Why does Sea-level rise impact the Hampton Roads so much and how it affects the Area?

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The coastal areas throughout the world are affected by Sea-Level rise including The Hampton Roads area. This area is very prone to be affected by sea-level due to the increase in weather storms, erosion of coastlines, and changes in ocean currents and climate change (Ezer and Atkinson, 2015; Ezer, 2022). Due to sea-level rise, it increases the vulnerability of flooding, endangerment, the infrastructure of the buildings, and the economy (Tompkins and Deconcini, n.d.)

Some researchers believe that sea level will rise in the Hampton Roads in the future by using Sea-Level Rise (SLR) projection rates, simulations, satellites, tide gauges, and flooding data levels (Ezer and Atkinson, 2015; Ezer, 2022). In the past, these methods show that the Mean Higher High Water (MHHW) rarely reached 1.5m ninety years ago (Ezer, 2022). However, these methods was able to show us that storm surges can reach to ~2m over MHHW in 2050 and ~3m over MHHW by 2100 (Ezer, 2022). Through the analysis of these methods, they are able to predict that the city is going to flood around 2100 (Ezer, 2022).

There are many factors that affect the land locations throughout Hampton Roads and Chesapeake which increase the local sea rise. The Glacial Isostatic Adjustment (GIA) shows that the Earth’s crust is rising in Northern regions of New York/Quebec area but is sinking in southern regions of New York and states below that, however the rate is between 0.6-1.8 mm/yr, it doesn’t show the recent acceleration in SLR and is a very slow process which can take up to over a thousand years (Ezer and Atkinson, 2015). Therefore, the northern part of the bay will be much more affected by the GIA compared to the southern bay. Recently, The Golf Stream affects the ocean currents which does help with sea level rise and tropical storms/hurricanes which causes flooding which affects many low-lying streets/communities in the Southern Bay of Virginia (Ezer and Atkinson, 2015). Two other facts that affect the Local Sea Level rise are the Underground Water Extraction and the Chesapeake Bay Impact Crater. Underground Water Extraction is one of the bigger contributions towards the subsidence where counties, such as Franklin and West Point, are not closer to the coastline and are much more likely to create groundwater withdrawals. These two counties together makes the subsidence rates of 3.8-4.8 mm/yr whereas VA Beach and Norfolk contributed 2.0-2.8 mm/yr (Ezer and Atkinson, 2015). The Chesapeake Bay Impact Crater, which was hit around the northern part of the Hampton Roads around 35 million years ago, plays a minor part of subsidence, however there is not enough data to conclude how much of the rate it contributes to the Local Sea Level Rise (Kleinosky et al., 2007; Ezer and Atkinson, 2015).

Based on the tide gauge at Sewells Point, the water level is roughly about ~1 ft above MHHW, however the estimated projections for future SLR rates until 2050 is about 4-8 mm/y (Ezer and Atkinson, 2015). The numbers of hours minor flooding in Norfolk shows that there is an exponential increase throughout the years from 1900-2020 and is predicted to change nonlinearly in the years ahead (Ezer, 2022). In comparison from the global average to the Hampton Roads average in Sea Level Rise, the Hampton roads has a maximum elevation of 54m above sea level compared to 10m above sea level globally (Kleinosky et al., 2007). Also, the sea level at Norfolk in the last 80 years is 80% higher (14.5 in.) than the global average (8 in.) in the last 140 years (Tompkins and Deconcini, n.d.). Flooding is one of the biggest problems in the coastal cities due to storms and sea level rise (Praharaj et al., 2021). Since the coastal area of Hampton Roads is so low, it can contribute to constant flooding which hinders transportation (Praharaj et al., 2021). Since the Hampton Roads are so prone to tropical storms and hurricanes, they are very much susceptible to constant flooding, sea level rising, infrastructure, and economic problems later on.

In the end, the Hampton Roads is going to have one the highest SLR rates throughout the East Coast of the United States. This will affect the people who live in this area, the military bases, including Naval Station Norfolk, and the local economy (Tompkins and Deconcini, n.d.). The state and local government are coming together to help create some mitigation and adaptation plans to help the Hampton roads from flooding (Tompkins and Deconcini, n.d.).

Works Cited Page

Ezer, T. (2022). A Demonstration of a Simple Methodology of Flood Prediction for a Coastal City Under Threat of Sea Level Rise: The Case of Norfolk, VA, USA. *Earths Future* 10. doi: 10.1029/2022EF002786.

Ezer, T., and Atkinson, L. P. (2015). Sea Level Rise in Virginia- Causes, Effects and Response. doi: 10.25778/8W61-QE76.

Kleinosky, L. R., Yarnal, B., and Fisher, A. (2007). Vulnerability of Hampton Roads, Virginia to Storm-Surge Flooding and Sea-Level Rise. *Nat. Hazards* 40, 43–70. doi: 10.1007/s11069-006-0004-z.

Praharaj, S., Chen, T. D., Zahura, F. T., Behl, M., and Goodall, J. L. (2021). Estimating impacts of recurring flooding on roadway networks: a Norfolk, Virginia case study. *Nat. Hazards* 107, 2363–2387. doi: 10.1007/s11069-020-04427-5.

Tompkins, F., and Deconcini, C. (n.d.). SEA-LEVEL RISE AND ITS IMPACT ON VIRGINIA.