MANGROVES PROVIDE SIGNIFICANT FLOOD PROTECTION SERVICE IN A CHANGING CLIMATE

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Mangroves are known to provide useful ecosystem services including biodiversity, fishery habitat, carbon sequestration, and shoreline stabilization. While a few recent studies have suggested that mangroves can provide flood protection for coastal communities, their results contain large uncertainties due to the lack of consideration of the pertinent physical and biogeochemical processes and the lack of validation of their methods and results. This study, funded by the NOAA National Centers of Coastal and Ocean Sciences, used the best available climate, coastal, ecological, and economic models and data to assess the value of mangroves for reducing coastal flood and flood loss of structures in southwest Florida where the largest mangrove forest of the Gulf of Mexico region resides.

A robust coastal surge-wave model CH3D-SWAN, which resolves the horizontal distribution and vertical structure of the mangrove forests, was used to simulate the coastal inundation during recent hurricanes including Irma in 2017 and Ian in 2023. The flood-induced loss of structures was estimated with the best loss model developed by FEMA and USACE, with and without the mangroves. The simulated coastal inundation values were found to compare well with over one hundred data points. The simulated losses were then compared to the FEMA NFIP loss payout data to ensure reliability of the flood loss estimation. It was determined that during Hurricane Irma, mangroves helped the communities to avoid 20% of the observed loss (~$65M) in Collier County, Florida. During Ian, which is a much stronger hurricane with very rapid intensification, mangroves helped to avoid 15% of the observed loss (~$2B) in Collier County.

Simulations have shown that the mangroves in southwest Florida will continue to provide valuable flood protection service even by 2100. These findings can help communities to develop mangrove protection and restoration plans.

PRESENTER BIO: Dr. Sheng is Emeritus and Adjunct Research Professor. He has extensive experience in coastal, estuarine, atmospheric processes and modeling. Since 2006, he has focused on the impact of climate change on coastal flooding and ecological processes. He led numerous projects on the role of coastal wetlands for flood protection.