Coastal wetlands around the United States, which primarily consist of salt marshes, are estimated to save USD 23.2 billion on an annual basis in the form of storm damage prevention (Costanza et al. 2008; Mitsch et al. 2009). Accurate digital elevation models (DEMs) in salt marshes are crucial for modeling storm surges and determining the initial DEM elevations for monitoring marsh evolution. Due to high biomass density, lidar DEMs in coastal wetlands are seldom reliable (Hladik and Alber 2012; Medeiros et al. 2015; Morris et al. 2005). In an aim to reduce DEM error, several multilinear regression, random forest and neural network models were developed and tested to estimate biomass density in the salt marshes near Saint Marks Lighthouse in Crawfordville, Florida. Between summer of 2017 and spring of 2018, two field trips were conducted to acquire true elevation and biomass density measures. Combined with vegetation monitoring imagery acquired from Sentinel-2 and Landsat Thematic Mapper (LTM) satellites, 64 field biomass density samples were used as target variables for developing the models. Biomass density classes were assigned to each biomass sample using a quartile approach. Moreover, 346 in situ elevation measures were used to calculate the lidar DEM errors. The best model was then used to estimate biomass densities at all 346 locations. Finally, an adjusted DEM was produced by deducting the median DEM error of the corresponding biomass density class for each location. A random forest regression model achieved the highest R-squared value of 0.92. The adjusted DEM based on the estimated biomass densities reduced the root mean squared error of the original DEM from 0.38 m to 0.18 m while decreasing the raw mean error from 0.33 m to 0.14 m, improving both measures by 54% and 58%, respectively.

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Approved for distribution by Stephen Medeiros, Committee Chair, on May 17, 2019.

The public is welcome to attend.