IMPACT OF SEA LEVEL RISE ON FLOODING AND WAVE LOAD: THE CASE OF THE GLASS WINDOW BRIDGE, BAHAMAS

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The Glass Window Bridge (GWB) located in Eleuthera, The Bahamas, is the only bridge connecting Eleuthera's northern and southern mainland, facing the Atlantic Ocean to the east and the Great Bahama Bank to the west. This bridge is under constant threat from hurricanes and large swells in the Atlantic Ocean. The existing bridge has been subjected to severe damage arising from wave impact forces since its construction. The Perfect Storm of 1991 displaced the GWB by twelve feet westward toppling a lane of traffic. Although the damaged section of the bridge has been fixed, its complete reconstruction is being currently planned. However, as the global climate warms and sea level rises (SLR), the GWB will be subject to more extreme intense hurricanes and likely more intense overtopping. Therefore, there has been an urgent need to assess the impact of potential SLR on the GWB to guide the GWB redesign and reconstruction, in particular the bridge elevation and its distance from the coastline. This study bridges the influence of the current trends in SLR and climate change on communities and the infrastructure connecting them. The findings from this research will aid in understanding climate variability and risk in current and future decision-making for road infrastructure plans. One of the primary considerations for the redesign is to quantify the maximum horizontal and vertical reach of the spray generated by storm waves. We meet this need by developing a multiphase computational fluid dynamics (CFD) model that estimates spray generation for three major historical storm events, as well as for three different estimates of SLR. Our results suggest that, due to SLR, the islands will be subjected to increased overtopping, which will occur even during normal wave conditions. Notably, a nonlinear increase in the horizontal and vertical reach of the spray is observed with SLR.

PRESENTER BIO: Edwin Rajeev is Ph.D. student working under the guidance of Dr. Alberto Canestrelli with the Civil and Coastal Engineering Department at UF. He has experience in numerical modeling for riverine and coastal flows. He has a background in instrumentation and robotics for environmental flows.