CHARACTERIZING COMPOUND FLOODING POTENTIAL AND ASSESSING ADAPTATION STRATEGIES IN COLLIER COUNTY

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The vulnerability of South Florida to pluvial, fluvial, coastal, and groundwater flooding is rooted in its hydrogeology, low-lying topography, geographical location, climatic factors, and complex water management system. Adding to this complexity, projections indicate an escalating trend in sea level rise along with intensified extreme rainfall events. In recent years, Collier County has experienced flooding from storm surge as well as rainfall events, which has resulted in compound flooding, causing impacts for both urban and rural areas. A highly detailed urban flood model was developed to gain comprehensive understanding on the combined impacts of both flood drivers. This model is characterized by the representation of urban elements, including buildings, channels, hydraulic structures and a complex storm drain system, featuring 6,500 inlets, 1,400 manholes and 6,600 conduits., and allowing characterization of compound flooding, differentiating between two flood mechanisms: rainfall-induced inland flooding and coastal storm surge flooding.

This presentation primarily centers on how the calibrated and validated FLO-2D model was used, with a 3-day temporal rainfall distribution for four subdomains. This model integrates data from a vegetation-resolving coastal surge-wave model (CH3D-SWAN) and a rainfall-driven inland flooding model (BCB-FLOOD). Simulations cover hurricane storm surge and rainfall-driven design events at various recurrence intervals (10-YR, 20-YR, 50-YR and 100-YR), while considering different sea level rise scenarios. Furthermore, we explore the effectiveness of mangrove restoration scenarios in mitigating storm surge impacts. While the results highlight a reduction in flood-affected areas resulting from mangrove restoration, the SFWMD-FIAT tool is being employed to quantify estimated annual damages and compare the economic benefits of flood reduction under mitigation and non-mitigation scenarios.

Dissecting the roles played by different flood drivers enables decision makers to distinguish areas affected by pluvial or coastal flooding, as well as to identify the transition zone. This understanding is critical for the design and development of more precise, locally tailored mitigation measures for specific flooding conditions at both local and regional levels.

PRESENTER BIO: Francisco Peña, PhD. is a Resiliency Project Manager at the SFWMD. Francisco has extensive experience in 2D hydraulic modeling, compound flooding, resilience planning, GIS, and disaster risk reduction, having work with international organizations in Latin America and Europe. He holds two Ph.D. degrees in Earth Systems Science and Civil Engineering from the US and Italy. Currently, Francisco serves as the International Committee Co-Chair of the Association of Floodplain State Managers (ASFPM).