

An Estimation of the Chlorophyll-a Concentration by Landsat-8/OLI and Sentinel-2A/MSI Imageries

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Abstract: The Uwa Sea of Uwajima City and Utsumi of Ainan Town of Ehime Prefecture in Japan are very famous places for the birthplace of a perfect circle pearl. By a pearl farming, it is very important to grasp marine information correctly of the chlorophyll-a concentration and the seawater temperature etc. In this paper, we estimated the chlorophyll-a concentration in the Uwa Sea of Japan by using the linear combination index (LCI) proposed by Frouin et al. (2006) derived from several satellite imageries. As the satellite imageries, we used the Landsat-8/OLI imagery of the spatial resolution 30 m and the Sentinel-2A/MSI imagery of the spatial resolution 10 m. For the Landsat-8/OLI imagery, we computed the LCI derived from band 1 (443 nm) having the strong absorption of the chlorophyll-a, and computed the LCI derived from band 2 (483 nm) having the strong absorption of the chlorophyll-b. On the other hand, for the Sentinel-2A/MSI imagery, we computed the LCI derived from band 2 (492 nm) having the strong absorption of chlorophyll-b. Next, we approximated by a quadratic polynomial the relationship between the LCI from satellite imageries and the in situ measurements of chlorophyll-a concentrations. By a total of 20 data for the Landsat-8/OLI imagery, the coefficient of determination for the band combinations 1, 3, 5 became 0.346 and that for band combinations 2, 3, 5 became 0.318. On the other hand, by a total of 23 data for the Sentinel-2A/MSI imagery, the coefficient of determination for the band combinations 2, 3, 8 became 0.461. Finally, we compared the estimated chlorophyll-a concentrations obtained from both satellite imageries. From the analysis results, firstly, we confirmed that the chlorophyll-a concentrations derived from the Landsat-8/OLI are the low sensitivity with wide range, although the chlorophyll-a concentrations derived from the Sentinel-2A/MSI are the high sensitivity with narrow range. Secondly, we confirmed that the chlorophyll-a concentration in the Uwajima Bay was higher than the outside of the bay in the Uwa Sea. Finally, we also confirmed that the chlorophyll-a concentrations in the Uwa Sea and the Bungo-suido Channel are stable in approximately 1 mg/m³, although the chlorophyll-a concentrations in the Suonada, the Iyonada, and the Hyuganada of March are higher than those of July.

Keywords: Chlorophyll-a, Linear Combination Index, Landsat-8/OLI, Sentinel-2A/MSI