



Malaysian Insurance Highlights 2021

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Malaysian Insurance Highlights

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Foreword Malaysian Re

Little did we know that flood as the most frequent and severe natural catastrophe in Malaysia would be as topical for this year's third edition of the *Malaysian Insurance Highlights (MIH)*. On 16 December 2021, a tropical depression made landfall in North-Eastern Malaysia, quickly inundating eight provinces across the peninsular. Causing heavy and prolonged rainfalls, more than 100,000 people were displaced by the flash floods. 54 people died and at least two went missing, making this the most severe natural catastrophe disaster to have hit Malaysia since 1996.

Thousands of volunteers were mobilized throughout the country to help those displaced by the floods with shelter, blankets or food. The government announced to provide RM 1.4 billion (US\$ 336 million) to at least 30,000 affected households in cash aid, including death benefits, relief on utility bills and vehicle repairs. As the floods also hit Malaysia's richest and most populous areas like Selangor, the authorities were faced with mounting challenges for their rescue efforts, particularly, as many of those displaced by the floods had to spend the initial nights without shelter.

The General Insurance Association of Malaysia, PIAM, announced in late December that it calculates with a total flood-related claims exposure of RM 2 billion to RM 3 billion (up to US\$ 720 million). According to our own assessment the insured loss could amount to approximately RM 1.5–2.0 billion, roughly 20 % –30 % of the economic loss of RM 5.3 billion to RM 6.5 billion, estimated by the Department of Statistics.

The Great Malaysian Flood in December illustrates the rising risk that Malaysia faces as the impact from climate change aggravates. Malaysia's population might be more than ever aware of the risk, but still underestimates its severity. Insurance penetration is still low, as only few businesses and people are insured, and often only in regions that are perceived as flood prone. However, this year's floods have demonstrated that the risk can also strike in regions usually spared from flooding.

Today, the insurance industry presents itself well prepared to cover the flood risk. Insurance capacity is sufficiently available and risk models are well advanced. However, particularly the lower income bracket of Malaysia's population as well as the SME companies, which are most exposed to flood risk in our country, need solutions that in combination with government support are closely attuned to their exposure. The recent flood has shown that the current public ex-post solutions are inefficient in providing immediate, broad and just risk protection and coverage.

We hope this report provides a good assessment of the current flood risk in Malaysia, its main trends and developments, and serves as an inspiration to further increase flood insurance penetration. We would like to express our deepest gratitude to the industry leaders who contributed to this survey and openly shared their expertise. We are also appreciative to Bank Negara Malaysia and the General Insurance Association of Malaysia (PIAM) for their unwavering support of our initiative.

May you have an enjoyable read of MIH 2021.

Zainudin Ishak

President & Chief Executive Officer,
Malaysian Reinsurance Berhad

Foreword Faber Consulting

We are proud to present the third edition of the *Malaysian Insurance Highlights (MIH)*. This year's issue examines the impact of flooding – the country's most frequent and severe natural catastrophe – on its economy and insurance markets. Just as 2021 drew to a close Malaysia was hit by one of the worst floods that the country ever experienced. Floods, mudslides and landslides resulting from the heavy rain affected and displaced more than 100'000 people, potentially causing insured losses of RM 1.5 – 2.0 billion (US\$ 360 – US\$ 480 million).

About 5 million Malaysians live in flood-prone areas. Yet, only a fraction of the country's population and businesses are insured against flooding. Despite the low insurance penetration, there is sufficient capacity available. The country's general insurers are adequately capitalized to carry the risk, which predominately affects Malaysia's rural areas, while the country's urban areas are more densely insured. However, buyers are highly price sensitive and often only purchase the cover in flood-prone regions or in the aftermath of an event.

As in our previous editions, the *Malaysian Insurance Highlights* rests on two pillars: thorough market research and in-depth interviews with insurance executives operating in the country. This time we focused in our research section on the key drivers that shape Malaysia's flood risk and on current trends that help to mitigate and shoulder the risks. In our survey part this time, we opened the floor to both chief executives and lead underwriters to broadly identify how Malaysia's insurance industry assesses its growing flood risk.

Once again we would like to express our deepest gratitude to Malaysian Re for facilitating this research project. In addition, we would like to thank our interviewees, representing different insurers, reinsurers, brokers and association members, who enabled this research by openly sharing their time and expertise with us.

We hope you enjoy reading this edition of *Malaysian Insurance Highlights* and find its insights useful.

Henner Alms

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Methodology

The findings of this report are based on structured interviews with more than 24 executives representing 22 Malaysian insurers, reinsurers, intermediaries and trade associations. The interviews were conducted by Faber Consulting, a Zurich-based research, communication and business development consultancy, from September to early December 2021.

We would like to thank the following organizations for sharing their insight with us:

AIA General Berhad
AIG Malaysia Insurance Berhad
AmGeneral Insurance Berhad
Axa Affin General Insurance Berhad
Berjaya Sompo Insurance Berhad
Etiqa General Takaful Berhad
General Insurance Association of Malaysia (PIAM)
Liberty Insurance Berhad
Lloyd's, Asia Pacific
Malaysian Reinsurance Berhad
MPI Generali Insurans Berhad
Progressive Insurance Berhad
RHB Insurance Berhad
Swiss Re Asia Pte. Ltd., Malaysia Branch
Syarikat Takaful Malaysia Am Berhad
Takaful Ikhlas General Berhad
The Great Eastern Life Assurance Co Ltd
Tokio Marine Insurans (Malaysia) Berhad
The Pacific Insurance Berhad
Tune Insurance Malaysia Berhad
Willis Re Labuan Limited
Zurich General Takaful Malaysia Berhad

Executive summary

Flooding is regarded as Malaysia's most severe and frequent disaster causing the highest amount of annual average losses. This has been painfully evidenced once again in December 2021, when the most severe flood event since 2014 struck the country, killing about 50 people, displacing more than 100,000 and causing estimated economic losses of RM 5.3 billion – RM 6.5 billion (US\$ 1.26 billion – US\$ 1.55 billion). Historically, Malaysia experienced adverse flood events every three years. In addition, flash floods occur on a more frequent basis. From 1998–2021, around 14 major flood events took place in Malaysia. Apart from the December 2021 event, a flood event in 2014, affecting the east coast region was one of the worst hydrological disasters to hit the country.

According to the Malaysian Disaster Management Agency (NADMA) about 5 million Malaysians live in flood prone areas. However, less than 25 % of all homeowners are insured against flood risk, according to a study by Zurich Insurance. Thus, underinsurance or the low flood insurance penetration is a major challenge. As a result, the government supports people affected by flood. In the recent event, it committed a financial contribution of RM 1.4 billion (US\$ 336 million) in cash and other forms of emergency assistance. Since only about 5 % of all vehicles in Malaysia are flood insured, the country's general insurance association, PIAM, supported vehicle owners with a flood relief fund of RM 2.4 million to cushion the losses suffered from water-damage.

Malaysia's insurers see no capacity issue for flood insurance

Despite the low insurance penetration, insurance and reinsurance capacity for flood risk is sufficiently available, according to the interviewees participating in this year's edition of the *Malaysian Insurance Highlights*. The country's general insurers are adequately capitalized to shoulder the risk, which predominately concerns Malaysia's rural regions. However, the pricing of the risk is perceived as high and, as a result, flood cover is often only purchased in flood prone regions or following recent events.

While Malaysia's large corporations and public institutions are seen to recognize the risk, SMEs and consumers tend to underestimate it. The limited understanding of the risk, its magnitude and potential financial impact, influence the price sensitivity, as the insurance is perceived as expensive. Human interventions into nature, such as deforestation and urbanization, but also climate change are seen as drivers for flood coverage but mainly among those, who already buy the product.

Demand is also influenced by the government's willingness to support and partially compensate the low-income segment of the country for the loss caused by a disaster. Although the government budgets for these kinds of events, there is a high consensus that historically the government's bail-out measures have been insufficient to compensate the lower income sections (B40 segment) for its losses.

Executive summary

Supply side shortcomings are rare. They only arise in flood prone areas that are mostly inhabited by the country's low-income population. Flood models have greatly improved and although they might still lack granularity, their availability is continuously improving with vendor models now complementing the most widely used broker and reinsurer models.

Flooding predominately affects the B40 segment, as it hits most frequently the rural east coast of the Malaysian peninsular or lower lying urbanizations prone to inundations. Our interviewees also left no doubt that Malaysia's government should take a more prominent role in improving risk protection to the lower income segment. Currently, the government assumes the role of an insurer of last resort. Going forward, insurers believe that some form of premium subsidies for this part of society or a compulsory insurance scheme would be a more efficient, predictable and reliable solution.

Drivers of flood insurance

Climate change has become a driver to purchase more flood protection with more people realizing that weather patterns have changed, and catastrophes occur more frequently. In addition, human interventions, such as urbanization, deforestation and the expansion of agriculture have changed the ability of the environment to absorb or retain water from heavy rainfall. Furthermore, drainage systems are often either insufficient or blocked. Finally, assets and values have been growing as the country's GDP increased. Insurance penetration is mainly seen to have progressed in tandem, but not in excess of value creation.

Due to its scale, frequency, data availability and obtainable capacity, insurers regard Malaysia's flood risk as insurable. Flash floods triggered by heavy or continuous rain are the most common form of flooding, although the magnitude of the loss they cause is usually limited. Nevertheless, they are difficult to predict and model because they happen quite localized. Particularly in urban areas flash floods can trigger hefty damages, especially if drainage systems are insufficient or blocked. Storm surges also pose a risk for Malaysia's east coast, but usually the damage caused is small, given the rural nature of the region.

However, as evidenced by the recent December flood, Malaysia's central part also suffers from flooding, causing severe losses. Insurers also pointed out that there are striking differences between residential and commercial properties, as residential properties are often located in lower areas with a higher flood exposure, while commercial properties are frequently situated in safer places with more reliable drainage systems.

Flood risks are mainly covered through property and fire insurance. Coverage is bought most consistently by the larger corporations, while in the SME segment penetration is low. Business interruption is the second most frequently mentioned line of business affected by flood losses, although the impact is limited as the insurance is mostly bought by large corporations and its coverage is capped and only kicks-in after the deductible has been exhausted.

Executive summary

Stable pricing

Prices for flood coverage have been stable to declining for the last three years. As part of property/fire or motor insurance, flood coverage used to be tightly regulated by the tariff scheme governed by Bank Negara. Since the launch of the de-tariffication of both lines, insurers gained some flexibility to adjust and reduce the pricing for property and fire by 30 % maximum and by 10 % for motor. Going forward, much will depend on the launch of the next phase of the de-tariffication, which has been postponed due to the COVID-19 pandemic. Insurers therefore expect a rather stable to slightly declining pricing for as long as rates are regulated.

Modelling is seen to have greatly improved and to have contributed to a stable risk appetite. Insurers assess their flood risk through models provided by the main brokers, the leading reinsurers or through vendors of natural catastrophe models. As more events have been recorded in recent years, there is more data available to assess flood risks. However, models still lack granularity because the country's postal codes, which form a basis for the flood models, cover a geographic area, which is far too broad and diverse to enable a robust risk assessment. In addition, available models are criticized for not providing sufficient foresight, as current data does not yet accommodate for the impact of climate change on the Malaysian risk landscape.

The December '21 flood event had to be expected

Interview with Ahmad Noor Azhari, Chief Underwriting Officer at Malaysian Re

With economic losses of RM 5.3 billion to RM 6.5 billion (US\$ 1.26 billion – US\$ 1.55 billion) last year's great flood, which hit Malaysia from 16 to 21 December 2021, was by far the largest and costliest flood event that the country has experienced thus far. The flooding extended across eight Malaysian States or 33 districts and brought floods depth of up to 1.5 meter, caused by more than 36 hours of continuous rain.¹ On 18 December 2021, 316mm of rain fell in Kapar in Klang district of Selangor, 364.5mm in Pekan in Pahang state and 405mm in Kuantan within 24 hours.²

December's severe flood event was caused by a combination of the seasonal North-Eastern monsoon season, which typically affects the country from November to March, a low-pressure weather system that had formed over the South China Sea, named Tropical Depression 29W and Typhoon Rai, which initially had formed over the Pacific Ocean. Before the tail of Typhoon Rai brushed across Malaysia in the night of 18 December, it had already caused havoc in the Philippines, where it had made landfall as a powerful super typhoon of the category 5 on 15 December.

Prior to Typhoon Rai, the Tropical Depression 29W made landfall in Malaysia on 17 December on the east coast of Malaysia. Due to the combination of the Tropical Depression 29W with Typhoon Rai, the low-pressure system had been able to pick up an exceptionally high level of moisture as both weather systems travelled across the South China Sea in an anticlockwise fashion with exceptionally strong winds.

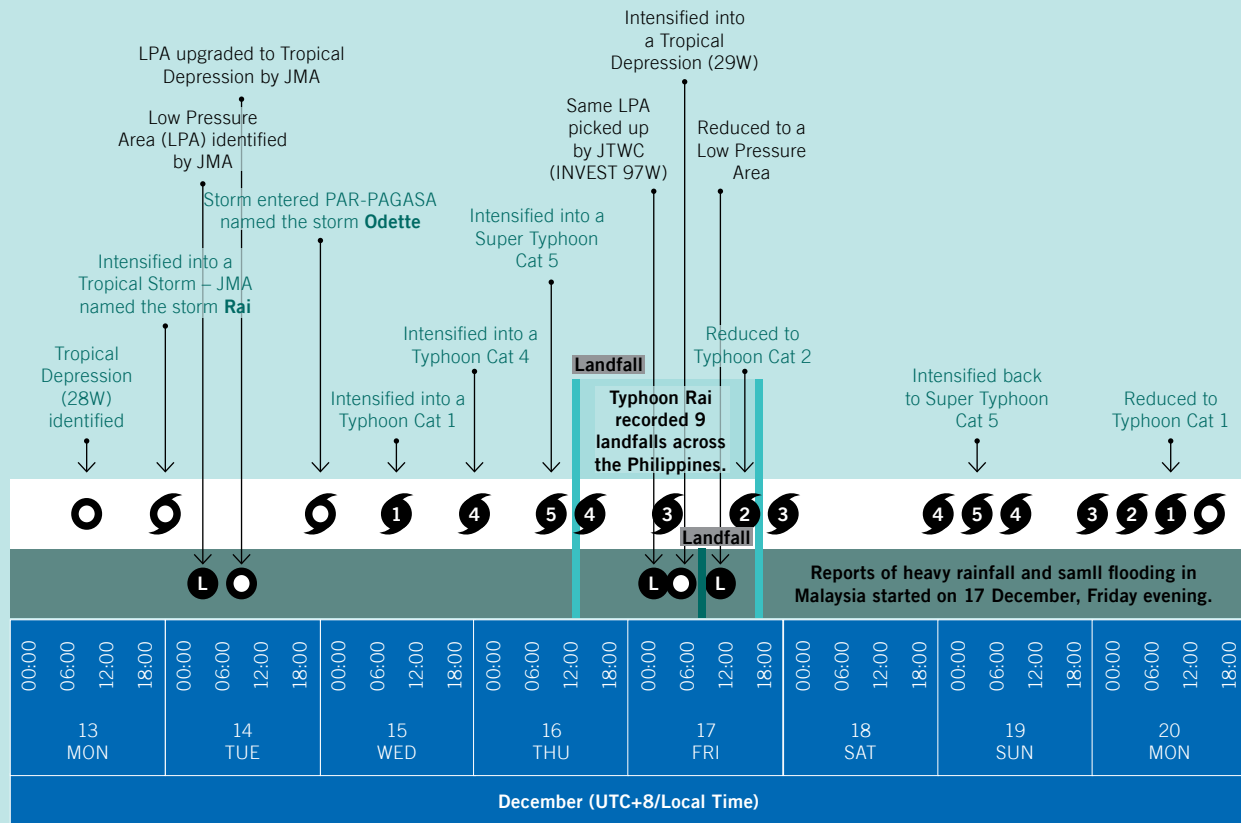
Typhoon Rai thus influenced the depression's wind severity and intensified the monsoon's effects, pushing the depression across the Malaysia's Titiwangsa mountain range, which usually shelters the more populous and industrious Western Malaysian regions from the effects of the North-Eastern Malaysian monsoon season. In addition, climate change will have played its role in the December floods, as insurers observed a steady increase in rainfalls over the past five to ten years.

The intense flooding displaced more than 100'000 people across the country. Its effects were further exacerbated by multiple landslides, road blockages and ultimately also the Covid-19 pandemic, as displaced citizens were faced with the threat of the spreading virus, which also might have slowed down the attention and the response to the flood's devastation.

1 JBA Risk Management; Super Typhoon Rai and South East Asia Floods: A Retrospective, 2021

2 Asian Disaster Reduction Center, Disaster Information, Malaysia Flood

Chronological order of events – Typhoon Rai and Tropical Depression 29W



* Timeline of events at local time (UTC+8) respective to Typhoon Rai and 29W. PAR = Philippine Area of Responsibility; PAGASA = Philippine Atmospheric, Geophysical and Astronomical Services Administration; JMA = Japan Meteorological Agency.

Source: JBA Risk Management Limited, 2021

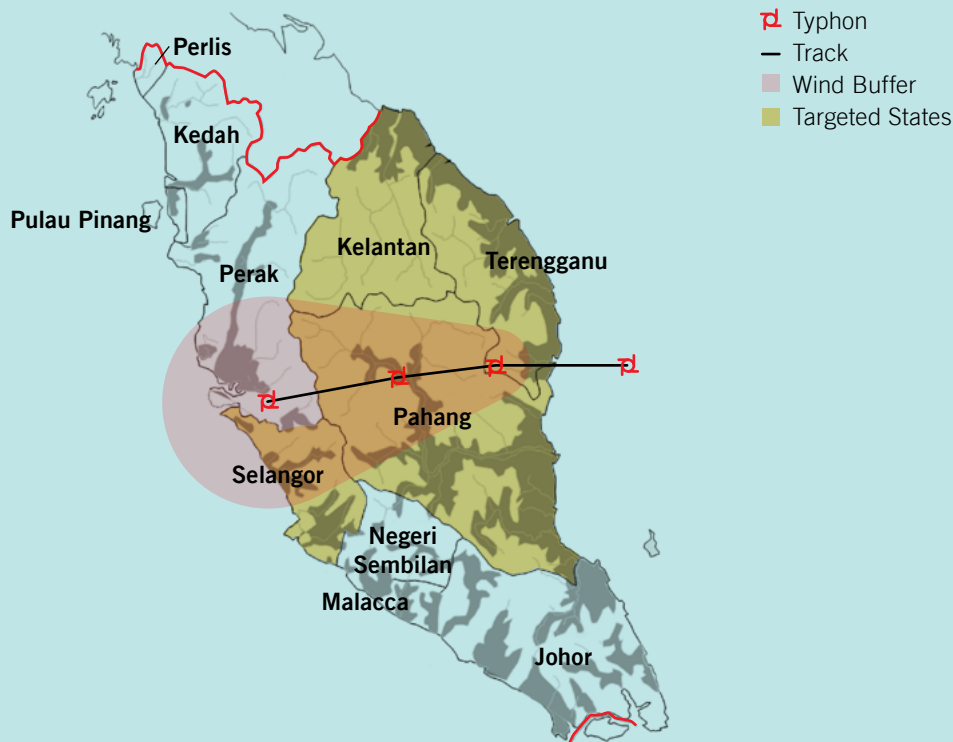
Insured loss estimated at up to 30 % of economic loss

While Malaysia's government determined that the extreme rainfall causing the floods had been a 1 in 100years event, the jury is still out to reconcile the return period for the flooding and the insured loss. According to Ahmad Noor Azhari, Chief Underwriting Officer at Malaysian Re, the event value will have a return period of 40 to 50 years. Malaysian Re expects that country's risk carriers will be faced with an insured loss in the range from RM 1.5 to RM 2.0 billion (US\$ 360 million to US\$ 480 million). Compared to the economic loss that represents an insured loss of 20 % to 30 %, which is exceptionally high for Malaysia, where historically flood events caused an insurance loss of around 10 %.³

The reason for this high ratio is due to the share of industrial losses which occurred as the Federal Territory of Kuala Lumpur and the State of Selangor were heavily affected. While typically the flooding affecting the east coast of Malaysia triggers residential losses, this time advanced manufacturing industries, like semi-conductor electronics, clean rooms but also SMEs properties were affected with some single losses exceeding RM 50 million. In addition, losses for vehicles inundated as well as the higher sums-insured for the residential properties in Malaysia's more prosperous and densely populated urbanizations contributed to the exceptional loss.

³ See also page 17.

Path of Tropical Depression 29W



Source: OCHA, OSM Contributors, ICRC, IFRC, GDACS, 17 December 2021

Impact on demand and pricing

The December floods will have an immediate effect on Malaysia's insurance markets. Azhari expects a surge in demand for insurance coverage, particularly for the extensions of motor policies, as flood cover is an optional addition. Furthermore, flood cover for residential and commercial properties and the content of households will increase as well.

In terms of reinsurance demand 60 % of renewals had been done when the flooding hit Malaysia. However, due to the significant impact of this event, insurers may be looking at reviewing its structure moving forward as to ensure sufficient coverages are in place. Besides, insurers are reassessing their understanding of their flood risk. While previously, they had considered Malaysia – although close – but not as a part of the Pacific «Ring of Fire», that view is changing especially for weather related perils. Premium growth had been flat while aggregates had increased double digit. That trend will reverse in the coming renewals, when the December flood will demonstrate its impact especially on programs that experienced losses.

The pricing of the original property and fire policies by primary insurers will be less affected as flood is an additional peril to be insured optionally. However, reinsurance pricing is expected to increase substantially in the coming renewals. This is in line with global retrocessions pricing which has been raising in the last several years. However, due to its limited natural catastrophe exposure, Malaysia's insurance market had been spared of this trend.

The external perspective on flood risk is changing as the industry has to reevaluate how it assesses its flood risk. Within a single year it experienced unprecedented flood losses in Germany and Belgium in summer this year, followed by the severe Henan flooding in China in October and finally the Malaysian flood – all caused by torrential rainfalls.

Tightening terms and conditions

Nevertheless, Malaysian Re is not expecting substantial changes in insurance or reinsurance capacity which currently is considered adequate. However, according to Azhari, many of Malaysia's insurers have been hit hard by the recent flood. In order to improve market conditions, the focus will be on pricing and exposure, leading to a tightening of terms and conditions and influence how capacity will be deployed.

While risk models had been adequate, the December event has been entirely within the curve of expectations. However, going forward insurers and reinsurers will require more granular and detailed information to understand their peak risks, which may need to be assessed in isolation. To better manage portfolios, insurers must consider adequate pricing in accordance to their exposure per region and clients.

Malaysian Re expects that the supervisory is unlikely to change the schedule of the de-tariffication of the fire and motor policy, due to the recent event. However, the December flood has been a major event and insurers need to assure that their financial strength and liquidity is sufficient to cope with future events and to also provide coverage to their clients which reflects their risks.

Improving flood risk mitigation and coverage

Finally, the government is likely to further enhance its flood mitigation program as a result of the December flood. Following the SMART tunnel built in Kuala Lumpur a further stormwater tunnel is planned to mitigate future issues. In addition, existing pump systems located at the prone flooding areas need to be reconsidered as in the December floods public installation had simply been unable to cope with the masses of water.

From an insurance point of view, there is a need to push for a deeper discussion to find a solution to better cover the country's flood risk by bringing together the insurance sector, the regulator (Bank Negara), Malaysia's Natural Disaster Management Agency (NADMA), and the government. While previously, the focus had been on developing a coverage which first and foremost addressed the exposure of the lower-income segments of Malaysia's population, the B40 group, the current wholesome solutions aim to provide faster protection to consumers and encompass all parts of society or policyholders.



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Financial Strength Rating of 'A' Strong (Stable Outlook) by Fitch Ratings
Financial Strength Rating of 'A-' Excellent (Stable Outlook) by A.M. Best

Flood risk overview

The rise in sea level due to climate change, population growth, and rapid urbanization has given rise to more frequent and severe flood disasters in many countries around the globe, including Malaysia. Those living near the seashore and rivers are the most affected by floods, which often force them to relocate. Flood risk, due to intense or prolonged rain, climate change, rising population and poorly adapted land use, is by far the most prolific natural disaster to impact on Malaysia. This natural hazard has caused more damage than any other hazard the country experiences.

One of the factors that leads to degradation of the environment and represents a principal cause of flood in Malaysia is the fact that human activities, including the rapid development of densely populated flood plains, destruction of forests, and encroachment on flood-prone areas for development are viewed as a positive development, neglecting their negative impact on the environment. The consequences of floods in Malaysia include the loss of human and animal life, a deterioration of health conditions following an event and the destruction of landscapes, agriculture and infrastructures.

Flood risk = hazard × exposure × vulnerability

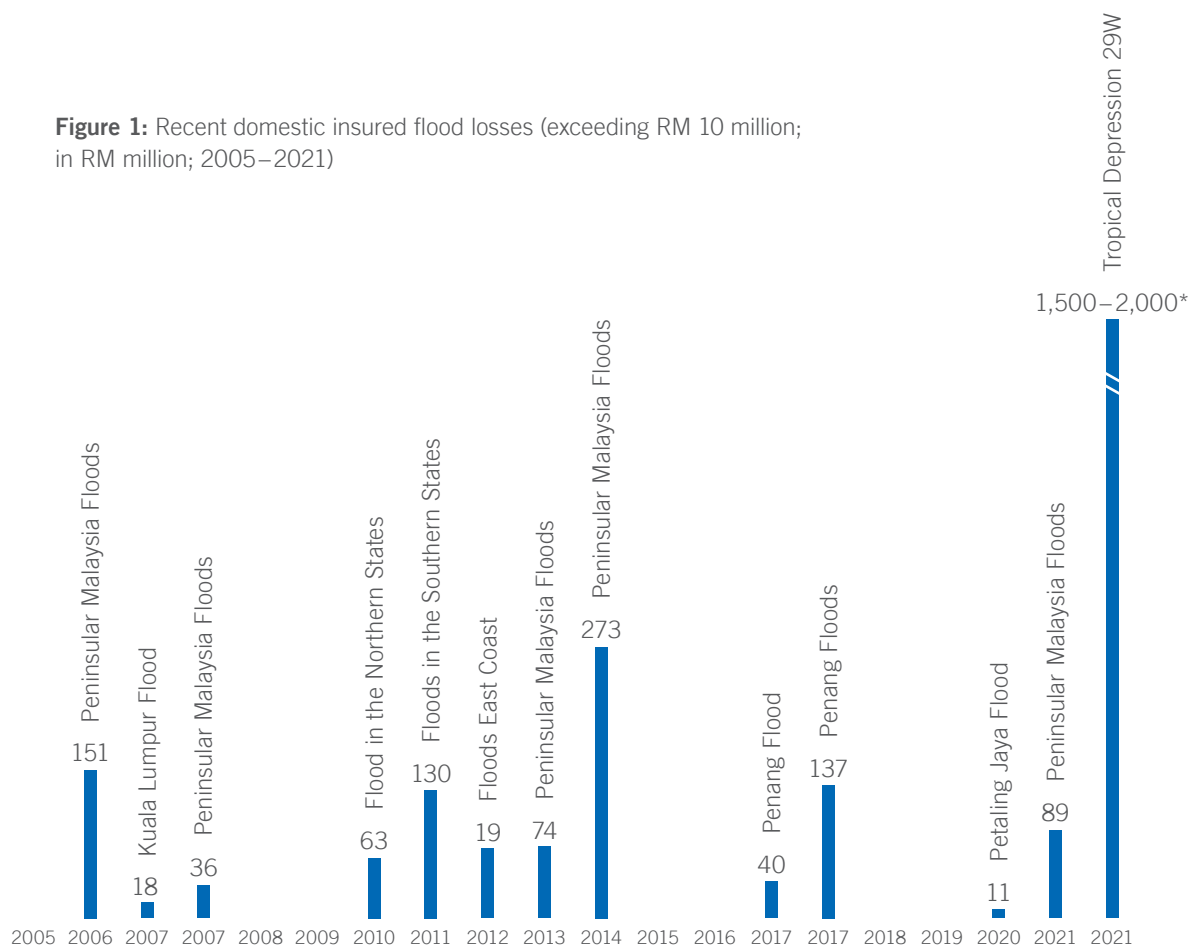
Flood risk is a function of the flood hazard, the exposed values / assets and their vulnerability. An increase in flood risk must be attributed to changes in at least one of these variables

Man-made factors have contributed significantly to the severity of historical flood losses

Historically, Malaysia has experienced adverse flood events once every three years on average. In addition, quickly striking flash floods occur on a frequent basis and in most cases without warning. As far back as 1886, a severe flood with gale-force winds was first mentioned, having caused extensive damages in the state of Kelantan. From 1998–2021, around 14 major flood events took place in Malaysia. Within those 23 years, the 2014 flood event affecting the east coast region was the worst hydrological disaster to hit the country, exceeded by last year's December event. There is a total of 189 river basins in Malaysia, with the main channels flowing directly to the South China Sea and 89 of them are prone to recurrent flooding.¹

¹ Malaysian Water Partnership (2017): GAP Analysis Report: Flood disaster management in Malaysia

Figure 1: Recent domestic insured flood losses (exceeding RM 10 million; in RM million; 2005–2021)



* Preliminary assessment (according to Malaysian Re)

Source (insured market losses): Malaysian Re

In December 2021, the Tropical Depression 29W made landfall in an area in Kemaman District (north-eastern Peninsular Malaysia). Heavy rainfalls led to overflowing rivers, submerging many areas, damaging houses, cutting off roads and affecting the provision of essential services such as water, food and health. Eight states (namely Kelantan, Terengganu, Pahang, Melaka, Negeri Sembilan, Selangor, Perak and Kuala Lumpur) were hit by floods until early January. At least 50 people died, and thousands were evacuated, taking the total population affected by heavy rain during December 2021 and January 2022 to more than 100'000 people.

Flood risk overview

The Department of Statistics (DOSM) estimates that the total economic losses caused by the floods will amount to RM 5.3 billion – RM 6.5 billion.² Furthermore, the General Insurance Association of Malaysia (PIAM) has estimated that the total flood related claims exposure in the affected region could total up to RM 2 – RM 3 billion (up to US\$ 720 million). Based on these preliminary estimates and experience from the 2006/07 and 2014/15 flood events, in which slightly less than 10 % of the economic loss was insured, the 2021 floods may have caused insured losses of approximately RM 1.5–2.0 billion.

In addition, Malaysia's Government has pledged to provide RM 1.4 billion (US\$ 336 million) in cash and other forms of aid to those devastated by the severe flooding. Furthermore, Malaysia is seeking US\$ 3 million from the UN Green Climate Fund to develop a national plan to adapt to climate change. The plan will focus on areas such as water, agricultural, and food security, public health, forestry, and infrastructure.³

2014 East Coast flood: In mid-December 2014, heavy rains brought by the Northeast Monsoon battered vast stretches of Peninsular Malaysia. Precipitation persisted until the first days of 2015, and accumulated rainfall in some areas exceeded 1,750 mm, up to six times the amount usually observed in December. The most affected states were Pahang, Terengganu and Kelantan, where floods destroyed approximately 184,000 hectares of palm plantations and nearly halted palm oil production, an important sector of the Malaysian economy. The event caused economic losses of approximately RM 2.9 billion (about US\$ 900 million). In addition, the government provided RM 800 million (approximately US\$ 250 million) for the repair and reconstruction of critical infrastructure such as schools, hospitals, roads, and bridges. Infrastructure damages alone were estimated at US\$ 668 million.⁴ The event affected 250,000 people in Kelantan and more than 2,000 permanent houses were destroyed and needed complete reconstruction.⁵

In December 2006 and January 2007, two waves of floods hit Malaysia. Three states in Peninsular Malaysia (Johor, Pahang and Malacca) and two states in East Malaysia (Sabah and Sarawak) were affected. The floods were caused by heavy rainfall attributed to a typhoon which had hit the Philippines and Vietnam a few days earlier. More than 100,000 people were evacuated in Johor alone and at least 17 people were killed. Economic losses amounted to US\$ 420 million⁶ and the Government provided RM 200 million (about US\$ 57 million) of aid and supplied essential relief.

2 https://www.bernama.com/en/general/news_disaster.php?id=2044085

3 CNN: <https://edition.cnn.com/2022/01/02/asia/malaysia-floods-evacuation-intl-hnk/index.html>

4 Lim, K.Y. & Zakaria, N.A. & Foo, K.Y. (2019). A shared vision on the historical flood events in Malaysia: Integrated assessment of water quality and microbial variability. *Disaster Advances*. 12. 11–20.

5 Azimi, M.A. et al (2019) IOP Conf. Ser.: Earth Environ. Sci. 244 012009; Disaster risks from economic perspective: Malaysian scenario

6 MarshMcLennan, 17 April 2019. Understanding Flood Risk in Malaysia through Catastrophe Modeling.; <https://www.marshmclennan.com/insights/publications/2020/september/understanding-flood-risk-in-malaysia-through-catastrophe-modelling.html>

On 25 December 1996 tropical storm 'Greg' hit East Malaysia and caused the worst flooding in history in the State of Sabah on Borneo Island. The storm, with winds reaching 70 km/h and 24 hours of heavy rainfall, caused flooding that swept away more than 300 houses and left over 3,000 people homeless. At least 241 people died. The economic losses were estimated at approximately US\$ 300 million.⁷

1926 Great Flood: The 1926 flood is also known as «The storm forest flood» because it destroyed hundreds of square kilometers of lowland forest on the floodplains of the Kelantan and Besut rivers. Even nearly 100 years ago, several man-made factors contributed to the event: «La Niña caused exceptionally heavy rains in 1926. But mostly man-made environmental changes and poor (often conflicting) hydraulic management measures were to blame for the severity of the inundation. The transformation of land use, especially commercial plantation and industrial mining, eroded natural forms of flood defense through deforestation and clogged rivers with waste products.»⁸

Storm surges bearing the highest loss potential, flash floods can be locally devastating

Hazard: A potentially destructive physical phenomenon. Flood hazards can be divided into primary hazards that occur due to contact with water, secondary effects that occur because of the flooding, such as disruption of services, health impacts such as famine and disease, and tertiary effects such as changes in the position of river channels.

The main types of flood are (1) storm surge, (2) river flood, and (3) flash flood. Special cases include events such as tsunami, groundwater rise, dam break floods, glacial lake outburst floods and waterlogging.

- Storm surges bear the highest loss potential and can occur along the coasts of seas and big lakes. Although coastal defense can prevent very high losses, the loss potential of storm surges remains huge.
- River floods are the result of intense and/or persistent rain for a longer period of time over large areas. In most cases, the ground becomes fully saturated and the soil's capacity to contain the water is exceeded. The ground behaves as if it was sealed, and the precipitation runs off directly into creeks and rivers. Typically, river floods build up gradually, though sometimes within a short time. The area affected can be very large in the case of flat valleys with wide flood plains. Although inundation due to river floods starts from a water course and is somewhat confined to its valley, the areas affected can be far greater than those hit by storm surges.

7 Chan, N. W. (2012). «Impacts of Disasters and Disasters Risk Management in Malaysia: The Case of Floods», in Sawada, Y. and S. Oum (eds.), Economic and Welfare Impacts of Disasters in East Asia and Policy Responses. ERIA Research Project Report 2011-8, Jakarta: ERIA. pp.503-551.

8 Williamson, Fiona (2016). The «Great Flood» of 1926: environmental change and post-disaster management in British Malaya, Ecosystem Health and Sustainability 2:11 (2016). Ecosystem Health and Sustainability. 2. 10.1002/ehs2.1248.

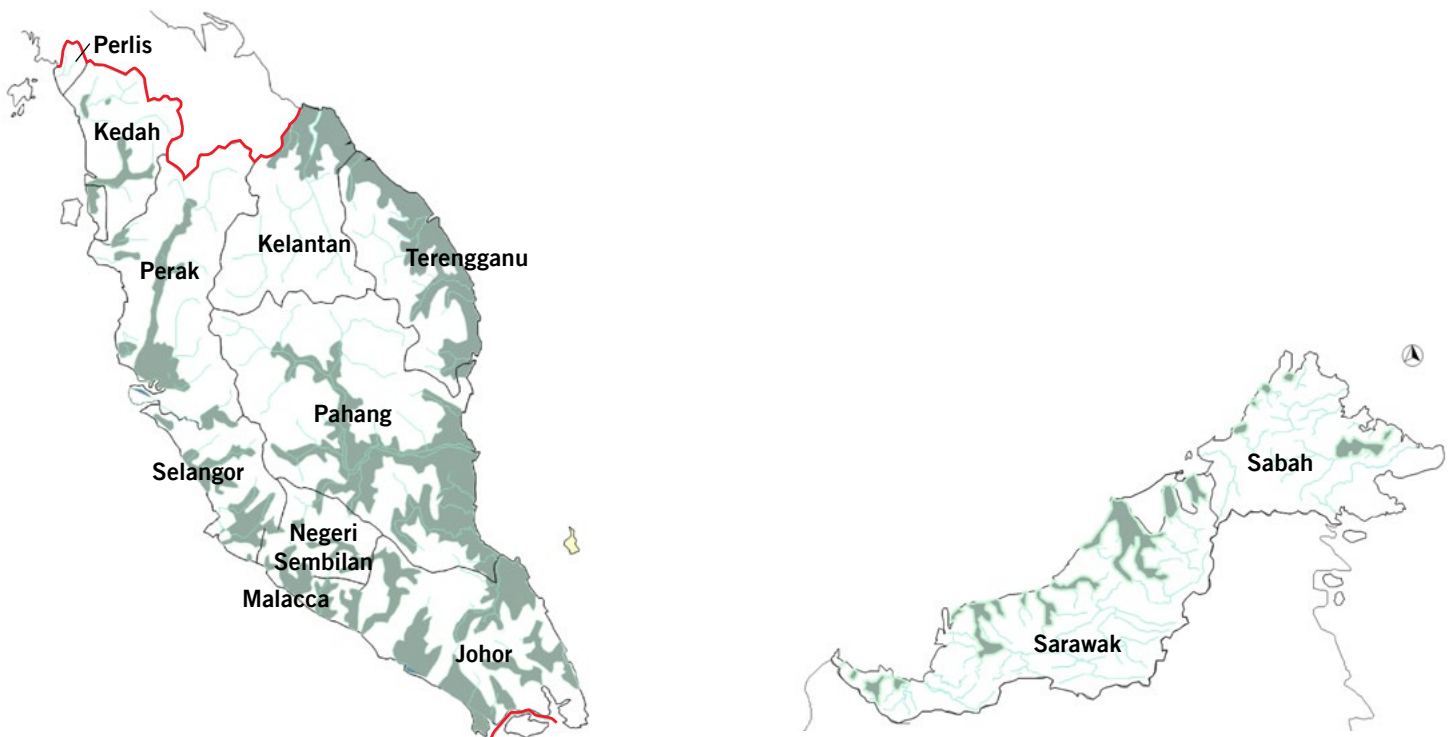
Flood risk overview

- Flash floods sometimes mark the beginning of a river flood but are most often local events. They are the result of intense rainfall over a small area. Although the ground is usually not saturated, the infiltration rate is much lower than the rainfall rate. Forecasting flash floods is almost impossible, as lead times for early warnings are typically in the order of minutes. Despite their often very local impact, flash floods have a high potential to cause devastating destruction.

The occurrence of flood events closely linked to heavy rain during Monsoon seasons

A total area of 29,800 km² or 9 % of land area of the country are prone to flooding. Large floods usually occur in the northern and eastern states of Peninsular Malaysia due to prolonged rainfall especially in the convening months of November and December. The states of Johor, Pahang, Terengganu, Pahang, Sabah and Sarawak are affected, and flooding occurs annually. Other states include Perlis, Kedah, Penang, Perak, Selangor, Negeri Sembilan and Melaka as well as the Federal Territory of Kuala Lumpur often experience flash floods.

Map 1: Flood prone areas in Malaysia



Source: Ministry of Environment and Water,
Department of Irrigation and Drainage

Flood risk overview

With the coastal areas facing the South China Sea, the rainfall distribution in Malaysia is largely determined by intense convective precipitation and is highly influenced by the Northeast and Southwest Monsoons. The annual average rainfall is 2,420 mm for Peninsular Malaysia, 2,630 mm for Sabah and 3,830 mm for Sarawak. The former Northeast Monsoon, prevailing between November and March brings heavy rainfall predominantly to the east coast of Peninsular Malaysia, Sabah and Sarawak. Rain bearing winds come with the Southwest Monsoon, extending from April to September, though rainfalls during this period are generally less than the Northeast Monsoon.

Steep increase of exposures closely tied to economic growth

Flood exposure: The location, attributes, and value of assets that are important to communities and that could be affected by floods.

The term flood exposure refers to people and assets located in floodplains. On a global level, human exposure to floods continues to increase due to changes in hydrology and land use. In Malaysia, the vulnerable population is most exposed to floods as they are disproportionately likely to live in flood-prone areas. Risk data can be used to determine and quantify exposure include GDP, agricultural production, population, and the value of buildings.

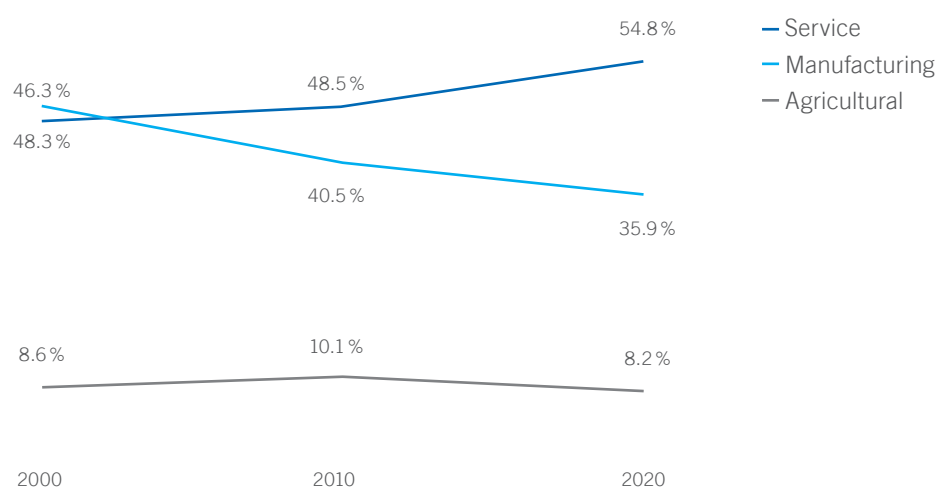
Table 1: Selected exposure indicators: Malaysia

Indicator	Unit	2000	2010	2020	CAGR 2000–2010	CAGR 2010–2020
Total GDP	RM billion	388.168	833.104	1,416.605	7.9 %	5.5 %
Services GDP	RM billion	179.726	403.864	776.087	8.4 %	6.7 %
Industrial, incl. construction GDP	RM billion	187.567	337.399	508.660	6.0 %	4.2 %
Agricultural GDP	RM billion	33.379	84.060	116.247	9.7 %	3.3 %
Population	People in million	23.495	28.589	32.939	2.0 %	1.4 %

Source: International Monetary Fund, World Economic Outlook Database (total GDP), October 2021 and World Bank (sectoral share of GDP)

Over the past 20 years, total GDP in Malaysia has grown much faster than the population. Until 2010, the agricultural sector achieved the highest growth rates, followed by the services and industrial sectors. During the second decade from 2010–2020, growth slowed down in all sectors compared to the preceding decade. Over the last 10 years, the services sector achieved the highest growth rate, accounting for nearly 55 % of the total economy in 2020, emphasizing Malaysia's continued shift to a service economy.

Figure 2: Selected exposure indicators, sector in % of GDP



Source: International Monetary Fund, World Economic Outlook Database (total GDP), October 2021 and World Bank (sectoral share of GDP)

Significant potential for human intervention to reduce vulnerability and mitigate flood risk

Flood vulnerability: A community's or an individual's susceptibility to flood hazards; its proneness to be impacted adversely by flooding, represented by the inability or incapacity of a community or a group to anticipate, cope with, resist and/or recover from its impacts. For material assets vulnerability means the likelihood that these assets will be damaged, destroyed and/or affected when exposed to a hazard.

According to a recent study, as much as 60 % of the Malaysian population live near or along the coastline due to their socio-economic activities. Most of small and medium enterprises (SMEs) tend to be in the coastal zones due to infrastructure and logistics. Furthermore, aggravating the flood risk in rural regions, the Peninsular Malaysia has suffered significant deforestation since 1960s, although this has slowed down since the 1980s. The drivers of deforestation are complex, but agricultural expansion for crops like palm oil plays a considerable role.

According to the Malaysian Ministry of Environment and Water (Department of Irrigation and Drainage), the main causes for flooding in Malaysia are:⁹

- increased run-off rates due to the urbanization,
- loss of flood storage as a result of development extending into and taking over flood plains and drainage corridors,
- inadequate drainage systems or failure of localized drainage improvement works extended insufficiently downstream,
- construction at bridges and culverts that are either undersized or partially blocked by debris build-up or from other causes,
- siltation in waterway channels from indiscriminate land clearing operations,
- localized continuous heavy rainfall,
- tidal backwater effects, and
- inadequate river capacity

Most of the identified causes are at least partially human-induced and relate to the vulnerability rather than hazard dimension of risk, indicating significant potential for human intervention to mitigate flood risk in Malaysia.

Rapid urbanization contributing to an increased peak discharge and higher frequency of floods

Malaysia is currently one of the most rapidly urbanizing regions around the world. Over the last twenty years, the urban population in Malaysia has increased from 61.7 % in 2000 to 77.2 % in 2020¹⁰. This growth is expected to continue, as people migrate from rural areas to urban areas due to the economy and employment continuing to shift from agriculture to industry and services. The changes in land use associated with urban development affect flooding in many ways. In undeveloped areas such as forests and grasslands, rainfall is collected and stored by vegetation, in the soil column, or in surface depressions. When this storage capacity is filled, run-off flows slowly through soil as subsurface flow. In contrast, urban areas, where much of the land surface is covered by roads and buildings, have less capacity to store rainfall. Removing vegetation and soil, grading the land surface, and constructing drainage networks increase run-off to rivers from rainfall. As a result, the peak discharge, volume, and frequency of floods increase in nearby rivers. Roads and buildings constructed in flood-prone areas are exposed to increased flood hazards, including inundation and erosion, as new development continues.

⁹ <https://www.water.gov.my/jps/resources/auto%20download%20images/584130f6ea786.pdf>

¹⁰ Department of Statistics Malaysia

Rural and low-income population segments most vulnerable to floods, depending on emergency aid

In Malaysia, relative poverty is defined and based on the Department of Statistics' methodology, whereby Malaysia's population is categorized into three different income groups: Top 20 % (T20), Middle 40 % (M40), and Bottom 40 % (B40). These income group definitions are not fixed, and the values may increase or decrease year-to-year, depending on the country's GDP, which is why the median household income is used as the determinant instead. Malaysia's government is well aware of the fact that those in the lowest income bracket (B40) are most vulnerable to natural catastrophes and flood risks and therefore allocates a budget to compensating the B40 population for losses arising from flooding such as losses and damage to crop, livestock or housing. In consequence, the Malaysian Department of Social Welfare provides the following post-disaster and crop damage social protection and relief services:

- Provision and management of the centers for relief or evacuation and forward supply bases. In Malaysia, there are a total of 3,417 designated relief/evacuation centers, which can accommodate 943,000 evacuees, and a total of 348 forward-supply bases.
- Supply and distribution of assistance such as food, clothing and other essential items
- Registration of disaster victims for rehabilitation purposes
- Post-disaster counselling services.

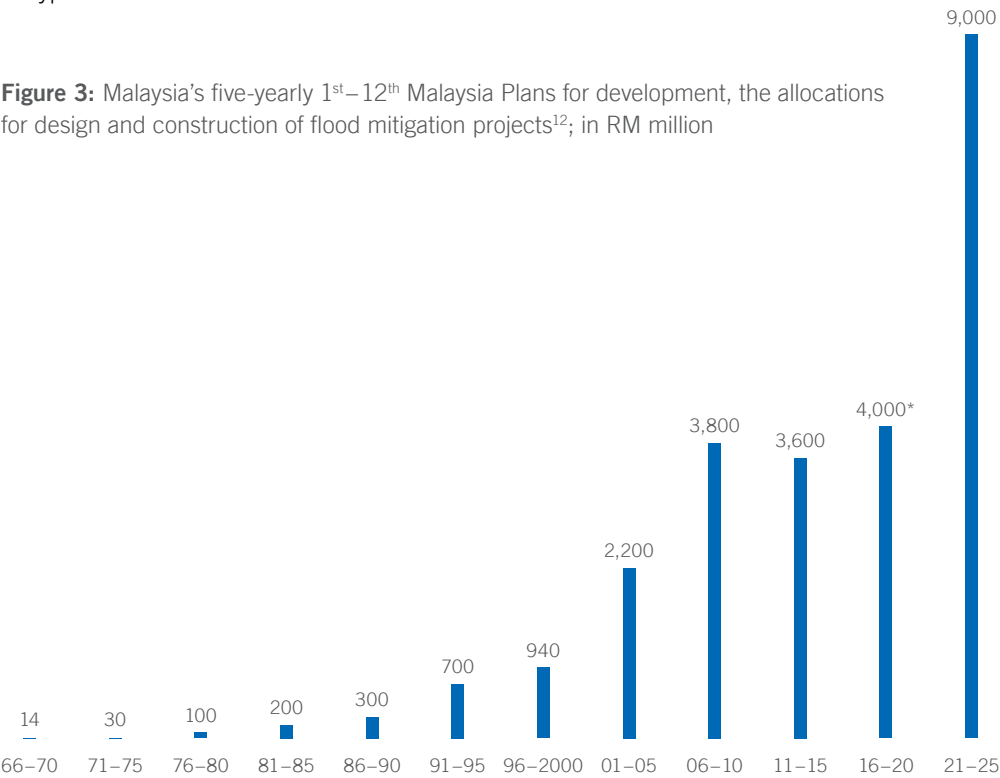
In addition, emergency financial assistance is also provided to families or individuals. After the end of 2014 floods, affected farmers in the MADA granary area received direct cash payments of RM 1,009 per ha for a total of RM 100.89 million from the government.¹¹ The formal system of social protection is supplemented by religious-based schemes, for example, the Muslim Zakat system, which also provides for those affected by natural disasters. However, as the current post-disaster financing schemes are inefficient and not reliable, the National Disaster Management Agency (NADMA) has approached Malaysian Re to look into different solutions in managing flood risk, including the potential implementation of a flood insurance pool.

¹¹ Malaysian Water Partnership: GAP Analysis Report: Flood disaster management in Malaysia (2017)

Until 2025, the government plans to invest more than RM 9 bn in flood mitigation projects

In the long run, most flood damages can effectively be mitigated through flood-risk management, where the identification and assessment of flood risk factors can provide the necessary foundation. In Malaysia, the National Security Council is responsible for flood management by implementing new techniques for flood control, forecasting, warning, and eviction, thus handling pre-disaster, disaster, and post-disaster activities. In the long run, most flood damages can effectively be mitigated through flood-risk management, where the identification and assessment of flood risk factors can provide the necessary foundation. After the extreme floods of 2014–2015, the Malaysian government set up the National Disaster Management Agency (NADMA) in December 2015, to coordinate government agencies in tackling all types of disasters.

Figure 3: Malaysia’s five-yearly 1st–12th Malaysia Plans for development, the allocations for design and construction of flood mitigation projects¹²; in RM million



*estimate – more than RM4 billion

Source: Ngai Weng Chan, Universiti Sains Malaysia¹³

12 https://www.iwra.org/member/congress/resource/1445_Chan_PS112007_Sidlaw_Tues.pdf

13 The Minister of Environment and Water revealed that the government has allocated over RM 9 billion for almost 100 flood mitigation and urban drainage projects under the 12th Malaysia Plan (2021–2025) to manage floods. <https://www.astroawani.com/berita-malaysia/severity-flooding-malaysia-requires-greater-concerted-effort-327436>

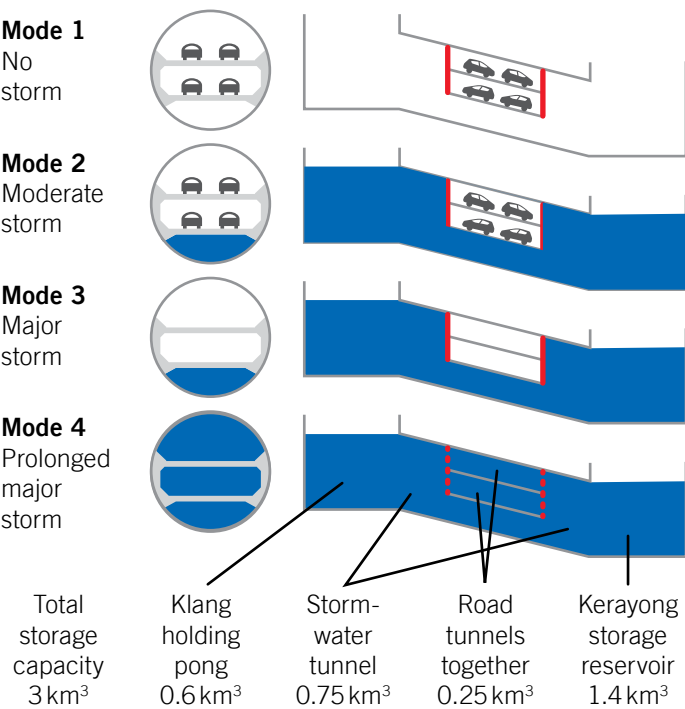
Flood risk overview

In addition, the government also provided emergency financial support in the aftermath of disasters. After the extreme floods at the end of 2014, the Prime Minister of Malaysia allocated a budget of RM 893 million for flood mitigation works, RM 800 million as initial allocation for the repair and reconstruction of basic infrastructure like schools, hospitals, roads, and bridges, RM 500 million for rehabilitation works and welfare programs, and RM 500 million special relief facility for SME loan financing.

The Stormwater Management And Road Tunnel (SMART): A structure that helps to make Kuala Lumpur more flood resilient

The 9.7 km long Stormwater Management and Road Tunnel (SMART) is the longest tunnel in Malaysia and the second longest stormwater tunnel in Asia. The main objectives of this tunnel are to solve the problem of flash floods in Kuala Lumpur and reduce traffic jams during rush hours. The tunnel has a combined water storage capacity of 3 million m³ and consists of a stormwater bypass tunnel, with a 4 km dual-deck motorway within the stormwater tunnel. During moderate storms, floodwater will be contained within the invert of the tunnel in a channel without interrupting traffic flow. However, in cases of severe storms the traffic can be evacuated, and floodwater allowed to fill the tunnel.

Figure 4: SMART tunnel Kuala Lumpur



Source: <https://tomorrow.city/a/smart-tunnel>

Total economic losses are difficult to quantify due to large uncertainties on indirect disaster costs

Disasters affect the economic system in multiple ways. However, defining their cost may prove tricky. Most common typologies usually distinguish between direct and indirect losses or between the immediate and delayed losses as a result of a disaster. In this context, direct disaster losses refer to directly quantifiable losses such as the number of people killed and the damage to buildings, infrastructure and natural resources. Indirect disaster losses include declines in output or revenue, and impact on wellbeing of people, and generally arise from disruptions to the flow of goods and services as a result of a disaster.¹⁴

The term economic loss describes the total economic impact that consists of direct economic loss and indirect economic loss. It describes the circumstances when an individual, an organization or a government loses money and includes instances of loss in income suffered by a person, business or government.

There are large uncertainties on indirect disaster costs, and these uncertainties arise both from insufficient data and inadequate methodologies. Various definitions and methods currently in use depend on whether the assessment is supposed to inform insurers, a potential prevention measure cost-benefit analyses, or international aid providers. Hence, any disaster cost assessment should start by clearly stating the purpose of the assessment and the cost definition that is used.

Floods had a negative impact on the agricultural GDP in Malaysia, but positively affected long-term growth in the manufacturing sector

From 1980–2010, flooding alone has caused average annual economic losses of more than US\$ 60 million in Malaysia. Seasonal monsoon floods alone have caused an average annual direct loss of RM 915 million.¹⁵

When analyzing the impact on different economic sectors, recent analytical research¹⁶ has shown that the economic impact of floods on the manufacturing sector is different from the agricultural sector. Historically the agricultural sector has been hit hardest, showing a negative correlation between the size of the affected area, total damage cost and GDP growth. The sectoral GDP decreased by 0.22 % per every one percent increase of flooded areas in the longer-term. Furthermore, the analysis indicates that a one percent increase in total damage cost, decreases GDP growth by 0.17 %. Overall, the bigger the area affected and the larger the damage cost, the higher the fall in GDP growth.

14 UNDRR PreventionWeb: <https://www.preventionweb.net/understanding-disaster-risk/key-concepts/direct-indirect-losses>

15 Malaysian Water Partnership: GAP Analysis Report: Flood disaster management in Malaysia (2017)

16 Malaysian Journal of Economic Studies 54(1): 61–81, 2017; Does Flood Disaster Lessen GDP Growth?

Evidence from Malaysia's Manufacturing and Agricultural Sectors. Mai Syaheera M. Shaaria, Mohd Zaini, Abd Karim, Bakti Hasan-Basri Universiti Utara Malaysia.

On the other hand, the results from the same study indicate a significantly positive relationship between total damage cost and GDP growth in the manufacturing sector. In this sector, a one percent increase in total damage cost is estimated to increase GDP growth by 0.65 %, as new machines will be purchased, and old technologies replaced. The replacement makes the production of goods more efficient, and hence, will generate GDP growth in the long run.

Among the four flood variables (1) flood size, (2) flood damage, (3) flood duration, and (4) flood frequency, two have significant relationships with GDP growth in the agricultural and manufacturing sectors in Malaysia in the long run: Both, flood size and flood damage negatively affect GDP growth in the agricultural sector, while positively affecting GDP growth in the manufacturing sector. On the other hand, both flood duration and flood frequency do not have significant relationships with GDP growth in both sectors in Malaysia in the long run.

Climate change expected to lead to increased rainfall amounts and a higher intensity of extreme events

According to a report jointly published by the World Bank and the Asian Development Bank, Malaysia's historical records show mixed trends in the country's annual rainfall between 1951 and 2013. For Peninsular Malaysia and Sabah there is a slight decrease in rainfall amounts, while for Sarawak there is a slight increase. However, from 1990 onwards, increased rainfall trends were observed across all three regions. The frequency and extremity of flood events have also increased in recent decades with projections showing they will continue to increase with continued global warming. For Malaysia, projections for precipitation, while highly variable, show (1) rainfall is likely to increase overall. In addition, (2) the intensity for extreme rainfall events is expected to rise as well.¹⁷

¹⁷ World Bank Group/Asian Development Bank (2021): Climate Risk Country Profile: Malaysia

Malaysian Flood Risk Modelling

Interview with Dr. Daniel Bernet, Senior Product Manager Global Climate Team,
Risk Management Solutions

What are the conceptual differences between earthquake, flood and cyclone risk modeling? What are the key challenges in flood risk modeling?

At a high level, the framework of modeling natural catastrophes probabilistically is the same. We create a stochastic set of events over a period of thousands of years to capture the whole range of probable events that could affect a certain domain. We assess the associated hazard for each of the events, calculate how the exposed values such as buildings, its contents and even business interruption are affected by each event, and determine the resulting losses at all the different levels of the risk transfer chain, e.g., from the losses to the houseowner, to the losses of the insurer, reinsurer, etc.

What sets flood modeling apart from other perils, is that the damage-generating mechanism, i.e., the inundation of assets, is spatially and temporally highly variable. For instance, while wind hazard fields tend to be fairly smooth and there are usually no large-scale mitigation measures against wind hazard in place, flood hazard shows particularly high hazard gradients and is a product of complex inter-linked natural and man-made processes including flood mitigation measures.

In order to reliably predict the inundation from a flood event, we need to capture all relevant processes including but not limited to the rainfall event itself, the transformation of rainfall to runoff and how this is influenced by the topography, soil characteristics, and the soil's water storage capacity before the event starts, land use and cover, drainage systems, how the flood wave propagates downstream through the river network, and then as mentioned before, flood protection measures that have been put in place to mitigate the adverse effects of flood events. The challenge to capture and predict all these relevant factors that determine the flood extent and severity is exacerbated by a lack of accurate input data at a high spatial (e.g., elevation data, flood defense data) and temporal resolution (e.g., precipitation data, flood extent observations).

What are the specific aspects to be considered when modeling flood risks in Malaysia?

When modeling flood risk in Malaysia, we need to make sure we capture the climatic factors properly. For instance, we need to make sure that we capture monsoon-induced rainfall, which can lead to long-lasting events, such as the very recent event that led to flooding from mid-December 2021 to early January 2022. At the larger scale, we need to be able to capture circulation patterns like the El Niño–Southern Oscillation (ENSO), that are influencing precipitation patterns in Southeast Asia. Other important aspects that need to be considered are urban flooding of extensive built-up such as areas in and around Kuala Lumpur, or the flood risk of industrial parks that can make up a significant portion of losses from flood events.

How do you assess the availability and quality of flood modeling data in Malaysia? Do flood models in Malaysia already provide robust results for decision makers?

We invest a lot of time in gathering local data, as well as data available from regional or even global data providers. With over 20 years of experience in flood risk modeling at RMS, we have a lot of in-house expertise and tools to do data quality checks, and create robust, reliable data sets informed by the best available data, suitable for modeling flood risk at a high spatial and temporal resolution in Malaysia. By applying our latest HD (for «High-Definition») flood modeling techniques, we model all relevant processes at a high spatial resolution of roughly 38m by 38m over a continuous simulation period of 50,000 years to comprehensively represent flood risk at the location level, while also capturing extreme

tail events. With our latest Southeast Asia Inland Flood HD Models, we are offering a comprehensive and robust solution for Southeast Asia that can not only serve the insurance and reinsurance industry but is well suited to inform decision making of other stakeholders as well.

According to your assessment, what are the key types of flood risks in Malaysia in terms of frequency and in terms of severity?

Flooding in Malaysia is mainly driven by heavy rainfall and is comprised of fluvial flooding (i.e., flooding from major rivers) and pluvial flooding (e.g., surface water flooding, flash flooding and urban flooding). In Malaysia, pluvial flooding tends to occur more frequently but less severely, on the other hand, fluvial flooding tends to occur less frequently, as the flood defenses along the main rivers prevent more frequent flooding. However, once the larger rivers start to overflow, the impact tends to be more severe. For example, areas with concentrated exposure along the Klang River in Selangor and Kuala Lumpur tend to have high standards of protection. Thus, the frequency of fluvial flooding in this river basin is low but has a high severity.

How difficult is it to take dynamic factors, such as climate change, into account when predicting the frequency and severity of future flood events in Malaysia?

The assessment of factors such as climate change can be challenging in data-scarce regions like Southeast Asia. The past observed precipitation and potential trend signals therein show very high uncertainty, with no clear consensus yet whether these signals are due to climate change or climate variability. An additional challenge is that severe local flood events often spawn investments in improving local flood defenses, which alter the flood risk for future events. For that matter, we allow the users to adjust the flood defenses to carry out «what-if-the flood defenses have changed» scenarios.

Predicting extremes over long timescales requires understanding and considering their interactions and feedbacks with human systems, for example, the implementation of protection measures after a severe flood event and the resulting reduction of flood risk. To what extent can flood models already be used to identify and quantify the most effective disaster risk reduction measures?

The probabilistic catastrophe modeling framework is designed around the need to answer questions around extremes. With this approach, we can explore the impact of the whole range of probable events that go way beyond the limited set of historical events and their consequences that have been observed in the recent past. Moreover, the modeling capabilities enable what-if scenario analyses, such as the quantification of the cost-benefit for investing in improved flood defenses, the impact of increased flood resilience at the property level, etc.



Risk transfer solutions

Flood modelling is complex, and the interpretation of results is not straightforward

Common challenges to drought and flood prediction and their joint assessment can be grouped into four interrelated categories: (1) data, (2) process understanding, (3) modeling and prediction, and (4) human–water interactions.

1. Data-related challenges arise both due to limited data availability and event definition. Limited data availability challenges precipitation related modeling such as drought and flood modeling because it prevents from the description of the full variability of extremes. The choice of event definition is crucial because it can have substantial effects on the outcome of extreme value analyses. Flood and drought predictions depend on event definitions because extreme events can be defined using different variables and different event identification approaches.
2. The analysis of hydrologic extremes is complicated by multiple driving mechanisms, their multivariate characteristics, for example, duration and peak flow, and the characteristic that they are regional phenomena often affecting several catchments at once. Furthermore, droughts and floods may be characterized by dynamic factors such as natural oscillations or long-term trends introduced by climate or land use change and water management.
3. For flood and drought prediction, a range of modeling tools including parametric distributions for frequency analysis and extrapolation, stochastic simulations for generating long time series of rare events, hydrological models for simulating streamflow in ungauged catchments or for future climate conditions are available. However, all of these tools face a variety of challenges, e.g. the difficulty to take dynamic factors, such as climate change, into account when predicting the frequency and severity of future events.
4. Hydrologic extremes are of societal importance because of their impacts on society and economy. Precipitation dependent flood and drought predictions can help alleviate these impacts because they facilitate the development of adaptation strategies and management plans. However, establishing a direct link between hazard and impact predictions is not straightforward, because feedback between hazards and society are hardly represented in models, and identifying an appropriate communication strategy is demanding. Addressing this challenge requires exploitation of new data sources to gain insight into direct human impacts on extremes and explicit representation of human influences in statistical and hydrological models.

In general, impact predictions may be easier to understand by the public than hazard predictions. Flood impact data is partly available on a global scale in non-flood specific disaster databases and via national databases, while spatially consistent information on a continental scale is largely missing. Predicting extremes over long timescales requires understanding and considering their interactions and feedbacks with human systems, for example, the implementation of protection measures after a severe flood event and the resulting reduction of flood risk.¹⁸ In 2021, a new risk transfer product for urban landslides in Colombia has been developed by Global Parametrics together with two Latin American catastrophe risk modeling firms. This product is most likely the first parametric urban landslide insurance solution in the world. This rainfall triggered landslide model is based on historical records from the rain-gauge network of Manizales and a large catalogue of historical events and the modeling results will be used to develop a parametric trigger for the insurance product.¹⁹

Public-Private-Partnerships in insurance benefit from increasing political momentum

Many countries are not well prepared to manage climate change induced increasing natural disaster risks, with potentially crippling effects on their economies and societies. This vulnerability is particularly acute for countries that are highly exposed to extreme weather events such as hurricanes and floods, in particular as these events have increased in frequency and severity in recent decades, while their impact has been further exacerbated by socio-economic trends such as urbanization and deforestation. In light of these challenges, some governments have stepped up their efforts to address the insurance protection gap. In general, there is an increasing political momentum favoring insurance-based solutions that mitigate disaster and climate risks. Many of these initiatives are government-sponsored, in close partnership with the private sector.

¹⁸ Brunner, M.I., Slater, L., Tallaksen, L.M., Clark, M. (2021). Challenges in modeling and predicting floods and droughts: A review. *WIREs Water*. 2021; 8:e1520

¹⁹ <https://www.artemis.bm/news/global-parametrics-ern-ingeniar-develop-first-parametric-landslide-risk-transfer/>

National Flood Insurance Program: An integrated risk management and insurance program facing financial challenges

The National Flood Insurance Program (NFIP) of the United States of America was established in 1968. The NFIP is more than just an insurance program. It is also intended to be a floodplain management and flood risk mitigation program. The program relies on flood insurance rate maps that carve up the country's floodplains—coastal and riverine, urban and rural—into zones of high and low flood risk.

Participating communities agree to adopt and enforce floodplain management ordinances to reduce future flood damage. Under this scheme, flood insurance is available to anyone living in one of the 22,500 participating NFIP communities in both high-risk and moderate-to-low risk areas. Residents in the US and its territories who live in high-risk areas are required to purchase flood insurance if they have a mortgage from a federally regulated lender and must carry the insurance for the life of the mortgage. This requirement also extends to disaster assistance loans from the Small Business Administration. Residents with a mortgage on a building outside high-risk areas may purchase flood insurance on a voluntary basis.

The NFIP is managed by the Federal Emergency Management Agency (FEMA) and is sold to prospective policyholders by a network of more than 50 insurance companies as well as on a direct basis. In principle, the premium rate for most NFIP policies is intended to reflect the true flood risk, although the US Congress has directed FEMA to subsidize flood insurance for certain older properties. The funding for the NFIP is primarily maintained in an authorized account called the National Flood Insurance Fund.

Historically, the NFIP has been funded through three sources:

- receipts from the premiums of flood insurance policies, including fees and surcharges;
- direct annual appropriations for specific costs of the NFIP; and
- borrowing from the U.S. Treasury when the balance of the NFIF has been insufficient to pay the NFIP's obligations (e.g., insurance claims).

The NFIP currently (November 2021) owes US\$ 20.525 billion to the U.S. Treasury, leaving US\$ 9.9 billion in borrowing authority from a US\$ 30.425 billion limit in law. This debt is serviced by the NFIP and interest is paid through premium revenues. As of March 31, 2021, slightly more than 5 million policies generated gross written premiums, fees, and surcharges of US\$ 4.6 billion.

In September 2016, FEMA bought reinsurance for the NFIP for the first time in its history. The purchase of private market reinsurance is meant to reduce the likelihood of FEMA needing to borrow from the Treasury to pay claims. In January 2021, FEMA purchased US\$ 1.12 billion of reinsurance to cover the period from January 1, 2021, to January 1, 2022, for a reinsurance premium of US\$ 196 million. In February 2021, FEMA issued a catastrophe bond to transfer an additional US\$ 575 million of risk to the capital markets.²⁰

20 Introduction to the National Flood Insurance Program (November 2021): <https://sgp.fas.org/crs/homesec/R44593.pdf>

Flood Re UK: A voluntary transitory market arrangement enabling insurers to offer competitive premiums²¹

Flood Re is a UK government-backed reinsurance scheme to promote the affordability and availability of flood insurance for homeowners across the country. It became operational as a non-profit organization in April 2016. The decision to create this new entity was made after long discussions between the government, the Association of British Insurers and other market participants, such as international reinsurers. It was created as a transitional vehicle to be in place until 2039 to enable the continued availability of affordable insurance cover. Over time, the scheme aims to reach 350,000 households. The scheme enables participating insurers to offer competitive premiums with lower policy deductibles for high flood risk households. To do so, insurance companies can buy subsidized reinsurance from Flood Re through a commercial arrangement. Flood Re is owned by the insurance industry but designated as a «Public Body», reporting to the British parliament.

To achieve affordable premium levels even for high-risk households, premiums charged by Flood Re to insurers are capped. These premium thresholds have been set at levels that are below the risk adequate level for high flood risk households, hence providing a subsidy for those properties. But thresholds are still set sufficiently high to ensure that participating insurers only cede high risk properties to Flood Re, as the scheme does not intend to interfere with the established open market for affordable and already commercially sustainable flood risks. Insurers still set the final pricing for high flood risks to consumers, but the risk premiums for the flood element of a property insurance policy are capped.

The difference between capped flood premiums and the corresponding risk adjusted flood premiums is a subsidy that insured high flood risk households receive under the Flood Re scheme. To finance this subsidy, a statutory annual levy of GBP 180 million per year is paid by all insurers authorized to write home insurance in the UK. Based on each insurer's market share, the total amount is shared between insurers.

To achieve a smooth and successful transition to a flood insurance market with risk-adequate pricing between now and 2039, Flood Re plans to reduce the subsidy provided through the scheme and the associated industry levy, with a first reduction of the levy 1 planned for 2021. For the year ending 31 March 2021, Flood Re has written more than 218,000 insurance policies and generated gross written premiums of GBP 39 million.

²¹ Bollmann, A. & Wang, S.S. (2019): International Catastrophe Pooling for Extreme Weather: An integrated Actuarial, Economic and Underwriting Perspective. Society of Actuaries (SOA).

Morocco Solidarity Fund against Catastrophic Events (FSEC): A sustainable public financing mechanism that aims to cover uninsured populations and the most vulnerable households

In March 2019, Morocco adopted a Draft Decree that made it compulsory for all Moroccan citizens to include coverage for natural and man-made disasters when buying general insurance products. For local insurers, the law introduced the obligation to include a guarantee against the consequences of catastrophic events in insurance contracts covering property damage or civil liability due to bodily injury or material damage caused to third parties. The Decree established a Solidarity Fund against Catastrophic Events (FSEC – Fonds de solidarité contre les événements catastrophiques) to protect victims of natural disasters financially unable to take out the disaster insurance. The FSEC is funded by a Solidarity Tax, which is a 1 % tax paid on all general insurance premiums.

This initiative has been supported by a US\$ 275 million Disaster Risk Management Development Policy Loan provided by the World Bank to enhance immediate governmental access to liquidity in the event of natural disasters over a 15-year period. The Loan Facility will support reforms designed to strengthen the financial, governance and operational frameworks of the FSEC as well as developing an inventory of beneficiaries to ensure timely and appropriate compensation to disaster victims.

For uninsured individuals the solidarity fund guarantees a minimum compensation for death, personal injury and property damage. For example, tenants of a main residence rendered uninhabitable are entitled to receive a payment fixed at 300 % of the monthly rent. Owners of a principal residence can receive an aid for the rehabilitation of the premises with a ceiling of DH 250,000 (US\$ approx. 26,750) and an allowance for the deprivation of use fixed at 600 % of the monthly rental value.

Two separate reinsurance operations for the domestic insurance market and the FSEC have been finalized since January 2020 to ensure rapid cash flows in the event of a severe disaster by tapping into international markets. They are an integral part of the national disaster risk financing strategy and provide the financial capacity for 99 % of the natural disaster events likely to hit Morocco. The local primary insurance company CAT and the domestic reinsurer SCR approached the international reinsurance market to purchase adequate reinsurance/retrocession coverage through international brokers, with Munich Re, Hannover Re and Swiss Re becoming co-reinsurers. SCR accepted 90 % of the primary insurance risk from the CAT. The Moroccan state provides a guarantee, intended to cover the risk of reinsurance. The reinsurer SCR also participated in the Aggregate XL reinsurance treaty of CAT which covers the insurer's retention up to 30 % as well as accepting 100 % of the earthquake parametric coverage of the Solidarity Fund against Catastrophic Events with a 2 % retention.

Philippines Catastrophe Insurance Facility (PCIF): Creating a well-diversified large pool of natural disaster risks for domestic insurers, facilitating a higher domestic market retention

The PCIF is intended to expand the domestic insurance industry's ability to take on more risk. Currently, insurance firms need to seek reinsurance coverage overseas for their natural disaster-related insurance products. Through the facility, non-life insurers will be able to cede a portion of their catastrophe risks, with the results being a more diversified and larger pool, which will allow the facility to benefit from economies of scale. However, rather than seeking international reinsurance for this pool of catastrophe risk, the idea is to allow the PCIF to share the pooled risks back to the domestic non-life insurers. The plan is to help the insurers more efficiently manage their catastrophe exposures, presumably by giving them a slice of the more diversified pool instead of their own more concentrated risk portfolio, improving their net capacity to take on more catastrophe risks.

The PCIF has been established by the Insurance Commission, working alongside the National Reinsurance Corporation of the Philippines (Nat Re) and the Philippine Insurers and Reinsurers' Association (PIRA). PCIF is currently in the inception phase and targeted for launch by April 2022. According to the regulator, P&C insurers under its jurisdiction will have to implement a new pricing structure for catastrophe risk policies, effective April 2022. The Philippine Catastrophe Insurance Facility (PCIF) framework is expected to price catastrophe risk policies based on so-called risk zones.

The South-East Asia Disaster Risk Insurance Facility (SEADRIF): Boosting regional disaster resilience in ASEAN member states

SEADRIF is the first regional catastrophe risk facility established in Asia by ASEAN member states. Incorporated and domiciled in Singapore, the SEADRIF insurance company was officially launched and licensed as a general insurer in October 2019. The company is fully owned by SEADRIF members and regulated by the Monetary Authority of Singapore. SEADRIF's insurance solutions are intended to reduce disruptions to national budgets and reliance on humanitarian assistance which can take time or is uncertain. Unlike traditional indemnity insurance, the countries determine how much premium they can pay, and the SEADRIF Insurance Company calculates the level of coverage it can offer in return.

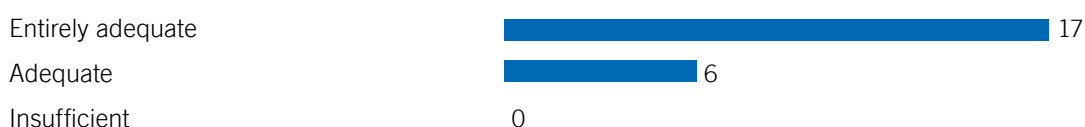
SEADRIF's first product provides insurance to Lao PDR against climate shocks and natural disasters. The insurance policy has a three-year period and consists of two complementary components: (1) The core feature of SEADRIF's first insurance product is its parametric component which uses a stepped payout structure. The

Risk transfer solutions

structure has fixed parameters that correspond to predefined levels of the modelled number of people affected by a flood, which trigger pre-agreed payout amounts. (2) The finite risk component provides countries with protection against events that might not trigger a payout under the strictly objective rules of the parametric component. This could be due to: a) basis risk; b) small flood events that do not trigger a payout under the parametric component; or c) losses that are caused by natural disasters which are not flood-related, but for which the insured country requires a degree of financial support. To qualify for a payout under this component, the insured country is required to provide evidence that a disaster event has occurred.

Survey results

Figure 5: Availability of private sector capacity for natural catastrophe insurance – including international reinsurance (number of mentions).



Insurance capacity for flood risk is sufficiently available in Malaysia. The country's non-life insurers are sufficiently capitalized to shoulder the risk, which is generally regarded as a natural catastrophe risk of limited scale. Apart from the December 2021 event, which also hit with Kuala Lumpur the commercial centre of the country, flood events mostly affect Malaysia' rural east coast where the concentration of values is considerably lower than in the country's industrious centre.

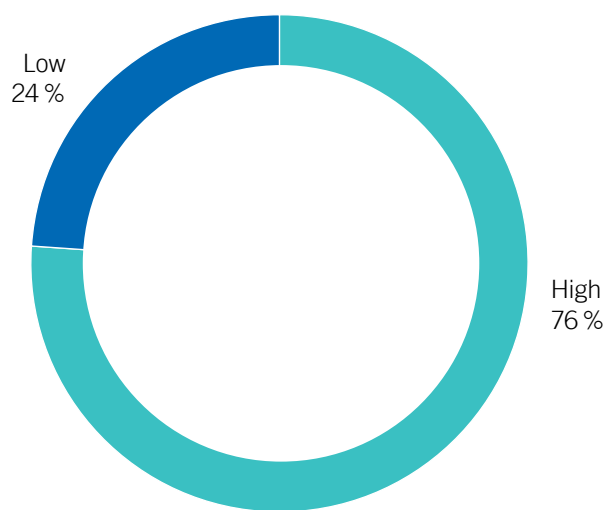
Reinsurance capacity is also regarded as sufficiently available, given the potential size of a flood event, also in comparison to natural catastrophe risks in Malaysia's neighbouring countries, such as Thailand, Indonesia and the Philippines. While the potential size of an event is less of a concern to insurers, the pricing of the risk from a client's perspective is still perceived as high or expensive. As a result, flood cover – which is offered as a voluntary addition to the standard tariffed fire policy – is often only purchased in flood prone regions or following previous events, when the memory of past disasters is still fresh. Obviously, this type of adverse selection will continue to affect the pricing of the risk even in a fully de-tariffed future.

The cost for flood insurance is rather nominal. The cover is available as an extension to the standard fire police and costs about 0.086 % of the sum-insured. However, in Malaysia mostly only homeowners are insured as the banks arrange the cover as part of the mortgage. As a consequence, only those people who due to their income are regarded as creditworthy, will have access to flood insurance. However, the B40 segment, who struggle to

access financing, are also exposed to flood risk, but have to rely on the government to compensate them in case of an event. Together with Bank Negara and Malaysia's National Disaster Management Agency we are currently developing a pool solution that ties together those who can afford to insure with those who cannot afford it but are in need of cover.

Zainudin Ishak, CEO, Malaysia Reinsurance Berhad

Figure 6: Assessment of the demand for insurance solutions for natural disasters (independent of the supply situation /restrictions)



Demand for flood insurance is generally perceived as high by the majority of our interviewees. Flood insurance is purchased as an optional part of the standard fire or motor policy and is subject to the tariff regulation of Bank Negara. Only large policies, exceeding a sum-insured of more than RM 300 million are exempted from the tariff pricing and conditions.

Although the coverage is purchased recurrently, overall penetration is still low, affected by limited awareness as well as short-termism, as soon after a major flood event demand declines. Insurers, however, clearly differentiate between commercial and retail clients, with the prior seeking protection in areas known for their flood exposure, but less so in regions where flooding is rare. Flood insurance penetration obviously increases with the size and value of the companies, with small to mid-sized enterprises frequently remaining uninsured.

Survey results

Retail clients typically purchase flood insurance as part of the mortgage that they sign with their bank to finance their property. However, since Malaysia's mortgage market is highly competitive, banks frequently offer the lease without the additional security of a flood cover. Among home-owners, who no longer rely on a mortgage, flood insurance is rare and only purchased for the lower levels of a building.

Flood cover is also taken out as an add-on to the motor policy. However, such a policy is only signed if the flood exposure is regarded as high. In fact, most consumers in Malaysia are of the opinion that in case of a flood they will be able to move their vehicles.

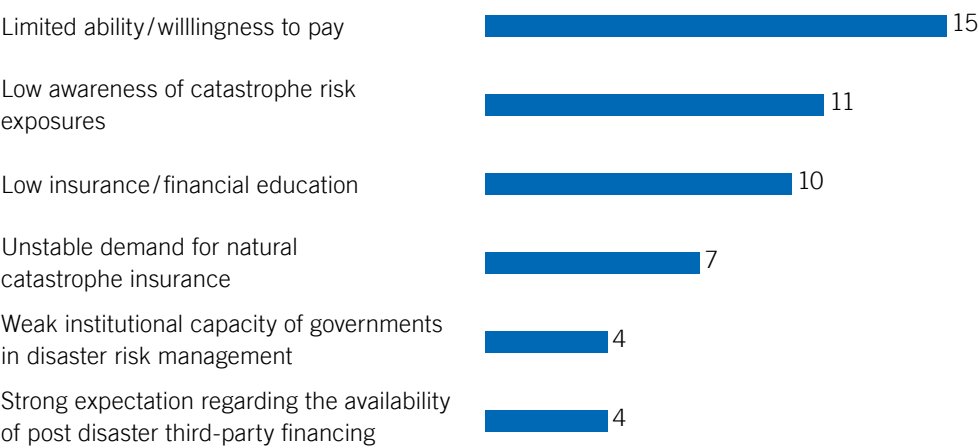
The availability of capacity for natural catastrophe coverage is less a question of supply than demand. Although demand has been trending upwards, the ASEAN insurance markets remain highly price sensitive. The focus remains on insurance as a cost. As a result, we see international capacity being reallocated to risks which seem to offer a more attractive risk/return ratio.

Pavlos Spyropoulos, Country Manager, Singapore & CEO, Lloyd's Asia at Lloyd's

Demand for flood insurance is very much affected by awareness, financial understanding and a high price sensitivity for the cost of flood cover. Furthermore, the memory for flood events is relatively short lived. After an event, demand surges, but over time, if no further event happens, it declines again soon. On the supply side we see that exposures are increasing in the flood models of the reinsurers, which affects their pricing and the access to their capacity. Flood models themselves have improved considerably in recent years. Access to detailed flood risk data at local level – a major issue of the past – has improved greatly and allows for a high granularity and precision in today's flood risk models.

Paul Rajan, Head of Underwriting, Syarikat Takaful Malaysia Am Berhad

Figure 7: Demand side market imperfections (number of mentions)



The demand for flood coverage is largely determined by the limited willingness to pay and low awareness for flood risk. While Malaysia’s large or public institutions, like the government and the leading main corporations have a good understanding of the risk, smaller entities, like SMEs and even more so, consumers, tend to underestimate the risk and rely on self-insurance or on the expectation that the government will support them in case of a disaster. The limited understanding of the risk, its magnitude and its potential impact on peoples’ wallets influence the price sensitivity, as the policy is perceived as expensive compared to the risk. In addition, the price sensitivity is also based on short-termism, as policies are often only bought as a consequence of a prior event which is still fresh in memory.

Among Malaysian insurers, demand for NatCat and flood cover is driven by rising awareness of these exposures and climate change as well as increasing pressure from the regulator. Insurers are expected to think ahead and account for a rise in potential flood events. Insurers

need to anticipate this development and integrate it into their risk analysis. In addition they need to factor in sustainability and ESG trends in the future.

Faris Davidson, Managing Director, Willis Re

Survey results

Also, of limited impact on the demand for flood coverage are the human interventions into nature, as for instance deforestation and urbanization. Interviewees agreed that there is an acknowledgement of this risk, but primarily only by those who already buy the cover. They also recognize that implementation of building codes as well as the ability of urban drainage systems to absorb flash flooding is insufficient to protect against damages. Climate change and the high attention that the topic fetches in social and mainstream media is seen as a driver for flood coverage but, again, mainly among those, who already buy the product.

Finally, insurance demand is also influenced by the fact that the country's government is willing to support and partially compensate the low-income segment of the country, the B40 segment, for the loss caused by a disaster. While this segment of the population might not afford to buy insurance protection, it is nevertheless the taxpayer, who funds this kind of support that otherwise might be financed by insurance.

Although the government budgets for these kinds of events, there is a high consensus among insurers that historically the government's bail-out measures have been insufficient to compensate the B40 segment for its losses in case of a natural disaster. Besides, that ability will be further restricted by the impact from COVID-19 on public finances.

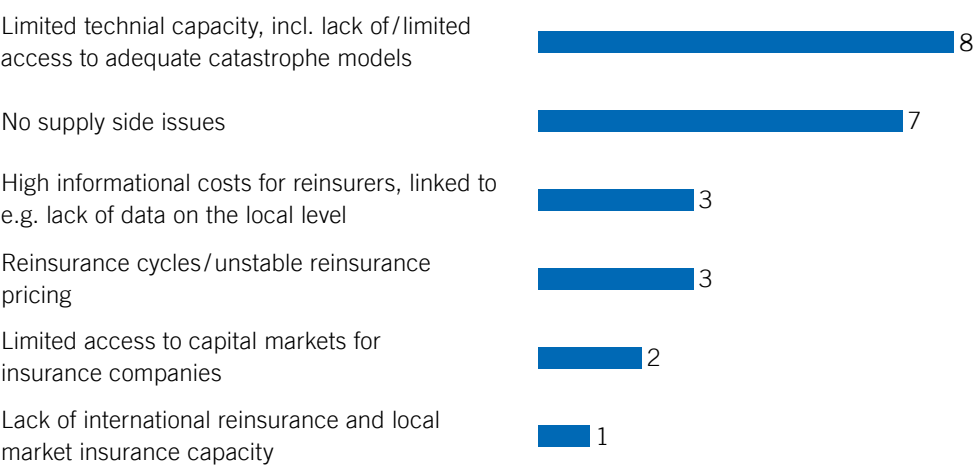
Demand for natural catastrophe insurance has been steadily rising in the past years. Climate change is certainly one of the drivers as people recognise themselves that weather patterns have changed and that we witness phenomena, which seem unheard off. As a result, we also see a different attitude towards human intervention and ESG as well, which is met with strong acceptance in markets such as Singapore and Malaysia, where it is also strongly endorsed by the insurance regulators in both markets.

**Jimmy Tong, Managing Director
General & Group Insurance, The
Great Eastern Life Assurance Co Ltd**

There is a clear disparity between the B40 and non-B40 insurance penetration rates across Malaysia's states, and also between urban and rural areas. Insurance distribution mechanisms need to be adjusted to facilitate a cost-efficient approach in rural areas.

**Dave Loo, Underwriter – all lines,
Progressive Insurance**

Figure 8: Supply side market imperfections (number of mentions)



As capacity is sufficiently available, supply side shortcomings are rare. They only arise where the flood prone areas experience flooding quite recurrently and are mostly inhabited by the country’s low-income segment. The insurance penetration increases in the more wealthy urban areas where flooding plays a role, but not dramatic enough to cause supply-side shortages. According to some interviewees the bundling of property and flood insurance products with mortgage loans might cause issues with reinsurers due to the fear of the accumulation risk in these typical bancassurance products.

The rural and low income segment of Malaysia’s population is most exposed to the impact from flooding. Since that part of society is least capable to digest the damages potentially caused by flooding, the government and the society at large currently serves to cover losses via various fundings and subsidies. Technically the insurance industry would be able to deal with the risk,

but given the concentration of the risk in certain regions, we would be confronted with adverse selection. The government may be required to define a compulsory cover resolving that issue.

Soo Wai Har, Chief Technical Officer, Axa Affin General Insurance Berhad

Survey results

Apart from these rather isolated geographical issues, interviewees agreed that there are no significant supply side issues. Flood models have greatly improved and although they might still lack granularity, their availability is continuously improving with vendor models now complementing the most widely used broker and reinsurer models available for the Malaysian insurance market.

Furthermore, Malaysia's regulator, the Bank Negara, is not seen to try and reduce the risk appetite of the country's insurers for flood risk. Rather to the contrary: Bank Negara is known to encourage the insurers to take on more flood risk aiming to strengthen the insurance penetration among the most vulnerable parts of society.

We expect the demand for NatCat and flood coverage in Malaysia to rise due to new regulatory requirements and the effects of climate change. Bank Negara Malaysia plans to enact a new RBC framework by 2024 which will require insurers to factor-in their NatCat risk. According to the current draft, a principle based quantification of flood risks will become mandatory, replacing

the current practice which does not require the NatCat exposure to be taken into consideration. In addition, climate change will continue to accelerate and lead to an increase in flood risks, in particular along river banks and coastal areas.

**Marcel Omar Papp, Head Retakaful,
Swiss Re Asia Pte. Ltd., Malaysia
Branch**

Figure 9: Tasks and responsibilities to be assumed by the public sector in the natural catastrophe insurance market (number of mentions)



The Malaysian peninsular experiences two monsoon seasons per year, one on the east coast of the country from October to March and one on the west coast, which takes place from May to October. Predominately the east coast monsoon causes flooding, mainly hitting its rural coastal region, which is less densely populated, industrialized or urbanized. As a result, the insurance penetration in that region is low. Even if flooding takes place further inland, causing damages in some of the country’s urban areas, these disasters mainly affect the lower income parts of the population that are hardly insured.

The Malaysian government recognizes the problem and provides support to the B40 segment of the population suffering losses caused by natural catastrophes. Given the recurrent nature of these events, the government created the National Disaster Management Agency (NADMA), following a major flood event in 2014, which is in charge to manage national disasters – such as the current COVID-19 pandemic too – and to disburse the funds in case of a catastrophe. However, interviewees pointed out that the compensation provided is often insufficient and not necessarily reaching those most in need.

With regards to the demand side and its impact on premium volume, we see two conflicting developments in Malaysia. On the one side, exposures to flood risks are rising. According to a recent study about 50 % of Malaysia’s population is exposed to some sort of flood risk. This is particularly true for the east coast of Malaysia. On the other side, flood is available as extension

coverage in the standard fire policy, subject to underwriter’s assessment. The current de-tariffication allows insurers to reduce rates by up to 30 % that were typically granted to risks where flood exposures considered as acceptable by the underwriter.

**Nazrul Hisham Abdul Hamid, CEO,
Zurich General Takaful Malaysia**

Survey results

Nevertheless, interviewees also left no doubt that the government must play a major role in improving the risk protection for the lower income segment as standard insurance coverages are not affordable for this part of society. Currently the government assumes the role of an insurer of last resort. Going forward, insurers believe that some form of premium subsidies for this part of society or a compulsory insurance scheme, sharing the coverage across as many shoulders as possible, would be a more efficient, predictable and reliable solution. Alternatively, insurers could envision a solution based on premium subsidies or a pool solution, in which the government would assume the role as a reinsurer of last resort.

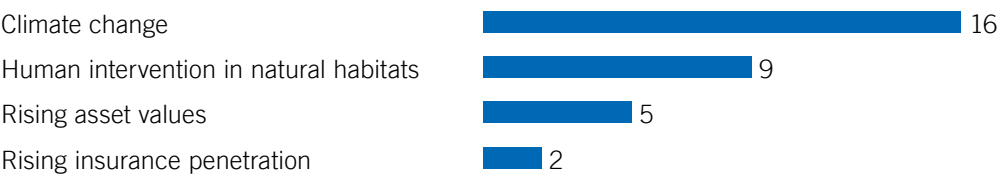
In terms of the insurance capacity available for natural catastrophe coverage, we need to keep in mind that small households and the B40 segment is still covered by the Malaysian government. While that view is shifting and the private sector is asked to take on more of that risk, the frequency of flood events and the losses thereof are rising. Insurers are thus been asked by the regulator to include the right information into their risk management and assess the impact of a once in 200 years-event to their capital. Based on the current exposure, insurers are adequately capitalised. However once additional risks are introduced, overall underlying exposure of each insurer will be altered and thus overseas capacity may help to elevate the consequential pressure on capital.

**Ahmad Noor Azhari (Arie), SVP
& Head of International Treaties,
Malaysia Reinsurance Berhad**

The provision of premium subsidies for the B40 population segment and the introduction of mandatory insurance for certain risks would significantly accelerate the development of the flood insurance market in Malaysia.

**Ahmad Fariman, Senior Vice
President, Takaful Ikhlas**

Figure 10: Main reasons for rising demand for natural catastrophe covers
(number of mentions)



Demand for flood risk protection is seen to be rising. One of the key drivers for the heightened interest in flood coverage is the growing recognition that climate change alters the risk landscape in Malaysia too. Insurers point out that on the one side climate change is perceived to have become more tangible with people realizing in the more recent past that weather patterns have changed, and catastrophes seem to occur more frequently. On the other side, the topic of climate change is also quite present in the public domain, with the mainstream as well as the social media. In addition, the topic is also pushed by Malaysia’s government which committed to the Paris accord of reducing the country’s carbon footprint. As a result, Bank Negara as the regulator for the financial services sector also endorses the installation of ESG measures across the banking and finance sector and also in other industries.

Malaysia’s insurance clients also recognize that the human intervention into nature, urbanization, deforestation and the expansion of agriculture have changed the ability of the habitat to absorb or retain water from heavy rainfall. Riverbeds have been altered and the increase in housing and infrastructure construction led to a sealing of more soil. In addition, drainage systems are often either insufficient or simply blocked. As a result, the risk of flash floods increases.

Finally, it goes without saying that assets and values have been growing as the country’s GDP increased. Insurance penetration is mainly seen to have progressed in tandem, but not in excess of value creation.

In terms of ESG we must not forget that Malaysia is a strong fossil fuel producer and exporter. Although in the past decades we have further diversified our economy into sectors such as electronics and tourism, these are not without environmental challenges either. As insurers we

must therefore manage this transformation carefully. We need to support our clients in their transition towards a business model which reduces their carbon emissions.

Antony Lee, Chairman of the board of PIAM

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Figure 11: Most severe type of flood risks (number of mentions)



According to our interviewees Malaysia is mostly affected by flash floods, caused by heavy or continuous rain. These types of flood events are difficult to predict and model because they happen quite localized. Given their scale though the magnitude of the loss is usually limited. However, particularly in urban areas flash floods – then often also regarded as pluvial floods – can trigger hefty damages, especially if drainage systems are blocked – frequently due to long and ongoing construction work, as interviewees pointed out.

Malaysia’s government is recognizant of the risk of flash floods in cities such as Kuala Lumpur and has been seeking remedies against the sudden rise of water. For this reason, the city installed its SMART tunnel, a 9.7 km long stormwater tunnel which helps to mitigate the city’s flooding problems by diverting flood waters away from central Kuala Lumpur.

Given Malaysia’s exposure to monsoon seasons, storm surges also pose a risk, although most interviewees agree that the risk mainly exhibits on the east coast and usually causes limited damage. Apart from the 2004 tsunami, Malaysia’s insurers regard the risk from a sudden rise of seawater as slim.

Given the scale, frequency and available capacity, insurers regard all of these types of flood as insurable.

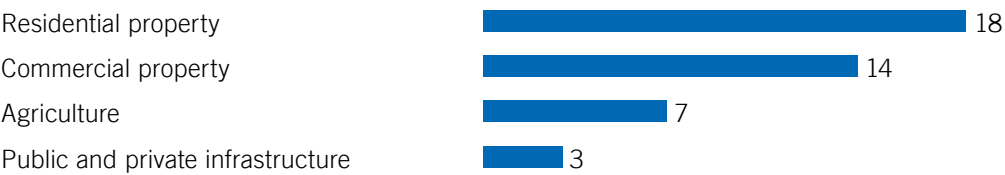
Awareness for the NatCat and flood risk in Malaysia has been rising steadily in the recent past. This is also reflected in the heightened importance of ESG and a motivation of Equita to take the initiative and implement a robust ESG framework for our company. We are collaborating with industry partners and

academia to first analyse and assess our own risk. In a second step we will be able to assist our customers in their transformation to improve their ESG compliance.

Shahrul Azuan Mohamed, CEO, Etiqa General Takaful Berhad

Survey results

Figure 12: Assets most affected by floods in recent years (number of mentions)



Flood losses predominately affect residential property, most likely reflecting that the rural east coast region is most frequently hit by flooding. The more industrialized regions of Malaysia, like Selangor, the Federal Territory of Kuala Lumpur or Johor are less exposed to floods. However, as evidenced in the recent December flood, the centre of Malaysia also suffers recurrently from flooding, causing severe financial losses. Insurers also pointed out that there are striking differences between residential and commercial properties, as residential properties are often located in lower areas with a higher flood exposure, while commercial properties are frequently situated in safer places with more reliable drainage systems.

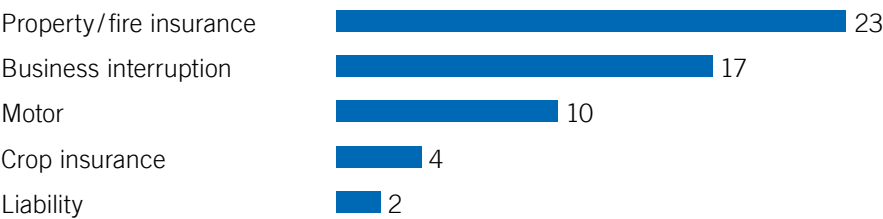
Agricultural insurance is rarely purchased in Malaysia. Only very few of the palm oil plantation or paddy farmers enjoy crop insurance, leave alone flood insurance. Insurers mentioned that the government is evaluating opportunities as some of the agricultural insurance programs with public sector participation, namely those in India, might serve as a template for similar solutions in Malaysia. Also, public infrastructure is hardly insured, although in some isolated cases coverage is provided.

Although the reinsurers use quite sophisticated tools and models to assess the flood risk in Malaysia, the current modelling system based on Malaysia' postal codes is still not so accurate. While in Malaysia one postal code can actually cover quite a wide area, Singapore is more advanced as each building complex has its own postal code.

**Hans Joachim Zimmermann, CEO,
Tune Insurance Malaysia Berhad**

Survey results

Figure 13: Lines of business mainly affected by flood risks (number of mentions)



Flood risks are mainly covered through property and fire insurance. That is true for both the commercial and personal lines business, although the penetration in the former is regarded as far higher than in the latter. In addition, coverage is bought most consistently by the larger corporations, while in the SME segment penetration is low. The limited take-up of the coverage is mainly due to awareness, pricing, but also claims payments often only cover a fraction of the actual loss.

In December 2021, prolonged rain across the region resulted in our nation suffering from one of the worst floods in history affecting large urbanized states destroying homes and unfortunately, taking lives. The reality of climate change is apparent and we need to anticipate that such disastrous events are expected to occur again in the future, potentially with higher frequency. The government works on improving flood mitigation measures, disaster

planning and promoting sustainable development. As responsible insurers, we need to continue to raise awareness on the importance of a flood insurance and improve penetration rate for flood coverage to ensure that our people are protected against severe financial losses arising from such disasters.

Daniel Nee Yong Hong,
Chief Actuary, AmGeneral
Insurance Berhad

Survey results

Business interruption is the second most frequently mentioned line of business affected by flood losses, although the impact is seen as rather limited as firstly, business interruption insurance is only bought by the large corporations and secondly, the coverage is capped and only kicks-in after the deductible has been exhausted.

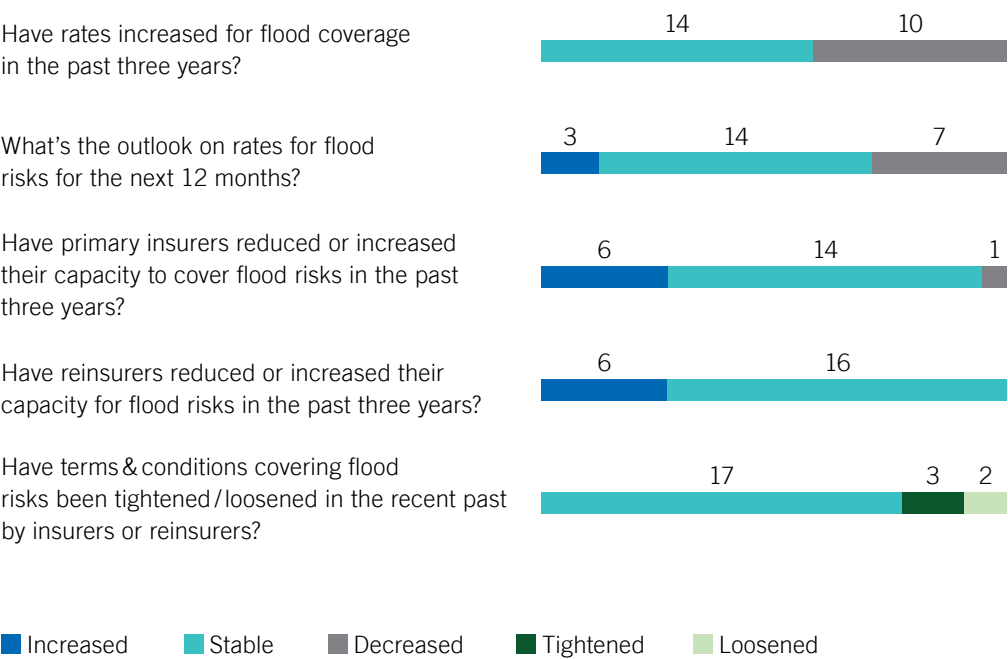
Similarly, flood cover as a top-up to the regular motor is also scarcely bought. According to our interviewees, only about 5 % of cars in Malaysia are flood insured as consumers either regard the risk as low or believe that in case of flooding they can move their cars to a location less exposed to the inundation.

Crop insurance for palm oil plantation or rice farmers is hardly sold in Malaysia. Currently discussions are under way to develop a crop insurance solution that would also include some kind of governmental involvement to increase the uptake of the cover.

Overall, in Malaysia flood risk is adequately covered by the general fire policy. Corporate clients have access to sufficient capacity. Given the current exposure the private sector is well equipped to handle and cover the risk. SMEs and consumers are more reluctant to buy the cover. Here might be a role for the government to support demand with solutions such as micro insurance or public private partnerships.

**Kong Shu Yin, MD/CEO,
RHB Insurance Berhad**

Figure 14: Flood insurance: Pricing and capacity (number of mentions)



In the last three years the rates for the coverage of flood risk have remained flat or decreased due to the partial de-tariffication in property insurance. However, the property/fire cover is still profitable and thus there is substantial competitive pressure from Malaysian insurers, which try to expand their

market share and lower their prices. Going forward we expect this trend to continue, resulting in either flat or declining rates.

Gary Hoo, Head of Conventional Business at AIA General, AIA General Berhad

Survey results

According to our interviewees prices for flood coverage have been stable to declining for the last three years. As part of property & fire or of motor insurance, flood coverage is tightly regulated by the tariff scheme governed by Bank Negara. Since the launch of the second phase of the de-tariffication of both lines of business insurers have gained some flexibility to adjust and in fact reduce the pricing for property and fire by 30 % maximum and by 10 % for motor insurance from the tariff rate. However, a flexibility beyond this point only exists for large commercial contracts, which due to their size are placed outside of the tariff scheme. Since property & fire had been priced quite generously, some insurers took advantage of the pricing flexibility introduced by the de-tariffication and lowered their rates. However, even if rates were decreased by as much as 30 %, the line is still considered profitable.

Malaysia's insurers are still waiting for the launch of the third phase of the de-tariffication, which has been postponed due to the COVID-19 pandemic, preoccupying the attention of both regulator and insurers. Therefore insurers are also hesitant in their outlook on property & fire as well as motor lines and basically expect a rather stable to slightly declining pricing for as long as rates are regulated.

Capacity has mainly developed in tandem with the underlying risks. As such today's capacity will be larger than three years ago in total terms, but proportionately to the underlying risk insurers regard their own capacity as unchanged or even slightly smaller as they have taken on more risk per dollar unit. Reinsurance capacity has remained largely unchanged. Reinsurers are said to have focused closely on risk and accumulation transparency. Improved modelling has led to a better understanding of the risk and in some cases even led to a lower need for reinsurance capacity.

Finally, for flood risks terms & conditions have remained largely unchanged, which is also due to the fact that under the tariff scheme, these are fixed. Slight changes have only come from the reinsurance side, as reinsurers adjusted their limits from a cession to an event basis.

The exposure of Malaysian flood risk has increased in recent years due to climate change resulting in rising rainfalls, increased urbanisation and higher values-at-risk. However, insurers have not expanded their capacity for flood risks in tandem as the modelling capabilities in the market are greatly improved. Insurers are able to differentiate between flood prone areas and those

that are less exposed enabling to move to more risk adjusted prices. New product innovation (Detariffed products) also led to flood offered with sublimits versus full value, so this lowers the insurers' flood aggregates yearly.

Puneet Pasricha, CEO, Liberty Insurance Berhad

Figure 15: Improvement of flood risk modelling and model availability (number of mentions)



Malaysia’s insurers have access to a variety of different natural catastrophe models to assess flood risk, namely through the main reinsurance brokers, the leading reinsurers or, most recently, also through vendors of natural catastrophe models. Although in particular flash floods, which are Malaysia’s most frequent flood event, are difficult to model due to their localized occurrence, modelling is seen to have greatly improved and contributed to a stable risk appetite.

As more events have been recorded in recent years, there is more data available to predict flood risks. However, while smaller insurers still rely predominately on existing models, those players who regard their flood risk as substantial, bemoan a lack in granularity and complement available models with their own data. Interviewees regard the country’s postal codes, which form a basis for the geocoding in the flood models, as far too broad and heterogenic to enable a robust risk assessment. In addition, available models are not sufficiently forward looking, as current data does not yet accommodate for the impact of climate change on the Malaysian risk landscape.

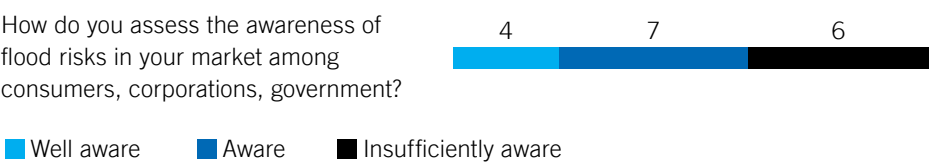
Malaysia’s ESG goal will be largely driven by corporations, and particularly by financial institutions that are supervised by Bank Negara Malaysia. Insurers will take a step-by-step approach, gradually reducing risks with potential negative ESG implications, while increasing their investments and underwriting of risks that have a positive impact such as renewable energy initiatives. This gradual process approach will allow customers time to transition, especially in the area affecting climate change.

Kok Kheng Ng, CEO, Great Eastern General Insurance (Malaysia) Berhad

Flood risk is very difficult to model. Although modelling capabilities have greatly improved in Malaysia, flooding remains a very localised risk and current models still don’t provide sufficient granularity to assess it adequately. We therefore deploy our own risk engineering to identify and assess flood prone areas. This is very important as under Malaysia’s tariff regime, pricing is still largely predetermined and we therefore need to manage our exposure and returns through cautious risk selection.

K.G. Krishnamoorthy Rao, CEO, MPI Generali Insurans Bhd

Figure 16: Flood risk awareness and mitigation (number of mentions)



Overall, Malaysia’s insurers agree that government and corporations are sufficiently aware of flood risks, while consumers and SME’s tend to underestimate the risk. However, insurers bemoan a tendency to underestimate the risk and not take the necessary precaution to mitigate it. Even those who insure only cover the minimum of what they perceive as a plausible risk and exclude the rest, which obviously can end in an awakening that in case of an event, insurance only covers a fraction of the actual loss.

Thus far, the government budgets and provides the B40 segment with some financial support after an event has occurred. Acknowledging the inherent injustice in this measure, as flood victims are frequently not at all, insufficiently or erroneously compensated for a loss event, the government has entered in a discussion with PIAM and the insurance market to develop an ex-ante approach that also involves a pool solution assuring a fairer approach to flood loss compensation.

In addition, following the devastating 2014 flood event the government has founded and assigned the National Disaster Management Agency with the responsibility to establish a disaster risk management that takes care of the measures needed ahead, during and after an event. That might also include some type of micro-insurance that addresses the needs of paddy farmers as well as the B40 segment.

We are not concerned about the modeling results as such, but the accuracy and granularity of input data for flood models is our key challenge. Approximately 30 % of risks are still modeled using street level data.

Jesudass Chettiah, Head of Corporate Business, Allianz

For a start, premium subsidies can be an effective tool for achieving a higher natural disaster insurance penetration in the B40 population segment. Nevertheless, to ensure long-term sustainability, we must have well-thought-out medium to long-term plans.

Ong Hong Keat, Chief Operating Officer, RHB Group

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