CREST Chronicle

INNOVATIVE TECHNOLOGIES TO SERVE EARTH SYSTEM SCIENCE, ENGINEERING AND SOCIETY

Observing, modeling, and understanding a changing Earth

January – April 2026

In focus

COASTAL RESILIENCE

CUNY CREST
SCIENCE & TECHNOLOGY TO SUSTAIN THE EARTH

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January–April 2026

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PREFACE

Charting a Vision for Research, Collaboration, and Community Impact

Dr. Rick Spinrad

Administrator of the National Oceanic and Atmospheric Administration (NOAA, 2021-2025)

The inaugural issue of the CREST Chronicle marks a significant milestone in advancing the work and mission of the City University of New York's Remote Sensing Earth System (CREST) Institute. With this new platform, CREST reaffirms its commitment to research excellence, global partnerships, and the cultivation of future leaders in science and education. Positioned at the forefront of research on so many critical issues, including natural hazards, climate change, and coastal flooding, CREST addresses challenges that profoundly affect communities both locally and globally.

CREST's research is propelled by the urgent need to understand and respond to the intricate dynamics of Earth's systems. From hurricanes and extreme weather events to rising sea levels and coastal erosion, its students and scientists pursue solutions designed to protect lives and livelihoods. CREST approaches these challenges with a transdisciplinary spirit, integrating knowledge from environmental science, engineering, policy, and social science. This comprehensive perspective is increasingly vital as climate change impacts intensify, and communities must adapt to the realities of natural hazards.

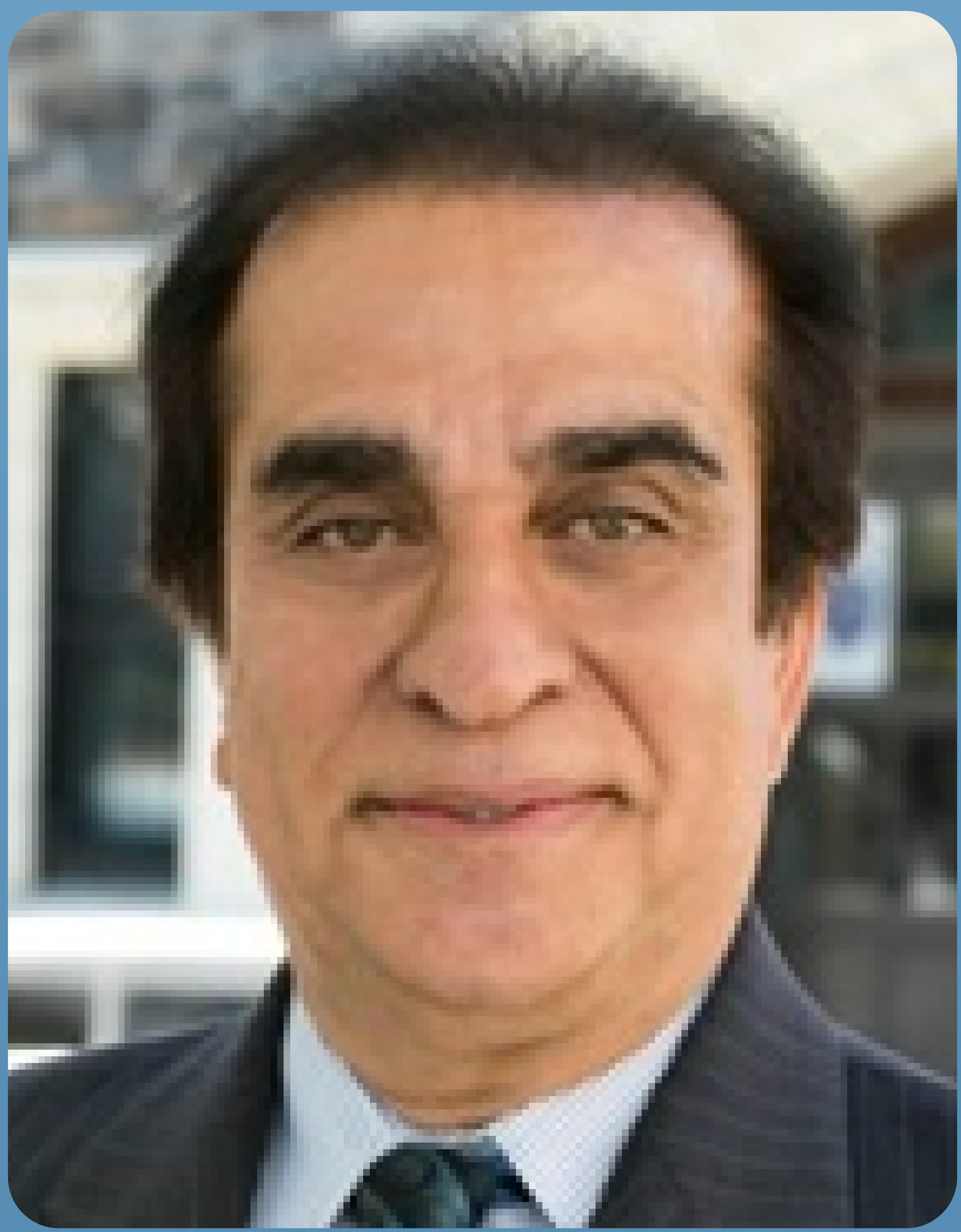
Global partnerships and collaborative research are central to CREST's mission. The institute recognizes that scientific progress thrives on crossing boundaries—geographical, disciplinary, and cultural. By fostering alliances with institutions, researchers, and mentors worldwide, CREST establishes a dynamic network for sharing ideas, resources, and best practices. Mentoring the next generation of scientists is a cornerstone of this vision, ensuring diverse voices and perspectives are empowered to drive future breakthroughs.

From my decades of experience in "environmental intelligence", I know that the landscape of science, social science, policy, and emerging technologies is evolving at a rapid pace. Advances in remote sensing, data analytics, and artificial intelligence are transforming the ways in which environmental threats are monitored, predicted, and addressed. Policy frameworks and social science research provide crucial insights into resilience, adaptation, and equity. CREST is committed to leveraging these developments to build a robust workforce prepared for the challenges ahead. Workforce development, in CREST's view, extends beyond technical skills, encompassing the cultivation of adaptable, ethical, and forward-thinking leaders.

The stakes for communities are substantial. Decisions made today will shape the safety, sustainability, and prosperity of future generations. In this pivotal moment, science and education must promote innovation, encourage collaboration, and translate research into practical solutions. Through the CREST Chronicle, CREST aims to advance knowledge, empower communities, and build a future in which science serves humanity.

FROM THE EXECUTIVE DIRECTOR

Coasts, Communities, and Code: Innovating for Resilient Futures



Dr. Reza Khanbilvardi
NOAA Chair Professor of Civil Engineering, CCNY
Director, CREST

As Director of CREST, I am pleased to introduce the inaugural issue of the *CREST Chronicle*.

At CREST, we believe that today's most pressing challenges demand an interdisciplinary approach, one that brings together Earth system science, remote sensing, engineering, and the social sciences. Our work is rooted in translating complex Earth data into actionable knowledge that supports decision-making and strengthens communities. Over the years, we have built a distinct niche at the intersection of science, technology, and society, where innovation meets real-world impact.

The *CREST Chronicle* is an extension of that mission. Through this platform, we aim to share insights from our work across both global and local scales, from international collaborations to challenges facing urban coastal regions such as New York City. Our research spans physical processes, societal impacts, and emerging AI-driven solutions, reflecting the full spectrum of Earth system inquiry. More importantly, it highlights how these efforts contribute to building more resilient, informed, and adaptive communities.

Published three times a year—in April, August, and December—the Chronicle will serve as a forum for engagement with academia, policymakers, funders, and the broader public. This inaugural edition focuses on the dynamic interface between urban systems and coastal environments. Understanding this intersection is essential as we work toward resilient futures at the water's edge.

We envision the *CREST Chronicle* as more than a publication; it is a space for dialogue. We welcome your insights, questions, and perspectives as part of an ongoing exchange. Together, we can strengthen not only the science we produce, but also the impact it delivers.

This is the beginning of that conversation. We are proud to share our journey, and even more committed to shaping it alongside you.

A NOTE FROM THE DEPUTY DIRECTOR

From a Federal Investment to a Living Institution

Dr. Shakila Merchant

Deputy Director, CREST

CUNY CREST's story begins not in 2010, but in 2001, when NOAA — through its Educational Partnership Program — selected The City College of New York as one of four universities to establish a Cooperative Remote Sensing Science and Technology Center. Over the next decade, that investment-built laboratories, forged partnerships, and trained a generation of scientists at one of the world's most diverse urban campuses. By 2009, what NOAA had cultivated was too valuable to remain tied to a single funding stream. As a co-founder of the CUNY CREST Institute, I was part of the determined team that turned that conviction into a permanent institution — approved by the CUNY Board of Trustees in June 2010 and inaugurated that November — a deliberate sustainability plan to extend our reach beyond one agency, one city, and one community, toward global impact.

Fifteen years on, CREST operates across five intersecting strategic pillars — Research and Applications, Education and Training, Community Resilience and Stakeholder Engagement, International Collaboration, and Entrepreneurship, Innovation and Ventures — making us a singular beacon within CUNY and New York City: a proof of possibility for first-generation students from every borough and across the globe who arrive at City College ready to tackle the environmental challenges that matter most.

The CREST Chronicle is an expression of that same founding spirit. I am proud to have co-conceived and championed this publication — a vehicle to amplify our voice, share our science and stories, and affirm that knowledge generated here belongs to everyone. It aligns squarely with our institutional roadmap and identity. That it opens with a Preface from Dr. Richard Spinrad, former NOAA Administrator, closes a circle that began over two decades ago. Welcome to the Chronicle. These pages are for all of us to celebrate together.

FROM THE CHIEF SCIENTIST
From Science to Impacts

Dr. Mitchell Goldberg

Chief Scientist, CREST

As Chief Scientist of the CUNY CREST Institute, I am pleased to welcome you to this inaugural issue of the CREST Chronicle. This publication offers an important opportunity to reflect not only on the work we do, but also on the larger scientific and societal questions that drive it.

At CREST, our research is rooted in the understanding that today's environmental challenges are interconnected, dynamic, and consequential. Addressing them requires more than disciplinary excellence alone. It calls for scientific vision, innovation across fields, and a commitment to translating knowledge into forms that can inform decisions, strengthen resilience, and improve lives.

The CREST Chronicle is intended to serve as a window into that process. Through these editions, we will highlight the scientific advances, partnerships, and emerging ideas that define our work across Earth system science, remote sensing, environmental analysis, engineering, and data-driven discovery. Just as importantly, the Chronicle will underscore the broader value of this work in helping society better understand and respond to a rapidly changing world.

This first issue, Where City Meets Sea: Unraveling Coastal Resilience in a Changing Climate, focuses on a challenge that is both scientifically complex and deeply human. Coastal resilience is not only about understanding physical systems, but also about anticipating risk, supporting communities, and shaping more sustainable and adaptive futures. It is exactly the kind of challenge that demands the integrated perspective CREST is uniquely positioned to provide.

I hope this Chronicle will inspire reflection, dialogue, and new connections among researchers, students, partners, and stakeholders. At its best, science does more than generate knowledge; it expands possibility. It is my hope that these pages will convey both the depth of CREST's work and the promise it holds for the future.

THEME: COASTAL RESILIENCE

Coastal regions are dynamic spaces where natural systems and human communities continuously interact, adapt, and evolve. As pressures on these regions grow, understanding coastal resilience requires more than a single perspective; it calls for a broader, more integrated way of thinking that brings together science, practice, and lived experience.

This issue explores coastal resilience through a range of contributions that reflect this breadth of perspectives. From research that advances our understanding of coastal processes to approaches that support decision-making and planning, each piece highlights how different forms of knowledge can come together to address complex challenges.

Equally important are the voices of emerging scholars and students, whose contributions bring fresh ideas and critical reflections to the conversation. Their work not only enriches the discussion but also reinforces the importance of building future capacity in this space.

Together, these contributions align with the core pillars of the CUNY CREST Institute: advancing research, strengthening education and workforce development, fostering innovation, building partnerships, and supporting community engagement. By connecting these areas, this issue reflects a shared commitment to translating knowledge into meaningful impact.

We hope this collection encourages readers to think across boundaries, engage with new perspectives, and consider how their own work connects to the shared goal of building more resilient coastal systems.

Photo credit: Vartika Chandra Saman

Featured Articles

Photo credit: Maria Tzortziou

Reading the Color of the Ocean from the Sky

How light, satellites, and coastal science reveal hidden environmental change

Maria Tzortziou

Dr. Maria Tzortziou is an Endowed Professor of Environmental Sciences and Director of the Bio-Optics Laboratory at the Center for Discovery and Innovation, City College of New York (CUNY), and Director of Research and Applications at the CREST Remote Sensing Earth Institute. She is also affiliated with NASA Goddard Space Flight Center, where she leads NASA's Earth Venture Suborbital Mission FORTE, and has served as the Applied Science Lead for NASA's Mission GLIMR and the Deputy Program Applications Lead for the PACE NASA mission.

Her research advances understanding of marine biogeochemistry, ecology, and biodiversity by integrating satellite remote sensing, field observations, AI/ML approaches, and ecosystem modeling. She has led field campaigns across diverse environments—from the Sea of Japan to South African coastal waters and the Arctic—and has received three NASA Group Achievement Awards.

Dr. Tzortziou is a National Geographic Explorer, a WINGS Women of Discovery Explorer, and a Fellow of The Explorer's Club. She also serves on multiple national and international advisory boards shaping ocean science, technology, and policy, including the National Ocean Research Advisory Panel. The new NASA Earth Venture Mission she leads has been endorsed by the Intergovernmental Oceanographic Commission of UNESCO as an official United Nations Decade Project.

From orbit, the ocean often appears as a uniform expanse of blue stretching beyond the horizon. Yet this apparent uniformity conceals a highly dynamic optical environment shaped by biological productivity, riverine inputs, suspended sediments, and dissolved organic matter. Subtle variations in ocean color can reveal nutrient pulses following storms, the expansion of algal blooms, and long-term ecosystem changes under climatic and anthropogenic stress.

For Maria Tzortziou, ocean color is not simply a visual phenomenon but a quantitative record of environmental change. Her research lies at the intersection of remote sensing, coastal biogeochemistry, and ecosystem ecology. By integrating satellite observations with field measurements and hyperspectral analysis, reflected radiance can be translated into indicators of chlorophyll concentration, suspended particulate matter, dissolved organic compounds, and coastal carbon cycling.

Coastal Systems as Earth System Integrators

Coastal environments occupy a critical position in the Earth system. They regulate exchanges of carbon between the ocean and atmosphere, sustain fisheries and biodiversity, and support many of the world's most densely populated regions. At the same time, they are increasingly influenced by nutrient enrichment, warming temperatures, altered hydrological cycles, anthropogenic pollution, and intensifying weather extremes.

Traditional field sampling remains essential, but it cannot capture variability across the spatial and temporal scales at which coastal processes operate. Satellite ocean color observations provide a complementary perspective, enabling continuous and near real-time monitoring of environmental change across regional and global scales.

From Cities to the Arctic

This work extends beyond urban coastlines to remote and rapidly changing environments. In the Arctic, warming temperatures and declining sea ice are transforming coastal ecosystems by altering how sediments, nutrients, and organic carbon move from land to sea. Satellite observations provide a critical window into these evolving systems, supporting scientists, land managers, and communities in understanding how river discharge, permafrost thaw, and coastal erosion are reshaping Arctic waters.

The Challenge of Reading Ocean Color

Interpreting ocean color in coastal environments presents significant scientific challenges. Unlike the relatively uniform optical properties of the open ocean, coastal zones are influenced simultaneously by sediments, phytoplankton, and dissolved organic matter.

To address this complexity, this research advances methodological frameworks that disentangle overlapping optical signals. Through hyperspectral remote sensing and improved retrieval algorithms, satellite observations can more accurately quantify water quality and biogeochemical parameters in optically complex environments.

Carbon, Ecosystems, and Climate

Far from being mere boundaries, estuaries and continental shelves act as dynamic integrators where water, carbon, and nutrients are transformed and exchanged across terrestrial, marine, and atmospheric interfaces.

By integrating satellite-derived productivity estimates with field observations and biogeochemical modeling, researchers are improving our understanding of whether coastal systems act as carbon sinks or sources under changing climatic conditions.

Photo credit: "Coastal Arctic," courtesy of Maria Tzortziou, Arctic Rivers Carbon Project.

> "Ocean color is not simply a visual phenomenon but a quantitative record of environmental change."
>
> Maria Tzortziou

In Conversation with Maria Tzortziou

What drew you to remote sensing?
My journey into remote sensing began during my MSc research, where I used satellite data to track sulfur dioxide and ozone in the atmosphere. While studying how these gases block ultraviolet and visible blue light, I became curious about the light that does reach the ocean—and how it affects life underwater. That curiosity led me from the atmosphere into coastal systems, where I began decoding ocean color to understand biodiversity and ecosystem processes.

Why are coastal waters so challenging to study?
The very features that make coastal waters vital—their biodiversity and their position at the land–ocean–atmosphere interface—also make them optically complex. These systems are influenced by terrestrial inputs, biological activity, and rapid environmental change. Their heterogeneity pushes the limits of standard remote sensing, requiring high spectral, spatial, and temporal resolution observations across multiple platforms.

How can satellite observations help cities?
The coastal waters from New Jersey to New York to Connecticut form a connected system supporting a major global economy. Satellite observations provide a synoptic view of this system, helping track wastewater flows, combined sewer overflows, and harmful algal bloom risks.

Because satellites offer both historical context and real-time updates, they play a critical role in strengthening coastal resilience and supporting better-informed urban adaptation strategies.

Why study the Arctic, and what is FORTE?
The Arctic is one of the most inaccessible frontiers on Earth, yet changes in these remote regions ripple out to affect the entire global system. My research focuses on how shifting hydrology influences carbon cycling, nutrients, and ecosystem health. The NASA FORTE mission applies a powerful integration of surface, airborne, and satellite observations, capturing processes from the micro to the larger ecosystem scale. As a UN Ocean Decade Project, it contributes to global efforts toward sustainable ocean science.

What does hyperspectral sensing change?
Hyperspectral imaging allows us to move beyond broad color observations to detect subtle spectral differences linked to specific biogeochemical signatures. It enables us to distinguish between phytoplankton communities and better understand carbon quality in coastal waters. This capability is central to missions like the NASA PACE mission, which is transforming how we observe marine ecosystems.

What role does CREST play?
CREST serves as a cross-disciplinary hub integrating satellite observations of land, atmosphere, and ocean systems. It connects data, technology, and stakeholder engagement, helping translate scientific insights into real-world applications and resilience strategies.

What are the key questions ahead?
A major challenge is integrating real-time satellite data with predictive models and socio-economic indicators to create effective early-warning systems.

> "The goal is not just better observation, but ensuring that scientific insights are embedded in decision-making processes—supporting communities, planners, and industries in building resilient coastal systems."
>
> Maria Tzortziou

Reimagining Coastal Resilience in a Multi-Hazard World

Sanjay Kumar Srivastava

Dr. Sanjay K. Srivastava is a CUNY CREST affiliate and an Adjunct Research Professor at the UNU-Hub (R-SIRUS) at the City College of New York and the S. Radhakrishnan Chair Professor at the National Institute of Advanced Studies, India.
With extensive experience across international organizations and space agencies, he has been a leading voice in advancing disaster risk reduction through the integration of science, policy, and technology. From 2014 to July 2025, he served as Chief of Disaster Risk Reduction at the United Nations Economic and Social Commission for Asia and the Pacific, where he led regional efforts to strengthen resilience across Asia and the Pacific.
His earlier roles include Regional Adviser at UNESCAP, Head of the SAARC Disaster Management Centre, and Deputy Project Director at the Indian Space Research Organisation, where he contributed to the use of space-based technologies for disaster management.
Dr. Srivastava has authored over 150 publications and served as lead author of major regional assessments, including the Asia-Pacific Disaster Report and the State of the Climate in Asia and the Southwest Pacific. He holds a PhD in Remote Sensing and an Executive Certificate in Digital Transformation from the University of California, Berkeley (2023).

Coastal zones across the Indian Ocean and wider Asia-Pacific are at the frontline of a rapidly evolving risk landscape. These regions, long defined by their economic vitality and ecological richness, are increasingly exposed to multi-hazard threats arising from the intersection of geophysical processes and climate change. Dr. Srivastava works at the intersection of science, policy, and global risk, where coastal resilience is no longer a distant concern but an immediate and evolving challenge across the region.

Coastal risk is no longer episodic or singular. It is systemic. Earthquakes beneath the ocean floor can trigger tsunamis that traverse national boundaries, while intensifying cyclones interact with sea-level rise and extreme rainfall to produce compound flooding. Rapid urban expansion into low-lying coastal zones further amplifies exposure.

This convergence of hazards is generating cascading and compounding risks, where impacts propagate across interconnected systems — energy, water, transport, health, and livelihoods — creating disproportionate and nonlinear consequences.

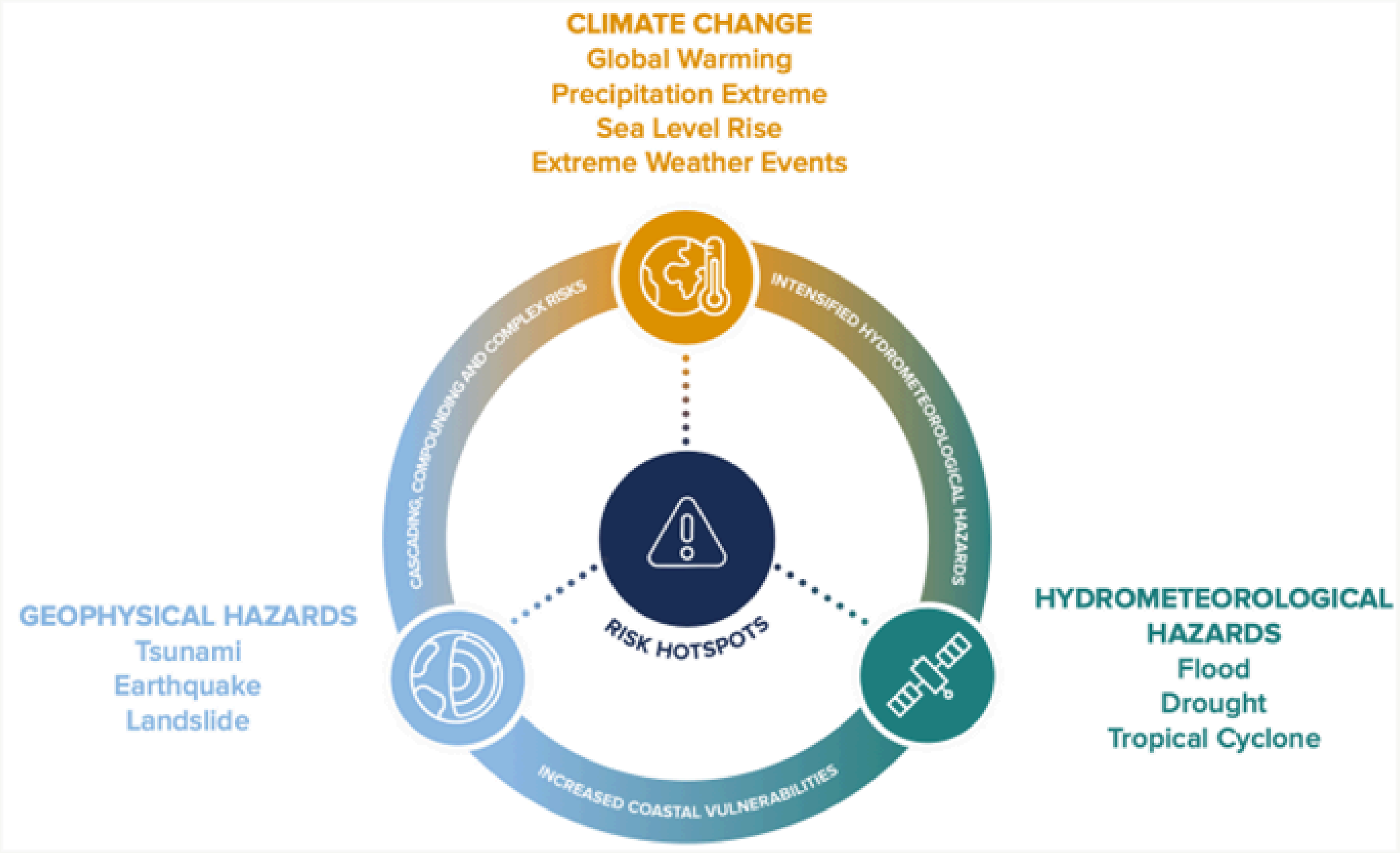


Image: A multi-hazard context of coastal risk: Cascading, compounding, and complex risk

Coastal cities are growing rapidly, often without adequate planning. Informal settlements are expanding into flood-prone and low-lying areas, driven by the need for jobs and housing. For example, coastal cities in the Indian Ocean basin are expanding into high-risk zones exposed to tsunamis, earthquakes, flooding, and cyclones. Unplanned growth is also leading to informal settlements in vulnerable areas, while 2 million residents in coastal cities may face displacement by 2030 due to sea-level rise and storm surges. By 2030, more than half the region's population will be concentrated in a small number of high-risk cities. For many, living near the coast is not a choice—it is a necessity. But it also means living with constant exposure to risk.

Tsunamis, cyclones, and ocean systems connect countries across the region. This makes cooperation essential. International cooperation helps countries share data, strengthen early warning systems, and respond collectively.

Early warning systems have improved significantly. But the challenge is no longer just issuing warnings—it is ensuring they lead to timely and effective action. Advances in science and technology are helping bridge this gap; for example, satellite data provides real-time monitoring. AI enables prediction of impacts, not just hazards; digital tools, including digital twins, simulate how cities respond to disasters. This shift—from predicting events to understanding impacts—is transforming how decisions are made.

> "It is important to remember that we all share the same wave. Hazards do not respect national boundaries."
>
> Sanjay K. Srivastava

Image: Cities at risk: urban vulnerabilities in the Indian Ocean coasts

Rethinking Resilience

Coastal resilience is no longer just about building stronger infrastructure. It is about living with risk in smarter ways, which requires integrating science, technology, and local knowledge; protecting and restoring natural ecosystems; designing inclusive systems that reach the most vulnerable and strengthening cooperation across borders. Ultimately, resilience is about moving from reacting to disasters toward anticipating and preparing for them. The coastlines of Asia-Pacific are on the frontline of a changing climate and evolving risks. Yet they are also spaces of innovation and opportunity.

In Conversation with Sanjay Kumar Srivastava

What is your research focus in coastal resilience?
My research focuses on multi-hazard coastal risk assessment, early warning systems, and anticipatory governance in the Indian Ocean and Southwest Pacific. It examines how geophysical hazards —such as earthquakes and tsunamis—interact with climate risks like cyclones, storm surges, and sea-level rise to create cascading impacts.
The key challenge is moving from siloed hazard analysis to integrated, systems-based risk understanding, and translating science into operational, decision-ready tools, particularly in low-capacity countries.

Which regions are central to your work, and why are they vulnerable?
My work centers on the Indian Ocean and Southwest Pacific, among the most hazard-exposed coastal regions globally. Their vulnerability stems from long coastlines, dense populations, critical infrastructure in high-risk zones, socio-economic constraints, and environmental degradation. Together, these factors create high exposure, high vulnerability, and intensifying multi-hazard risk.

How can research inform real-world coastal resilience strategies?
My work bridges science and policy by translating risk knowledge into operational frameworks. Contributions to regional platforms and flagship reports have supported evidence-based policymaking and the development of coastal resilience strategies across the Asia-Pacific region.

How have international collaborations shaped your work?
Engagement with international institutions has strengthened my work in impact-based forecasting and risk analytics. Adopting global best practices has supported the development of multi-hazard modeling frameworks and contributed to the implementation of initiatives like Early Warnings for All.
Collaborations with organizations such as the Pacific Disaster Center have been particularly influential in shaping my approach to impact-based forecasting.

What role do emerging technologies play in your work?
Emerging technologies are central to advancing coastal resilience. Earth observation enables real-time monitoring, AI and GeoAI support predictive analytics, and digital twins allow simulation of coastal systems. Together, these tools shift the focus from hazard prediction to impact intelligence, enabling more anticipatory and informed decision-making.

> "The shift we need is from predicting hazards to understanding their impacts—only then can we enable truly anticipatory and effective resilience."
>
> Sanjay K. Srivastava

What are the biggest gaps in current resilience efforts?
Key gaps lie in integrated multi-hazard risk understanding, actionable risk intelligence, and institutional capacity. Despite advances in science, translating data into decision-ready insights remains limited—especially in low-capacity settings.
Strengthening the link between science, governance, and finance is essential for scaling resilience.

What role do collaborations like UNU-Hub (R-SIRUS) and CREST play?
Institutional collaborations such as CREST and the UNU Hub (R-SIRUS) play a critical role in bridging science, policy, and practice, particularly in developing country contexts. They provide scalable platforms to address knowledge and capacity gaps while strengthening the science–policy interface in support of resilience-focused Sustainable Development Goals.
These partnerships enable the co-production of knowledge aligned with policy needs, support capacity development, and foster regional learning across high-risk geographies.
My engagement with the CREST Institute has focused on advancing the shift from hazard and risk assessment to impact-based forecasting and anticipatory action. In cities like Mumbai, this means understanding how hazards translate into disruptions to infrastructure, services, and livelihoods—helping inform more targeted resilience strategies.
Ultimately, such collaborations are essential for moving toward integrated, solution-oriented approaches that can be implemented at scale.

What are your priorities moving forward?
Future priorities include leveraging advances in Earth observation for real-time monitoring, AI and machine learning for predictive risk analytics, and digital twin technologies to simulate coastal systems and test policy scenarios. Integrated data platforms that link hazard, exposure, and vulnerability will also be key.
At the same time, technological innovation must be complemented by stronger regional cooperation for transboundary early warning systems, integration of resilience into infrastructure planning, and inclusive approaches that ensure vulnerable populations benefit from these advances.
The goal is to build scalable, interoperable, and people-centered resilience systems that support both risk reduction and sustainable development.

The Power of Science Is Realized Through the People It Serves

Nia H. René

Dr. Nia H. René leads technology transfer at NOAA through CESSRST, where she works at the intersection of environmental science, community engagement, and applied innovation. A biogeochemist by training, her work focuses on translating coastal and water quality research into practical solutions through partnerships across academia, government, nonprofits, and industry.
She has led national coastal monitoring initiatives for harmful algal blooms at NOAA, while also advancing community-based science programs that connect local knowledge with scientific research to strengthen resilience and environmental stewardship.

> "When science moves beyond the lab and into the hands of the people, it becomes more than knowledge—it becomes a tool for resilience, equity, and change."
>
> Nia H. René

Dr. Nia H. René works at the intersection of environmental science and community engagement, where research is not only measured in data, models, and publications, but in how it reaches people, strengthens communities, protects livelihoods, and builds pathways for inclusion.

Through her development of a national aquaculture phytoplankton monitoring network (PMN), aquaculture operations, ranging from private shellfish growers to university-led hatcheries, gained the tools to monitor harmful algal blooms (HABs). These blooms pose serious risks to shellfish safety and economic stability. By training growers to collect and analyze water samples, this effort not only reduced the risk of contaminated harvests but also strengthened partnerships between the aquaculture industry and NOAA biotoxin researchers. The result was a more resilient, informed, and connected coastal economy.

As the network expanded, so did an important realization: the communities most connected to coastal ecosystems were not always represented in these scientific efforts. Addressing this gap required a shift from delivering science to co-creating it.

Engagement began in Brooklyn through a nonprofit partnership with the RETI Center, supported by her role at NOAA, creating new pathways for participatory science. Residents took part in water quality research connected to kelp farming in Gowanus Bay, gaining insight, through NOAA's PMN and ecotoxicology expertise, into water quality, heavy metal accumulation, and impacts on food safety and environmental health. This work grounded science in everyday realities, linking data to local food systems, environmental justice, and economic opportunity while building hands-on skills and community awareness.

“The true power of environmental science emerges in how it reaches people and strengthens communities.”

Nia H. René

Photo credit: Nia H. René

This wave of engagement deepened when she moved to Charleston, South Carolina, within the Gullah Geechee Cultural Heritage Corridor. The Gullah Geechee community is a culturally rich group of descendants of West Africans who have preserved their heritage, language, and deep ties to coastal fishing and land-based traditions along the southeastern U.S. coastline. She reached out to local organizations and was invited to community-led events to listen. Community leaders, fishermen, educators, and residents shared their experiences navigating the impacts of sea level rise and environmental change on their livelihoods and traditions.

From these conversations emerged a co-created participatory science monitoring program. Dr. René leveraged support from NOAA’s Office of Aquaculture to provide sampling equipment, training, and access to scientific institutions for local youth and aspiring fishermen. Students gained hands-on experience in aquaculture, working alongside Gullah fishermen and visiting research laboratories. More importantly, the program elevated traditional ecological knowledge, ensuring that cultural practices and lived experience informed scientific understanding.

Impact extended beyond data by being present at community events, participating in marine debris cleanups, and cultivating local partnerships with shared goals. NOAA was highly supportive of this type of engagement, and the Southeast Atlantic and Caribbean Regional Team provided her group with resources to host a workshop that brought together scientists, community leaders, and stakeholders across multiple states—centering local voices on aquaculture and coastal resilience while compensating participants for their time and expertise.

The workshop led to tangible outcomes. A local business, Gullah Man Oyster, the South Carolina Sea Grant Consortium, and Dr. René secured $100,000 in funding from the Pew Charitable Trusts. This investment supported an oyster relay project that improved water quality while strengthening the aquaculture workforce, demonstrating how community-driven science can yield both environmental and economic benefits.

Across these experiences, a consistent theme emerges: science is most effective when it is inclusive, collaborative, and responsive to community needs. Positions of influence within scientific institutions carry an opportunity and responsibility to expand access, build trust, and ensure that the benefits of research extend beyond traditional boundaries.

As similar approaches are applied to emerging challenges in the New York City metropolitan area, including flood monitoring and community alert systems, these lessons remain essential. Technical innovation alone is not enough. Lasting impact depends on meaningful engagement, trusted partnerships, and a commitment to ensuring that science serves all communities.

When science moves beyond the lab and into the hands of the people, it becomes more than knowledge—it becomes a tool for resilience, equity, and change.

In Conversation with Nia H. René

Photo credit: Nia H. René

How does your research contribute to coastal resilience?
My work integrates high-resolution environmental monitoring with community-informed data collection to better understand flooding, water quality, and ecosystem stressors. By pairing real-time data with local knowledge, we can improve predictive models and early warning systems, enabling more effective responses to environmental risks.

What challenges did you face in translating science into action?
One of the biggest challenges is that data alone does not drive action—trust and accessibility do. Translating science into impact requires simplifying complex information and making it relevant to people's lives. Strong partnerships can often deliver meaningful outcomes even without new funding.

What role do communities play in resilience?
Local communities are essential. They provide context, lived experience, and long-term stewardship. When communities are engaged as partners, not just participants, resilience strategies become more effective and lasting.

What role does CREST play?
CREST plays an important role in bridging disciplines and preparing students to tackle complex environmental challenges. Its focus on interdisciplinary learning and leadership helps develop solutions that are both innovative and grounded in real-world needs.

How do your solutions support sustainability?
Sustainability is often rooted in nature-inspired approaches. Solutions like green infrastructure and nanobubble technologies draw on natural processes to address contamination while protecting ecosystems and human health, creating long-term resilience.

How can research be better translated into practice?
Research becomes impactful when it is designed with application in mind. This means working across sectors to co-create solutions that are usable, scalable, and accessible. Clear communication and strong partnerships are key.

Photo credit: Nia H. René

Early Career & Student Highlights

Parisa Heidary

Parisa Heidary is a researcher at CUNY CREST working at the intersection of hydrology, remote sensing, and machine learning to connect physical flood hazards with real-world socioeconomic outcomes. As part of the CHARM project, she develops data-driven models that estimate flood-related insurance claims using environmental and socioeconomic data, with an emphasis on bridging Earth observation and community-level impacts. She holds a Ph.D. in Civil Engineering with a focus on Water Resources Management from George Washington University.

Flood data can indicate when and where flooding has occurred, but it does not always capture what those events mean for the communities affected. Parisa's research focuses on addressing this gap by integrating environmental observations with machine learning approaches to estimate real-world impacts, particularly flood-related property insurance claims.

As part of the research and analytical efforts within the CHARM project, and under the supervision of Dr. Mitch Goldberg at CUNY CREST, she is developing a machine learning framework that incorporates a diverse set of inputs. These include precipitation, river discharge, coastal flooding indicators, landcover, topography, and socioeconomic characteristics, alongside National Flood Insurance Program claims data. By combining these variables, the framework captures the compound nature of flooding, where atmospheric, terrestrial, and coastal processes interact to influence damage outcomes.

This work is closely aligned with the concept of coastal resilience. It establishes a direct link between what environmental data and Earth observation systems can measure and the human and economic consequences of flooding. Such connections are particularly critical in coastal regions, where flood impacts are often driven by multiple interacting processes rather than a single hazard.

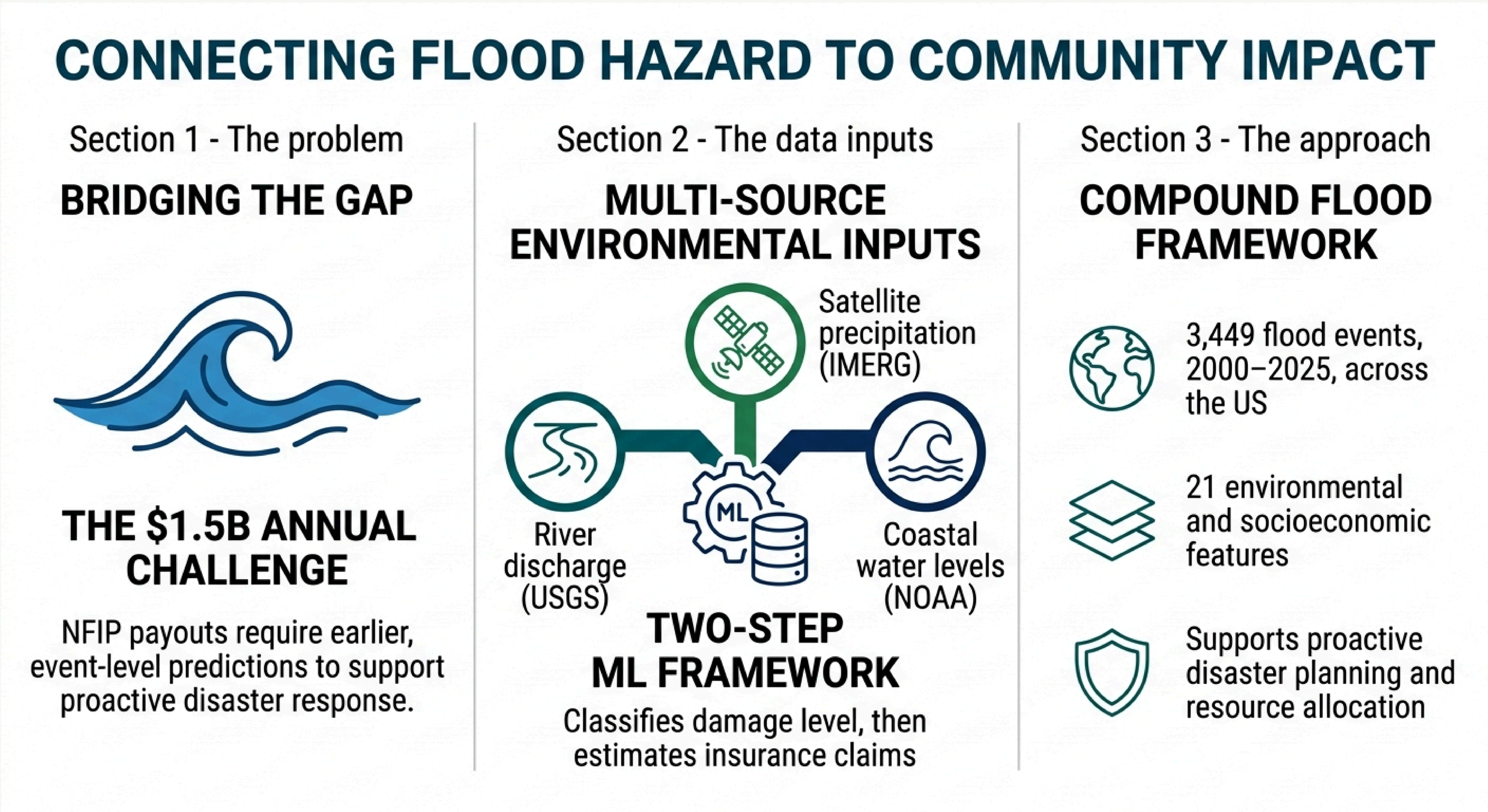


Image: Linking multi-source flood data to community impacts using a two-step machine learning framework

More broadly, this research reflects a central objective of the CHARM initiative: moving beyond data access and visualization toward actionable insight.

Flood losses are shaped not only by the magnitude of environmental events but also by their interaction with infrastructure and exposed communities. By improving the understanding of these relationships, this work contributes to more informed approaches for assessing, preparing for, and responding to flood risk in coastal systems.

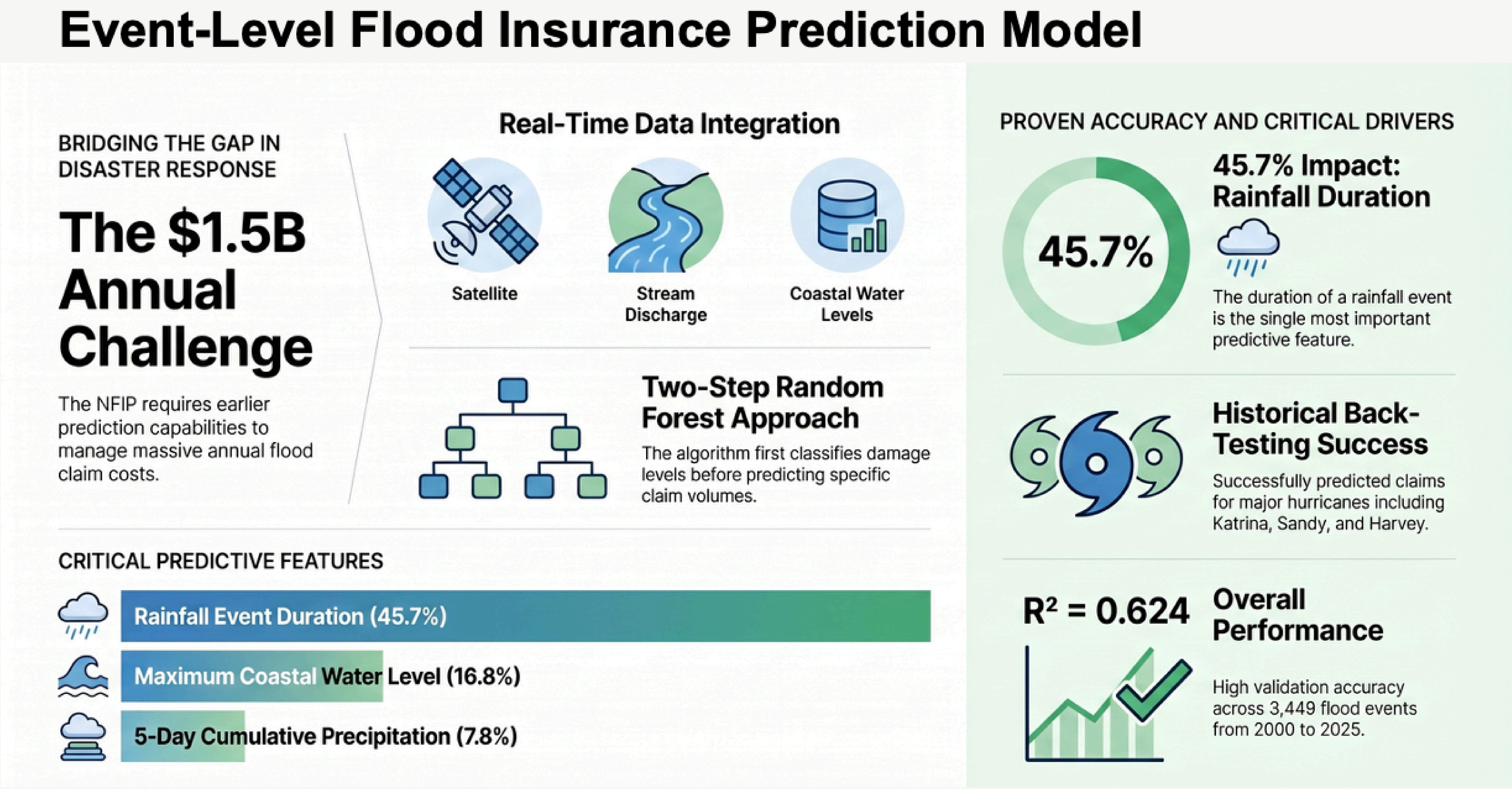


Image: Event-level flood insurance prediction using a two-step Random Forest model with key drivers and strong performance.

Q & A with Parisa Heidary

What is the wider relevance of your research?
Flooding is increasingly well observed and modeled, but there is still a significant gap when it comes to quickly understanding what those hazards actually mean for communities in terms of damage and loss. This research aims to help close that gap by estimating flood-related insurance claims early, before full ground assessments are available. That kind of information can directly support emergency response, resource allocation, and recovery planning. This is especially valuable in coastal areas, where flooding is driven by multiple interacting processes and the physical hazard alone does not always tell the full story of community impact.

What are your next steps or future directions?
A key next step is expanding the dataset to include more historical flood events, improving the model's ability to capture diverse and extreme conditions. There is also a focus on better incorporating socioeconomic and infrastructure-related factors to represent vulnerability more realistically. Longer term, the goal is to integrate this framework with near-real-time data sources, enabling faster impact assessments during or immediately after flood events, moving beyond a model that performs well on paper toward something that can support real decisions when flooding happens.

What is one key challenge you face in your research?
One major challenge is the imbalance in flood data, where extreme events are rare but account for most damages. This makes it difficult for models to accurately capture high-impact events. A model can look good on average metrics and still fail on the cases that matter most. To address this, a two-step modeling approach is used to better represent different damage levels. But ultimately, data availability for severe events remains a key constraint, and in this kind of work, the quality and representativeness of the data are just as important as the modeling approach itself.

What advice would you give to students or early-career researchers pursuing a PhD or career in this field?
Don't be afraid of working between disciplines. Many of the most interesting problems are inherently interdisciplinary, and having interests that don't fit neatly into one field is actually an advantage. Getting comfortable with messy, real-world data early is equally important, since a lot of meaningful research work happens at the stage of making imperfect datasets usable. And finally, seek mentorship from people who understand how research connects to real systems and decisions. Someone who helps you zoom out and see the bigger picture early on can make a significant difference.

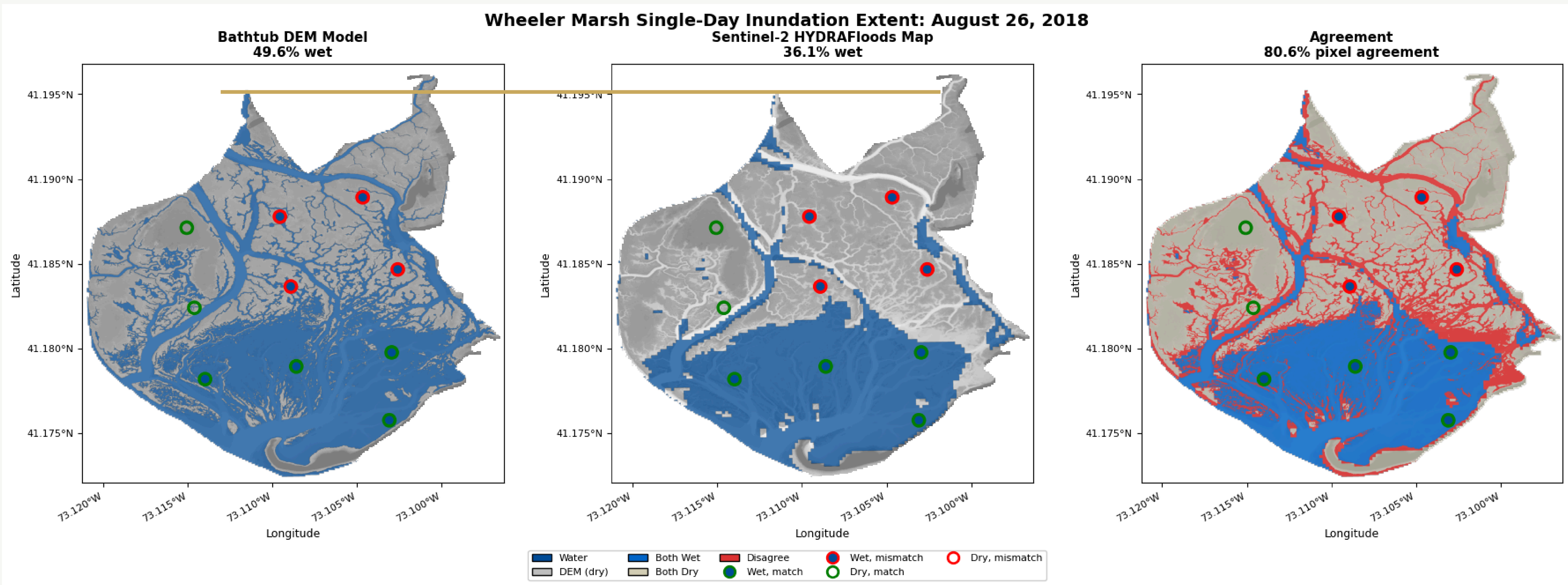
Britnay Beaudry

Britnay is a current graduate student earning her MSc in Earth and Atmospheric Science here at CCNY, with the plan to start her PhD in Earth and Environmental Science at CUNY Graduate Center this fall. After completing a Bachelor of Science from UMass Amherst, she spent 4 years as part of NASA's DEVELOP and ARSET programs, creating water quality tools for project partners and leading trainings for utilizing Earth-observing datasets. During her time at CCNY, she was selected as a recipient of NASA's FINESST grant, where she links remote sensing of flood risk and extreme inundation events to satellite observations of key coastal hazards. In her free time, Britnay can typically be found getting yet another iced latte at Cafe One near campus.

Britnay's research connects satellite observations of flood extent and storm events to downstream coastal hazards such as impaired water quality, eutrophication, and harmful algal blooms. These hazards have real consequences for both ecosystem and human health, so improving the ability to monitor them on a large scale is essential to managing coastal systems. To do this, she uses SAR imagery from Sentinel-1 alongside optical imagery from Sentinel-2 and Landsat to map inundation patterns in the land surrounding Long Island Sound. Datasets are processed through HYDRAFloods, a flood detection tool developed by NASA's SERVIR-Mekong program, allowing her to compare how different sensors capture the same events. This work is funded through NASA's FINESST program and is conducted in collaboration with her advisor and mentors at CCNY's Bio-Optics Lab and at the USGS.

When storm events or tidal fluctuations push water into marshland, that water eventually drains back into the Sound, carrying sediments, nutrients, and other constituents that can measurably impact the health of the watershed. By pairing flood maps with water quality data, her research helps us understand those connections more precisely. It also surfaces something important about the tools themselves: different satellites have very different characteristics, including spatial resolution, temporal frequency, and sensitivity to surface conditions, and those differences directly affect how reliably we can track flooding over time. Understanding where our observational tools succeed and where they fall short is just as valuable as the science they enable.

Image: Inundation comparison at Wheeler Marsh (Aug 26, 2018)—DEM bathtub model (left), Sentinel-2 HYDRAFloods extent (center), and pixel-level agreement (right).



Q & A with Britnay Beaudry

What is the wider relevance of your research?

My work links land-surface flooding to downstream water quality impacts, affecting fisheries, recreation, and public health. The satellite-based methods are scalable to other coastal systems, especially where field monitoring is limited. With increasing storms and sea-level rise, such flood monitoring frameworks are critical for informed coastal management.

What is one key challenge you face in your research?

A major challenge is data timing—satellite overpasses often miss key flood events, and cloud cover limits optical data. While SAR helps overcome clouds, it introduces complexity in marsh environments due to vegetation and soil moisture effects.

What are your next steps or future directions?

I'm extending this work to water quality, examining how flooding affects chlorophyll-a, CDOM, and turbidity in Long Island Sound. I also plan to integrate new sensors like NISAR for improved detection in vegetated areas. Long term, I aim to apply this framework across diverse coastal systems.

What advice would you offer to students?

Embrace uncertainty—remote sensing involves constant troubleshooting and learning. Treat unexpected results as opportunities. Also, value communication and training; enabling others to use these tools expands the impact of your work.

CREST Project Highlight

From Climate Data to Coastal Resilience: Translating Earth Observations into Actionable Intelligence through the CHARM Initiative

Coastal regions are increasingly shaped by the convergence of climatic, oceanic, and urban pressures. Rising sea levels, intensifying precipitation, and expanding built environments are altering the frequency and impact of coastal flooding. Addressing these challenges requires not only advances in scientific understanding but also improved access to climate information that can inform decision-making across scales.

The Climate Hub for Analytical Research and Monitoring (CHARM) initiative responds to this need by rethinking how large environmental datasets are accessed, analyzed, and applied. Developed through a collaboration between The City College of New York and San Diego State University, CHARM brings together expertise in Earth observation, climate science, and statistical modeling. The initiative is led by Mitchell Goldberg, Chief Scientist at the CREST Institute at The City College of New York, and co-led by Sam Shen, Distinguished Professor of Mathematics and Statistics at San Diego State University.

At its core, CHARM builds upon the extensive climate data archives maintained by NOAA's National Centers for Environmental Information. These datasets, which span multiple decades, provide critical records of atmospheric, oceanic, and terrestrial processes, but their scale and complexity often limit their use beyond specialized research communities. CHARM addresses this gap through the development of an integrated framework, iCHARM, designed to make climate data more accessible, interpretable, and actionable.

The iCHARM dashboard enables users to explore and analyze climate, hydrologic, coastal, land-surface, infrastructure, and socioeconomic datasets in an interactive environment, supporting applications ranging from pre-event risk assessment and real-time disaster response to post-event recovery and long-term planning. Its potential use cases extend across sectors, including insurance and reinsurance, real estate, urban planning, and disaster preparedness.

By reducing technical barriers and enabling interaction with climate data through intuitive platforms, iCHARM broadens the range of users who can engage with environmental information, helping connect national-scale data resources with local and regional decision-making processes.

Images 1 and 2 illustrate examples of the iCHARM interface, highlighting global temperature anomalies derived from satellite observations and the Global Historical Climatology Network. These examples demonstrate the platform's flexibility in working with different data sources. Users can interact with datasets, select regions or time periods, and generate statistics such as time series analyses (Image 3), showcasing the broader potential of iCHARM for exploring complex environmental data.

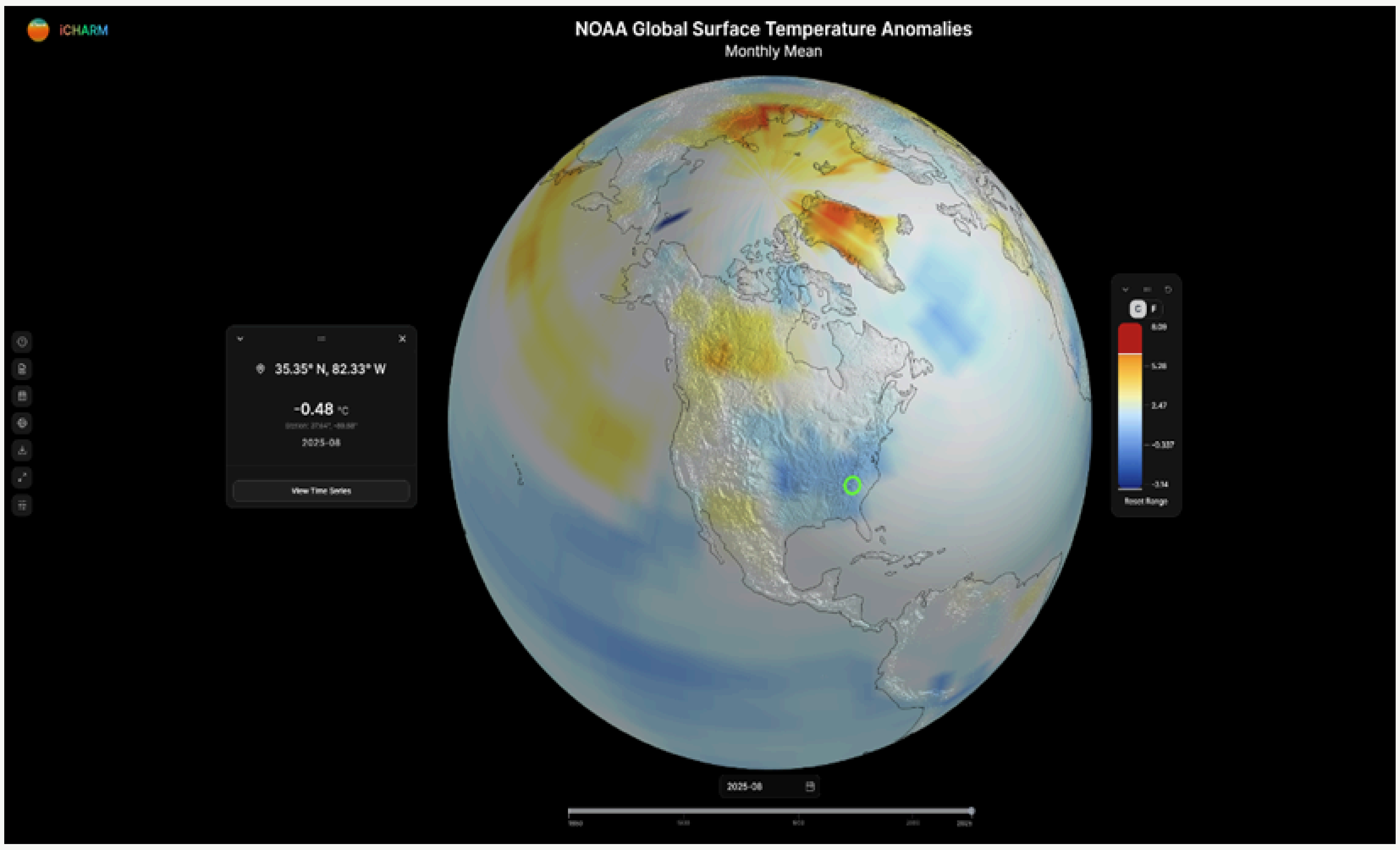


Image 1: Global surface temperature anomalies (NOAA, monthly mean) visualized through iCHARM

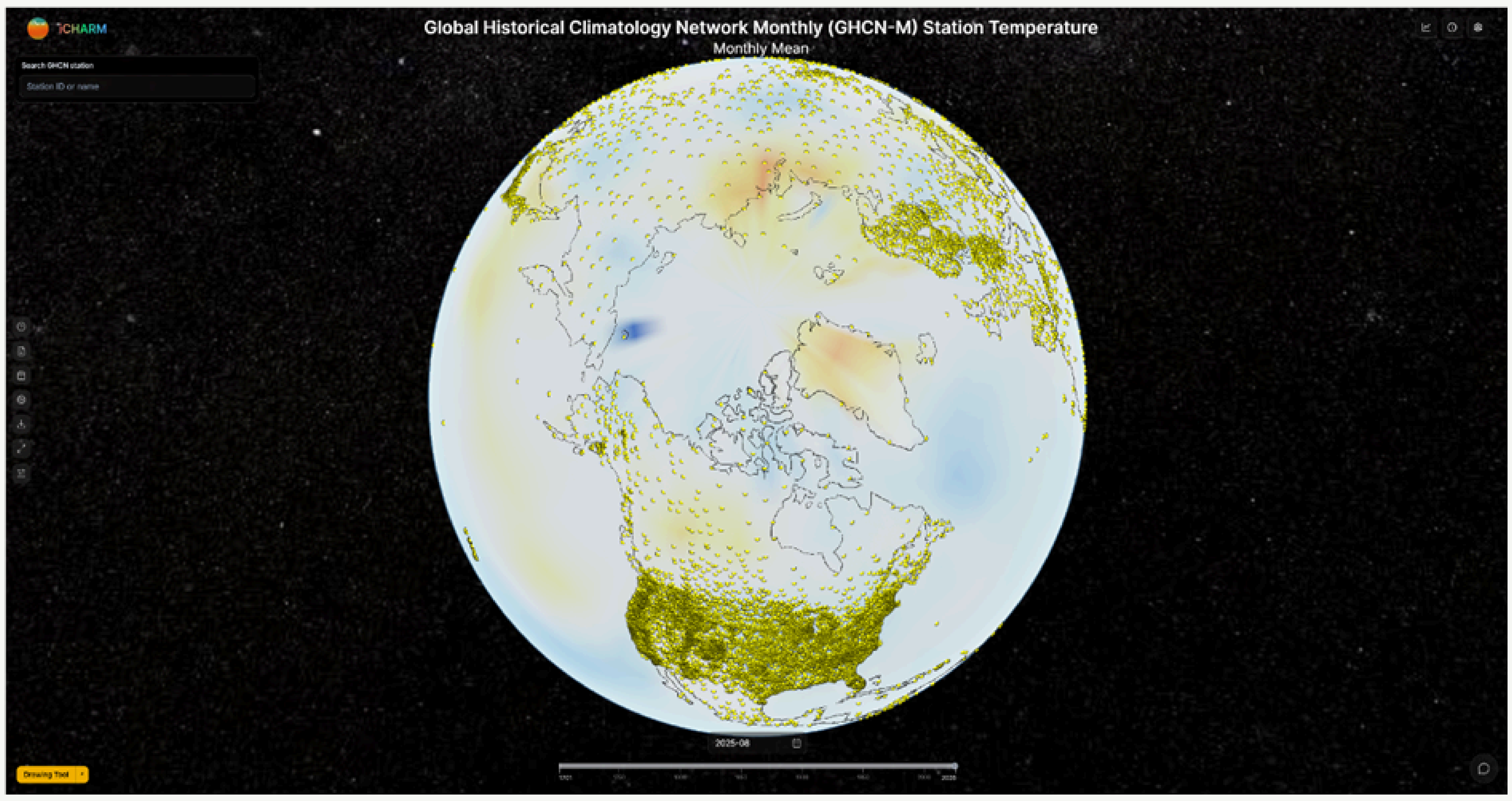


Image 2: Global GHCN-M station temperature data (monthly mean) visualized in iCHARM

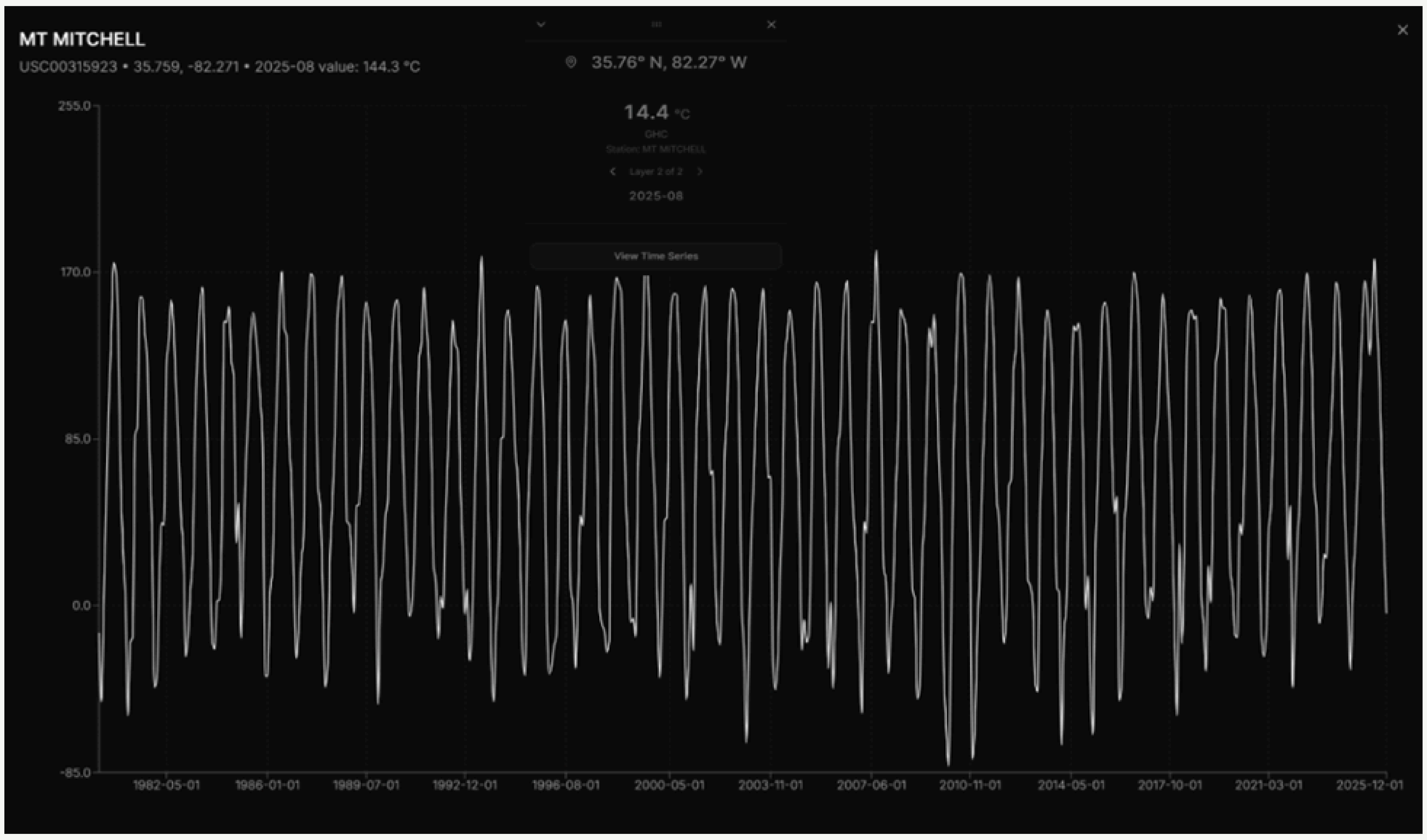


Image 3: Time series of monthly temperature variability at Mt. Mitchell (GHCN-M)

As part of the CHARM initiative, a flood insurance prediction model was developed to provide advanced analytical tools that move beyond simple data access and visualization toward assessment of real-world impacts. The model predicts event-level flood insurance claims to support disaster response planning and resource allocation, drawing on a dataset of 3,364 flood events spanning 2000–2025 across the contiguous United States and a set of forecast and environmental input features (Image 4).

Claims are grouped into progressively higher damage categories: Level 2 representing lower but still meaningful damage (100–999 claims), Level 3 representing moderate damage (1,000–9,999 claims), and Level 4 representing the most severe cases (10,000+ claims). Level 1 events (<100 claims) are excluded here but will be incorporated in future iterations. The differing sample sizes across categories are consistent with the structure of real-world loss datasets, where lower-damage events are more common than extreme cases.

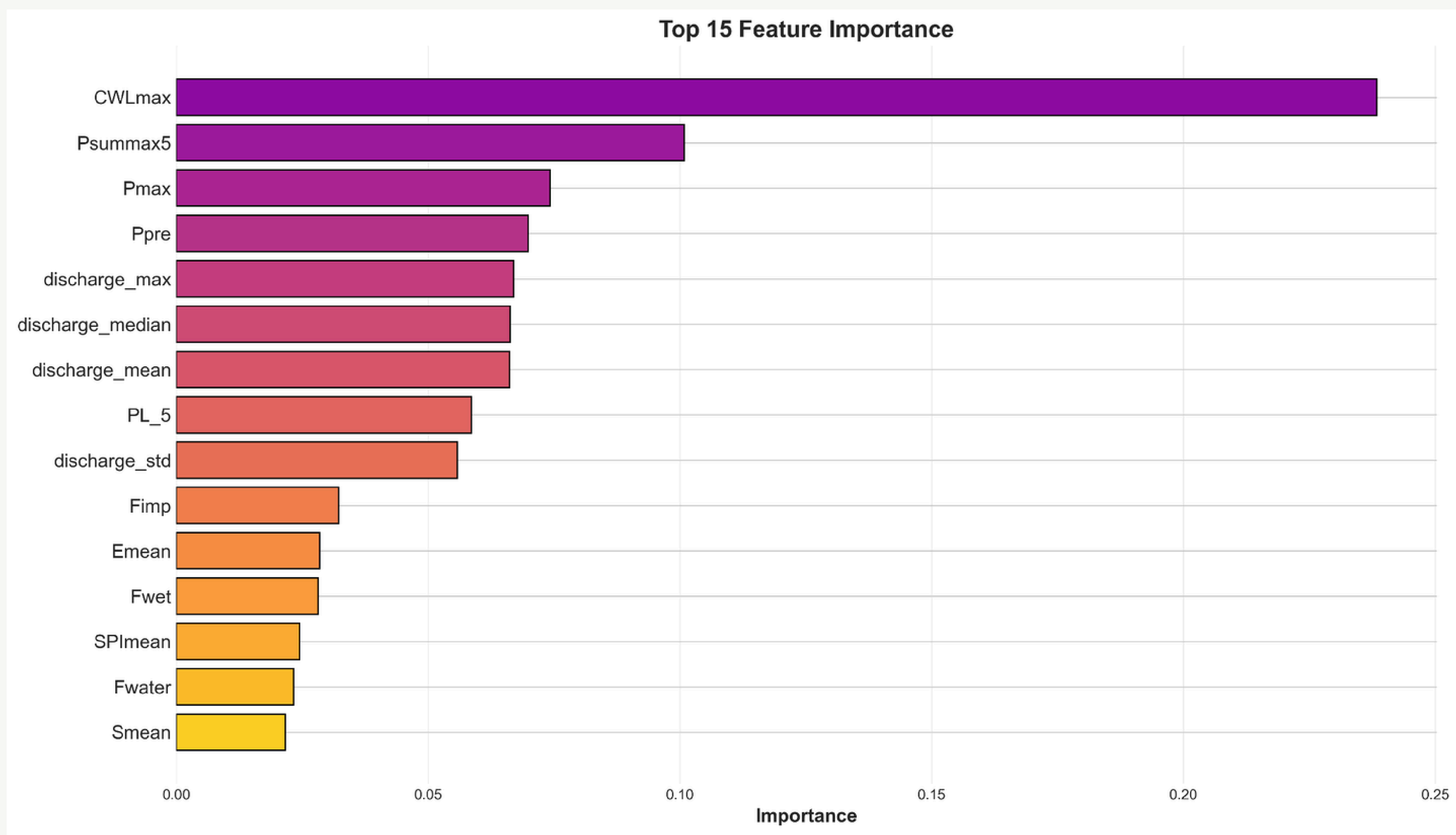


Image 4: 10 most important features. Coastal water level and precipitation features are dominant.

The predictive inputs represent the kinds of environmental conditions that shape flood risk in coastal settings. Coastal water-level information captures the marine contribution to flood risk, which can strongly influence inundation in low-lying zones. Rainfall variables characterize the magnitude and intensity of hydrometeorological forcing. Land-based features represent how water moves across the landscape, including runoff, ponding, and localized accumulation. Considered together, these variables reflect the compound nature of flooding, where atmospheric, terrestrial, and oceanic processes interact to produce damage.

Image 5 illustrates model performance across the 3,364 events, showing how predicted claim levels compare to observed outcomes. The results highlight both the potential and the current limitations of the approach, providing a useful baseline for a dataset of this size and diversity.

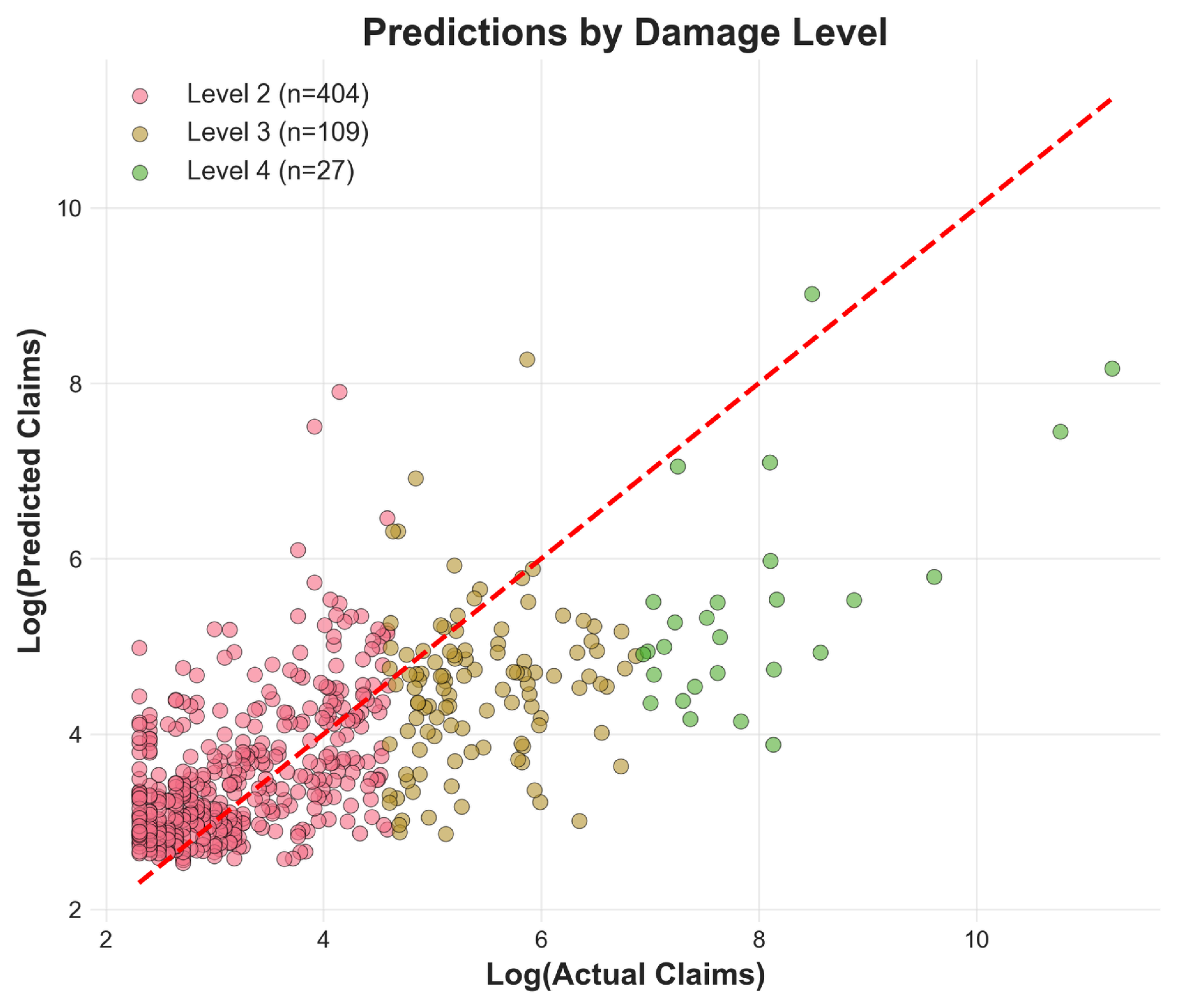


Image 5: Comparison of predicted flood claims (iClaim model) versus actual flood claims

More broadly, this analysis reflects a core goal of the CHARM framework: connecting environmental intelligence to societal consequence. Insurance claims are not triggered by hazard alone; they arise from the interaction between a physical event and the built and human environment exposed to it. By linking forecast and environmental features to insurance-claim outcomes, iCHARM helps organize climate and Earth observation data in ways that are directly relevant to coastal resilience, risk, and loss.

Toward Integrated Coastal Resilience

CHARM contributes to an evolving approach to climate science in which observation, analysis, and application are more closely aligned. By combining long-term climate records with analytical tools and predictive methods, the initiative supports a transition from retrospective analysis toward more anticipatory forms of planning.

This capability is particularly relevant in coastal regions, where timely and informed decisions can significantly influence outcomes. The integration of environmental data with socio-economic and infrastructural information enables more grounded assessments of where vulnerability is concentrated and where resilience can be built.

In this sense, CHARM is not simply a data platform but part of a broader effort to translate Earth observation into actionable knowledge. As sea levels rise and storm patterns shift, such approaches will play an increasingly important role in supporting informed and adaptive responses along the coasts most exposed to change.

LOOKING AHEAD........

Water, Intelligence and the Urban Flood Crisis

Science, Community, and the Future of Resilient Cities: When Science Meets the Streets

Our next issue turns its lens on one of the most urgent and complex challenges facing our cities around the world - **WATER**!

From the streets of New York to vulnerable urban communities across the globe, the intersection of aging infrastructure, intensifying storms, and rising seas - we will focus on it all.

The Chronicle's second issue will bring together the voices of leading researchers from within CREST and across its global network to explore how science, emerging technologies, training the next generation and community well-being are converging to confront this crisis - head-on!

Some questions we will address include: What do residents experience when the water rises? What do leaders need that researchers are not yet providing? How do we close that gap and break silos?

These questions will shape our next issue and we hope it will spark the conversations that our cities, our communities, and our nation urgently need!

Stay tuned. We will be back soon.

CREST Chronicle

Advancing science. Connecting communities.
Shaping resilient futures.

The City University of New York Remote Sensing Earth System Institute, widely known as CUNY CREST, is a leading hub for research, education, and innovation in Earth system science, with a strong emphasis on remote sensing. Founded in 2010 as a sustainability initiative to institutionalize nearly a decade of NOAA-funded Earth system science, CREST has grown into a multidisciplinary institute at the intersection of remote sensing, atmospheric science, environmental engineering, and social science to address challenges from New York City to the global stage.

CREST operates across five intersecting strategic pillars: Research & Applications, Education & Training, Community Resilience & Stakeholder Engagement, Entrepreneurship, Innovation & Ventures, and International Collaboration. Through these core pillars, CREST prepares the next generation of scientists while advancing solutions that inform policy and practice.

From City College to the world, CREST connects science with society and demonstrates that impactful research can emerge from and serve diverse urban communities.

CUNY CREST SCIENCE & TECHNOLOGY TO SUSTAIN THE EARTH

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