



Integrating Multi-Resolution Remote Sensing Satellites and DTU10 Tide model to Reconstruct Tidal Flat DEM

Kuo-Hsin Tseng (1,2), Yuanyuan Jia (3), Yen-Ti Chen (4), Joseph Mascaro (5), and Che-Kwan Shum (3)

(1) Center for Space and Remote Sensing Research, National Central University, Taiwan (khtseng@csrr.ncu.edu.tw), (2) Institute of Hydrological and Oceanic Sciences, National Central University, Taiwan, (3) Division of Geodetic Science, School of Earth Sciences, The Ohio State University, OH, USA (jia.102@osu.edu; ckshum@osu.edu), (4) Department of Land Administration, Ministry of the Interior, Taiwan (moi1692@moi.gov.tw), (5) Planet Labs Inc., San Francisco, CA, USA (joe.mascaro@planet.com)

The digital elevation model (DEM) for intertidal zone can be reconstructed by integrating optical remote sensing imageries and reference tide heights as reported in the literature. The idea is to first use either waterline method or inundation frequency method for relative waterline locations in different tidal levels. After that, the waterline distribution can be converted into actual elevation by giving height references from tide gauges or numerical models. However, the spatial resolution of image sources limits the details of such reconstructed DEMs. Also, the sun-synchronous orbit of Earth resource satellites operating visible bands mostly revisit in the morning of local time, when the tidal heights tend to be higher than mean low water (MLW). Therefore, the elevation towards mean lower low water is difficult to be revealed. In this study, we aim to depict more details in the coastal DEM by incorporating Sentinel-1 SAR mission and PlanetScope constellation images to mitigate deficiencies of low-tide issue and resolution restriction in the existing methods, respectively. The mean solar local time of Sentinel-1's orbit is 18:00h, which has higher chance to meet low-tide requirement. Besides, present PlanetScope images providing 4 m resolution in visible-infrared channels meet the needs of detailing waterline locations. Our experimental site is Waisanding Zhou intertidal flat lie nearshore off Chiayi County, Taiwan. We use intensity thresholding method on SAR images and apply the normalized difference water index (NDWI) on optical imageries for water identification. The inundation frequency method is employed as combined with DTU 10 tide model to reconstruct a coastal DEM. The result is validated with bathymetry measured by an in situ multibeam echosounder and the accuracy of relative elevation, in terms of the root-mean-square of the difference (RMSD), is about 30–50 cm. This approach effectively provides up-to-date coastal DEM and can be used to study erosion/deposition of sediment in the coastal areas.