Episode 3: Flooding Featuring Philip Orton (PO)

Hosted by Helen Cheng (HC)

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The sea can be calming but never underestimate it. Fueled by unstable air and moisture, strong storms are created. Strong winds blow; waves crash; water overwhelms the land. Respect water's strength and power. Welcome to Jamaica Bay.

-Music Interlude-

You're listening to Jamaica Bay, a podcast series bringing you stories of the people that work, live, and play in Jamaica Bay, New York City. I'm your host, Helen Cheng. And I'm from the Science and Resilience Institute at Jamaica Bay and New York Sea Grant.

-Music Interlude-

Water influences the lives of New Yorkers every day, especially those living on the edges of Jamaica Bay. While water can be gentle, around 100 miles of the shorelines of Jamaica Bay – inhabited by structures like sea walls, and behind those, communities – water can overwhelmed the land.

PO: "There has been a problem with flooding around Jamaica Bay and there's many places that flood - some streets that flood, at least some parts of them - every month, every spring tide or nearly every spring tide. And then maybe once a year, there are also neighborhoods where the streets actually get water on them, maybe a foot deep, you know not necessarily impacting homes but this is gradually been coming up because of sea level rise, there's been a slow rise in these floods over the past few decades."

I had the opportunity to chat with

PO: "Philip Orton; I'm a research assistant professor in physical oceanography at Stevens Institute of Technology in Hoboken, New Jersey."

Philip Orton studies the movement and forces of water. He has worked in dozens of estuaries across the country, from Willapa Bay in the U.S. Pacific Northwest to Winyah Bay in the U.S. Southeast, and currently in New York waters. But he does his research in an interesting way.

PO: "I spend a lot of time working in front of a computer, studying the ocean and estuaries. And my specialty is with computational modelling, so trying to recreate aspects of, mainly the physics of the ocean and estuaries in a computer."

I asked Philip, what modelling is.

PO: “Sure, water is one of the more predictable things on the planet, unlike things like economics or climate as a matter of fact; it’s relatively well predicted. So we know about how forces lead to movement of water, and there’s some complexity there but it is something that’s fairly well understood going back many decades if not centuries even.”

That’s true. We know that water rises and falls at specific times of the day, every day. Known as tides, they are caused by the gravitational force of the moon and the sun and by the rotation of the earth. We know the movements of the solar system which then influences the tides, therefore changes in tide height and time are predictable.

PO: “So a computational model of water movement is used to predict how the forces on the water lead to the velocity of the water, the movement of the water such as tides, or waves - wind-blown waves, how the wind blows up waves on the ocean; those are some of the kind of things that we can predict, and using a computer model is kind of a very detailed way of doing it where you create a miniature version of the ocean in a computer code that has many aspects of the ocean, and it can take a super computer, it can take a lot of effort.”

There are a lot of concerns with flooding in the communities surrounding Jamaica Bay but Philip is utilizing the predictability of water and his modelling expertise to help.

PO: “My work has been mainly on flooding, storm surge, tides, and how they can create flooding, and sea level rise also, so looking at how these things will change in the future. And actually I’ve done a lot of work looking at the past, and how things have changed in terms of landscape and tides and storm surges and sea levels over the past 150 years or so.”

I took the chance to interject with a common question I get from people I encounter at work:

HC: ‘So you mentioned this term, “storm surge;” can you can explain that in terms of waves?”

PO: “Sure. A storm surge by definition is the wind-blown, storm-driven increase in water level at the coast. That’s mainly driven by wind, it can also be driven by differences in atmospheric pressure - if there’s very low atmospheric pressure during a storm, which is typical, then the sea rises up a little bit more. And then also wind-blown waves can also drive up water levels a little bit. But the main driver of storm surges is the wind.”

Storm surge is different being tossed by a wave. it’s the abnormal rise in seawater levels, typically happens during strong storms or hurricanes; during these times, water is pushed up onto the shore and can be extremely tall, powerful, and dangerous.

With his work in computational modelling, Philip is looking at how water moves and examining the threat of flooding from storm surges, rainfall, and sea level rise to coastal communities surrounding Jamaica Bay. He has also created tools to help forecast flooding in local areas and demonstrate how the added threat of sea level rise will impact storm-driven flooding.

HC: “So all these things you have to model together: how water moves, the land, how wind drives the water (PO: “True.”), is that really difficult to balance all of these factors?”

PO: “It’s not easy, I mean I’ve spent this whole weekend working on this kind of stuff so it’s not a 9-5 job on a computer unfortunately; not my average weekend. (HC: “I imagine it’s frustrating.”). I mean it is complicated and difficult but I feel like at the same time, I enjoy doing work that impacts society and this work has a little bit of a creative process in it too and I enjoy that. But yea, there’s a lot of tedious work with developing computer models and making sure there accurate before you trust them. But it’s not so difficult.”

Philip explains that while the movement of water is predictable, the natural environment has lots of randomness and uncertainties, for example the weather.

PO: “And so sometimes we’ll not just run the model with one wind-forecast for storm surge but we’ll run it a hundred times with a hundred different wind forecasts that try to represent all the randomness of the weather. Increasingly scientists are getting smart to that, providing an uncertainty by putting all the uncertainty into their predictions and not acting like that there’s only one possible future”

HC: “So thinking about the uncertainties first before kind of what you hope the results would be or what you hypothesized.”

PO: “Right, you don’t want to get too caught up. And so with my computer modelling of something hypothetically, I’ll try to understand the theory behind why it works and look at it from that angle, I’ll use the computational model and look at it from that angle, I’ll also try to use someone else’s computational model that’s set up differently and there are different models that have different formulations. And so you do want to try, and I should do it even more than I do, but you do want to try to get many different perspectives on the same question.”

Philip doesn’t spent all his time in front of the computer; he has gone out to experience the Jamaica Bay.

PO: “I went striped bass fishing on a charter boat once with a couple of friends, and that was a lot of fun. I don’t think I ever caught a fish in my life; I’ve lived on water all my life and anytime I picked up a fishing rod, I think I was the least gifted, or the least patient person at fishing. But they basically, on these charters, they caught menhaden with a net and used them as bait and basically the striped bass would swallow them whole and then you’d have the striped bass on your hook and it was pretty fool proof (HC: “That’s awesome.”). And they handed you the rod, and immediately, the first time the guy handed me the rod, boom! I got a hit and pulled up the fish.”

HC: “How big was the striped bass?”

PO: “I don’t know, couple feet long. I mean they’re really big fish, so that was a lot of fun.

“I mean beyond that though, I’d say, since I’m kind of a people person in addition to being a computer person, and I spend so much time in the office and in front of a computer and working with numbers, probably my true most significant experiences around Jamaica Bay have been going to events around the bay with Rebuild by Design, with Science and Resilience Institute.”

With his models and ability to provide numbers to questions, Philip can start to address management challenges that would influence entire communities with the risk of coastal hazards.

PO: “I think when it comes to answering questions about adaptation to hazards like flooding, like climate change, like sea level rise, I think there are a lot of opinions, and a lot of people who advocate for things, but there often haven’t been a lot of quantification of the different alternatives. A good example of that are wetlands. Everybody wants to see wetlands restored in the bay and wetlands serve a lot of positive functions such as with ecosystems and fish. And at the same time we found all along that wetlands in the center of the bay don’t reduce the storm surge, driven water levels, and flooding of neighborhoods around the bay and we found that with a few different studies. What they can do however, and we’ve quantified also, is that they can reduce wave heights. And that’s one thing that I came into this whole conversation around Jamaica Bay with the tools to address quantification. And so one thing that I’m really happy I can help to do is try to provide numbers on things.”

-Music Out-

PO: “I’ve been at events around the bay where there have been a lot of people, and a lot of locals. Just hearing people’s stories and actually seeing people, and learning about different kinds of people around the bay. Because there are so many people and it’s such an important bay in terms of a big population, hundreds of thousands of people who live nearby and it just, I don’t know, it always just kind of warms my heart to meet all the different people who are interested in the bay.”

-Music Out-

Many thanks to Philip Orton.