Modeling storm surge flooding for participatory transformation of barrier islands: Hatteras Island, NC, USA NC STATE UNIVERSITY



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Barrier Islands are increasingly vulnerable to storm surge flooding due to sea level rise and increased storm intensity and frequency



Flooding of Hatteras Village on Hatteras Island during Hurricane Dorian. The village experienced up to 2m of storm surge flooding.

Introduction



Communities on barrier islands need to consider more complex and innovative adaptations to increase resiliency from storm surge flooding, such as building levees around important infrastructure, raising community elevation, or building infrastructure around vulnerable hot spots to allow barrier island sections to return to natural processes.

How does implementing an inlet-bridge adaptation change the magnitude and duration of storm surge flooding?

Pea Island

Adaptation Design and Implementation

Hurricane Arthur (2016)











Rodanthe Bridge Adaptation: built around vulnerable hot spot to prevent the need for future road maintenance related to breaching and dune migration

_ 0 m

Rodanthe

Waves

Salvo



Tropical Storm Beryl approached from the southwest and was a tropical depression at landfall on Hatteras Island.

Hurricane Arthur approached from the southwest and was a category 2 storm at landfall on Hatteras Island.

— Inlet Adaptation

Hurricane Dorian

Water levels (m) for the duration of the storm at the adaptation and at the neighboring village.



Implementing the inlet-bridge adaptation increased tides during non-storm conditions and decreased storm surge height and duration directly at the inlet.

Participatory Transformation



Resident Responses to Mapping	
Though the naps show ly moderate change for Avon and	"I would be most grateful for even a foot of increased safety for our home."
ery little for e vulnerable o of Buxton, do feel that inlets and oridges are ne answer."	"I can anticipate strong push back to an inlet and bridge north of Buxton, but believe it is necessary to preserve the Buxton community."

Hatteras

Hurricane Dorian approached from the southwest and was a category 1 storm at landfall on Hatteras Island.



The adaptation did not significantly affect the tides, storm surge height, or storm surge duration at Buxton.

Conclusions

- Adaptations can affect flood hazard, but the extent of the effect is dependent on the adaptation placement and storm characteristics.
- The inlet-bridge adaptation led to local reductions in flood height, but minimally affected community flood hazard.
- More work needs to be done to investigate the impact of inlet location and size on storm surge duration and magnitude.



Buxton Inlet Adaptation: designed from Hatteras Inlet and the Rodanthe **Bridge Adaptation**

Avon



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