LBA Sea Level Rise

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NS50: Empirical Analysis

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Coastal flooding will be one of the biggest factors responsible for socio-economic negative impacts on the planet for the next few years (Shirzaei and Bürgmann, 2018). The accelerated increase in the rate of global Sea Level Rise (SLR) is attributed to the substantial ice mass loss at glaciers and polar ice caps, caused by the ocean's rise in temperature (Shirzaei and Bürgmann, 2018). The approximate 3.1mm/year SLR rate detected at the beginning of the century (Shirzaei and Bürgmann, 2018) is not evenly distributed around the globe (California Coastal Commission, 2018). In San Francisco, sea levels are predicted to rise to 6'' by 2030, hitting the mark of 36'' by 2100 (San Francisco Sea Level Rise Action Plan, 2016). However, these numbers are further exaggerated by flooding as a result of Local Land Subsidence (LLS) (Griggs, 2018), which alone would put 45km^2 of the Bay Area at risk, and paired up with SLR, by 2100 would affect an area from 98 to 218 km^2 (Shirzaei and Bürgmann, 2018).

While most of the areas close to the San Francisco Bay Area are prone to subsidence at less than 2mm/year, the San Francisco International Airport (SFO) is subsiding 10mm/year (Shirzaei and Bürgmann, 2018). Currently, SFO's assets such as its "runaways, taxiways, terminal buildings, emergency facilities, and tenant operation centers" are susceptible to flooding from extreme storm events, aggravated by SLR (San Francisco Sea Level Rise Action Plan, 2016). If the ratings of SLR and LLS continue to constantly be in the actual margin, SFO will suffer from severe impacts from flooding, being partially flooded by 2050 and completely submerged by 2100 (Figure 1).[1] This data can be inferred through the Climate Central model that takes into consideration SLR and annual flood projections, combining the effect of pollution pathways and levels of pessimism based on scientific data. Grounded on

[1] **#breakitdown:** I effectively decomposed into tractable components parts of SF that will be affected by SLR, focusing at the airport. From this process, I managed to address specific problems of a specific location, being easier and possible to resolve those issues, having in mind the greater goal of protecting San Francisco as a whole.

peer-reviewed scientific research and databases that offer information about elevation data and coastal defenses, the model enables the user to see how SLR will behave in the next 80 years.[2]

[2] **#modeling**: I effectively identified a model that describe a SLR system, based on empirical data, that makes predictions about my researched area. I accurately determined which variables, assumptions and mechanisms used on the model, while highlighting its relevance to the subject at hand.

Figure 1: Pictures from the Sea level rise map and coastal flood model provided by Climate Central (2021). Both figures show predictions of how the airport area will suffer from flooding in the next 30 years (2050) and 80 years (2100).

Only in 2018, SFO had around 29 million visitors deplaning, generating a revenue of approximately $10 billion to the city (San Francisco Travel, n.d.). In 2020, because of COVID-19 restrictions, only 8 million people deplaned, generating a revenue of approximately $3 billion. Scenarios that limit passengers to arrive in the city, such as COVID, impose a great loss to San Francisco's economy—a long-term threat such as SFO flooding would inflict a much higher risk of San Francisco losing its tourists (Figure 2).

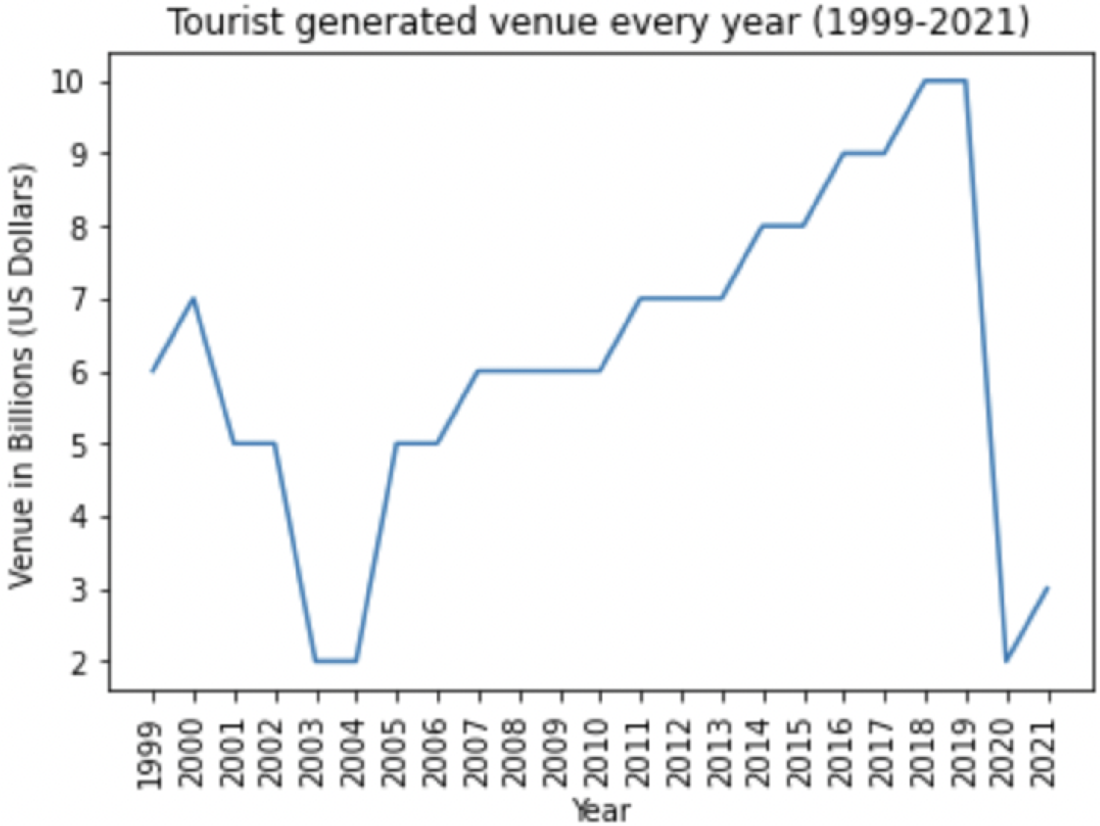

Figure 2: Line graph showing the revenue in dollars generated by tourists in San Francisco. The graph takes into consideration the number of deplaned passengers in SFO every year and clearly shows how the low number of passengers due to COVID-19 impacted negatively this aspect of the economy, indicating the relationship between SFO's passengers and revenue generation.[3]

The airport response action plan to the issue already provides different solutions, such as seawalls, but the defences put still contain gaps, such as in the US Coast Guard segment (Figure 3), that may allow flooding in the area, as reported by San Francisco Sea Level Rise Action Plan. In the same report, vague alternative solutions are provided. A new airport could be the solution to this problem. However, airports cost 30 million dollars per 3km runway

[3] **#dataviz**: I effectively chose a type of graph that shows clearly all the information I wanted to portray. My graph is clear, having a plausible title and labels, while also being analyzed and interpreted before and on its caption.

(SCMO, n.d.)—SFO now has approximately 12km in length and 0.2km in width (San Francisco International Airport, 2015). If those gaps are not resolved, SFO will face negative consequences of flooding, impacting San Francisco's economy, a plausible hypothesis given the COVID-19 example.[4]

Figure 3: Photo provided by the San Francisco Sea Level Rise Action Plan, 2016. U.S. Coast Guard boat access ramp showing vulnerability to flooding.

Word Count: 490 words.

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[4] **#hypothesisdevelopment**: I effectively identified links between patterns on my dataviz and the SLR used model, explained it and generated my hypothesis based on that. I made sure my hypothesis is testable and plausible (both based on the COVID-19 observations) .

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