Storm Surge Validation Study of Hurricane Iota

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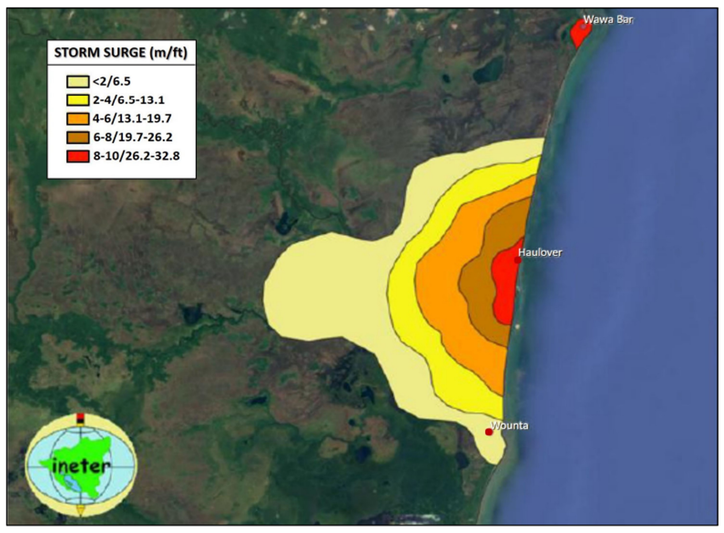
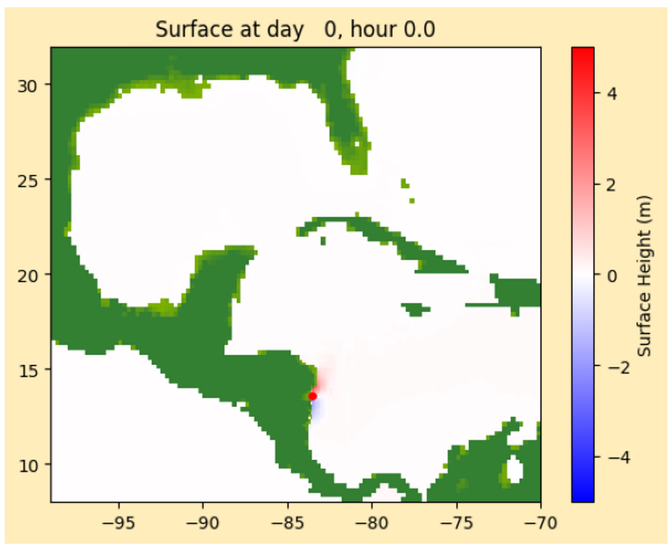
Introduction:
The decrease in air pressure during a storm results in flooding, or a “storm surge”. By using the shallow water equations, we can predict the extent of flooding based on the velocity and position of the associated hurricane, as well as the bathymetry of the sea floor. To do this, we used *Clawpack*, a tool used to solve first order hyperbolic partial differential equations. Geoclaw solves geophysical flows.
This study in particular will use *Clawpack* to model hurricane Iota, and compare the predicted storm surge against the measured values in order to test the accuracy of the *Clawpack* software.
Data on hurricane Iota was gathered directly from NOAA, topographical data was gathered on gebco, and storm surge values were given by INETER (Nicaraguan Institute of Territorial Studies).

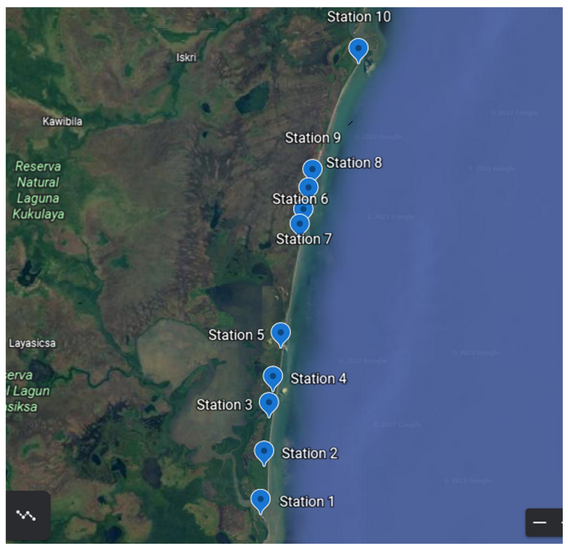


Storm surge values (meters/feet) associated with hurricane IOTA, graphic courtesy of INETER

Point of Impact.



Locations of storm surge values.



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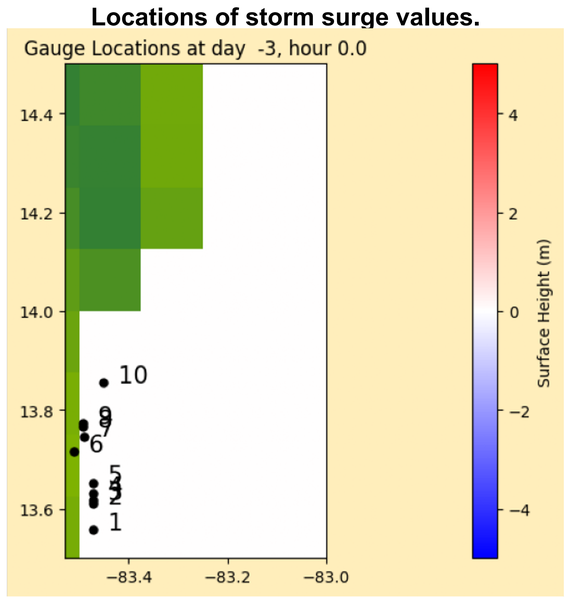
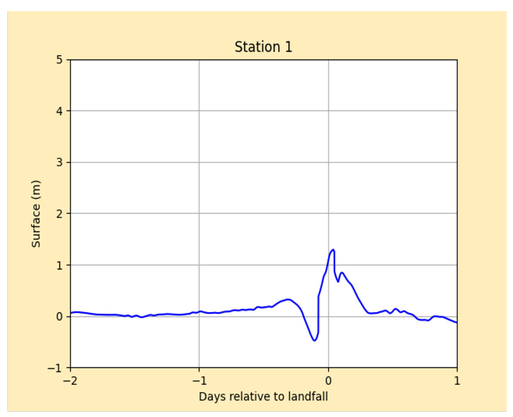
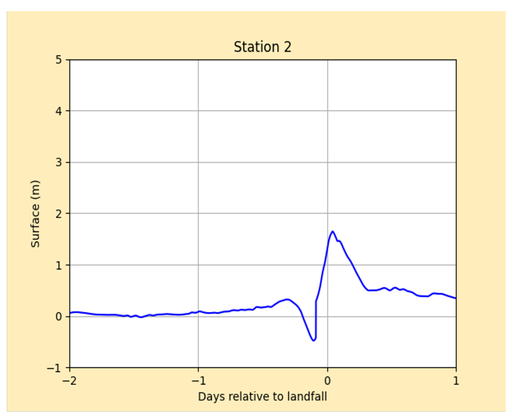
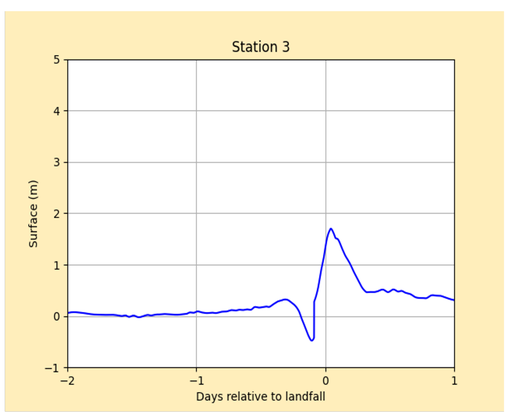
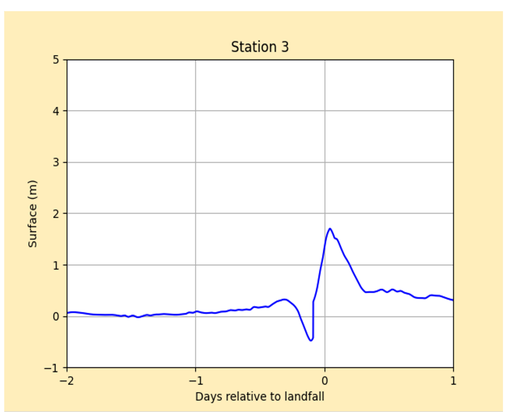


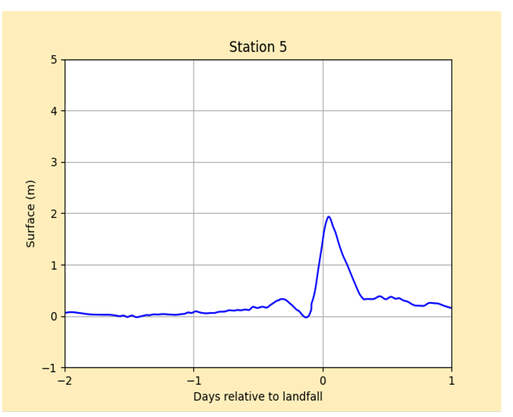
Storm surge predicted at gauge locations.

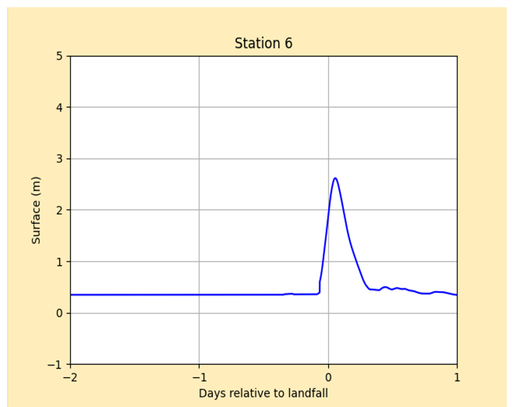


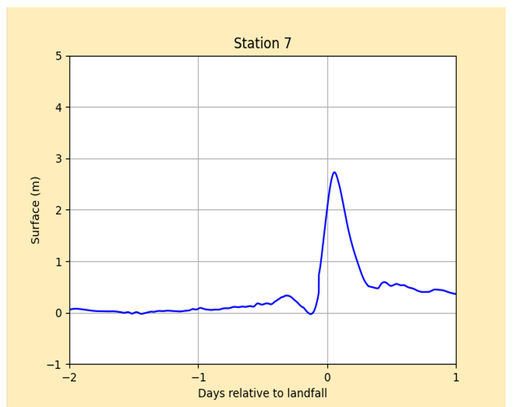


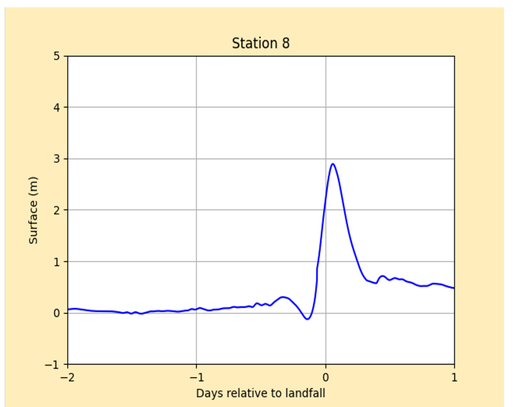


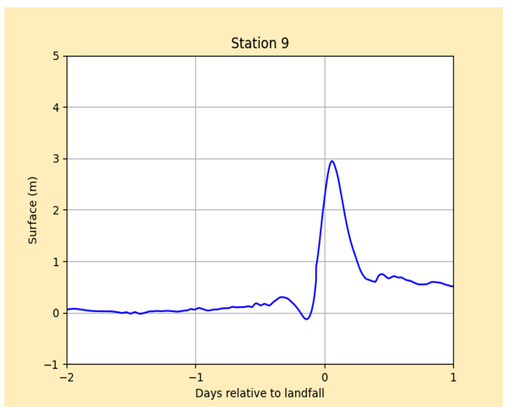


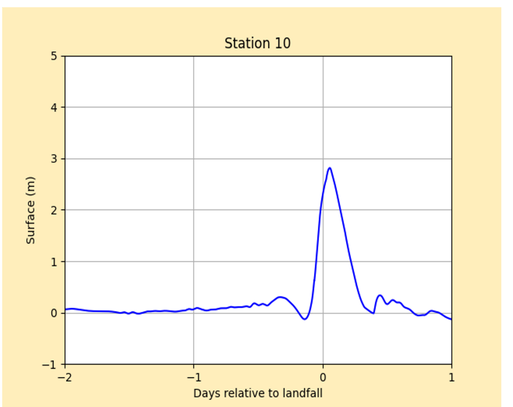












Results:
As is shown in the graphs, clawpack was unable to generate a model that accurately depicted the storm surge values posted by INETER. The greatest cause of this uncertainty is due to hurricane eta having previously hit the same area, making it harder to generate accurate data. Following that, clawpack seems to favor a smoother gradient in calculating it’s maximums, and it calculated the highest storm surge value for the wave to occur somewhere between Haulover and Wawa Bar, indicating that it was blending these two areas together.
the program runs out of memory and it ends up crashing in many case examples, which indicates either incorrect boundary conditions or a memory leak.9
All of this is under the assumption that the data provided by INETER is accurate, but there are several locations that cause unease. The graphic states that Wawa Bar and Haulover both reach between 8 - 10 m of storm surge, despite being separated by a region with none. Furthermore, the region surrounding Wawa Bar has a dramatic drop from 8-10 m of storm surge to 0 m.