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## Bathymetry inversion with optimal Sentinel-2 imagery using random forest modeling

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Bathymetry inversion using remote sensing techniques is a topic of increasing interest in coastal management and monitoring. Freely accessible Sentinel-2 imagery offers high-resolution multispectral data that enables bathymetry inversion in optically shallow waters. This study presents a framework leading to a generalized Satellite-Derived Bathymetry (SDB) model applicable to vast and diversified coastal regions utilizing multi-date images. A multivariate regression random forest model was used to derive bathymetry from optimal Sentinel-2 images over an extensive 210 km coastal stretch along southwestern Florida (United States). Model calibration and validation were done using airborne lidar bathymetry (ALB) data. As ALB surveys are costly, the proposed model was trained with a limited and practically feasible ALB data sample to expand the model's practicality. Using multi-image bands as individual features in the random forest model yielded high accuracy with root-mean-square error values of 0.42 m and lower for depths up to 13 m.