Using Lidar to Identify Impacted Areas Superstorm Sandy Induced on Coastal Jersey

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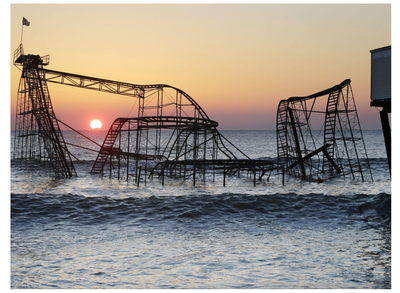


INTRODUCTION

Hurricane Sandy is the largest diameter tropical cyclone to have formed in the Atlantic Ocean. Hurricane Sandy made its landfall on New Jersey on October 29, 2012. Sweeping through at sustained winds of 80 mph, the hurricane left areas near the coastal shore in shambles. The heavy rain and flooding from Hurricane Sandy damaged over 300,000 homes and destroyed one of the state's famous landmark, Seaside Heights. Due to mass destruction, extensive time was required to repair and restore New Jersey. Through the analysis of Light Detection and Ranging (lidar) data collected between 2012 and 2017, the progression of land cover differences and elevation changes can be identified.

MATERIALS & METHODS

Data from 5 lidar surveys was obtained from NOAA Digital Coast Digital Elevation Models (DEMs), downloaded in geotiff format. The 2012 and 2013 DEMs were collected by the United States Geological Survey team while the images from 2014 and 2017 were taken by the United States Army Corps of Engineers. To track the gains and losses of the storm's aftermath, difference maps were generated and analyzed over a five year period between 2012 and 2017. From these difference maps, elevation maps were then produced to provide quantitative data on the terrain's height changes. Areas with significant changes, such as houses, sand dunes, and the Casino Pier by the shore are highlighted with profiles.

RESULTS

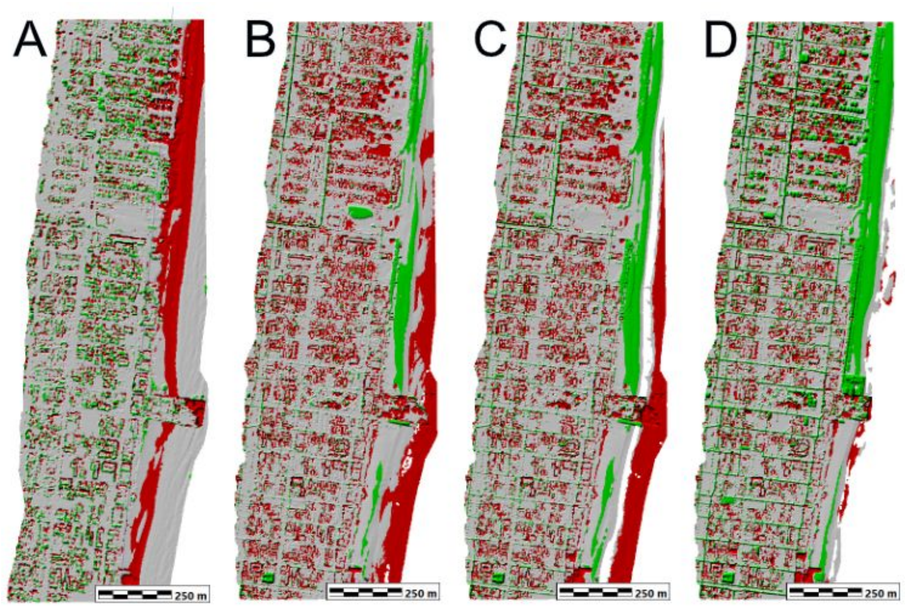
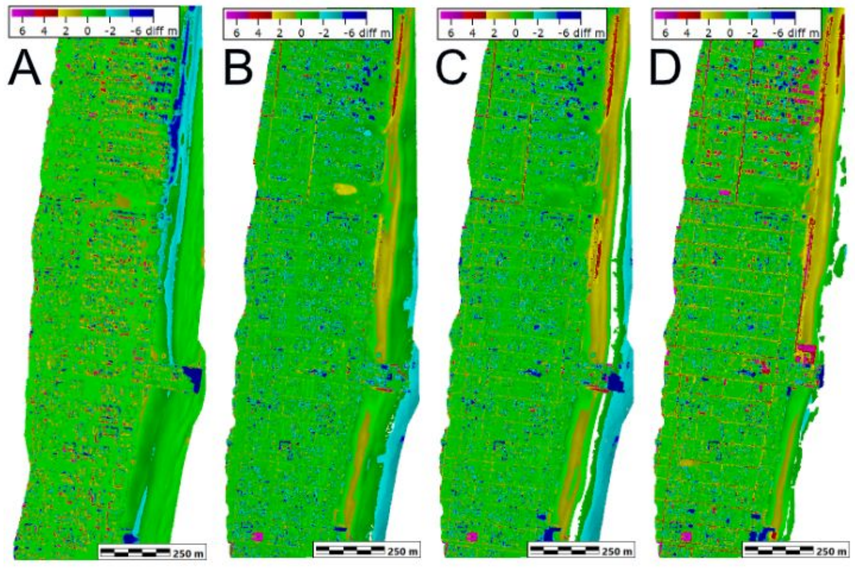


Figure 1a-1d displays difference maps of four time periods, 2012, 2013, 2014, and 2017 in Seaside Heights, NJ. The maps consist of three colors, red, green and grey. Red denotes a negative change, green shows a positive change, and grey indicates no changes. The biggest impact occurred along the coast. The entire strip of red as displayed in figure 1a. were sand dunes that eroded during the storm in 2012. The pier also suffered a great deal of lost with its rides being destroyed by the ocean. The iconic roller coaster, Jet Star was swept away. This is displayed by the red triangle on the pier. As renovation took place in the next 5 years, the strip of sand and pier that was once red is now green as demonstrated in figures 1b-1d. These difference maps are proof of how much work and time it took to restore a small section of Coastal Jersey after Hurricane Sandy.



Figures 2a-2d are elevation maps of Seaside Heights, NJ in 2012, 2013, 2014, and 2017. The scale at the top of these maps represent how much elevation was either gained or lost at the time Hurricane Sandy struck and during reconstruction. Darker colors represent elevation gains while brighter colors represent elevation loss. Elevation differences ranged from a minimum of -6m to a maximum of 7m. As shown by the blue strip in figure 2a, 2012 had the biggest dune erosion with up to 6m of sand loss. In addition, as displayed in the dark blue triangle, a portion of the casino pier portion sunk in the ocean to include the Jet Star roller coaster. With reconstruction overtime, the sand dunes and amusement park were brought back which are represented by the yellow and pink spots in figures 2b-2d. The new roller coaster, Hydrus, replaced Jet Star. Elevation gain in these particular areas was approximately 3m in 2013, 4m in 2014, and 7m in 2017. These elevation maps correspond closely to the difference maps by showing how the dunes and Casino pier took the heaviest toll during Hurricane Sandy.

CONCLUSION

Geographic information system (GIS) allowed for a wider range and ease of analysis of the effects Hurricane Sandy had on Seaside Heights, NJ. Comparing the land features and elevation differences from the time Hurricane Sandy made its landing to five years after provided a clearer understanding of how lethal the storm was. It would be interesting to further this analysis by looking at either another parameter or another region and noting the similarities and differences between the two places.

ACKNOWLEDGEMENTS

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