Using Airborne Lidar Data Sets with UAV–Derived Topographic Data to Monitor Texas Beach-Dune Changes and Track Recovery after Major Storm Events

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Abstract

The hurricane and tropical storm frequency increase can be seen in the record-breaking 31 named storms during the 2020 Atlantic hurricane season. Historically, Texas has been susceptible to hurricanes and tropical storms. However, Hurricane Harvey in 2017 was the highest-category storm event to cross Texas since 2000. Our regional change analysis used 2016 and 2018 lidar-derived elevation models with 1 m spatial resolution to determine above-sea level changes due to Hurricane Harvey. The upper Texas coast experienced shoreline erosion, with local depositional events occurring on the southeastern sides of jetties and groins. Incidents of dune washout and overwash fans were present along the barrier islands of the upper Texas coast, as well as erosion to foredune complexes and a decrease in dune heights. As of March 2018, recovery is visible through berm buildup and backbeach aggradation. Our multiyear analysis (above sea level) of four sites within Galveston and Follett's islands determined the immediate impact of Harvey (2016–2017) and followed recovery until March 2019. The multiyear analysis determined that all four sites experienced varying levels of recovery by 2018. UAV surveys conducted in May 2022 showed potential in acquiring topographic data for comparison with 2019 beach-dune conditions. Galveston–Follett's Island UAV surveys conducted in December 2022 were used to examine the evolution of beach-dune systems as of May 2022.