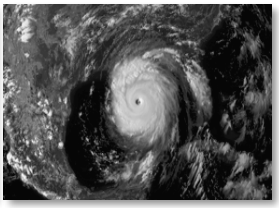
Managing Climate Change Risk for Coastal Facilities Vulnerable to Surge Inundation

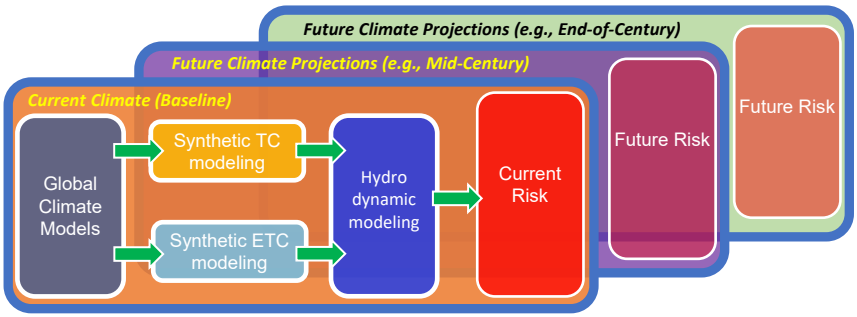



Coastal facilities and infrastructure are increasingly at risk of flooding due to rising sea levels and climate change, posing a threat to human safety, operations, and mission readiness. Effective long-term strategic planning requires consideration of the severity, frequency, and extent of anticipated flooding, accounting for potential losses, consequences, and mission impact resulting from future climate conditions.

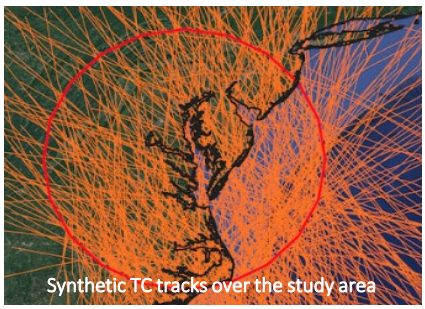
Integrated Coastal Inundation Risk Assessment

Binera has developed an integrated methodology to evaluate the potential future risk of climate change related to storm surge inundation for at-risk coastal infrastructure. This methodology enables facility owners to gauge the risk posed by surge inundation on their core facility missions, both under present climate conditions and under evolving climate scenarios through the end of the century. By applying this integrated risk assessment, coastal facilities can pinpoint specific areas and critical infrastructure susceptible to future flooding and identify cost-effective strategies to mitigate the adverse effects of flooding.

A cutting-edge capability for assessing climate change risk has been developed employing the latest advancements in climate science, sea-level risk projections, state-of-the-art compound inundation models, advanced statistical analysis, and best practices in quantitative risk assessment.

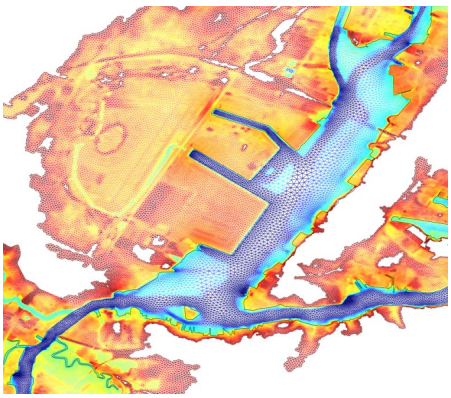


Modeling Components



The process involves the application of advanced weather models from the Coupled Model Intercomparison Project (CMIP6) to simulate thousands of synthetic storms under projected future climate conditions. By doing so, we account for potential changes in storm frequency, propagation, intensity, and sea-level rise. To address the inherent uncertainty in future climate conditions, the approach evaluates risk across multiple future climate pathways identified by the International Panel on Climate Change, known as shared socio-economic pathways (e.g., SSP5-8.5) and sea level risk projections.

The resulting inundation is assessed for each storm using hydraulic compound modeling on a high-definition geographical mesh of the study area, producing highly detailed flood maps and pinpointing specific vulnerable locations and infrastructure. By repeating this approach across the entire set of synthetic storms – thousands of tracks – a statistically robust dataset is produced. A probabilistic evaluation of this dataset allows Binera to determine the expected frequency of flooding to a defined threshold at each point on the computational mesh and corresponding with the location of mission critical infrastructure. The process then includes an evaluation of how flooding within each storm area could physically impact existing infrastructure and how these impacts could affect the facility's ability to conduct operations and fulfill its assigned missions.



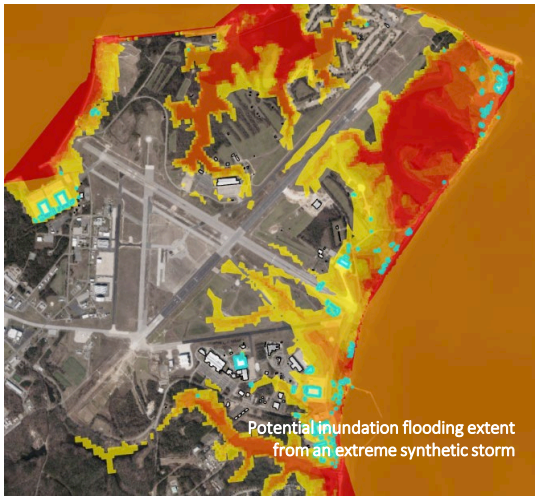
High resolution computational mesh

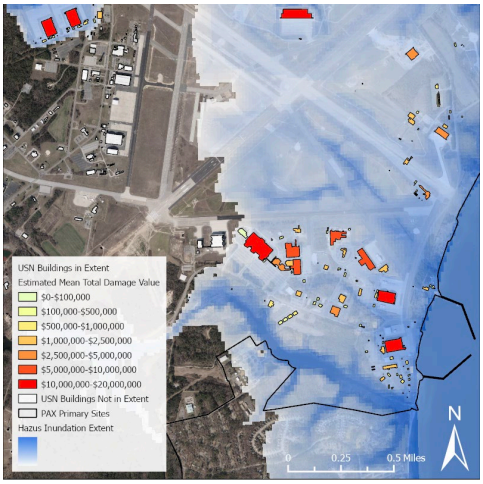
binera

Proof-of-Concept at NAS Patuxent River

Binera, along with our partners at W.F. Baird & Associates, is conducting a complete proof-of-concept at **Naval Air Station Patuxent River (PAX)** for the Office of Naval Research to assess surge inundation risk, both under current climate state and changing climate conditions through the end of the century.

Engagement with PAX stakeholders establishes the basis for quantifying losses and to develop a complete understanding of operational priorities and facility capabilities, including functionality and criticality of individual facilities and infrastructure at the base. Consequence data is combined with the flooding frequencies developed from the synthetic storm catalog to calculate inundation risk under current climate and various future climate states, demonstrating the expected change in risk over time at the facility.





Potential dollar losses of building stock

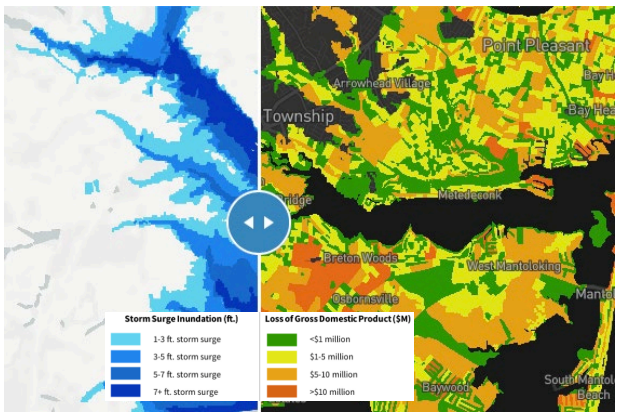
The methodology assesses both monetary and non-monetary consequences for all asset categories across each combination of inundation and climate scenario. Products include detailed maps identifying infrastructure and locations at PAX most at risk from future flooding, GIS models indicating flood frequency at defined future time periods, and a facility risk report detailing the nature and drivers of future flooding risk at PAX.

To determine future inundation risk under each potential climate scenario and sea-level rise case, the methodology outlines the process of combining flooding event frequency with the aggregate consequence corresponding to that specific flooding event to produce annualized expected loss estimates and provide stakeholders with a basis of comparison and data to inform long-range planning and investment in mitigation.

Methodology Applications

The general approach including major model components was successfully tested through its applications in various geographic settings including the US East Coast region (Port Authority of New York & New Jersey), and locations in the tropics (the US Embassy in Timor-Leste).

The developed proof-of-concept is applicable to a diverse range of coastal locations at risk around the globe. The products allow to identify specific vulnerabilities of the facilities and potential mitigation solutions, support benefit-cost analysis for the long-term planning, emergency management and design of the protective engineering solutions.



Converting inundation results into estimates of economic losses

Binera, Inc. is a minority, woman-owned disadvantaged business enterprise and a recognized expert in the areas of all-hazard risk assessment and risk management.

https://www.binera.com info@binera.com (301) 585-8570