



WADING INTO Uncertain Waters

As maps and models advance to give the industry a better understanding of flood risk, insurers consider dipping their toes in the U.S. flood market and increase their efforts to improve flood resilience around the globe.

by Kate Smith

Hheavy rains began to fall across South China in the middle of last June. Floods spread through seven provinces, affecting 3.7 million people, displacing 197,000 and collapsing 10,500 homes.

And that was just in the first week.

By the end of the summer, flooding along the Yangtze River basin had caused more than \$28 billion in economic losses in southern and eastern China, while flooding along the Huai River in northeastern China caused an additional \$4.7 billion.

At the same time, halfway across the globe, prolonged summer storms dropped 20 inches of rain

in the greater Baton Rouge area of Louisiana, causing historic flooding and leaving behind an estimated \$10 billion to \$15 billion in economic losses.

“When you get these record-breaking rainfall amounts associated with a storm, the flooding that relates to that precipitation event is catastrophic,” said Jackie Noto, a flood risk expert with RMS.

Flood events are wreaking havoc around the globe. According to Aon Benfield, flooding has been the costliest peril for four straight years. In 2016, it accounted for \$62 billion of the \$210 billion in global disaster-related economic losses.

Yet despite its heavy economic toll, flood remains one of the most underinsured perils. There was a total of \$12 billion in global insured flood losses last year,

AP Photo/Chen Zhiyong

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**STORM AFTERMATH:**

Cars half-submerged by floodwater caused by heavy rain in Wuhan in central China. The storm that began on June 30, 2016 caused floods, hail and landslides that killed more than 160 people.

Aon Benfield reported, and less than 3% of China's \$28 billion loss was insured.

"It's probably only below earthquake in terms of being underinsured" said Matt Junge, senior treaty underwriter for Swiss Re.

At one point in time, that made sense. When the National Flood Insurance Program (NFIP) launched in 1968, flood was considered uninsurable by the private market.

That time is passing.

Insurers are inching their way toward a solid grasp of this highly complex peril. And with the NFIP up for reauthorization in September, experts say greater private market participation is on the horizon.

For that to happen though, insurers must be confident in the tools they're using to underwrite this

Key Points

Underwater: Flood has caused more economic losses than any other peril for four straight years.

Changing Tide: Once considered uninsurable, flood is becoming a peril the industry is more comfortable with, thanks in part to advances in mapping and modeling.

Wave of Opportunity: With the National Flood Insurance Program up for reauthorization, there is growing momentum for more private participation in the U.S. flood market.

ever-changing risk. In the past few years, significant strides have been made in that realm. Increased availability of data has allowed new and more granular flood maps to hit the market. At the same time, advancements in technology and computing power are enabling catastrophe modeling firms to develop the tools necessary for better evaluating and pricing the risk.

Though their understanding of flood still lags behind other natural catastrophe perils, insurers are making a push to narrow that knowledge gap. In the process, they also hope to narrow the protection gap.

"The private sector is beginning to be willing to take the risk," Junge said. "We're well positioned to take it. It's what we do—evaluate and price risk. And with the advancements in technology, we're now able to do that with flood."

NFIP at Center Stage

Reauthorization of the NFIP has moved flood insurance into the national spotlight in the United States. With the program buried beneath \$24 billion of debt, there is momentum to increase private-sector participation in the flood market.

Experts say the Federal Emergency Management Association's purchase of private reinsurance for the NFIP shows a willingness to collaborate with the private market. Last September, FEMA, which oversees the NFIP, transferred \$1 million of flood risk in its first-ever private reinsurance contract. In January, it expanded its coverage, transferring \$1 billion of the NFIP's financial risk to 25 reinsurers.

"With the scrutiny that the NFIP is facing in advance of this fall's reauthorization, the use of reinsurance to manage potential losses makes sense," Junge said. "Their willingness to work with the private sector is also really important. We have creative, innovative solutions. We've got the capacity to help the government with this."

Bob Hartwig, professor of risk management at the University of South Carolina and former president of the Insurance Information Institute, said the government's procurement of private reinsurance was a positive sign.

"Given the reauthorization of the program that's expected to occur later this year—and I think it will be reauthorized, no one is pushing for the program's elimination—the use of private reinsurance for the first time is a step in the right direction toward what should be greater private sector participation in general in the program," Hartwig said. "Ultimately the program should be one in which the maximum number of policies possible are written through the private sector at rates that reflect the true risk. If this is the case, this will not only provide growth opportunities for private property and casualty insurers and reinsurers, but it will also shield U.S. taxpayers in the event that future large events occur. And they will occur."

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"First and foremost, we think the NFIP is a critical, valuable and necessary program," Ryan Lumsden, senior vice president of flood at Assurant, said. "Getting to a timely and multiyear reauthorization is critical. But we do believe there are some opportunities for reform as well.

"Simplification of the program around underwriting and execution will really assist [customers]. We also encourage private flood insurance participation in the market. While we think the NFIP is a great program, providing homeowners with additional options is always a good thing. Lastly, we would encourage [the NFIP] to continue to look at reinsurance to limit its exposure in times of large cat storms."

Private Participation

Experts say insurers are cautiously interested in entering the flood market.

"At the moment there are not a lot of people offering private flood insurance [for homeowners], but I think we will see that change drastically over the next couple of years," Junge said. "We at Swiss Re see a lot of interest in the flood peril. So far that hasn't translated into everybody wanting to write it. But as the NFIP reauthorization nears, there seems to be broad support for increasing the private market or encouraging a more robust private market. So companies are starting to look into it."

Homeowners also are interested in more options. Since the passage of the Biggert-Waters Flood Insurance Reform Act of 2012, the NFIP has been moving toward actuarially driven rates. That means rates have increased for many policyholders.

"Consumers are now looking for alternatives," Lumsden said. "As the subsidies have started to be removed, that is where the private insurers can find opportunities because pricing can make sense for the market."

As rates begin to reflect actuarial reality, there will be more opportunities for private insurers to dip a toe into the flood market, perhaps on an excess basis at first or by coverage with separate deductibles.

"Where I think policyholders will respond favorably is if they're able to purchase first-dollar, seamless flood coverage that dovetails perfectly with their standard homeowners insurance policy," Hartwig said. "So if you have a combination wind and water event, or simply a flooding event, they don't need to worry about having to deal with the National Flood Insurance Program and a different set of rules and regulations and coverage restrictions and limits on their policy. People would like to have the same insurer,

the same agent, the same coverage, the same deductible, that they have under the standard homeowners insurance policy. That's a longer term aspiration. But I think what will happen is insurers will supply a limited amount of coverage and there may in fact be a separate deductible, as there is for windstorm in some parts of the country."

There is plenty of room available in the market. A 2016 poll by the Insurance Information Institute found just 12%

of American homeowners had a flood insurance policy, a 2% decrease from 2015.

"The actual take-up rate for flood insurance is abysmally low, so if both the private market and the NFIP can improve the take-up rate just a little bit, both will have plenty of room to play," Junge said. "The private market can compete just fine with the NFIP without anyone charging different premiums."

Flood Models

The growth of the flood market hinges on insurers understanding the peril. Getting a handle on flood is a tall task, as many factors can contribute to the risk or alter it altogether.

Any changes to terrain, for example, can cause water to flow differently, potentially creating new flood zones. Maps, therefore, can quickly become outdated.

"Flood maps often become out of date almost one or two years later because there is so much new development occurring," said Steve Bowen, meteorologist and director at Aon Benfield's analytics and impact forecasting division. "If you build a new shopping center or create a new neighborhood, water has to go somewhere and will find a path to flow."

Flood is also highly sensitive to elevation changes, meaning even the slightest variance in topography can be the difference between an inundated structure and a dry one. Unlike perils such as earthquake and hurricane, which tend to affect swaths of land in a similar fashion, flood risk can vary between adjacent properties based on factors such as elevation. Therefore, modeling this peril requires a highly granular level of data. It also requires intense computing power, which until recently was cost prohibitive.

Now that those pieces—data and computing power—are available, modeling firms are aggressively pursuing more robust flood models. RMS, for instance, is developing a fully probabilistic U.S. flood model, which is set to be released in early 2018.

To put the magnitude of this endeavor in perspective, Noto called U.S. flood "the largest project RMS has ever taken on." The firm has dozens of developers working exclusively on the project, she said.

"We built a powerful GPU [Graphics Processing Unit] system in order to build our U.S. flood model," Noto said, noting that the Mississippi Basin alone is

larger than the entire European flood domain. "It's a very computationally expensive peril because of the gradients—that high-resolution, high-definition approach that RMS uses. It's very common with flood to have two adjacent properties that have a substantial difference in their flood risk for a variety of reasons. In order to reconcile that, you have to account for a lot of interdependent physical attributes and relationships, and you have to do that across a time scale that is still statistically sound and allows for appropriate correlations. So RMS has done 50,000 years of hourly simulations at a 10-meter and 30-meter scale in order to produce our U.S. flood models."

Models, Noto said, are crucial to the expansion of flood insurance.

"Higher definition underwriting maps allow companies to write in areas that they otherwise wouldn't," she said. "Insurance companies can look outside the FEMA flood plains and have really good information to inform the risk selection and underwriting process. RMS high resolution flood maps provide severity of flooding on a return period basis for each location. So it's not just about elevation. And it's not just about proximity to a river. It's the relationship that comes out of simulating 50,000-year events

for the entire physical process. That's what allows insurance companies to identify the most attractive risk, or the appropriate price, regardless of whether they're on or off the FEMA flood plain.

"The penetration of NFIP has been closely related to those areas where it's mandatory that flood insurance be purchased. Now there's more information to supplement. You get a second opinion to the FEMA flood maps, as well as the actual variation and depth across a FEMA flood zone. That's more for the personal lines. For the commercial space, the market just lacks the tools they need to be able to price these risks. The model will give them a reliable tool for pricing these risks with a fair amount of certainty."



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RMS

Global Perspective

RMS considers its U.S. flood model to be an important benchmark for future models because of its scale.

“Nothing is more complicated than U.S. flood,” Noto said. “It’s the hardest to get right.”

At the same time, it’s also one of the easiest countries to get data on. The U.S. has significantly more observational data than other parts of the world.

Scarce and inconsistent data has been a hindrance to the development of global flood maps and models. FM Global became acutely aware of this when its engineers tried to assess flood risk for clients that were going global.

“Outside the United States, the availability of maps was limited,” said Brion Callori, senior vice president and manager of engineering and research at FM Global. “The quality varied. The basis they were built on varied from country to country, where they even existed. So it really became a very inefficient effort on the part of our engineers to try to assess flood risk for our clients.”

As a result, FM Global five years ago began collaborating

with outside consultants, governments and academics around the world to build a global flood map. Along the development path, it released regional flood maps in areas of industrial importance for its clients. Its global map, however, was just released to the general public this year.

Callori said FM Global’s map differs from others in that it is physically based.

“Most if not all of the maps that have been built on a global basis are more statistical in nature,” Callori said. “They look at past floods that have happened and build maps off that.”

“We’re looking at topography of the land, the topography of the river bed, actual rainfall, the flow of the water through the rivers. We think it gives us better quality. And as better data becomes available, we can add it into our map.”

FM Global’s global flood map has a 90-meter resolution, compared to the 25- to 30-meter resolution of its regional maps.

“We plan to keep adding enhancements,” Callori said. “We’re working on bringing the global flood map down to a 30-meter resolution by early next year.”

Building Resilience

While maps and models may vary in sophistication from country to country, the drivers of flood loss are universal. Population migration, land development and a warming climate are elevating flood risk around the globe.

“There are more people moving toward the coastline, so you’re getting more people building in areas that are prone to flood,” said Bryan Wood, meteorologist for Assurant. “And [there are] changing weather patterns.

“There have been studies that have shown the warmer the air is, the more moisture it can hold. So when you have storms tapping into that, you have more opportunity for heavy rainfall. And if you have storms that tend to stall out over an area, you tend to get a lot more rainfall in a shorter amount of time. We talk about flood as a coastal peril, but away from the coast if you get a rainstorm that sets up for a day or two over a populated area, you’re finding properties that are flooding that are not necessarily next to a river or next to a coastline.”

Geno Fernandez, chief underwriting officer of Zurich North America, said these trends are bigger than the insurance industry. They are social trends.

“People are moving rapidly toward areas of greater concentrated risk,” Fernandez said. “We aren’t going to curb social trends. What we can do is help governments create

building standards that protect themselves against the perils of windstorm and the perils of flood.”

Insurers are trying to improve resilience in communities around the globe. One of the loftiest of those endeavors has been the creation of the Insurance Development Forum, a public-private partnership launched last year by the United Nations, World Bank and the insurance industry.

Zurich, which identifies flood resilience as one of its corporate social responsibilities, also has created a partnership to address resilience. In 2013, motivated by the idea that flood needs to be tackled by multiple stakeholders, the company created its Global Flood Resilience Program, a collaboration with the International Federation of the Red Cross and Red Crescent

Societies, the International Institute for Applied Systems Analysis, the Wharton School, and nongovernmental organization Practical Action. The group collaborated to create a resilience measurement framework, a tool that measures a community’s resilience and provides a roadmap for improving it.

“Resilience is a core part of our academic and intellectual capital investment,” Fernandez said. “Building resilient communities is the best response we, as a company, can have globally. It’s the only responsible way to address this.”

The Costliest Floods of 2016

When	Where	Deaths	Economic Losses
Summer	China	475	\$28 billion
August	United States	13	\$10 billion - \$15 billion
May/June	Western/Central Europe	20	\$5.5 billion
July	China	289	\$4.7 billion
April	United States	9	\$2 billion
April	Argentina/Uruguay	0	\$1.3 billion
September	Australia	0	\$765 million
December	Vietnam	24	\$650 million
November	Vietnam	26	\$500 million
September	India	28	\$479 million

Source: Aon Benfield