Improving Satellite-Derived Intertidal Topography by Tidal Sampling Correction

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The intertidal zone, serving as a protective barrier between land and water, plays a crucial role in mitigating coastal erosion, regulating climate, and fostering diverse ecosystems. Consequently, effective and sustained monitoring of this area holds paramount importance. This research aims to establish a Digital Elevation Model (DEM) of the intertidal zone by integrating optical satellite imagery with the Technical University of Denmark Global Ocean Tide Model (DTU16). Each optical image underwent calculation of the normalized difference water index (NDWI), employing a predefined threshold to discern between land and water regions. These normalized images were aggregated and normalized based on the overall image count, enabling the determination of inundation frequency for individual pixels. By coupling the inundation frequency with tidal heights, the elevation relative to the mean sea level for each pixel could be ascertained. However, as the optical images were captured by sun-synchronous satellites at consistent local times, there existed a heightened likelihood of capturing images during high and low tides, particularly noticeable in the context of Taiwan. This nonuniform sampling approach could potentially introduce distortions in the reconstructed topography. To enhance the precision of the DEM, this study employed the Sampling Error Reduction (SER) technique, resulting in preliminary outcomes displaying a Root Mean Square Error (RMSE) of 0.5 meters compared to the topography reconstructed by a single beam echo sounder.

Keywords: intertidal zone, DEM, global ocean tide model, optical satellite, NDWI