

Spatial Characteristics of Various Water Quality Indices and the Influence of Multiple Environmental Factors in Yilan Bay

Jiun-Yu Yang*¹, Po-Chun Hsu¹

¹ Center for Space and Remote Sensing Research, National Central University, Taiwan

Yilan Bay, located at the northeastern tip of Taiwan (121.85-122°E, 24.6-25°N), derives its water from three primary sources, including inflow from the Lanyang River, offshore Kuroshio waters, and coastal waters. This research utilizes satellite snapshot data from the Moderate Resolution Imaging Spectroradiometer (MODIS) onboard the AQUA satellite, with a spatial resolution of 1 km, covering the period from 2019 to 2022. The Lanyang River flow and Yilan region's precipitation are divided into multiple seasonal conditions. The water quality indices utilized in this study include the Apparent Visible Wavelength (AVW), Colored dissolved organic matter (CDOM), and chlorophyll concentration (Chl), all of which are derived from the Remote Sensing Reflectance (Rrs). The AVW is a weighted average calculated from Rrs data between 400 and 700 nanometers. The AVW is presented as a single wavelength value, which characterizes the water body's light absorption status across different wavelengths. For instance, an AVW value exceeding 580 nanometers suggests that the water body has a higher absorption for red light, causing the peak of the Rrs spectrum to fall within the blue light position. This not only signifies the spectral condition but also indicates a possible turbid water quality of reddish-brown color due to the high absorption of red light. Additionally, variations in CDOM and chlorophyll concentration respectively represent the quantity of colored dissolved organic matter and phytoplankton in the water. We first analyze the spatial distribution characteristics of Chl, CDOM, and AVW under various conditions to understand the marine environmental features of different water states. Subsequently, we investigate the temporal variations between the water quality indices and environmental factors within the bay. Lastly, we analyze the relationships among the water quality indices to understand the water quality status in Yilan Bay across different seasons.

Keywords: Water quality, Colored dissolved organic matter, Chlorophyll concentration, Remote Sensing Reflectance