A geographically adaptive model for satellite derived bathymetry

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Airborne lidar bathymetry (ALB) and multi-beam echo-sounders (MBES) are two commonly used methods employed by the hydrographic community for bathymetric data collection. Although these technologies can collect high resolution and accurate depth data, they present some limitations related to whether, cost, time, and survey difficulties in near-shore environments. Satellite Derived Bathymetry (SDB) is a relatively new promising technique that utilizes optical satellite remote sensing sensors for estimating bathymetry in shallow water areas. The practice in previous works is with considering a linear relationship between calibrations points and the SDB model, assuming null water column and constant bottom type returns, while a single global bathymetric model is calibrated for the entire scene. To address areas where these assumptions fail and non-uniform water column or bottom conditions can affect the performance of conventional global models, this work presents a vertically and horizontally adaptive model to improve bottom depth estimation. With a case study in Dry-Tortugas, Florida and utilizing Sentinel-2A image, lidar, and chart data in depths up to 30m, we demonstrate the ability of a locally calibrated, piecewise linear function, in providing improved bathymetric estimates compared to conventional techniques. The improved accuracy of the bathymetric estimates with the presented geographically adapted model can enhance the use of satellite derived bathymetry for nautical chart purposes.

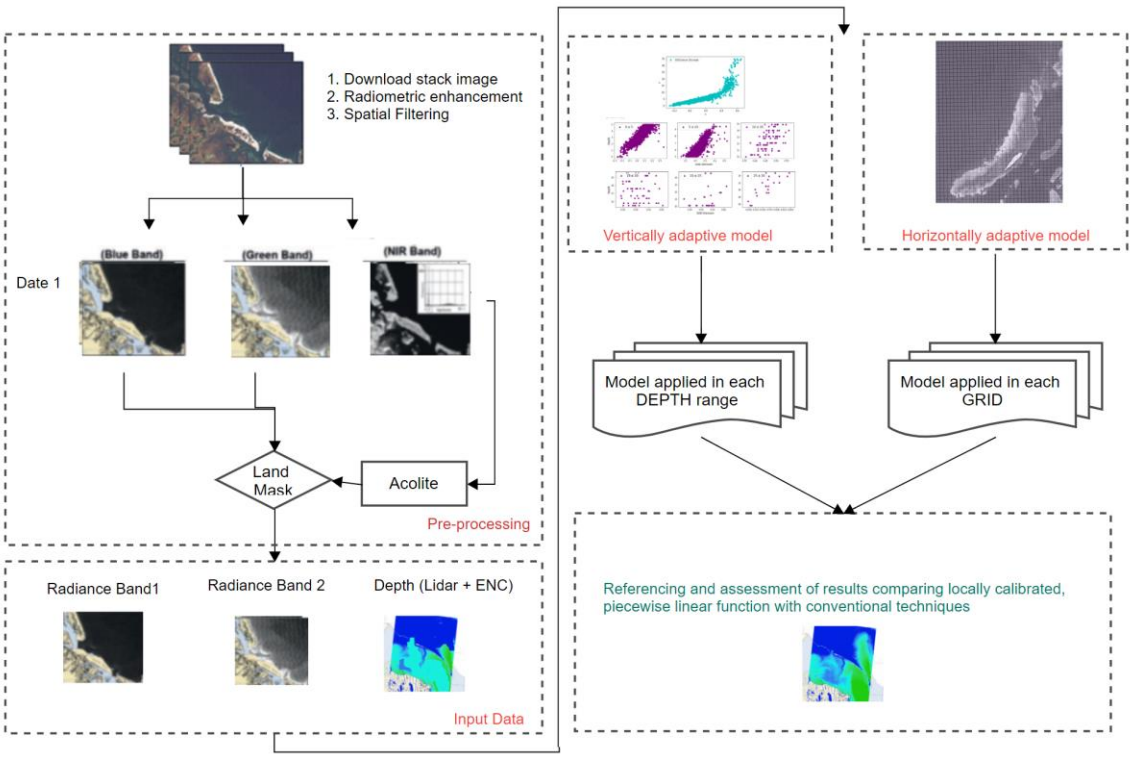

Figure: Workflow for deriving bathymetry using geographically adaptive model.