FOREWORD

Welcome to the latest edition of EXPOSURE magazine. At this year’s annual Exceedance conference, there is a real energy from the delegates here to both understand the issues that the risk management community face, and to move forward and embrace the changes, whether it is using new technology, science or disruptive thinking.

And the challenges continue to build. Our industry faces a seemingly never-ending barrage of sizable loss events, coming from across the world with increasing regularity, as we enter the era of constant catastrophes. As an example, wildfires in California that were regarded as attritional losses — two record-breaking seasons are forcing the industry to quickly re-evaluate what is now a tier-one peril. New categories of risk are growing, as the business world moves from having intangible assets instead of physical assets on the books. How can these intangible risks be quantified and protected?

Turning to technology, rather than focus on the technology itself, how will it help tackle these challenges? Getting the right insight to the people, to make informed decisions. And doing so to evaluate risks faster and in greater depth. Taking advantage of new risk data flows to understand these new intangible perils. This just scratches the surface of the potential.

With a greater understanding of the challenges we face, matched with an ability to deliver new and innovative solutions, we look forward to having you on our journey.

KAREN WHITE
CEO, RMS
FLOOD RISK

CLEAR LINK BETWEEN FLOOD LOSSES AND NORTH ATLANTIC OSCILLATION

RMS research proves relationship between NAO and catastrophic flood events in Europe

The correlation between the North Atlantic Oscillation (NAO) and European precipitation patterns is well known. However, a definitive link between phases of the NAO and catastrophic flood events and related losses had not previously been established—until now.

A study by RMS published in Geophysical Research Letters has revealed a direct correlation between the NAO and the occurrence of catastrophic floods across Europe and associated economic losses. The analysis not only extrapolated a statistically significant relationship between the events, but critically showed that average flood losses during opposite NAO states can differ by up to 50 percent.

A change in pressure

The NAO’s impact on meteorological patterns is most pronounced in winter. Fluctuations in the atmospheric pressure between two semipermanent centers of low and high pressure in the North Atlantic influence wind direction and strength as well as storm tracks.

The two-part study combined extensive analysis of flood occurrence and peak water levels across Europe, coupled with extensive modeling of European flood events using the RMS Europe Inland Flood High-Definition (HID) Model.

The data sets included HANZEE-Events, a catalog of over 1,500 catastrophic European flood events between 1870 and 2016, and a recent database of the highest-recorded flood events between 1870 and 2016.

“This analysis established a clear relationship between the occurrence of catastrophic flood events and the NAO phase,” explains Stefano Zanardo, principal modeler at RMS, “and confirmed that a positive NAO increased catastrophic flooding in Northern Europe, with a negative phase influencing flooding in Southern Europe. However, to ascertain the impact on actual flood losses we turned to the model.”

Modeling the loss

The HD model generated a large set of potential catastrophic flood events and quantified the associated losses. It not only factored in precipitation, but also rainfall runoff, river routing and inundation processes. Critically, the precipitation incorporated the impact of a simulated monthly NAO index as a driver for monthly rainfall.

The HD model generated a large set of potential catastrophic flood events and quantified the associated losses.

“It showed that seasonal flood losses can increase or decrease by up to 50 per cent between positive and negative NAOs, which is very significant,” states Zanardo.

“What it also revealed were distinct regional patterns. For example, a positive state resulted in increased flood activity in the U.K. and Germany. These loss patterns provide a spatial correlation of flood risk not previously detected.”

Currently, NAO seasonal forecasting is limited to a few months. However, as this window expands, the potential for carriers to factor oscillations phases into flood-related renewal and capital allocation strategies will grow. Further, greater insight into spatial correlation could support more effective portfolio management.

“At this stage,” he concludes, “we have confirmed the link between the NAO and flood-related losses. How this evolves to influence carriers’ flood strategies is still to be seen, and a key factor will be advances in the NAO forecasting. What is clear is that oscillations such as the NAO must be included in model assumptions to truly understand flood risk.”

THE HD MODEL

GENERATED A LARGE SET OF POTENTIAL CATASTROPHIC FLOOD EVENTS AND QUANTIFIED THE ASSOCIATED LOSSES

The correlation between the North Atlantic Oscillation (NAO) and catastrophic flood events in Europe, with a negative phase influencing flooding in Southern Europe. However, to ascertain the impact on actual flood losses we turned to the model.

Modeling the loss

The HD model generated a large set of potential catastrophic flood events and quantified the associated losses. It not only factored in precipitation, but also rainfall runoff, river routing and inundation processes. Critically, the precipitation incorporated the impact of a simulated monthly NAO index as a driver for monthly rainfall.

The HD model generated a large set of potential catastrophic flood events and quantified the associated losses.

“It showed that seasonal flood losses can increase or decrease by up to 50 percent between positive and negative NAOs, which is very significant,” states Zanardo.

“What it also revealed were distinct regional patterns. For example, a positive state resulted in increased flood activity in the U.K. and Germany. These loss patterns provide a spatial correlation of flood risk not previously detected.”

Currently, NAO seasonal forecasting is limited to a few months. However, as this window expands, the potential for carriers to factor oscillations phases into flood-related renewal and capital allocation strategies will grow. Further, greater insight into spatial correlation could support more effective portfolio management.

“At this stage,” he concludes, “we have confirmed the link between the NAO and flood-related losses. How this evolves to influence carriers’ flood strategies is still to be seen, and a key factor will be advances in the NAO forecasting. What is clear is that oscillations such as the NAO must be included in model assumptions to truly understand flood risk.”

THE HD MODEL

GENERATED A LARGE SET OF POTENTIAL CATASTROPHIC FLOOD EVENTS AND QUANTIFIED THE ASSOCIATED LOSSES

The correlation between the North Atlantic Oscillation (NAO) and catastrophic flood events in Europe, with a negative phase influencing flooding in Southern Europe. However, to ascertain the impact on actual flood losses we turned to the model.

Modeling the loss

The HD model generated a large set of potential catastrophic flood events and quantified the associated losses. It not only factored in precipitation, but also rainfall runoff, river routing and inundation processes. Critically, the precipitation incorporated the impact of a simulated monthly NAO index as a driver for monthly rainfall.

The HD model generated a large set of potential catastrophic flood events and quantified the associated losses.

“It showed that seasonal flood losses can increase or decrease by up to 50 percent between positive and negative NAOs, which is very significant,” states Zanardo.

“What it also revealed were distinct regional patterns. For example, a positive state resulted in increased flood activity in the U.K. and Germany. These loss patterns provide a spatial correlation of flood risk not previously detected.”

Currently, NAO seasonal forecasting is limited to a few months. However, as this window expands, the potential for carriers to factor oscillations phases into flood-related renewal and capital allocation strategies will grow. Further, greater insight into spatial correlation could support more effective portfolio management.

“At this stage,” he concludes, “we have confirmed the link between the NAO and flood-related losses. How this evolves to influence carriers’ flood strategies is still to be seen, and a key factor will be advances in the NAO forecasting. What is clear is that oscillations such as the NAO must be included in model assumptions to truly understand flood risk.”
VULNERABILITY

IN FOCUS

As international efforts grow to minimize the disproportionate impact of disasters on specific parts of society, EXPOSURE looks at how close public/private collaboration will be critical to moving forward.

There is a widely held and understandable belief that large-scale disasters are indiscriminate events. They weigh out devastation in equal measure, irrespective of the gender, age, social standing or physical state of those impacted.

The reality, however, is very different. Catastrophic events expose the various inequalities within society in horrific fashion. Women, children, the elderly, people with disabilities and those living in economically deprived areas are at much greater risk than other parts of society both during the initial disaster phase and the recovery process.

Cyclone Gorky, for example, which struck Bangladesh in 1991, caused in the region of 140,000 deaths — women made up 93 percent of that colossal death toll. Similarly, in the 2004 Indian Ocean Tsunami some 70 percent of the 250,000 fatalities were women.

Looking at the disparity from an age-based perspective, during the 2005 Kashmir Earthquake 10,000 schools collapsed resulting in the deaths of 19,000 children. Children also remain particularly vulnerable “long after disasters have subsided. In 2014, a study by the University of San Francisco stated that delayed deaths among female infants outnumbered reported typhoon deaths by 15-to-1 following an average typhoon season...”

The scale of the problem

These alarming statistics are now resonating at the highest levels. Growing recognition of the inequalities in disaster-related fatality ratios is now influencing global thinking on disaster response and management strategies. Most importantly, it is a central tenet of the Sendai Framework for Disaster Risk Reduction 2015–2030, which demands an “all-of-society engagement and partnership” to reduce risk that encompasses those “disproportionately affected by disasters.”

Yet a fundamental problem is that disaggregated data for specific vulnerable groups is not being captured for the majority of disasters.

“There is a growing acknowledgment across many nations that certain groupings within society are disproportionately impacted by disasters,” explains Alison Dobbins, principal catastrophe risk modeler at RMS. “Yet the data required to get a true sense of the scale of the problem simply isn’t being utilized and disregarded in an effective manner post-disaster. And without exploiting and building on the data that is available, we cannot gain a working understanding of how best to tackle the multiple issues that contribute to it.”

“WE CAN GO BEYOND STATISTICS COLLECTION, AND MODEL THOSE FACTORS WHICH LEAD TO DISCRIMINATORY OUTCOMES”

— NICOLA HOWE, RMS

The criticality of capturing disaster datasets specific to particular groups is clearly flagged in the Sendai Framework. Under the “Guiding Principles,” the document states: “Disaster risk reduction requires a multi-hazard approach and inclusive risk-informed decision-making based on the open exchange and dissemination of disaggregated data, including by sex, age and disability, as well as on easily accessible, up-to-date, comprehensible, science-based, non-sensitive risk information, complemented by traditional knowledge.”

Gathering the data

Efforts to change, however, requires a consistent approach to the collection of disaggregated information across all groups — first, to understand the specific impacts of particular perils on distinct groups, and second, to generate guidance, policies and standards for preparedness and resilience that reflect the unique sensitivities.

While efforts to collect and analyze aggregated data are increasing, the complexities involved in ascertaining differentiated vulnerabilities to specific groups are becoming increasingly apparent, as Nicola Howe, lead catastrophe risk modeler at RMS, explains: “You have to remember that social vulnerability varies from place to place and is often in a state of flux,” she says. “People move, levels of equity change, lifestyles evolve and the economic conditions in specific regions fluctuate. Take gender-based vulnerabilities for example. They tend not to be as evident in societies that demonstrate stronger levels of sexual equality.”

“Experiences during disasters are also highly localized and specific to the particular event or peril,” she continues. “There are multiple variables that can influence the impact on specific groups. Cultural, political and economic factors are strong influencers, but other aspects such as the time of day or the particular season can also have a significant effect on outcomes.”

This creates challenges, not only for attributing specific vulnerabilities to particular groups and establishing policies designed to reduce those vulnerabilities, but also for assessing the extent to which the measures are having the desired outcomes.

Establishing data consistency and overcoming the complexities posed by this universal problem will require the close collaboration of all key participants.

“It is imperative that governments and NGOs recognize the important part that the private sector can play in working together and converting relevant data into the targeted insight required to support effective decision-making in this area,” says Dobbin.

A collective response

At time of writing, Dobbin and Howe were preparing to join a diverse panel of speakers at the UN’s 2019 Global Platform for Disaster Risk Reduction in Switzerland. This year’s convening marks the third consecutive conference at which RMS has participated. Previous events have seen Robert Muir-Wood, chief research officer, and Daniel Stander, global managing director, present on the resilience dividend and risk finance.

The title of this year’s discussion is “Using Gender, Age and Disability-Responsive Data to Empower Those Left Furthest Behind.”

“One of our primary aims at the event,” says Howe, “will be to demonstrate the central role that the private sector, and in specific cases, the risk modeling community, can play in helping to bridge the data gap that exists and help promote the meaningful way in which we can contribute.”

The data does, in some cases, exist and is maintained primarily by governments and NGOs in the form of census data, health records, cemeteries, survey results and general studies.

“Companies such as RMS provide the capabilities to convert this raw data...”
Vulnerability in numbers

CYCLONE GORKY
Bangladesh, 1991
140,000 deaths
93% were women

INDIAN OCEAN TSUNAMI
2004
250,000 fatalities
70% were women

KASHMIR EARTHQUAKE
Pakistan, 2005
10,000 schools collapsed
19,000 children died

CAMP FIRE
California
2018
Residents aged 75 or over were 8 times more likely to die than the average of all bands

into actionable insight,” Dobbin says. “We model from hazard, through vulnerability and exposure, all the way to the financial loss. That means we can take the data and turn it into outputs that governments and NGOs can use to better integrate disadvantaged groups into resilience planning.”

But it’s not simply about getting access to the data. It is also about working closely with these bodies to establish the questions that they need answers to. “We need to understand the specific outputs required. To that end, we are regularly having conversations with many diverse stakeholders,” adds Dobbin.

While we date the analytical capabilities of the risk modelling community have not been directed at the social vulnerability issue in any significant way, RMS has worked with organisations to model human exposure levels for perils. Collaborating with the Workers’ Compensation Insurance Rating Bureau of California (WCIRB), a private, nonprofit association, RMS conducted probabilistic earthquake analysis on exposure data for more than 11 million employees. This included information about the occupation of each employee to establish potential exposure levels for workers’ compensation cover in the state.

“We were able to combine human exposure data to model the impact of an earthquake, ascertainig vulnerability based on where employees were likely to be, their locations, their specific jobs, the buildings they worked in and the time of day that the event occurred,” says Howe. “We have already established that we can incorporate age and gender data into the model, so we know that our technology is capable of supporting detailed analyses of this nature on a huge scale.”

She continues: “We must show where the modeling community can make a tangible difference. We bring the ability to go beyond the collection of statistics post-disaster and to model those factors that lead to such strong differences in outcomes, so that we can identify where discrimination and selective outcomes are anticipated before they actually happen in disasters. This could be through identifying where people are situated in buildings at different times of day, by gender, age, disability, etc. It could be by modeling how different people by age, gender or disability will respond to a warning of a tsunami or a storm surge. It could be by modeling evacuation protocols to demonstrate how inclusive they are.”

Strengthening the synergies
A critical aspect of reducing the vulnerability of specific groups is to ensure disadvantaged elements of society become more prominent components of mitigation and response planning efforts. A more people-centered approach to disaster management was a key aspect of the Sendai Framework, the Hyogo Framework for Action 2005–2015. The plan called for risk reduction practices to be more inclusive and engage a broader scope of stakeholders, including those viewed as being at higher risk.

“This approach is a core part of the ‘Guiding Principles’ that underpin the Sendai Framework,” he says. “Disaster risk reduction requires an all-of-society engagement and partnership. It also requires empowerment, inclusive, accessible and non-discriminatory participation, paying special attention to people disproportionately affected by disasters, especially the poorest. A gender, age, disability and cultural perspective should be integrated into all policies and practices, and women and youth leadership should be promoted.”

The framework also calls for the empowerment of women and people with disabilities, stating that enabling them “to publicly lead and promote gender equitable and universally accessible response, recovery, rehabilitation and reconstruction approaches.”

“This is a main area of focus for the U.N. event, explains Howe. “The conference will explore how we can promote greater involvement among members of these disadvantaged groups in resilience-related discussions, because at present we are simply not capitalizing on the insight that they can provide.”

“Take gender for instance. We need to get the views of those disproportionately impacted by disaster involved at every stage of the discussion process so that we can ensure that we are generating gender-sensitive risk reduction strategies, that we are factoring universal design components into how we build our shelters and feel supported and welcome. And then we can say we are truly recognizing the principles of the Sendai Framework.”

With California experiencing two of the most devastating seasons on record in consecutive years, EXPOSURE asks whether wildfire now needs to be considered a peak peril

Wildfire

Somes of the statistics for the 2018 U.S. wildfire season appear normal. The season was a below-average year for the number of fires reported — 58,083 incidents represented only 84 percent of the 10-year average. The number of acres burned — 8,767,492 acres — was marginally above average at 152 percent.

Two factors, however, made it exceptional. First, for the second consecutive year, the Great Basin experienced intense wildfire activity, with some 2.1 million acres burned — 253 percent of the 10-year average. And second, the fires destroyed 25,790 structures, with California accounting for over 23,600 of those structures destroyed, compared to a 10-year U.S. annual average of 2,701 residences, according to the National Interagency Fire Center.

As of January 28, 2019, reported insured losses for the November 2018 California wildfires, which included the Camp and Woolsey Fires, were at US$11.4 billion, according to the California Department of Insurance. Add to this the insured losses of US$11.79 billion according to the California Department of Insurance. Add to this the insured losses of US$11.79 billion.

With this in mind, the industry now needs to achieve a level of maturity with regard to wildfire that is on a par with that of hurricane or flood.”

However, he is wary about potential knee-jerk reactions to this hike in wildfire-related losses. “There is a strong parallel between the 2017-18 wildfire seasons and the 2004-05 hurricane seasons in terms of people’s gut instincts. 2004 saw four hurricanes make...
A recent report published in PNAS entitled "Rapid Growth of the U.S. Wildland-Urban Interface Raises Wildfire Risk" showed that between 1990 and 2010 the non-WUI has increased by much more than the WUI (189,000 square kilometers) — larger than Washington State. The report stated: "Even though the WUI occupies less than one-tenth of the land area of the contiguous United States, 43 percent of all new houses were built there, and 61 percent of all new WUI housing were built in areas that were already in the WUI in 1990 (and remain in the WUI in 2010)." "The WUI has formed a central component of how wildfire risk has been underestimated," explains Folkman, "but you cannot simply adopt a black-and-white approach to risk selection based on properties within or outside of the zone. At recent loss, and in particular the 2017 Northern California wildfires, have shown, regions outside of the WUI zone considered low risk can still experience devastating losses." For Beve, focus on the WUI is appropriate, particularly given the Coffey Park evacuation order. But, it is not enough to focus on the WUI. There is not enough focus on the intermix areas. This is the area where properties are interspersed with vegetation. "In some ways, the wildfire risk to intermix communities is worse than that at the interface," he explains. "In an intermix zone, you have both a wildfire and an urban conflagration impacting the town at the same time, while in interface location the fire has largely transitioned to an urban fire. In an intermix community, he continues, "the terrain is often more challenging and limits firefight access to the fire as well as evacuation routes for local residents. Also, many intermix locations are far from large urban centers, limiting the amount of firefighting resources immediately available to start combatting the blaze, and this increases the potential for a fire in high-wind conditions to become a significant event. Most likely we’ll see more scrutiny and investigation of risk in intermix towns across the nation after the Camp Fire’s decimation of Paradise, California."

Rethinking wildfire analysis
According to Folkman, the need for greater market maturity around wildfire insurance requires a rethink of how the industry currently analyzes the exposure and the tools it uses. "Historically, the industry has relied primarily upon deterministic tools to quantify U.S. wildfire risk," he says, "which relate overall frequency and severity of events to the presence of fuel and climate conditions, such as high winds, low moisture and high temperatures." While such tools can prove valuable for addressing "typical" wildfire events, such as the 2017 Thomas Fire in Southern California, their flaws have been exposed by other recent losses. "Such tools insufficiently address major catastrophic events that occur beyond the WUI into areas of dense exposure," explains Folkman, "or wind-driven travel and their contribution to high losses, and beyond the fire perimeter. Average ember contributions to structure damage and destruction is approximately 15 percent, but in a wind-driven event such as the Tubbs Fire this figure is much higher. This was a key factor in the urban configuration in Coffey Park."

The model also provides full contiguous U.S. coverage, and includes other model innovations such as ignition and footprint simulations for 50,000 years.

"While the frequency and severity of large, damaging fires is lower outside California, says Beve, "there are many areas where the risk is far from negligible." While acknowledging that the broader western U.S. is seeing increased risk due to WUI expansion, he adds: "Many may be surprised that similar wildfire risk exists across Southeastern U.S. as well as sections of the northwestern U.S. like in the Pine Barrens of southern New Jersey." As well as addressing the geographical gaps in wildfire analysis, Folkman believes the industry must also recognize the data gaps limiting their understanding. "There are a number of areas that are underestimated in underwriting practices currently, such as the far-ranging impacts of ember accumulations and their potential to ignite urban conflagrations, as well as vulnerability of particular structures and mitigation measures such as defensible space and fire-resistant roof coverings."

"In generating its US$9 billion to US$13 billion loss estimate for the Camp and Woolsey Fires, RMS used its recently launched North America Wildfire High-Definition (HD) Models to simulate the ignition, fire spread, ember accumulations and smoke dispersion of the fires. "In assessing the contribution of embers, for example," Folkman states, "we modeled the accumulation of embers, their wind-driven travel and their contribution to high losses, and beyond the fire perimeter. Average ember contributions to structure damage and destruction is approximately 15 percent, but in a wind-driven event such as the Tubbs Fire this figure is much higher. This was a key factor in the urban configuration in Coffey Park." The model also provides full contiguous U.S. coverage, and includes other model innovations such as ignition and footprint simulations for 50,000 years.

Flexible occurrence definitions, smoke and wind-driven loss and beyond the fire perimeter, and vulnerability and mitigation measures on which RMS collaborated with the Insurance Institute for Business & Home Safety.

Smoke damage, which leads to loss from evacuation orders and contents replacement, should be modeled in risk assessment models, despite composing a tangible portion of the loss, says Folkman. "These are very high frequency, medium-sized losses and must be considered. The Woolsey Fire saw 260,000 people evacuated, incurring hotel, meal and transport-related expenses. Add to this smoke damage, which often results in high-value contents replacement, and you have a potential of medium-sized claims that can contribute significantly to the overall loss." A further data resolution challenge relates to property characteristics. While primary property attribute data is typically well captured, believes Beve, many secondary characteristics key to wildfire are either not captured or not consistently captured. This leaves the industry overly reliant on both average model weightings and risk scoring tools. For example, information about defensible spaces, roof covering and materials, protecting vents and vents and other factors are just a few of the additional fields that the industry is relying on to better assess wildfire risk to a property.

A highly complex peril
Beve is, however, conscious of the fact that wildfire behavior is extremely complex and non-linear. He continues: "While visiting Paradise, I saw properties that did everything correct with regard to wildfire mitigation but still burned and risks that did everything wrong and survived. However, this variability can improve the probability that a structure survives." With more data on historical fires, Folkman concludes, "more research into mitigation effectiveness and increasing awareness of the risk, wildfire exposure can be addressed and managed. But it requires a shift in the mindset of the (re)insurers, homeowners, communities, policymakers and land-planners — all playing their part."
LIVING IN A WORLD OF CONSTANT CATASTROPHES

(Re)insurers are waking up to the reality that we are in a riskier world and the prospect of ‘constant catastrophes’ has arrived, with climate change a significant driver.

“THE USE OF NEW TECHNOLOGY, DATA AND ANALYTICS WILL HELP US PREPARE FOR UNPREDICTED ‘BLACK SWAN’ EVENTS AND MINIMIZE THE CATASTROPHIC LOSSES”
— MOHSEN RAHNAMA, RMS

Take Hurricane Harvey as an example. Two independent attribution studies agree that the anthropogenic warming of Earth’s atmosphere made a substantial difference to the storm’s record-breaking rainfall, which inundated Houston, Texas, in August 2017, leading to unprecedented flooding. In a warmer climate, such storms may hold more water volume and move more slowly, both of which lead to heavier rainfall accumulations over land.

Attribution studies can also be used to predict the impact of climate change on the return-period of such an event, explains Pete Dailey, vice president of model development at RMS. “You can look at a catastrophe event, like Hurricane Harvey, and estimate its likelihood of recurring from either a hazard or loss point of view. For example, we might estimate that an event like Harvey would recur on average say once every 250 years, but in today’s climate, given the influence of climate change on tropical precipitation and slower moving storms, its likelihood has increased to say a 1-in-100-year event,” he explains.

“This would mean the annual probability of a storm like Harvey recurring has increased more than twofold from 0.4 percent to 1 percent, which is likely to mean an insurer can have a dramatic effect on their risk management strategy.”

Climate change studies can help carriers understand its impact on the frequency and severity of various perils and throw light on correlations between perils and/or regions, explains Dailey. “For a global (re)insurance company with a book of business spanning diverse perils and regions, they want to get a handle on the overall effect of climate change, but they must also pay close attention to the potential impact on correlated events.

“For instance, consider the well-known correlation between the hurricane season in the North Atlantic and North Pacific,” he continues. “Active Atlantic seasons are associated with quieter Pacific seasons and vice versa. So, as climate change affects an individual peril, is it also having an impact on activity levels for another peril? Maybe in the same direction or in the opposite direction?”

Understanding these “teleconnections” is just as important to an insurer as the more direct relationship of climate to hurricane activity in general, thinks Dailey. “Even though it’s hard to attribute the impact of climate change to a particular location, if we look at the impact on a large book of business, that’s actually easier to do in a scientifically credible way,” he adds. “We can quantify that and put uncertainty around that quantification, thus allowing our clients to develop a robust and objective view of those factors as a part of a holistic risk management approach.”

Of course, the influence of climate change is easier to understand and measure for some perils than others. “For example, we can observe an incremental rise in sea level annually — it’s something that is happening right in front of our eyes,” says Dailey. “So, sea level rise is very tangible in that we can observe the change year over year. And we can also quantify how the rise of sea levels is accelerating over time and then combine that with our hurricane model, measuring the impact of sea-level rise on the risk of coastal storm surge, for instance.”

Each peril has a unique signature with respect to climate change, explains Dailey. “When it comes to a peril like severe convective storms — tornadoes and hail storms for instance — they are so localized that it’s difficult to attribute climate change to the future likelihood of such events.”

In his hotly anticipated annual letter to shareholders in February 2019, Warren Buffett, the CEO of Berkshire Hathaway and acclaimed “Oracle of Omaha,” warned about the prospect of “The Big One” — a major hurricane, earthquake or cyberattack that he predicted would “ dwarf Hurricanes Katrina and Michael.” He warned that “when such a mega catastrophe strikes, we will get our share of the losses and they will be big — very big.”

The question insurance and reinsurers need to ask themselves is whether they are prepared for the potential of an intense U.S. landfalling hurricane, a Tōhoku-size earthquake event and a major cyber incident if these types of combined losses hurt their portfolio each and every year, says Mohsen Rahnama, chief risk modeling officer at RMS. “We are living in a world of constant catastrophes,” he says. “The risk is changing, and carriers need to make an educated decision about managing the risk. So how are (re)insurers going to respond to that? The broader perspective should be on managing and diversifying the risk in order to balance your portfolio and survive major claims each year,” he continues. “Technology, data and models can help balance a complex global portfolio across all perils while also finding the areas of opportunity.”

A barrage of weather extremes How often, for instance, should insurers and reinsurers expect an extreme weather loss year like 2017 or 2018? The combined insurance losses from natural disasters in 2017 and 2018 according to Swiss Re sigma were US$219 billion, which is the highest-ever total over a two-year period. Hurricanes Harvey, Irma and Maria delivered the costliest hurricane loss for one hurricane season in 2017.

Contributing to the total annual insurance loss in 2018 was a combination of natural hazard extremes, including Hurricanes Michael and Florence, Typhoons Jebi, Trami and Mangkhut, as well as heatwaves, droughts, wildfires, floods and convective storms.

While it is no surprise that weather extremes like hurricanes and floods occur every year, (re)insurers must remain diligent about how such risks are changing with respect to their unique portfolios.

Looking at the trend in U.S. insured losses from 1980–2018, the data clearly show losses are increasing every year, with climate-related losses being the primary drivers of loss, especially in the last four decades (even allowing for the fact that the completeness of the loss data over the years has improved).

Measuring climate change

With many non-life insurers and reinsurers feeling bombarded by the aggregate losses hitting their portfolios each year, insurance and reinsurance companies have started looking more closely at the impact that climate change is having on their books of business, as the costs associated with weather-related disasters increase.

The ability to quantify the impact of climate change risk has improved considerably, both at a macro level and through attribution research, which considers the impact of climate change on the likelihood of individual events. The application of this research will help (re)insurers reserve appropriately and gain more insight as they build diversified books of business.

The losses keep growing

Munich Re’s global loss summary from 1980–2018 clearly shows the economic and insured losses significantly increased in the last four decades where U.S. major hurricanes since 1992–2018 and recent California wildfires contributed to more than U.S.$425 billion of insured loss in 2018 values. The 2017 and 2018 U.S. events contributed more than 40 percent of the overall losses. Key U.S. events that contributed to the global loss are highlighted.

U.S.$200bn

Source: Munich Re
an event. But for wildfire risk, there’s high correlation with climate change because the fuel for wildfires is dry vegetation, which in turn is highly influenced by the precipitation cycle.” Satellite data from 1993 through to the present shows there is an upward trend in the rate of sea-level rise, for instance, with the current rate of change averaging about 3.2 millimeters per year. Sea-level rise, combined with increasing exposures at risk near the coastline, means that storm surge losses are likely to increase as sea levels rise. In 2010, we estimated the amount of exposure within 1 meter above the sea level, which was US$3 trillion, including power plants, ports, airports and so forth,” says Rahnama. “Ten years later, the exact same exposure was US$2 trillion. This dramatic exposure change reflects the fact that every centimeter of sea-level rise is subjected to an increase in potential for catastrophic models to be used on both sides of the balance sheet as the influence of climate change grows. Dailey points out that many insurance and reinsurance companies invest heavily in real estate. “You still need to account for the risk of climate change on the portfolio, whether you’re insuring properties or whether you actually own them, there’s no real difference.” In fact, asset managers are more inclined to a longer-term view of risk when real estate is part of a long-term investment strategy. Here, climate change is becoming a critical part of that strategy. "What we have found is that often the team that handles asset management within a (re)insurance company is an entirely different team to the one that handles catastrophe modeling," he continues. “But the same modeling tools that we develop at RMS can be applied to both of these problems of managing risk at the enterprise level. “In some cases, a primary insurer may have a one-to-three-year plan, while a major reinsurer may have a five-to-10-year view because they’re looking at a longer risk horizon,” he adds. “Every time I go to speak to a client — whether it be about our flood model or our North American hurricane model — the question of climate change inevitably comes up. So, it’s become apparent this is no longer an academic question, it’s actually playing into critical business decisions on a daily basis.”

There is potential for catastrophe models to be used on both sides of the balance sheet as the influence of climate change grows. "What we have found is that often the team that handles asset management within a (re)insurance company is an entirely different team to the one that handles catastrophe modeling," he continues. “But the same modeling tools that we develop at RMS can be applied to both of these problems of managing risk at the enterprise level. “In some cases, a primary insurer may have a one-to-three-year plan, while a major reinsurer may have a five-to-10-year view because they’re looking at a longer risk horizon,” he adds. “Every time I go to speak to a client — whether it be about our flood model or our North American hurricane model — the question of climate change inevitably comes up. So, it’s become apparent this is no longer an academic question, it’s actually playing into critical business decisions on a daily basis.”

Regulation also has an important role in pushing both (re)insurers and large corporates to map and report on the likely impact of climate change on their business, as well as explain what steps they have taken to become more resilient. In the U.K., the Prudential Regulation Authority (PRA) and Bank of England have set out their expectations regarding firms’ approaches to managing the financial risks from climate change. Meanwhile, a survey carried out by the PRA found that 70 percent of U.K. banks recognize the risk climate change poses to their business. Among their concerns are the immediate physical risks to their business models — such as the exposure to mortgages on properties at risk of flood and exposure to countries likely to be impacted by increasing weather extremes. Many have also started to assess how the transition to a low-carbon economy will impact their business models and, in many cases, their investment and growth strategy. “Financial policymakers may not drive the transition to a low-carbon economy, but we will expect our regulated firms to anticipate and manage the risks associated with that transition,” said Bank of England Governor Mark Carney, in a statement. The transition to a low-carbon economy is a reality that (re)insurance industry players will need to prepare for, with the impact already being felt in some markets. In Australia, for instance, there is pressure on financial institutions to withdraw their support from major coal projects. In the aftermath of the Townsville floods in February and widespread drought across Queensland, there have been renewed calls to boycott plans for Australia’s largest thermal coal mine. To date, 10 of the world’s largest (re)insurers have stated they will not provide property or construction cover for the US$1.5 billion Carmichael mine and rail project. And in its “Mining Risk Review 2019,” broker Willis Towens’ Watson warned that finding insurance for coal is likely to become increasingly challenging — especially if North American insurers begin to follow the European lead.”

Sudden and dramatic breakthroughs become more likely in a highly interconnected and increasingly polarized world, warns the “Global Risks Report 2019” from the World Economic Forum (WEF). “Firms should focus as much on risk response as on risk mitigation,” advises John Drzik, president of global risk and digital at Marsh, one of the report sponsors. “There’s an inevitability to having a certain number of shock events, and firms should focus on how to respond to fast-moving events with a high degree of uncertainty.” Meanwhile, such climate change, urbanization and digitization are all combining in a way that makes major claims more impactful when things go wrong. But are all low-probability/high-consequence events truly beyond our ability to identify and manage?...
From nonphysical-damage business interruption and reputational harm to the theft of intellectual property and a cyber data breach, the ability for underwriters to get a handle on these risks and potential losses is one of the industry’s biggest modern-day challenges. The dearth of products and services for esoteric commercial risks is known as the “intangibles protection gap," explains Muir-Wood.

“There is this question within the whole span of risk management of organizations — of which an increasing amount is intangible — whether they will be able to buy insurance for those elements of their risk that they feel they do not have control over.”

While the (re)insurance industry is responding with new products and services geared toward emerging risks, such as cyber, there are some organizational peril, such as reputational risk, that are best addressed by instilling the right risk management culture and setting the tone from the top within organizations, thinks Wayne Ratcliffe, head of risk management at SCOR.

“Enterprise risk management is about taking a holistic view of the company and having multidisciplinary teams brainstorming together,” he says. “It’s a tendency of human nature to work in silos in which everyone has their own domain to protect and to work on, but working across an organization is the only way to carry out proper risk management.

“There are many causes and consequences of reputational risk, for instance,” he continues. “When I think of past examples where things have gone horribly wrong — and there are so many of them, from Deepwater Horizon to Enron — in certain cases there were questionable ethics and a failure in risk management culture. Companies have to set the tone at the top and then ensure it has spread across the whole organization. This requires constant checking and vigilance.”

The best way of checking that risk management procedures are being adhered to is by being really close to the ground, thinks Ratcliffe. “We’re moving too far into a world of emails and communication by Skype. What people need to be doing is talking to each other in person and cross-checking facts. Human contact is essential to understanding the risk.”

Spotting the next “black swan”

What of future black swans? As per Donald Rumsfeld’s “unknown unknowns,” so called black swan events are typically those that come from left field. “They take everyone by surprise (although are often explained away in hindsight) and have an impact that cascades through economic, political and social systems in ways that were previously unimaginable, with severe and widespread consequences. “As (re)insurers we can look at past data, but you have to be aware of the trends and forces at play,” thinks Ratcliffe. “You have to be aware of the source of the risk. In the Big Short by Michael Lewis, the only person who really understood the impending subprime collapse was the one who went house-to-house asking people if they were having trouble paying their mortgages, which they were.

“Sometimes you need to go out of the bounds of data analytics into a more intuitive-based way of picking up signals where there is no data,” he continues. “You need imagination and to come up with scenarios that can happen based on a group of experts talking together and debating how exposures can connect and interconnect.

“It’s a little dangerous to base everything on big data measurement and statistics, and at SCOR we talk about the ‘art and science of risk,’ he continues. “And science is more than statistics. We often need hard science behind what we are measuring. A single point estimate of the measure is not sufficient. We also need confidence intervals corresponding to a range of probabilities.”

In its “Global Risks Report 2019,” the WEF examines a series of “what if” future shocks and asks if its scenarios, while not predictions, are at least a “reminder of the need to think creatively about risk and to expect the unexpected.”

“Future shocks could come about as a result of advances in technology, the depletion of global resources and other major macro-trends clashing in new and extreme ways.

“The world is becoming hyperconnected,” says Ratcliffe. “People are becoming more dependent on social media, which is even shaping political decisions, and organizations are increasingly connected via technology and the internet of things. New technologies are creating more opportunities but they’re also making society more vulnerable to sophisticated cyberattacks. We have to think about the systemic nature of it all.”

As governments are pressured to manage the effects of climate change, for example, the use of weather derivative and catastrophe insurance products such as cloud seeding to induce or suppress rainfall — result in geopolitical conflicts? Could biometromics and AI that recognize and respond to emotions be used to further polarize and/or control society? And will quantum computing render cryptography obsolete, leaving sensitive data exposed?

The risk of cyberattack was the No. 1 concern among business leaders in virtual meetings in 2018. “In cyber defender, if you have a weak system, you will be attacked. But if you have a strong system, you will be ignored,” he says. “But in real life, no one is strong enough.”

“NEW TECHNOLOGIES ARE CREATING MORE OPPORTUNITIES BUT THEY’RE ALSO MAKING SOCIETY MORE VULNERABLE TO SOPHISTICATED CYBERATTACKS”

— WAYNE RATCLIFFE, SCOR

“THE RISK OF CYBERATTACK WAS THE NO. 1 CONCERN AMONG BUSINESS LEADERS IN VIRTUAL MEETINGS IN 2018.”

— WAYNE RATCLIFFE, SCOR
Risk data delivered to underwriting platforms via application programming interfaces (API) is bringing granular exposure information and model insights to high-volume risks.

"UNDERWRITING
WITH 20/20 VISION"

The insurance industry boasts some of the most sophisticated underwriting capabilities in the world. And yet the average property underwriter does not have access to the kind of predictive tools that carriers use at a portfolio level to manage risk aggregation, streamline reinsurance buying and optimize capitalization.

"There is still an insufficient amount of data being gathered to enable the accurate assessment and pricing of risks [that] our industry has been covering for decades," says Talib Bains, founder and CEO of managing general agent (MGA) platform Volante Global.

"Vulnerability is critical to accurate underwriting. Hazard alone is not enough. When you put building characteristics together with the hazard information, you form a deeper understanding of the vulnerability of a specific property to a particular hazard. For a given location, a five-story building built from reinforced concrete in the 1920s will naturally react very differently in a storm than a two-story wood-frame house built in 1964 — and yet current underwriting approaches often miss this distinction," says Franklin.

In response to demand for change, RMS developed a Location Intelligence application programming interface (API), which allows preformatted RMS risk information to be easily distributed from its cloud platform via the API to any third-party or in-house underwriting software. The technology gives underwriters access to key insights on their desktops, as well as informing fully automated risk screening and pricing algorithms.

The API allows underwriters to systematically evaluate the profitability of submissions, triage referrals to cat modeling teams more efficiently and tailor decision-making based on individual property characteristics.

"The emphasis of our latest product development has been to put rigorous underwriting in the hands of underwriters and to give them a far more comprehensive view of the risk," he says. "Insurers can now overlay more comprehensive risk profiles for individual locations than before."

"In the traditional insurance model, the bad risks are subsidized by the good — but that does not have to be the case. We can now use data to get a lot more specific and generate much deeper insights," says Franklin. And if poor risks are screened out early, insurers can be much more precise when it comes to taking on and pricing new business. This requires them to shift more decision-making to straight-through processing using sophisticated underwriting guidelines driven by predictive data insight. Straight-through processing is already commonplace in personal lines and is expected to play a growing role in commercial property lines too.

"Technology has a critical role to play in overcoming this data deficiency through greatly enhancing our ability to gather and analyze granular information, and then to feed that insight back into the underwriting process almost instantaneously to support better decision-making," says Bains. "However, the infrastructure upon which much of the insurance model is built is in some instances decades old and making the fundamental changes to update it is a challenge. Many insurers are already in the process of updating legacy IT systems, making it easier for underwriters to leverage information such as past policy information at the point of underwriting.

But technology is only part of the solution. The data being input is also a critical factor. Are brokers collecting sufficient levels of data to help underwriters assess the risk effectively? That’s where Franklin hopes RMS can make a real difference. "For the cat element of risk, we have far more predictive, higher-quality data than most insurers right now," he says. "Insurers can now overlay that with other data they hold to give the underwriter a far more comprehensive view of the risk."
It’s our job to work for all parties and provide the best neutral science-based perspective on risk, whether that’s around climate change or earthquake risk in New Zealand. And we and our clients believe that by having the best science-based assessment of risk they can make effective decisions about their risk management.

**Spouting a gap in the science**
On September 28, 2018, a large and shallow M7.5 earthquake struck Central Sulawesi, Indonesia, triggering a tsunami over 2 meters in height. The shaking and tsunami caused widespread devastation in almost the entire province. According to a report published by the GEER Association, it was liquefaction and landslides that caused thousands of buildings to collapse in a catastrophe that claimed over 4,000 lives. It was the latest example of a major earthquake that showed that liquefaction — where the ground moves and behaves as if it is a liquid — can be a much bigger driver of loss than previously thought.

The Tohoku Earthquake in Japan during 2011 and a series of earthquakes in Christchurch in 2010 and 2011 were other high-profile examples. The earthquakes in New Zealand caused a combined insurance industry loss of $5.5 billion, with widespread liquefaction undermining the structural integrity of hundreds of buildings. Liquefaction has been identified by a local engineer as causing 50 percent of the loss.

Now, research carried out by RMS scientists is helping insurers and other stakeholders to better understand the impact that liquefaction can have on earthquake-related losses. It is also helping to pinpoint other parts of the world that are highly vulnerable to liquefaction following earthquake.

Before Christchurch we had not appreciated that you could have a situation where a midrise building may be completely undamaged by the earthquake shaking, but the liquefaction means that the building has suffered differential settlement leaving the floors with a slight tilt, sufficient to be declared a 100 percent loss,” explains Muir-Wood.

“We realized for the first time that you actually have to model the damage separately,” he continues. “Liquefaction is completely separate to the damage caused by shaking. But in the past we treated them as much of the same. Separating out the hazards has big implications for how we go about modeling the risk, or identifying other situations where you are likely to have extreme liquefaction at some point in the future.”

**The missing link**
Tim Ancheta, a risk modeler for RMS based in Newark, California, is responsible for developing much of the understanding about the interaction between groundwater depth and liquefaction. Using data from the 2011 Christchurch earthquake and boring data from numerous sites across California to calculate groundwater depth, he has been able to identify sites that are particularly prone to liquefaction.

“Liquefaction, if you think about all the rivers that flow through Los Angeles or the San Francisco Bay Area, you can try and model them in the same way as we did with the Avon River in Christchurch. We discovered that not all rivers have a similar lateral spreading on either side of the riverbank. Where the river courses have been reworked with armored slopes or concrete linings — essentially reinforcement — it can actually mitigate liquefaction related displacements.”

The second type of severe liquefaction is called “flow slides” triggered by liquefaction, which is where the soil behaves almost like a landslide. This was the type of liquefaction that occurred in Central Sulawesi when the village of Balaroa was entirely destroyed by rivers of soil, claiming entire neighborhoods.

“Plus it’s a type of liquefaction that is extremely rare,” he adds, “but it can cause tens to hundreds of meters of displacement, which is why they are so devastating. But it’s much harder to predict the soils that are going to be susceptible to them as well as you can for other types of liquefaction surface expressions.”

Ancheta is cognizant of the fact that a no-build zone in a major urban area is likely to be highly contentious from the perspective of homeowners, insurers and policymakers, but insists that now the understanding is there, it should be acted upon.

“There’s a Pandora’s box for us in the Cantabrian Mountains in Spain, we found out that the research told us where the lateral spreading would occur,” he says. “We have five earthquakes that produced lateral spreading so we know with some certainty where the lateral spreading would occur and where it wouldn’t occur. With severe lateral spreading, you just have to demolish the buildings affected because they have been extended so much.”
The ART OF EMPOWERMENT

A new app from RMS intuitively synthesizes complex risk data for a single location, helping underwriters and coverholders to rate and select risks at the touch of a button.

The more holistic view of risk a property underwriter can get, the better decisions they are likely to make. In order to build up a detailed picture of risk at an individual location, underwriters or agents at coverholders have, until now, had to request exposure analytics on single risks from their portfolio managers and brokers. Also, they had to gather supplementary risk data from a range of external resources, whether it is from Catastrophe Risk Evaluation and Standardizing Target Accumulations (CRESTA) zones to look-ups on Google Maps.

This takes valuable time, requires multiple user licenses and can generate information that is inconsistent with the underlying modeling data at the portfolio level. As the senior manager at one managing general agent (MGA) tells EXPOSURE, this misalignment of data means underwriting decisions are not always being made with confidence. This makes the building of unwanted risk aggregation in a particular area a very real possibility, invariably resulting in "senior management breathing down my neck."

With underwriters in desperate need of better multi-peril data at the point of underwriting, RMS has developed an app that leverages sophisticated modeling information, as well as a view of the portfolio of locations underwritten, to be easily understood and quickly actionable at the point of underwriting. But it also goes further as the app can integrate with a host of data providers so users can enter any address into the app and quickly see a detailed breakdown of the natural and human-made hazards that may put the property at risk.

In addition to synthesized RMS data, users can also harness third-party risk data to overlay responsive map layers such as, arson, burglary and fire-protection insights, and other indicators that can help the underwriter better understand the characteristics of a building and assess whether it is well maintained or at greater risk.

The app allows the underwriter to generate detailed risk scores for each location in a matter of seconds. It also assigns a simple color coding for each hazard, in line with the insurer’s appetite—whether it’s green for acceptable levels of risk all the way to red for risks that require more complex analysis. Crucially, users can view individual risks, the risk they are writing, with a single location, helping them avoid unwanted risk aggregation and write more consistently from their desktops and tablet devices—and then soon their smartphones.

In complex cases where deeper analysis is required, the view of the risks underwritten working together with cat modelers will still be a necessity. But for most risks, underwriters will be able to quickly screen and filter risk factors, reducing the need to consult their portfolio managers or cat modeling teams. “With underwriting assistants a thing of the past, and the expertise the cat modelers offer being a valuable but finite resource, it’s our responsibility to understand risk at the point of underwriting,” one underwriter explains.

"As a risk decision-maker, when I need to make an assessment on a particular location, I need access to insights in a timely and efficient manner, so that I can make the best possible decision based on my business," another underwriter adds.

The app is not intended to replace the deep analysis that portfolio management teams do, but instead reduce the number of times underwriters are asked for information by their underwriters, giving them more time to focus on the job at hand—helping underwriters assess the most complex of risks.

Bringing coverholders on board

Similar efficiencies can be gained on coverholder agents with authorized business. In the past, there have been issues with coverholders providing coverage that takes a completely different view of risk to the syndicate or managing agent that is providing the capacity. RMS has ensured the app works for coverholders, to give them access to shared analytics, managing agent rules and an enhanced view of hazards. It is hoped this will both improve underwriting decision-making by the coverholders and strengthen delegated authority relationships.

Coverholder business continues to grow in the Lloyd’s and company markets, and delegating authorities often worry whether the risks they are underwriting on their behalf are done so with the best possible information available. A better scenario is when the coverholder contacts the delegating authority to ask for advice on a particular location, but receiving multiple referral calls each day from coverholders seeking decisions on individual risks can be a drain on these growing businesses’ resources.

"Delegated authorities obviously want coverholders to write business doing the proper risk assessments, but on the other hand, if the coverholder is constantly pinging the managing agent for referrals, they aren’t a good partner," says a senior manager at one MGA. "We can increase profitability if we improve our current workflow, and that can only be done with smart tools that make risk management simple," he notes, adding that better risk information tools would allow his company to redeploy staff.

A recent Lloyd’s survey found that 55 percent of managing agents are struggling with resources in their delegated authority teams, and with the Lloyd’s Corporation also seeking to cleanse the market of sub-par performance after swinging to a loss in 2018, any solution that drives efficiency and enables coverholders to make more informed decisions can only help drive up standards.

"It was actually an idea that stemmed from our clients’ underwriting coverholder business. If we can equip coverholders with these tools, managing agents will receive fewer phone calls while being confident that the coverholder is writing good business in line with the agreed rules," says Razzaq. "Most coverholders lack the infrastructure, budget and human resources to run complex models. With this app, we can now offer them deeper analytics, by leveraging expansive model science, in a more accessible way and at a more affordable price."
RMS solutions help insurers, financial markets, corporations and public agencies evaluate and manage risks throughout the world, promoting resilient societies and a sustainable global economy.

Risk Management Solutions, Inc.
7575 Gateway Blvd., Suite 300
Newark, CA 94560 USA
www.rms.com

©2019 Risk Management Solutions, Inc. RMS is a registered trademark and the RMS logo is a trademark of Risk Management Solutions, Inc. All other trademarks are property of their respective owners.