Quantifying depths in a shallow, hypersaline estuary with airborne Lidar, sonar and satellite bathymetry: Laguna Madre, Texas

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Abstract

In 2017, Bureau of Economic Geology researchers at the University of Texas at Austin, acquired topographic and bathymetric airborne Lidar data over Lower Laguna Madre, which is a shallow hypersaline estuary at the southern Texas. The nature of this data acquisition campaign is unique due to size (1600 km^2) and the dynamic environmental conditions that influence the depth and water quality. Researchers acquired 60 hours of airborne Lidar data and completed *in-situ* measurements from a boat to quantify water quality and depths. Data analysis included processing Sentinel-2 L1C satellite imagery to predict water quality and to determine areas with high turbidity. To confirm the topographic heights and water depths, Lidar measurements were compared to GPS elevations, sonar, and satellite bathymetry using the least-squares algorithm. Because airborne Lidar technology is superior in detail compared to satellite imaging, comparison results produced skewed distribution for satellite bathymetry with an average depth disparity of 6-25 cm (RMSE of 22-35 cm) where water depths were shallower than 1.5 m. The study concluded that satellite bathymetry can be a cost-effective method to complement airborne Lidar mapping efforts; however, varying environmental conditions, bottom properties and tidal influences have a direct impact on depth accuracy and wholeness of data sets.