



Understanding flood - from research to risk assessment

Matthew from Instech is joined by Fathom's Chief Operations Officer Dr Andrew Smith and Chief Research Officer Dr Oliver Wing to discuss the creation of its US flood model and how Fathom evolved from a university research project into a successful commercial product.

You can [listen to the podcast here](#), or can read the full Q&A below.

INSTECH LONDON CII ACCREDITED CPD

PODCAST 130

DR ANDREW SMITH & DR OLIVER WING

FATHOM

UNDERSTANDING FLOOD - FROM RESEARCH TO RISK ASSESSMENT

Matthew: Fathom was formed back in 2013 out of a research project at the University of Bristol. What was the motivation for turning that project into a company?

Andrew: The motivation was interest from the insurance market. I sat next to my fellow co-founder Chris Sampson in our PhD office as we were both building computational flood models for our PhDs. Chris's PhD was funded by Willis and through those connections, we began to engage with the insurance market.

Insurers were telling us that what we were developing from an academic perspective was interesting to them. Some of the bolder ones even said they would licence the models if we made them, so that's what kickstarted it.

Matthew: Ollie, Fathom was still an early-stage company when you joined. What was it that gave you the confidence to join Andy and Chris?

Ollie: It was a natural progression in many ways. I studied in the research group that Fathom spawned from and Fathom directly funded both my PhD and my postdoctoral research.



Generally, academics have to choose between going into industry or remaining in academia, but I could do both with Fathom. The research output from our company rivalled, or frankly exceeded, most universities that were studying this sort of thing. I could have the best of both worlds here.

Matthew: Can you give us a definition of the different types of floods and the impacts they have from an insurance perspective?

Andrew: The primary forms of flooding that insurers are interested in because they are the most frequent, are climate-driven events. These are principally flash flooding, which involves intense rainfall over short periods; fluvial flooding, where rivers drain, fill up and then overtop, and coastal inundation, which includes extreme tides or even storm surges from hurricanes.

There are other mechanisms for flooding like tsunamis and even dam breaks. We have undertaken some preliminary efforts to do dam breach scenarios, but principally we're focused on the climate-driven forms of flooding.



Matthew: What does Fathom provide for insurers to help them make decisions within their businesses?

Andrew: It takes two principal forms really, the first being hazard information. Fathom provides hazard layers and we can provide hazard data anywhere in the world. We're also building catastrophe models that move from hazards through to plausible event footprints and vulnerability, so we're transforming the hazard into an estimate of loss. We use the Oasis Loss Modelling Framework as well, so instead of just hazard, the insurer gets an estimate of loss out of the end of the cat model.

Matthew: So you're taking the benefit of being able to access research data and really understanding it through the flood model, then linking to partners to provide the data in a way that's easy to consume and use?

Andrew: Yes, flood models are very difficult things to consume. The nature of the peril itself is very spatially complex and the models can become very large, so we work with partners like Nasdaq to make them easily accessible.

Fathom is a team of flood risk scientists and we know how to build flood models really well. The thing we didn't have experience of until a few years ago is how to build cat models and



the infrastructure insurers need to get the answers they want. The Oasis framework provides that and enables us to build the cat models.

Matthew: Fathom is one of the providers on the Nasdaq Risk Modelling for Catastrophes platform. How important is that platform to what you're trying to do?

Andrew: People like Nasdaq are providing platforms that Oasis can be easily consumed with. Our US flood model, for example, is over a terabyte in size, so providing that in a way that's quick and easy to consume is very difficult. Nasdaq is achieving that and will be key to our success over the next few years.

Oliver: Being able to interact with this data is just as important as producing it. The existence of the Oasis framework, and other companies who essentially bring the data to life, has been crucial in commercialising this product. It's all very well producing the models, but we have to get that data into the hands of people who can make use of it. That's what partners like Nasdaq provide.

Matthew: Producing a flood model covering an area the size of the US is very difficult. How has Fathom, as a relatively small company, achieved what larger organisations have struggled to do?

Andrew: That speaks to the heart of our philosophy as a modelling organisation. In the beginning, we set out to build models, not just of the US but of anywhere in the world. To do that, we had to change our perspective on how we built those models. Building models in a local way and spending a lot of hours on specific parts wouldn't achieve a comprehensive model of somewhere like the US, and definitely not for the whole planet.

The best evidence we have for this is the FEMA Flood Hazard catalogue. FEMA has been trying to build comprehensive models for the US for decades and they've spent over \$10 billion on small scale models. Our frameworks are in many ways semi-automated. The models build themselves to an extent and they're designed to be deployable anywhere in the world.

The other benefit of building models in the US is that it's a great place to test methodologies. The accuracy and precision of the models improves with better input datasets and there is a lot of data available in the US to validate the models. Our latest validation exercises indicate that our models are accurate in the US and we can largely replicate datasets that have previously cost billions of dollars to produce.

Matthew: The US government is opening up flood insurance into commercial markets through its National Flood Insurance Programme (NFIP). What's changing and how is that driving interest in your model?

Oliver: The NFIP has historically been an insurance provider managed by the government. If it was a private organisation, it wouldn't be solvent and so in recent years it's opened up to the private market. The regulations are if someone lives in a flood zone with a federally-backed mortgage, they have to get insurance and historically it's only been provided by the government.



Now the private market is stepping in, insurers want to accurately price insurance using data that isn't limited in terms of coverage and scope. A new model like ours, with complete coverage of all rivers for instance, offers a step-change in the understanding of US flood risk that the private market can use to inform the high rate of penetration that we hope will now happen.

Matthew: The flood itself is the hazard, but it's also very important to understand what happens when water goes through the front door of a building. How are you building vulnerability models and what's important to consider when using one alongside a flood hazard model?

Oliver: That translation into economics doesn't always receive as much attention as the physical modelling. We can have a model with one-metre resolution, but if we don't know how an event impacts losses to buildings, then the model's relevance for insurers is questionable.

Previously, the prevailing source of information for informing flood vulnerability in the US is depth damage curves developed by the US Army Corps of Engineers and the Federal Insurance Agency. Those curves were developed from flood event data points in the 1990s, rather than using full breadth of flood insurance information, principally in the form of claims, that we now have access to.

We have access through our academic ties to that fuller database, which also contains measures of flood depths. Using the two-and-a-half million data points from claims made across the NFIP's history, we can understand empirically what the impact of flooding on building losses is and essentially construct vulnerability functions directly from that.

Matthew: Can you share any examples of what Fathom's data is showing that wasn't previously known?

Oliver: We generally find that the traditional curves provided by the Army Corps systematically overestimate how much damage shallow floods can do. Models based on those curves generally report a higher risk than the empirical data would suggest.

The other point we've found is that the relationship between flood depth and damage, even for similar types of buildings, is enormously variable. A metre of floodwater in a one-story residence for event A could be wildly different to one for event B, or in location A versus location B.

Rather than essentially besmirching that uncertainty by having single deterministic functions, we embrace it. We model that uncertainty as part of the risk and that is what we want clients to understand.

Matthew: Is there a difference in vulnerability between different types of flood? Does it depend on how long the water is around for?



Oliver: It does and we see this borne out in the empirical claims data. Our research shows that coastal floods of a given depth, because of their velocities and saltwater content, are more damaging than fluvial floods.

Fluvial floods are generally more transient and involve more clean water, so we're starting to see a lot of intuitive variability on that front.

Matthew: What about globally? Are you starting to see regional variations in vulnerability?

Oliver: It's a question we'd love to be able to answer, but data scarcity is a problem. We can build a flood model for the US because of all the claims information we have to define vulnerability, as well as the physical flood modelling variables like river gauges and terrain data. We simply haven't got much data on the difference in vulnerability between the US and Africa, or Southeast Asia.

It's something that isn't going to be addressed anytime soon, but as insurance penetration expands across the world, claims will hopefully be collected in a way that helps us inform that.

Matthew: Google was one of Fathom's early clients. Can you talk about what you did with them and other clients that helped you get started?

Andrew: We started out working on projects for the World Bank to build models in data-poor areas. Google then gave us some grant money to work on its Google Earth Engine platform. Their team recognised that we were trying to build something quite innovative and gave us a sizable grant to explore those ideas.

We also got a grant from the UK government, specifically from the Natural Environmental Research Council, allowing us to sit within the university, build some prototype models and engage with the insurance market. That funding served as what's traditionally called seed round funding for new companies. It meant we didn't have to go out and sell the idea of Fathom to fundraisers and could focus on building technology, so a big thank you goes out to both organisations.

Matthew: You've now got several well-respected, well-known insurance companies working with you. Can share more about what you're doing with people in the industry?

Andrew: The insurance market has been really important for us and is still our principal focus. Even early on, organisations like Canopus were willing to take a bet on us producing good datasets and we've had a long and fruitful relationship with them. Our insurance clients are growing all the time. We work with Hiscox, Aon, Sampo, Chaucer, and more will join that list.

The encouraging thing we've seen in the last few years is that the demand for this kind of data and these models goes far beyond insurance. The data we produce is interesting for anybody interested in climate risk and we licence data to organisations across multiple sectors. Microsoft licences all our global data and uses it for internal exposure management. We licence all of our data to organisations like the World Bank and they have



global coverage from Fathom. We also licence data to engineering companies who use it for the screening of sites.

We're also working on forecasting models and we recently worked with the UK Government to provide rapid response to events, with our data being used by emergency responders on the ground.

Matthew: It's an impressive client list. What recommendations or advice would you give to others in the early stages of building a company?

Andrew: I would stress more than anything, to just focus on the technology. If a company focuses on building good products, then clients will come. We didn't really focus on anything else aside from building really good models and we ended up with long-term clients. Focusing on the technology is, for me, the most important take-home point.

Another simple piece of advice would be, get some advice. We were really lucky in that after we left the university, we moved immediately to a tech incubator space. It was an office environment that not only provided us with desks but also the support people need when they're forming a company. We got lots of hands-on advice from successful entrepreneurs and that was important early on.

Matthew: We're delighted to have you as a corporate member of InsTech London. It would be great to hear what led Fathom, as an early-stage company, to commit to joining us.

Andrew: We're delighted to be part of InsTech London. Technology in the insurance sector is driving innovation across multiple sectors, particularly in the catastrophe modelling world.

InsTech is providing a showcase for that innovation. It's great for us because we can keep up with what's going on in the market, and it allows us to tell others about what we're doing as well, so keep up the good work.