



Shoreline Position Assessment: A Comparison of Different Remote Sensing Data Sets, at Crash Boat Beach, Aguadilla



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Motivation for the Study

- Coastal erosion can occur as a response to man-made processes like extraction of sand, deforestation or construction near to the coast. It can also happen by natural processes such as tidal and strong wave action, large storms, and flooding.
- Puerto Rico continues to face challenges after Hurricane Maria and Irma in 2017. The most significant losses in coastal areas were from beaches in the north central, southeast and west-northwest where Aguadilla is located.
- Considering that sometimes the beaches are geomorphologically difficult to study, it is imperative to implement new techniques to map them.
- The use of UAVs, Light Detection and Ranging devices, and GPS provide alternate and innovative options to monitor the information retrieved from coastal zones by giving high-resolution images at a relative low cost that will let the user examine the changes on the shoreline in a short time.
- As a geology student, I recognize the importance of the study of coastal erosion to: protect our ecosystems and safeguard the quality of life of citizenship and their homes. Also, living on an island is the equal meaning of needing to stay informed about the coasts and their changes, because being informed is the only key to be capable to save people's lives in case of an atmospheric phenomenon. Beyond the powerful experience lived two years ago, after the arrival of Hurricane's Maria, I wanted to know how the nature in its own power has improved.

Objective

- To compare the shoreline position at Crash Boat Beach, Aguadilla, Puerto Rico acquired with GPS method.

Methods

- Installed the Trimble R8s GPS to the tripod and collect in situ data at the beach.
- Used Digital Shoreline Analysis System (DSAS) to compute the rate of change with the end point rate data (EPR).
- Compared the rate of change of the coastal shoreline between 2017 and 2019 at Crash Boat, Aguadilla with GIS.

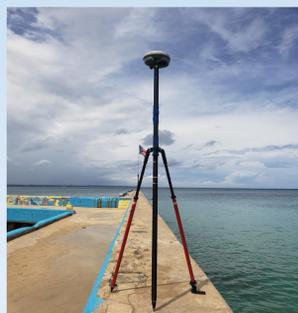


Figure 1 Trimble R8s at Crash Boat Aguadilla, Summer 2019.

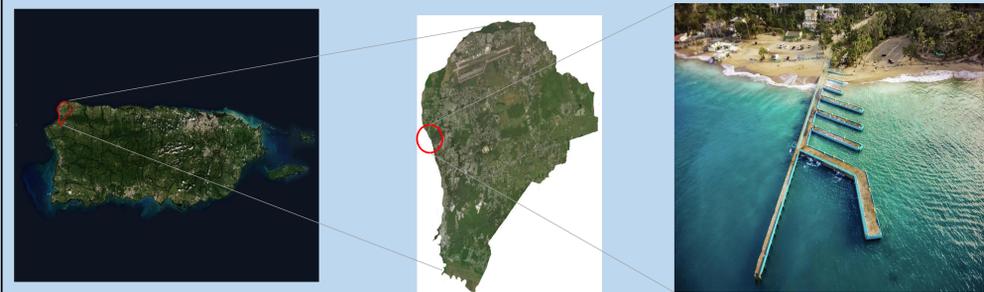


Figure 2 Crash Boat, Aguadilla Location

Results

- Based on the comparison between 2017 and 2019 data, the overall average rate of change of the shoreline is +8.6 m/year or +28 ft./year.
- Since the numbers are positive, this results in an accretion on the beach, which means that the coastal sediment is returning to the visible portion of the coast.

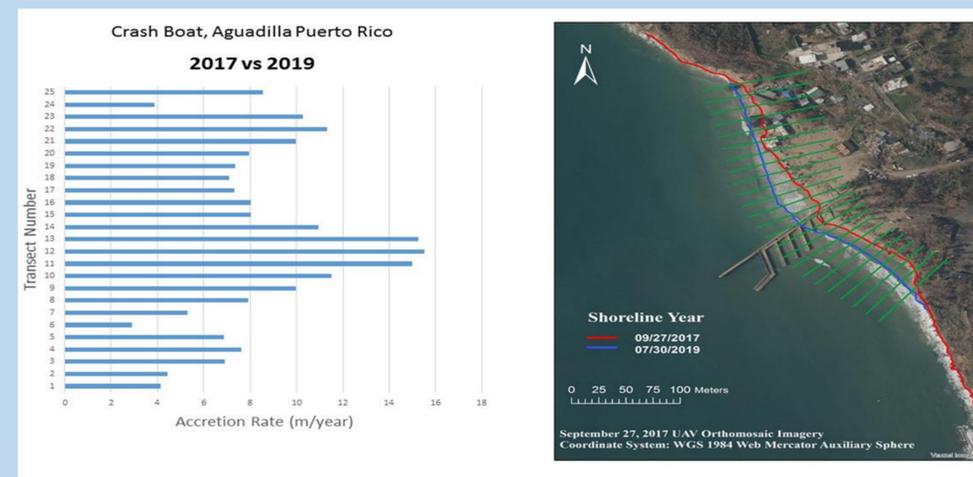


Figure 3 2017 vs 2019 Comparison

Future Work

- Considering that monitoring the impact of sea storms on coastal areas is fundamental to study beach evolution and the vulnerability of low-lying coasts to erosion and flooding. **Future Work** will establish the precision and reliability of different methods for determining the status of shoreline rapidly and in a low-cost manner.
- The Methods will include the used of a UAV based Velodyne Lidar and UAV based Aerial Photography.

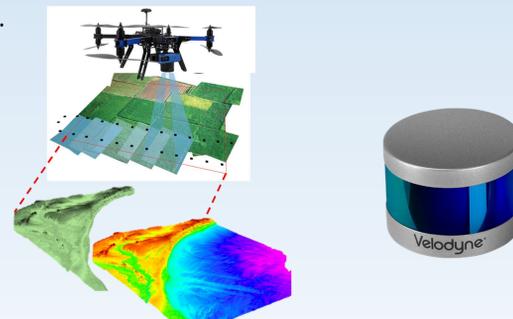


Figure 4 Conceptual Future Data Collection using UAVs.

Conclusions

- As the Figure 3 shows, the results indicate that Crash Boat Beach at Aguadilla, Puerto Rico is recovering from the severe erosion suffered after Hurricane Maria.
- The actual shoreline position has still not recovered to before Hurricane Maria conditions. Based on the 2017 and 2019 data comparison, the beach is increasing or acquiring land by the action of natural forces adding up sand, soil or silt from seashore.



Figure 5 Shoreline position at Crash Boat, Aguadilla, before (2016) and after Hurricane Maria (2017 & 2018). (Figure from Torres-Pagán, G., 2018)

- The continuous coastal monitoring is important to uncover the underlying knowledge on the changes in coastal environments and the phenomenon's which may cause damaging effects such as erosion and flooding to the low-lying coast.
- Coastal managers are highly dependent on the use of remote sensing to observe and quantify beach and near shore change, across spatial-scales ranging from centimeters to kilometers and time-scales ranging from seconds to years.
- With this work we can open the possibility for the creation of short and long-term monitoring program to protect infrastructures, properties and emphasize the security of the coastal communities.

References

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