

MACH Focus Areas



Housing, Insurance, and
Mortgage Markets



Adaptation Strategy Design



Municipal Finances



Household Decision-Making



Transdisciplinary Research
and Co-Production Design

coastalhub.org

Coastal Climate Risk

What problem does this focus area address?

As climate change accelerates, coastal areas around the world are facing mounting threats from rising sea levels, extreme weather events, and compounding natural hazards. The Coastal Climate Risk research group is investigating these complex challenges, focusing on two primary hazards that impact millions of people along the U.S. East Coast: flooding and heat stress. By combining observational data with advanced computational modeling, their work supports decision-makers in government, business, and communities—helping them to make informed choices about how to respond to climate-related risks.

At the core of the group's mission is the problem of flooding, particularly when multiple factors—such as sea level rise, storm surge, and heavy rainfall—combine to overwhelm waterways and drainage systems. This “compound flooding” is a significant risk in coastal areas, as it can lead to more frequent and severe inundation, made more complicated by landscape changes like eroding beaches and dunes.

Equally important is the group's work on the risks posed by extreme heat. Intense heat can lead to dangerous conditions, particularly for vulnerable populations such as people with certain chronic health conditions, the elderly, and people who work outdoors. The problem is especially acute in urban areas, which tend to be warmer due to heat-absorbing paved surfaces and a lack of tree cover. This research examines not only the immediate health impacts of heat stress but also how infrastructure—such as power grids—can fail under extreme conditions, compounding the risks to human health.

What is MACH?

The Megalopolitan Coastal Transformation Hub (MACH) is a consortium of 13 institutions that brings together academics, policymakers, and community leaders to research climate change impacts and develop effective, evidence-based responses in the Philadelphia–New Jersey–New York region and beyond. Learn more about MACH at coastalhub.org.

How can this research be used?

The methodology driving the group's work is as diverse as the risks it seeks to address. The group employs a hybrid approach, combining data from a variety of sources such as long-term observational data, reanalysis models, and storm simulations. The use of computational models allows researchers to generate thousands of possible scenarios, helping to identify the most extreme risks.

In addition to quantifying present-day risk, the research can also lead to identifying “emerging hotspots”—areas that are not yet at high risk but will become increasingly vulnerable as the climate continues to warm. With the right available data, the outputs could give local governments and communities time to plan and implement protective measures before disaster strikes.

Local decision-makers, particularly those in small cities and towns, are key stakeholders, as they are often the ones grappling with the immediate consequences of flooding and heat stress. But the research also extends beyond the local level, with implications for state and federal agencies, insurance companies, and large infrastructure projects. The findings can inform everything from municipal planning to how insurers assess the risk of properties in flood-prone areas.

At the heart of this effort is a flexible modeling system that blends traditional statistical techniques, physics-based models, and emerging machine-learning tools. The Coastal Climate Risk group isn't just providing data. They're offering a powerful method that can be customized for many different uses, in nearly any location.

How does this research relate to the work of other focus areas?

This modeling approach is already proving valuable to other research groups in the MACH network,

with plenty of opportunities for collaboration. The Adaptation Strategy Design group, for example, uses the data to identify how trade-offs between equity and economic benefits can be achieved, making the most of limited adaptation resources. The Municipal Finance group investigates how flooding and other events that influence the property tax base and demand for public services affect city budgets. The Housing, Mortgage, and Insurance group examines how portfolios of properties might be at risk. In short, the products developed by the Coastal Climate Risk group integrate across virtually all other MACH focus areas.

The work described here is conducted by researchers at the University of Central Florida, University of Florida, Princeton University, Columbia University, Tulane University, and Rutgers University affiliated with the MACH consortium. Contact coastalhubinfo@gmail.com for more information.

KEY POINTS

- The Coastal Climate Risk group focuses on flooding and heat stress. Compound flooding is of particular concern.
- The group combines long-term observational data, reanalysis models, and storm simulations to assess climate-related risk and identify emerging hotspots.
- The group's research is relevant to a wide range of stakeholders, including federal and state agencies, local decision-makers, insurance companies, and community organizations.
- Data and modeling can be used widely by other research groups within the MACH network.



MACH's Coastal Climate Risk group focuses on flooding—particularly “compound” flooding—and extreme heat.



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