

Mapping Intertidal Zone Extents and Seasonal Variations in Coastal Areas of Palawan Using Sentinel-2 Derived Bathymetry

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Intertidal zones are coastal wetland regions that support multiple ecosystem services and are significant carbon reservoirs. With the loss of intertidal extents worldwide over the past decades due to global sea level rise and anthropogenic factors, it is critical to map these areas to monitor any further losses and subsequent changes in tidal habitats. Being one of the most temporally and spatially variable marine habitats affected by diurnal tides, traditional survey methods can be quite difficult and expensive. On the contrary, remote sensing provides a more efficient and cost-effective way for mapping the intertidal zones at a high spatial resolution of 10 meters for sensors like Sentinel-2 MSI. These outputs can aid in coastal and biodiversity management practices including environmental planning, policymaking, and implementation. For this study, we have chosen the coast of Honda Bay in the eastern coast of Puerto Princesa City and Rasa Island in the biodiversity-rich island-province of Palawan, Philippines. While more popular methods to map the intertidal zone rely on measuring water occurrence frequencies using Normalized Difference Water Index (NDWI), this research aims to analyze the spatio-temporal variations using the satellite-derived bathymetry estimates to delineate the intertidal zone based on their vertical zone subdivision. The bathymetry is computed using a physics-based model inversion that retrieves water depth and bottom albedo from multi-spectral images. The model was applied over Sentinel-2 MSI L1C products covering the study areas from February to July of 2023 to show both wet and dry season. Initial accuracy assessments have shown good correspondence with actual depths derived from an Electronic Navigation Chart (ENC) of Puerto Princesa Bay. The outputs from two different methods of implementing the model are evaluated alongside the NDWI, estimated submergence times, and other tidal influences to determine any seasonal variations within the study area.

Keywords: Intertidal zones, remote sensing, bathymetry, Sentinel-2