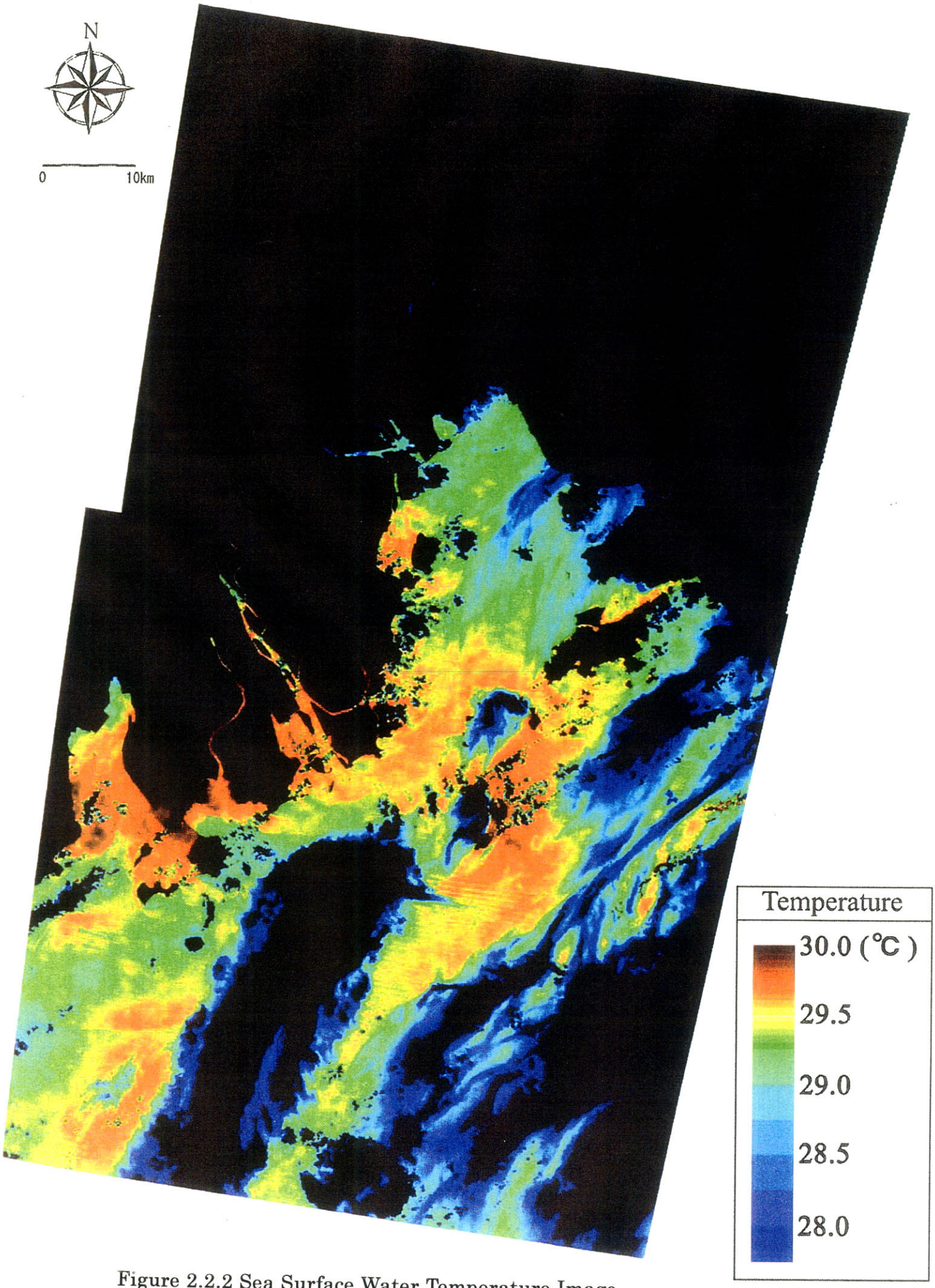


Figure 2.2.2 Sea Surface Water Temperature Image
(Date 2000/08/13)

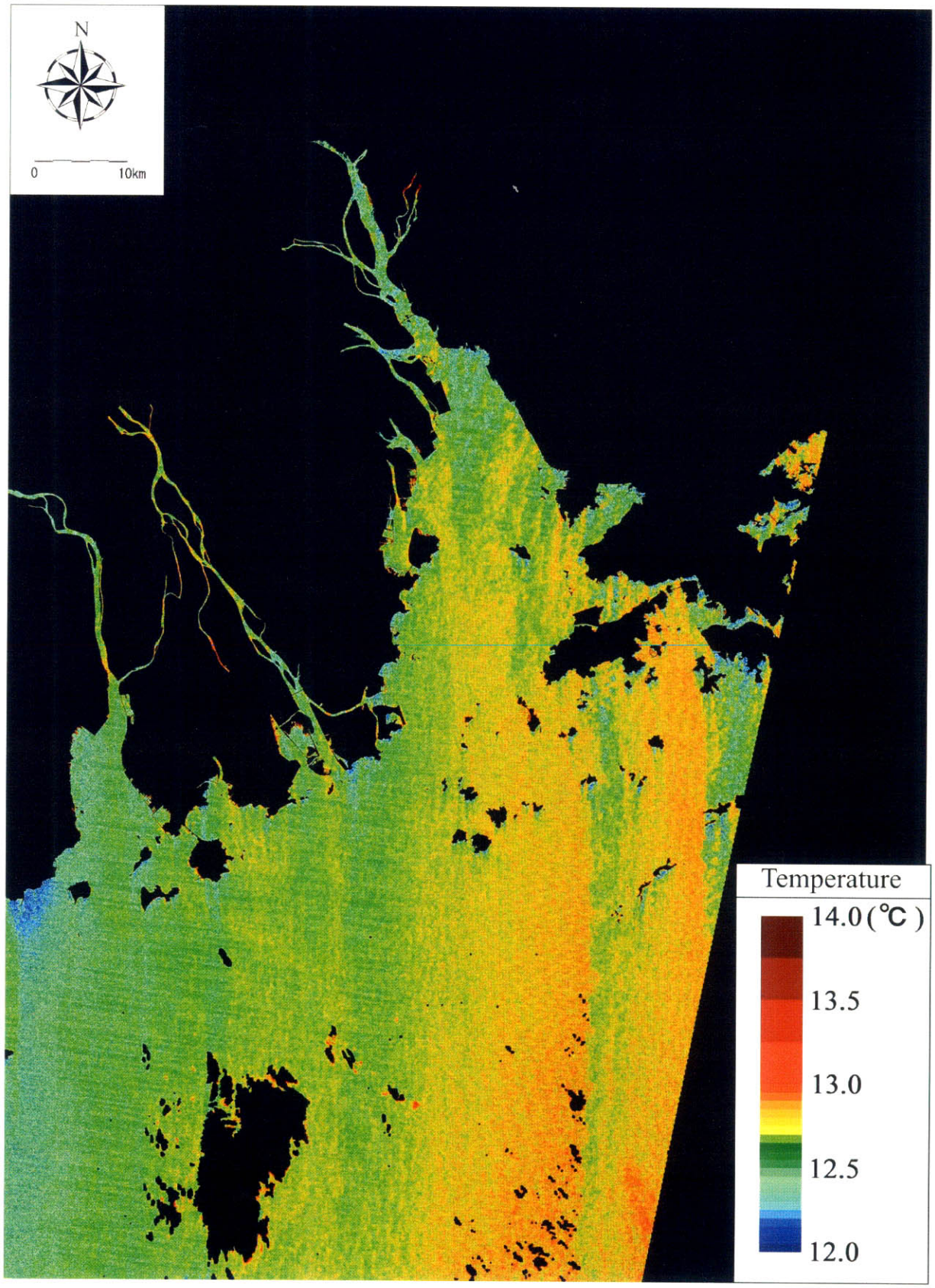


Figure 2.2.3 Sea Surface Water Temperature Image
(Date 2000/11/01)

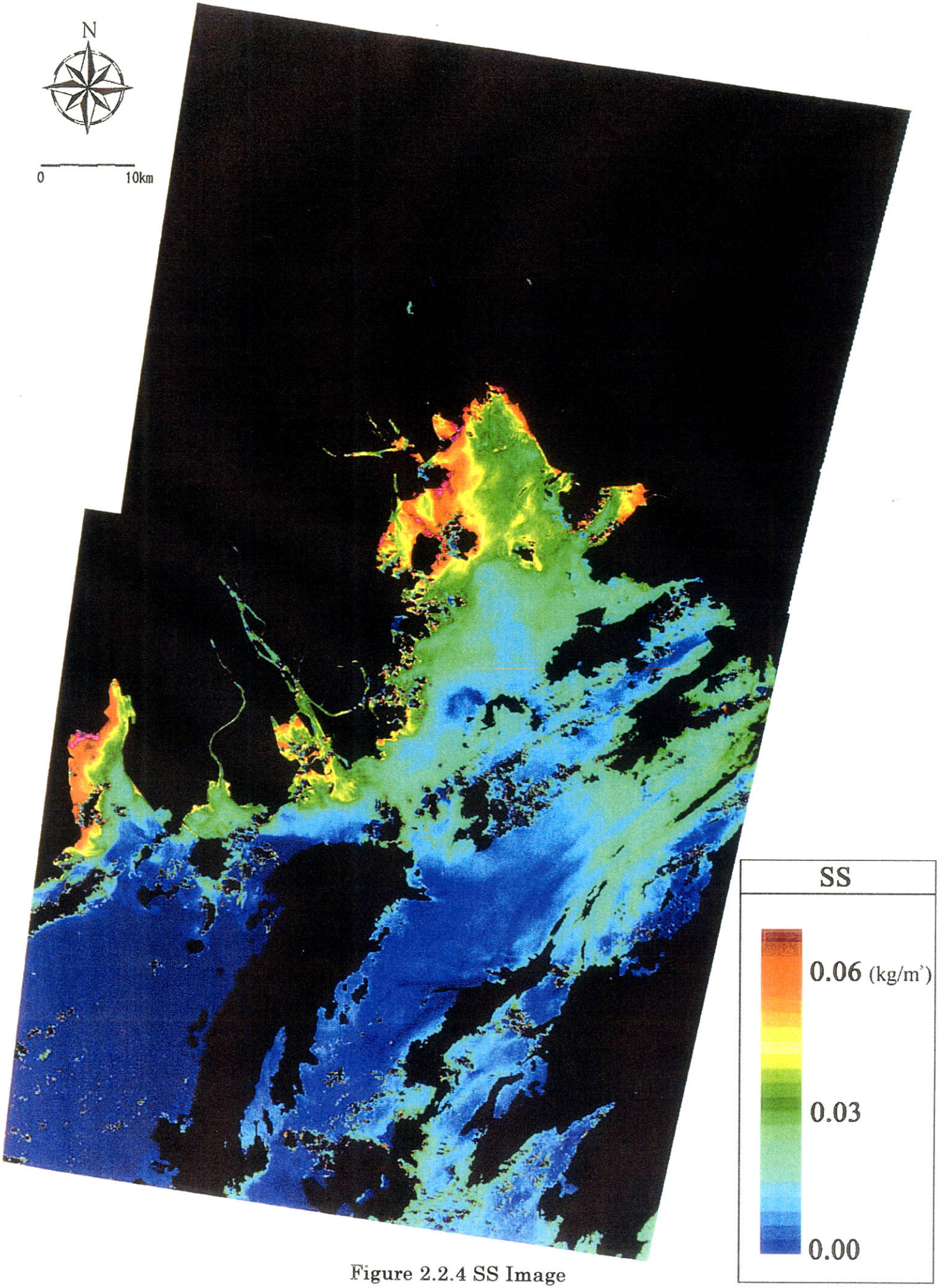


Figure 2.2.4 SS Image
(Date 2000/08/13)

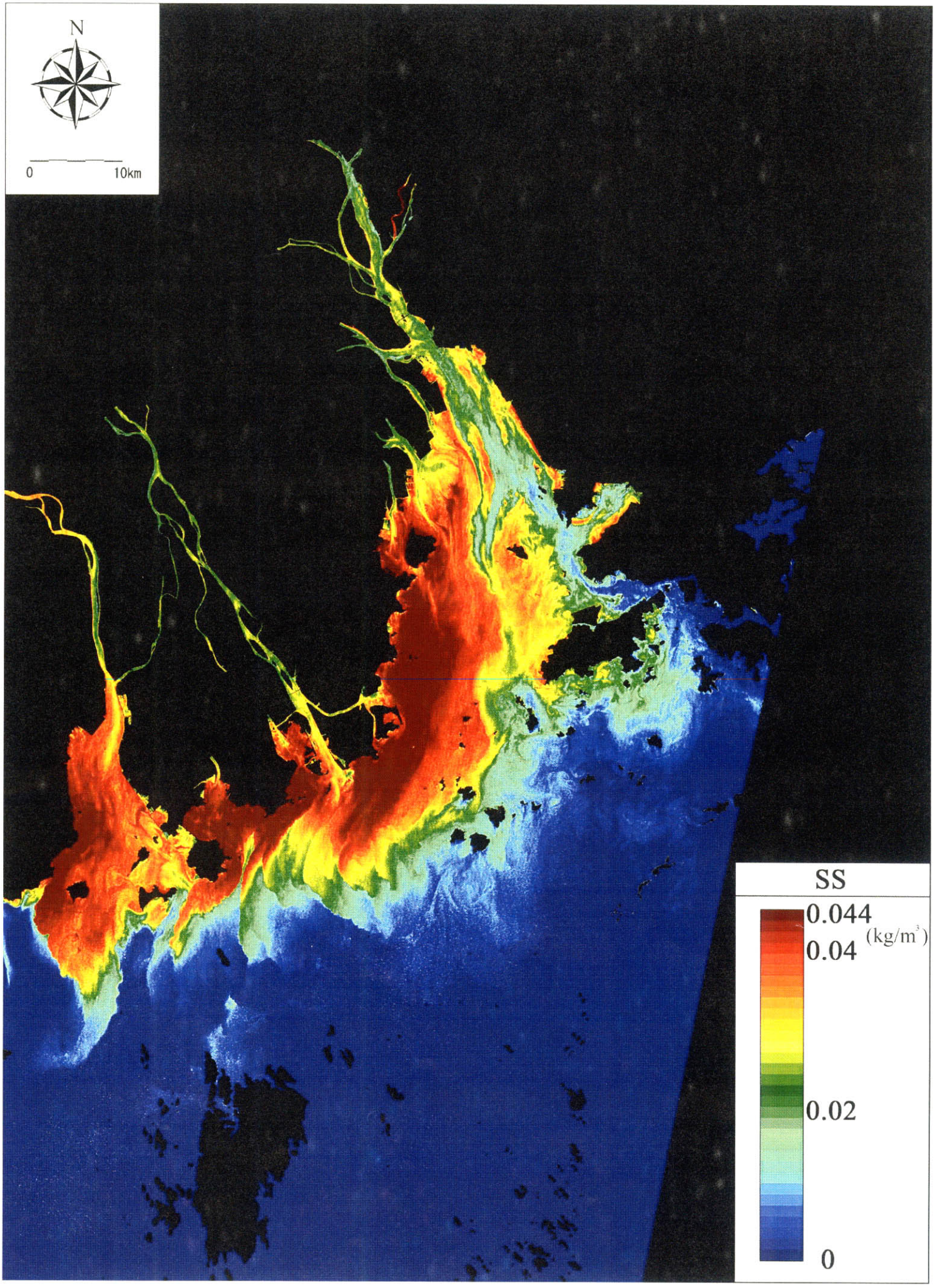


Figure 2.2.5 SS Image
(Date 2000/11/01)