

MODIS Validation for Water Quality Parameters in Mayaguez Bay

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The Moderate Resolution Imaging Spectroradiometer (MODIS) is considered an improved generation of ocean color sensors. However, its validation for coastal monitoring is still underway. The main objective of this research was to validate the accuracy of MODIS to measure phytoplankton Chlorophyll-a (Chl-a) and suspended sediments (SS) in Mayagüez Bay, Puerto Rico. Field measurements of Chl-a and SS were compared with those estimated from MODIS data. A low correlation was found between field and MODIS Chl-a values obtained with both, Terra ($R^2=0.0283$) and Aqua ($R^2=0.0265$), satellites and using the standard NASA OC3 algorithm. Since the standard Chl-a product provided by NASA routines was not good for our study area, it was decided to derive and test a local empirical algorithm using MODIS Bands 3 (469 nm) and 4 (555 nm), which provide 500 meter of spatial resolution. The regressed linear equation for B3/B4 ratio and field Chl-a was $y = -0.6614x + 1.4937$ and the $R^2 = 0.3886$; while the logarithmic equation was $y = -0.4939\ln(x) + 0.7243$ and the $R^2 = 0.3688$. In order to estimate SS with MODIS, Band 1 (645 nm) with 250 meter of spatial resolution was used to validate the algorithm developed by Miller and McKee (2004) in the Gulf of Mexico. However, the suggested equation failed in Mayagüez Bay. A second approach intended to develop a site-specific algorithm for SS using this same band, but low correlation was also found on various testing scenarios. They were $R_2 = 0.1443$ (overall), $R_2 = 0.0695$ (dry season), $R_2 = 0.2788$ (rainy season), $R_2 = 0.0473$ (inshore stations), and $R_2 = 0.0468$ (offshore stations). Image processing and analyses clearly demonstrated that MODIS is not the most appropriate ocean color sensor for Mayagüez Bay. Another sensor with better temporal, spatial, and spectral resolutions is still needed for the estimation of Chl-a and SS in coastal waters.