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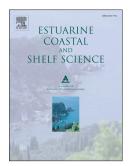
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Improving Salt Marsh Digital Elevation Model Accuracy with Full-Waveform Lidar and Nonparametric Predictive Modeling

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ABSTRACT

18 Salt marsh vegetation tends to increase vertical uncertainty in light detection and ranging 19 (lidar) derived elevation data, often causing the data to become ineffective for analysis of topographic features governing tidal inundation or vegetation zonation. Previous attempts at 20 improving lidar data collected in salt marsh environments range from simply computing and 21 subtracting the global elevation bias to more complex methods such as computing vegetation-22 23 specific, constant correction factors. The vegetation specific corrections can be used along with 24 an existing habitat map to apply separate corrections to different areas within a study site. It is 25 hypothesized here that correcting salt marsh lidar data by applying location-specific, point-bypoint corrections, which are computed from lidar waveform-derived features, tidal-datum based 26 27 elevation, distance from shoreline and other lidar digital elevation model based variables, using nonparametric regression will produce better results. The methods were developed and tested 28 29 using full-waveform lidar and ground truth for three marshes in Cape Cod, Massachusetts, U.S.A. Five different model algorithms for nonparametric regression were evaluated, with 30 TreeNet's stochastic gradient boosting algorithm consistently producing better regression and 31 classification results. Additionally, models were constructed to predict the vegetative zone (high 32 marsh and low marsh). The predictive modeling methods used in this study estimated ground 33 elevation with a mean bias of 0.00 m and a standard deviation of 0.07 m (0.07 m root mean 34 square error). These methods appear very promising for correction of salt marsh lidar data and, 35 36 importantly, do not require an existing habitat map, biomass measurements, or image based 37 remote sensing data such as multi/hyperspectral imagery.

Index words: *Spartina alterniflora*, Random Forests, TreeNet Stochastic Gradient Boosting,
regression trees, CART, DEM correction

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