

CLIMATE DRIVEN IMPACTS ON THE NORTH CAROLINA COAST



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▶ Purpose: The Outer Banks of North Carolina represent an excellent case study of climate change driven sea level rise. A convergence of manmade and natural factors will enhance the existing vulnerability to sea level rise. This project will focus on these causes, as well as the mechanisms and implications of the process. A solid understanding of this situation is critical for the long-term viability of North Carolina's economy and infrastructure.

Background Information

► Climate Change and Sea Level Rise: The manmade release of greenhouse gases (like CO₂) into the atmosphere will alter the Earth's temperature. This is also known as anthropogenic warming. Increasing global temperature melts glacial ice.

► Eustasy: A critical, but little known reason for sea level rise is the thermal expansion of water. As the atmosphere warms, higher ocean temperatures near the surface increase the volume of the water.

► Glacial melt and thermal expansion will be the **most dominant causes** for sea level rise this century. The best estimates from the International Panel on Climate Change have the absolute sea level rising between **0.5 meter to 1 meter** by 2100.

► What Is A Positive Feedback? When a system is forced out of equilibrium, the resulting changes amplify the originally induced effects. Positive feedbacks are also referred to as 'snowballing' or an 'echo chamber' effect.

There are many processes with positive feedbacks in the realm of climate change, including:

- concentration of atmospheric water vapor
- loss of polar sea ice
 reduction of permafrost

► The North Carolina Coast: This map describes the geographic focus of this study, and references some of the locations mentioned.



The Factors at Work

► Geomorphology: The Outer Banks are composed of low, sandy barrier islands well offshore from the mainland. They are much more vulnerable to the effects of storms and waves than rocky or steep coastlines.

► Isostasy: The relative sinking of the Earth's crust due to tectonic imbalances. In North Carolina, this subsidence accounts for the existing 0.4 m per century of oceanic rise.



The rate of sea level rise at Sewell's Point Virginia from 1930 to 2000. (NOAA)

► Hurricanes: North Carolina

nor'easters that it experiences.

most drastic coastal alterations

that gradual processes cannot.

is already well known for the

frequency of hurricanes and

These storms manifest the



Hurricane Isabel cut this inlet west of Frisco in 2003. (USGS)



► Rate of Rise: If the rate of sea level rise is slow enough, then a barrier island can compensate by moving landward. If the rate of rise is too fast, it will disintegrate. See the example of Isle Dernier in Louisiana, which disintegrated because of very high subsidence rates.



▶ Implications



Mechanisms of Breakdown (through 2100) :

- 1. Barrier islands are punctured by storm activity
- 2. Storm surges are amplified by moving over the shallow Pamlico Sound
- 3. Increased erosion of marshland enables more inland damage. The swampy, low-lying counties will be rapidly eroded, leaving the remaining barrier structures less accessible.
- 4. By 2100, the Outer barrier islands will have totally disintegrated, while new 'transverse' barrier islands develop closer to the new mainland.

► Conclusion:

- Climate change induces an increase in sea level rise
- A combination of variables makes the NC coast more vulnerable than most other areas of the U.S. Mid-Atlantic
- Coastal regions become more damaged with each storm
- A whole new regime of coastal processes develop
- Infrastructure, economy, transportation and ecology will all be severely impacted

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