

WATER QUALITY ANALYSIS ON THE INNERMOST PART OF THE ARIAKE SEA BY USING TERRA-ASTER SATELLITE IMAGES

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The Ariake Sea is a semi-closed bay surrounded by four prefectures of Kyushu Island in Japan. The sea water is exchanged with open sea almost through the Hayasaki Strait. An outermost part, a central part and an innermost part of the bay have different characteristics individually and suitable creatures exist in each area. Recently, it has been much reported that the environment of this bay has been suddenly changed. Monitoring the environment of the large bay for a long time requires much time and cost. Therefore, a satellite remote sensing can be considered as an effective solution to monitor a wide bay area. In this study, a technique to monitor water quality of the Ariake Sea by TERRA-ASTER sensor which is expected to be a strong tool as a successor of LANDSAT-TM/ETM+ sensor.

Large tidal flats of the Ariake Sea are influenced by a tidal fluctuation, and immersion and emersion are repeated regularly. Therefore, these areas are the most activated zone for creatures and also they are environmentally important. Moreover, the TERRA-ASTER image has a fine space resolution so that one image can not cover the whole area of the Ariake Sea. In this study, a studied field is focused on the innermost part of the Ariake Sea because of the importance of tidal flat environment and satellite image coverage. Used satellite images are those taken on 2002/3/13, 2002/9/21 and 2004/12/15. The reason to choose these data is that field observations were implemented on the same day and time. And there are also the LANDSAT-ETM+ images on 2002/3/13 and 2002/9/21 so that it is possible to compare the accuracy of estimation for the water quality indices from each satellite image. These images must be corrected geometrically and atmospherically. For the geometric correction, a vector data of coastline and administrative boundary is used as a reference. Visibilities on the above dates are used for the atmospheric correction. Used software is ERDAS IMAGINE and ATCOR for these corrections and analysis. Observed data are used for a linear regression analysis with 14 spectral bands DN (digital number) for the TERRA-ASTER image data. Obtained regression equations are utilized for making distribution map of the water quality indices in the innermost part of the Ariake Sea.

As the water quality indices, sea surface temperature, Secchi disk depth (water transparency), chlorophyll-*a* concentration and salinity are selected and regressed against observed data. For the TERRA-ASTER, 3 satellite images are used as mentioned above. For the LANDSAT-TM/ETM+, 8 images are used for the regression analysis. To compare the accuracy of the estimation equation from these images, the atmospheric correction for the LANDSAT images are newly conducted by the ATCOR which is the same condition with the TERRA-ASTER case because the LANDSAT images were atmospherically

corrected by LOWTRAN7 before.

Using observed data of water quality in the Ariake Sea, the estimation models for sea surface temperature, Secchi disk depth, chlorophyll-*a* and salinity are constructed. These models can retrieve water quality indices from the TERRA-ASTER images. From comparison between the results of TERRA-ASTER and those of LANDSAT-TM/ETM+, the former has much more potential to estimate water quality accurately in innermost part of the Ariake Sea. This study's result can be utilized to understand characteristics of the environment in the innermost part of this bay in future.

REFERENCES

- Gan, T.Y., Ohgushi, K. and Araki, H., 2000. Estimating water quality of the Ariake Sea in Japan using Landsat-TM data –Evaluation of SDD and SST -, *Lowland Technology International*, Vol.2, No.1, 47-64.
- Ohgushi, K., Gan, T.Y. and Araki, H., 2000. A study on estimation of water environment in Ariake Sea using remotely sensed data, *Proc. of 12th Congress of APD-IAHR*, Bangkok, Vol.2, 597-607.
- Ohgushi, K., Araki, H and Gan, T.Y., 2004. Water quality monitoring of the Ariake Sea by remote sensing and utilization of field observation, *Lowland Technology International*, Vol.6, No.2, 1-9.