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Natural catastrophes and inflation in 2022: a perfect storm

Executive summary

In 2022, insurance covered about 45% of the USD 275 billion in global economic losses resulting from natural catastrophes.

Property catastrophe re/insurance rates rose to 20-year highs in the January 2023 renewals, continuing a trajectory that began in 2018. Demand for covers has grown as natural disasters continue to wreak property damage across the world. Natural disasters resulted in global economic losses of USD 275 billion in 2022, of which USD 125 billion were covered by insurance, the fourth highest one-year total on *sigma* records. Beyond the natural catastrophes themselves, other factors such as the impacts of economic inflation and financial market losses have also fed into market hardening. An additional contributing factor has been the need for more discipline in the modelling and underwriting of secondary perils in particular. This has led to mismatches of risk assessment and actual exposures and, in turn, insufficient market capacity.

Last year's outcome reaffirms the long-term growth trend of 5–7% in annual insured losses.

The re/insurance rate gains of recent years coincide with a trend period of heightened natural catastrophe activity and elevated losses that started in 2017. The 2022 insured loss outcome reaffirms a 5–7% annual growth trend in place since 1992, this based mostly on rising severity of losses resulting from primary and secondary peril events. Today average annual insured losses of more than USD 100 billion are standard. The biggest loss event in 2022 was Hurricane Ian (estimated insured loss of USD 50–65 billion). Other large-loss events were floods in Australia and South Africa, hail in France, winter storms in Europe, and heatwaves in Europe, China and the Americas.

Economic factors remain the main driver of rising losses. In 2021–22, high inflation rates increased the value of insured assets.

Rather than the physical destructive force of natural catastrophes themselves, the main driver of resulting high losses are economic growth, accumulation of asset values in exposed areas, urbanisation and rising populations, often in regions susceptible to natural perils. We expect that these and the evolution of a range of present-day risk factors like climate change effects and, of late, inflation, will continue to drive losses higher. Economic inflation has surged over the last two years, averaging 7% in the advanced markets and 9% in the emerging economies in 2022. Initially sparked by pandemic-induced supply chain disruptions and large monetary and fiscal stimuli, soaring food and energy prices due to the war in Ukraine have compounded inflation pressures. The effect of high prices has been to increase the nominal value of buildings, vehicles and other insurable assets, in turn pushing up insurance claims for damage caused by mother nature. The impact has been most immediate in the construction sector. Increases in the costs for materials and labour because of shortages thereof have led to higher claims to cover the costs of building repairs. In the US, for example, the aggregate replacement cost of buildings in 2022 had risen by an estimated 40% since the start of 2020.

The 2022 catastrophes were driven by known risk factors, yet losses high.

Rising natural catastrophe losses and shortfalls in industry estimates of those losses point to the need for better understanding of all the risk drivers at play. The re/insurance industry has long monitored primary perils but this has not always been the case for secondary perils, the associated losses of which have been rising for many years. There is a need for greater discipline in the monitoring of the loss-driving secondary peril exposures and industry sharing of related findings. Lack of granular exposure data can also hinder understanding of all present-day risks. For instance, the increase in built-up land area and changes to the vulnerability of homes to hazards (eg, more solar panels on roof tops) are difficult to keep track of. The fast rate of change of such variables necessitates shorter update cycles of data sets and models, to mitigate risk accumulation and underestimation of loss trends.

Uncertainties around risk trends are constraining industry capacity. This will underpin continuation of hard re/insurance market conditions.

We expect the hard market in re/insurance to continue, based on increased demand for coverage and because of inflation-driven higher values of insured assets. Current supply-side stresses also underpin the hard market. For one, industry capital has fallen in response to rising interest rates. Adding to capacity shortages, six years of weak results in property underwriting have reduced risk appetite. In the face of higher financing costs given interest rate rises, some capacity providers have become more cautious with respect to the potential for misalignment of risk assessment and loss experience. In our view, as higher exposures encounter shrinking risk appetite, momentum for rising prices, higher retentions and tighter terms and conditions will likely continue.

Key takeaways

2022 in a nutshell: insured losses well above the 10-year average

Economic losses

Total
USD 284 billion*

2021: USD 303 bn
10-year average: USD 220 bn

Natural catastrophes
USD 275 bn

Man-made
USD 9 bn

0.27%
of global GDP

10-year average: 0.23%

*Ranks 16th in terms of GDP -normalised economic losses from natural catastrophes since 1970

Insured losses

Total
USD 132 billion

2021: USD 130 bn
10-year average: USD 91 bn

Natural catastrophes
USD 125 bn

Man-made
USD 7 bn

6% of global property
direct premiums written

10-year average: 4.6%

Natural catastrophe insured losses

Total
USD 125 billion

2021: USD 121 bn
10-year average: USD 81 bn

Secondary perils
USD 54 bn (43%)

2021: USD 77 bn

Primary perils
USD 71 bn (57%)

2021: USD 44 bn

Global protection gap

2021
USD 173 bn

2022
USD 151 bn

10-year average
USD 130 bn

Victims

>35 000

Catastrophe events

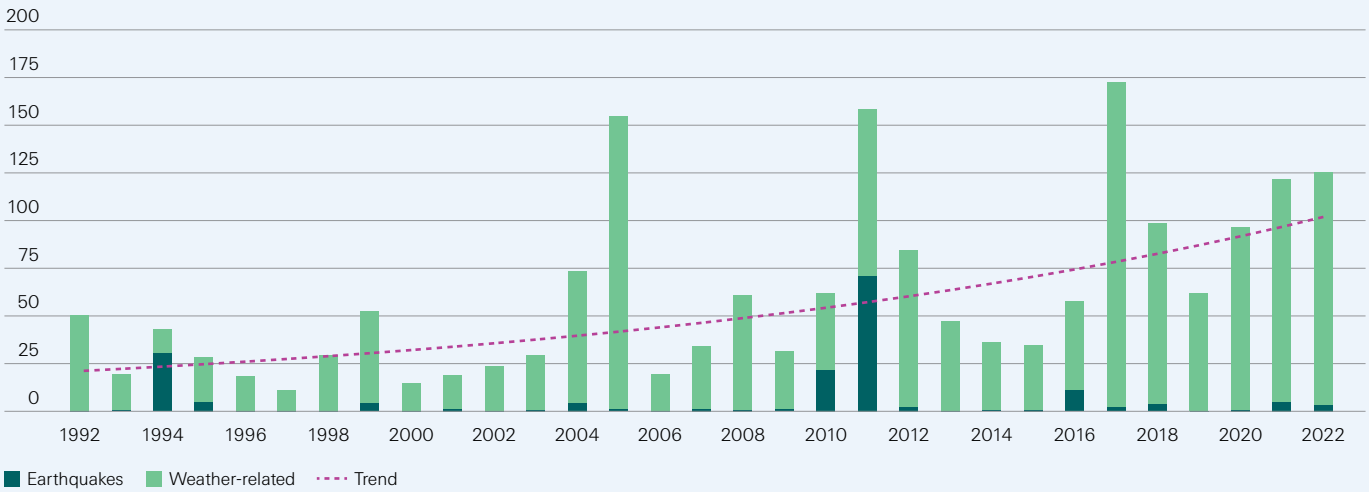
285

Source: Swiss Re Institute

Average annual growth trend of 5–7% in insured losses from natural catastrophes affirmed

Since 1992, insured losses have grown by 5–7% on an average annual basis. This includes the period 2012–16 when losses were at a lower annual mean. Irrespective of yearly volatility, insured losses will likely continue to grow at trend, even when real-time amplifying factors such as current high levels of inflation recede.

Growth in global natural catastrophe insured losses in USD billion (2022 prices)

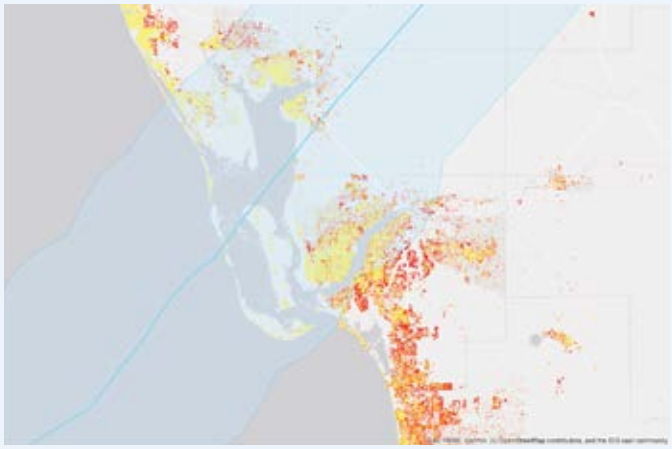


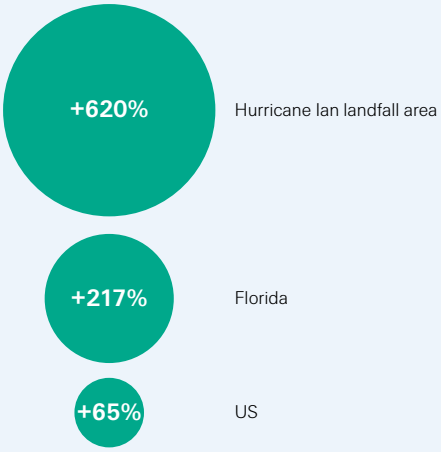
Source: Swiss Re Institute

Location, location, location: one storm is all it takes

Last year was "average" in terms of hurricane activity in the North Atlantic. Even so, the 2022 hurricane season is third most costliest on *sigma* records. The reason is Hurricane Ian, which resulted in estimated insured losses of USD 50–65 billion. When Ian made landfall in western Florida as a category 4 storm, it hit an area that has seen rapid population growth, expansion of built areas and accumulation of physical assets. Since 1970, the population where the storm made landfall has increased by 620%, exceeding both the population increase in the state of Florida (+217%) and the entire US (+65%). Hurricane Ian demonstrates that location of landfall rather than number of storms, is the main driver of heavy loss burdens.

Changes in built-up land in the Ian landfall area (left) and population growth statistics (right)



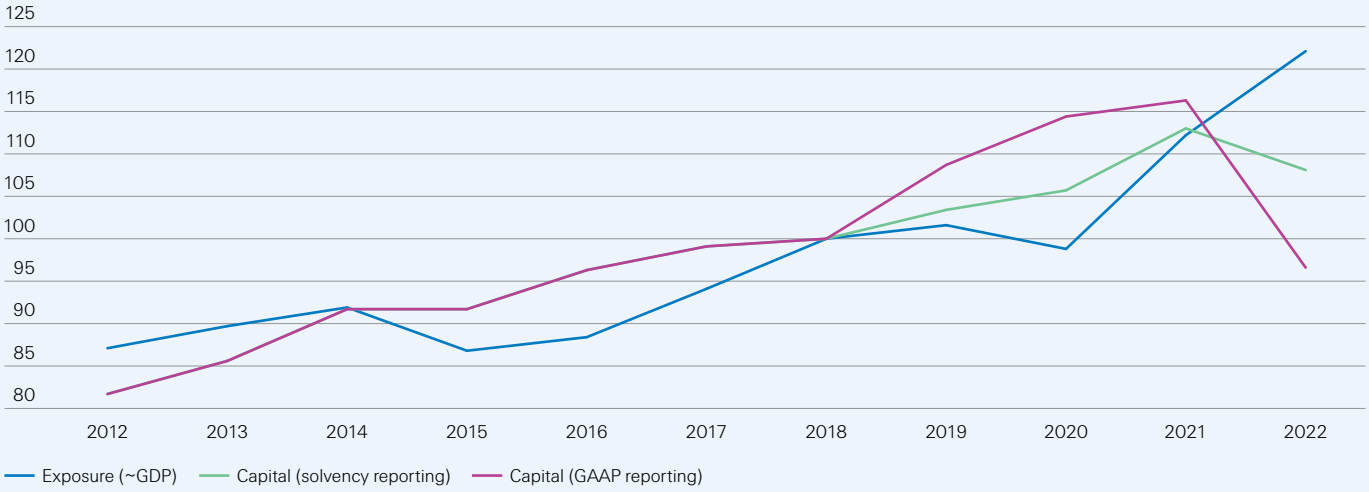


Source: German Aerospace Center, National Hurricane Center, US Census Bureau,Swiss Re Institute

Global reinsurance capital vs exposure growth: a mismatch that looks set to stay

Demand for coverage for natural disasters had risen on evidence of increased catastrophe activity, and because of higher insurable values of buildings and other fixed assets. At the same time, catastrophe claims pay outs have reduced the supply of re/insurance capital. Rising interest rates and lower financial asset values have also contributed to supply constraints. Risk appetite has further decreased due to poor property re/insurance underwriting results in recent years, and widely held perceptions that risk assessments are underestimating actual loss experience. This is leading to hesitation on the part of capital providers to commit new funds to re/insurance risks and replenish the industry capacity.

Global reinsurance capital vs exposure growth, 2018 = 100



Source: AM Best, Swiss Re Institute

In perspective: 2022 and longer-term trends

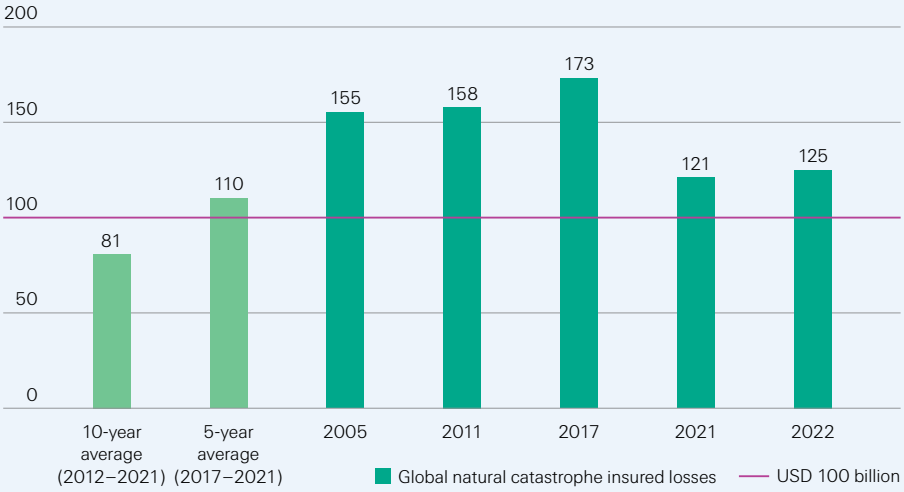
At USD 125 billion, global insured losses from natural catastrophes in 2022 are the fourth highest on *sigma* records. Each region of the world suffered a major event. Hurricane Ian was the year's biggest loss event, and ranks as the second-costliest insurance natural catastrophe loss ever on *sigma* records. Today, average annual industry losses from natural catastrophes of more than USD 100 billion are standard. Last year's outcome continued a run of seemingly elevated global insured losses since 2017 after a benign 2012–2016 period, reaffirming an average annual growth rate of 5–7% in losses in place since 1992. We expect this trend to continue, driven by growing loss severity on account of rising property and values-at-risk exposures, continued urban sprawl, economic growth and a backdrop of hazard intensification due to climate change effects.

Another year of above-average losses

Global insured losses from natural catastrophe events in 2022 were USD 125 billion.

Last year's natural catastrophe-related losses were, once again, high. Driven mostly by extreme weather events, global insured losses from natural disasters were USD 125 billion in 2022, well above the previous 5- and 10-year averages (USD 110 billion and USD 81 billion, respectively, inflation adjusted, see Figure 1). The losses were the fourth highest in any one year since 1970 (see Figure 21) and for first time ever, global insured losses exceeded USD 100 billion two years running (ie, in 2022 and 2021). The insured annual loss totals from natural catastrophes has surpassed the USD 100 billion-mark five times since 1970, and three times in the past six years (2017, 2021 and 2022). Economic losses of USD 275 billion point to a still large protection gap, with around 54% of the total losses uninsured. Though still large, this is less than the 61% average protection gap of the previous 10 years. Last year's main events hit areas of relatively higher insurance penetration, attesting to the fundamental value proposition of the industry to making households, businesses and institutions more resilient.

Figure 1
Global natural catastrophe insured losses, in USD billion at 2022 prices



Source: Swiss Re Institute

Hurricane Ian was the main loss event of the year.

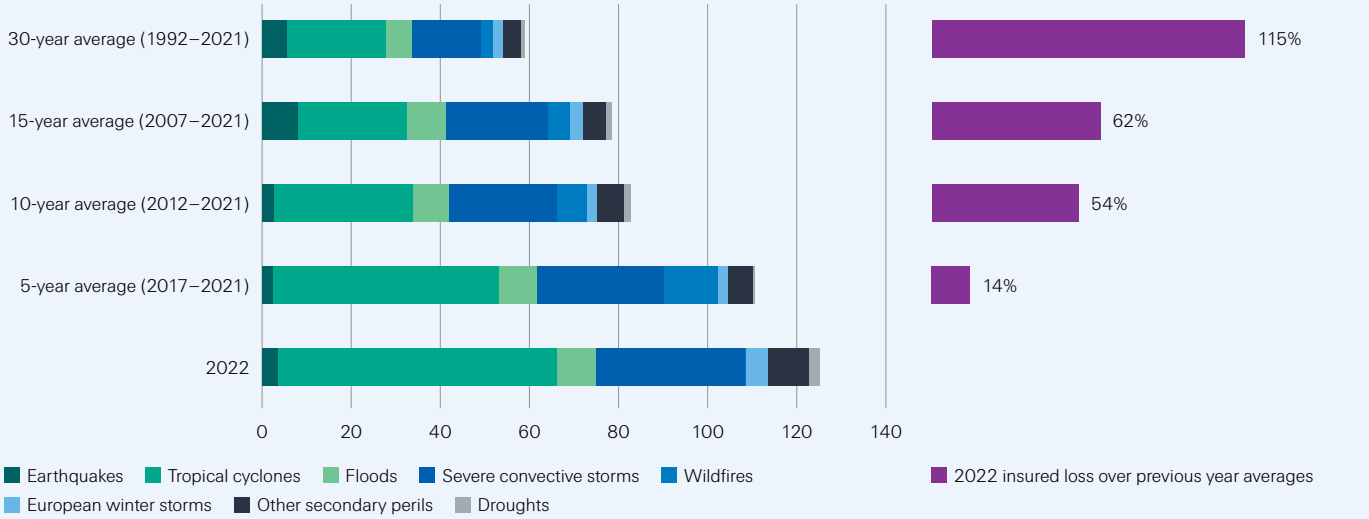
Hurricane Ian was the costliest event of 2022, resulting in estimated insured losses of USD 50 to 65 billion.[1] The category 4 hurricane made landfall in western Florida in September, bringing strong winds, torrential rain and storm surge. After Hurricane Katrina in 2005, Ian ranks as the second-costliest natural catastrophe insured loss event on *sigma* records. It pushed global insured losses from tropical cyclones above prior-period averages, making 2022 the third most expensive hurricane season on record after 2005 (Katrina, Wilma and Rita) and 2017 (Harvey, Irma and Maria).

[1] Includes National Flood Insurance Program (NFIP). The foregoing estimates are subject to uncertainty and may be subsequently adjusted as the claims notification and assessment process continues.

Flood and hailstorm events across the world also resulted in significant losses.

At over USD 33 billion, global insured losses from severe convective storms (SCS) were also above prior-period averages (see Figure 2), driven by thunderstorms with hail and tornadoes in the US. Another contributor was the highest-ever annual loss (USD 5 billion) from hailstorms in France. Global losses from floods were just above average, the main event being flooding in eastern Australia in February-March. The flooding resulted in insured losses of USD 4.3 billion, the biggest natural catastrophe claims event ever in Australia. Another national "costliest ever" event was flooding in Durban in South Africa in April, leading to estimated insured losses of USD 1.5 billion.

Figure 2
Global insured losses from natural catastrophes in 2022 by category, in USD billion at 2022 prices



Source: Swiss Re Institute

Losses from winter storms in Europe were above average.

After a few years with low loss-severity winter storms, in February 2022 a cluster of storms (Eunice, Dudley, Franklin) in northwestern Europe triggered combined claims of an estimated USD 4.1 billion, bringing the total for this category to almost double the previous 10-year average. Winds in winter storms are less severe than in tropical cyclones, but large parts of Europe can be impacted by a single storm, and damage in different locations can see combined losses accumulate to multi-billion levels.

Heatwaves and droughts led to crop yield losses in many regions.

At the opposite end of the temperature spectrum, weather variability and anomalous atmospheric circulation conditions caused severe drought and heatwaves across the world. Heat and drought impacted crop yields in many regions, adding to global food inflation pressures and elevated agriculture insurance losses. Table 1 shows the crop loss impacts in US dollar terms in select markets. In Europe, the summer of 2022 was the hottest on record.[2], [3] In Morocco, heat and dry conditions[4] coincided with a North Atlantic Oscillation phase of rainfall deficit.[5] In Brazil, monsoon rains were below average.[6] Crop yields, particularly for soybean and maize, suffered most.[7] Total precipitation across contiguous US in 2022 made the year the third driest on record,[8] and crops yield were lower than in 2021.[9] And in China, extreme heat and dry conditions in the Yangtze River and weak monsoon rains impacted summer crops.[10]

[2] *Summer 2022 Europe's hottest on record*, Copernicus, 8 September 2022.
[3] *Trockenheit in Europa 2022*, Deutscher Wetterdienst, July 2022
[4] *Drought in western Mediterranean February 2022*, European Commission, 22 March 2022.
[5] See *Climate Prediction Center*, National Weather Service.
[6] See "Phases of the South American Monsoon System", *Climate Prediction Center*, Natl Weather Service
[7] See *Crop Explorer – World Agricultural Production Briefs: Brazil*, Foreign Agriculture Service, USDA.
[8] *Record drought gripped much of the US in 2022*, National Oceanic and Atmospheric Administration, 10 January 2023.
[9] *Corn and soybean production down in 2022, USDA reports Corn stocks down, soybean stocks down from year earlier Winter Wheat Seedings up for 2023*, USDA, 10 January 2023.
[10] "Scientific interpretation of severe drought in the Yangtze River Basin", *Journal of Arid Meteorology*, 2022.

Table 1
Insured crop losses due to drought in select markets, USD billion

Country	Economic losses	Insured losses
Brazil	13	1
Europe	6.2	0.6
China	4.7	0.8
Morocco	0.25	0.04

Source: CAN, PSR, Ministry of Emergency Management, Swiss Re

Wildfire-related losses were less than in recent years.

Waves of high temperatures in Europe also inflicted a heavy human toll: according to the WHO, a series heatwaves in Europe caused at least an estimated 15 000 excess deaths.[11] In spite of the heatwaves, one peril for which losses were below recent-year totals and historical averages were those for wildfire.

Longer-term loss trends

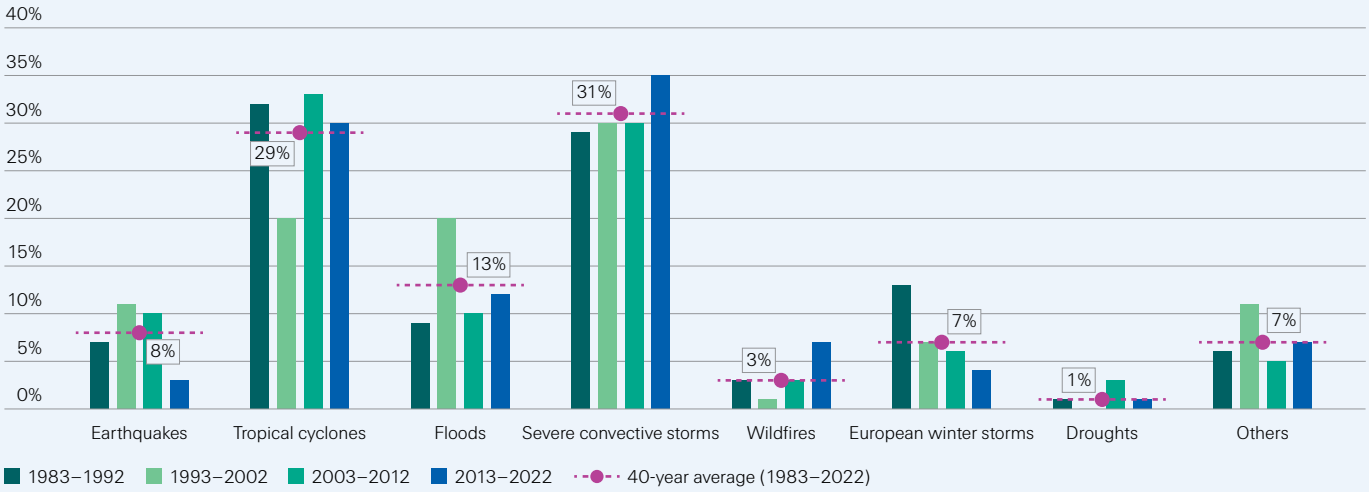
At 30% each, the contributions of tropical cyclones...

Losses from individual perils fluctuate year on year. That said, at on average 30% each, the contribution to global insured losses from the two biggest peril categories – tropical cyclones and SCS – have remained largely stable over the last 40 years (see Figure 3). On the east coast of the US, hurricanes (primary perils) originating in the North Atlantic are a main threat to residents and businesses.[12] Though rare, when a major hurricane strikes, the losses can be very severe. As in the case of Hurricane Ian, just one peak tropical cyclone event can wreak very large losses.

...and SCS to annual insured losses have remained largely stable.

SCS are categorised as secondary perils, occur more frequently and happen all over the world. Given the frequency, aggregated their annual loss amounts are less volatile.[13] Typically, losses resulting from SCS are lower than for primary perils, but there have been instances when a single SCS has resulted in insured losses of similar size to those coming in the wake of medium-sized hurricane. Noteworthy too is a marked step up in the share of all SCS to insured losses in the last decade.

Figure 3
Share of insured losses by peril type by decade



Source: Swiss Re Institute

[11] *Statement – Climate change is already killing us, but strong action now can prevent more deaths*, World Health Organization, 2 November 2022.

[12] Primary perils are natural catastrophes that tend to happen less frequently, but have high loss potential. They can include secondary effects. Examples include tropical cyclones, earthquakes and European winter storms.

[13] Secondary perils are independent natural catastrophe events that can happen frequently, typically generating low- to medium-sized losses. Examples include severe convective storms (thunderstorms, hail and tornadoes), drought, wildfire, snow, flash floods and landslides.

Heat-related perils like wildfires are contributing an increasing share of losses.

Another longer-term trend development has been a doubling of the share of natural catastrophe insured losses from wildfires over the last 30 years. Fire-related losses were low in 2022 itself but in recent years, large wildfires have wreaked huge damage and unprecedented losses, notably in North America (in Canada in 2016, and in California in 2017, 2018 and 2020). They reflect a rising risk due to ever-increasing populations in the wildland-urban interface, particularly in California. The trend may also signal hazard intensification as the planet warms, with extreme heat conditions adding fuel to wildfire formation. Projected changes in climate and prolonged periods of heatwaves in the next decades may well increase the frequency and loss severity of large wildfires and drought events.

European winter storms represent an ever-present primary peril loss-making threat.

Meanwhile, in the absence of major events, the share of European winter storms in annual natural catastrophe-related insured losses has been declining since the large storms of 1990 (winter storms Daria and Vivian) and 1999 (winter storms Lothar, Martin and Anatol). Nevertheless, winter storms are an ever-present hazard in Europe and, as the 2022 experience shows, just one event or cluster of storms can result in significant property damage. Equally, the comparably low level of earthquake losses over the last decade (ie, post the seismic events of 2010 and 2011 in Chile, Japan and New Zealand) should not lead to underestimation of this low frequency-high severity peril: earthquakes are rare but as with other primary perils, when a major quake strikes a heavily populated urban area, the resulting losses can be enormous.

Loss severity of individual primary and secondary peril events on the rise

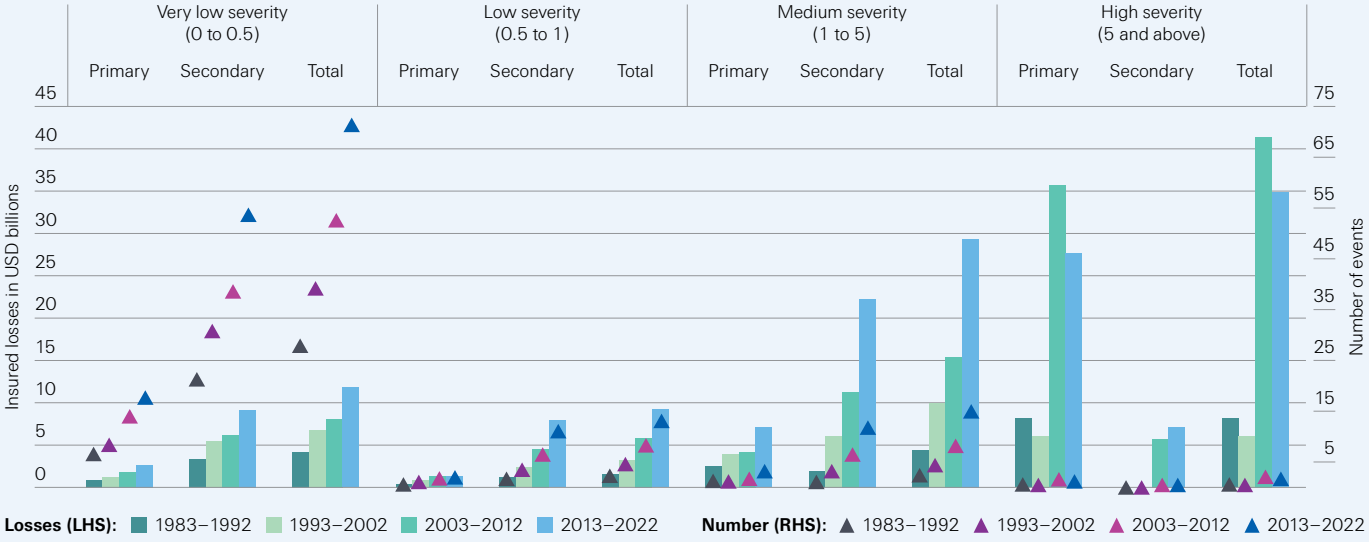
Growth in severity of losses resulting from primary and secondary perils is driving insured losses higher.

Across perils, there has been a shift in distributions to larger insurance loss amounts. Breaking down the losses by severity, medium (USD 1–5 billion of insured losses) and high severity (more than USD 5 billion) events contribute the majority of all insured losses (see Figure 4). Moreover, the associated losses are rising faster than those from very low severity events (less than USD 0.5 billion), even though the latter occur more frequently. From 2013–2022, there were on average 70 low severity events each year. Their contribution to total insured losses, however, was justUSD 11.7 billion. Over the same decade, an average of just two high-severity events each year contributed USD 34.4 billon cumulatively to total losses.

Tropical cyclones and SCS have consistently been the main contributors to global insured losses.

Thus, over the last 40 years, growth in annual losses has been primarily driven by rising severity of losses, these resulting from medium- to high-loss secondary and high-severity primary peril events. Tropical cyclones and SCS have consistently been the main contributors to global insured losses. High severity secondary peril events of the magnitude of the floods in Thailand (2011) and Germany (2021), and wildfires in North America were unheard of before 2011. The fact that these natural disasters have occurred more frequently in the last decade is indicative of the growing threat they present. Overall, this implies that the main physical driver of associated losses has been accumulation of value exposure as a result of economic development, urbanisation and rising population concentrations, often in regions susceptible to natural hazards (eg, coastal regions, river fronts, wildland urban interface).

Figure 4
10-year averages of insured losses (left) and number of events (right) by severity category in USD billion of insured loss per event, losses at 2022 prices

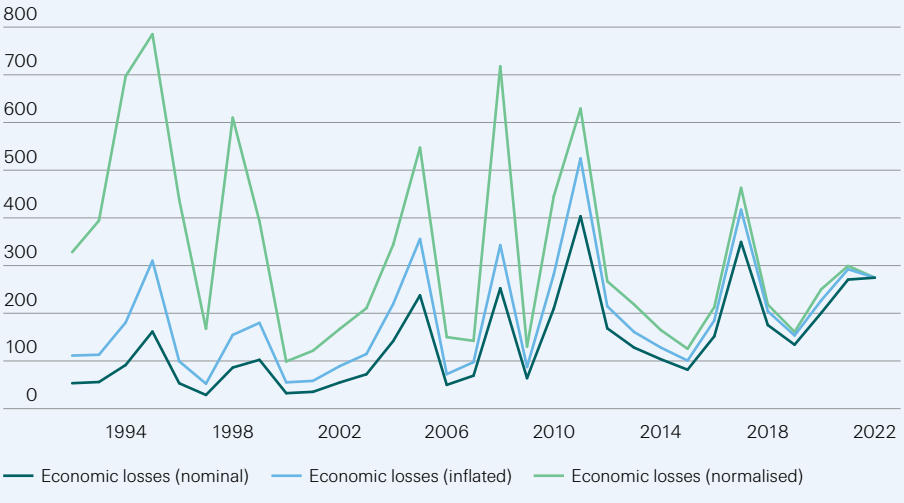


Source: Swiss Re Institute

Rising losses over the last 40 years have been mostly driven by economic growth and urbanisation.

Another way to demonstrate the impact of socio-economic factors on loss history is to "normalise" the economic losses triggered by natural catastrophes for nominal GDP growth effects. An event of the past, if it were to occur at equal magnitude today, would cause more economic damage than in the year of occurrence due to exposure value accumulation. A common approach is to apply real GDP and inflation factors to past economic losses (see Figure 5). We thereby estimate that the annual growth rate of global normalised (adjusted for inflation and real GDP growth) losses from natural catastrophes between 1992 and 2022 is around 1.2% on a 10-year moving average basis, still increasing but at much slower rate than shown by nominal losses (7%) and also real (adjusted for inflation) losses (4.5%) over the same time period.

Figure 5
Nominal, inflated (2022 prices) and normalised economic losses from natural catastrophes, USD billion



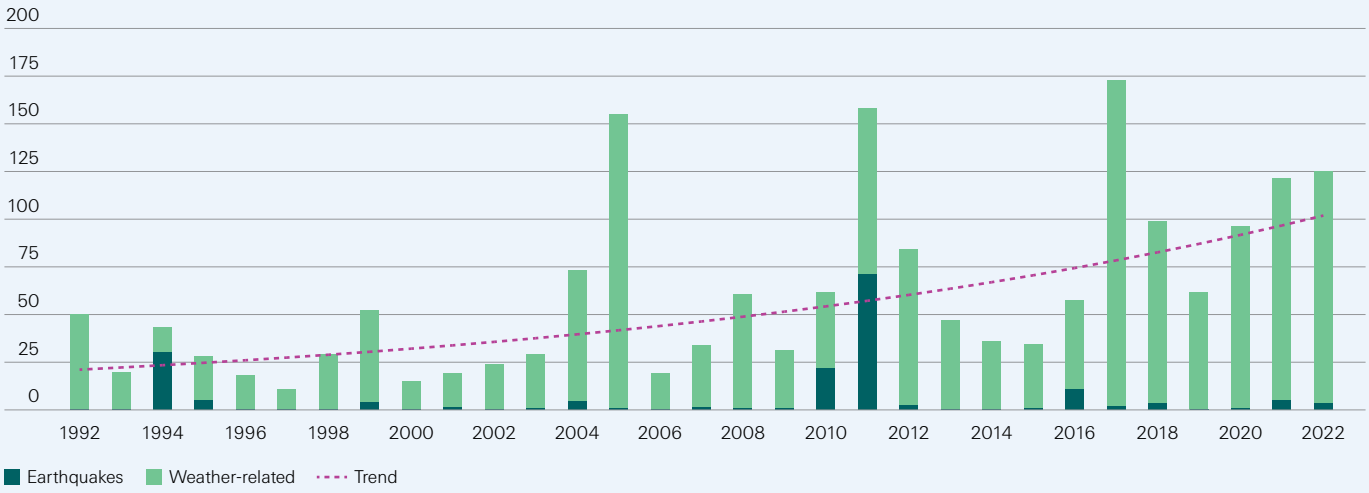
Source: Swiss Re Institute

Up-trend reaffirmed, and set to continue

We expect that average insured losses from natural catastrophes will continue to grow by 5–7% annually.

Insured losses from natural catastrophes have been on a long-term upward trajectory for much longer than the last six years. Since 1992, the average annual trend growth of losses has been 5–7% (see Figure 6). In the period 2012–2016, losses were at a lower annual mean, but there has been a return to said trend growth over the last six years and we expect this to continue. We project that irrespective of year-on-year volatility, insured losses will continue to grow at trend, even when real-time amplifying factors such as high inflation subdue.

Figure 6
Growth in global natural catastrophe insured losses in USD billion (2022 prices)



Source: Swiss Re Institute

Since 2017, average annual insured losses have exceeded USD 110 billion.

Starting from 2017, average annual insured losses from natural catastrophes have been above USD 110 billion, more than double the average of USD 52 billion over the previous 5-year period. This marks a notable step-up in the scale of losses after the 2012–2016 period of benign losses. Asset value accumulation in an area struck by an extreme weather or other natural catastrophe can spark heavy financial losses. Another factor has been changes in construction costs. Of late, aging infrastructure vulnerabilities and inflationary pressures have boosted repair costs. And, with demand-supply imbalances of materials and labour still in play in the post COVID-19 era, we expect construction costs to remain elevated into 2023, further inflating repair and reconstruction costs. This will impact attritional losses and further augment property losses over the next two years at least. Hazard intensification will likely play a bigger contributory role to rising losses in the coming decade also. With the world getting warmer, findings from scientific research infer that climate change effects on loss frequency and severity will intensify.

Losses of more that USD 100 billion annually are here to stay.

We also expect, irrespective of below-average loss years, that annual insured losses will average more than USD 100 billion from hereon. Our expectation is supported by other parties: for example, Verisk recently modeled the global insured average annual loss as USD 123 billion.[14] In any one year losses can be higher or lower depending on whether natural catastrophe events do or do not strike urban and more populated areas. A case in point, had Hurricane Ian last year made landfall in the Tampa Bay area as many predictions were showing, the resulting losses would have been much higher. There is no reason to anticipate that this, nor peak-loss disasters like Hurricane Katrina in 2005, will not happen again in the future. The takeaway is to not underestimate loss potential on account of a year or period of below trend growth.

[14] *Global Modelled Catastrophe Losses*, Verisk, 2022.

2022 natural catastrophes: lessons learned

The natural disasters of 2022 demonstrate that economic factors, in the last two years augmented by inflation, are the main driver of elevated insured losses from natural catastrophes. There were a number of high-loss events last year, including Hurricane Ian, floods in Australia and hailstorms in France. All of the events can be explained by known risk drivers, signalling need for continued discipline in property underwriting. The loss experience of the 2022 events offers several lessons for re/insurers including: better monitoring and sharing of granular exposure and claims data for secondary perils in particular; the importance of appropriate observation periods and a debiasing of historical losses; the need for models and underwriting decisions to more readily adjust to and take account of the rapidly changing risk landscape.

Loss drivers are manifold

The 2022 natural catastrophe year saw many loss drivers at play.

There were many large natural catastrophes in 2022 demonstrating the wide variety of risks across different perils around the world. The different events shed light on the underlying drivers of the long-term trend of rising catastrophe-related insured losses. Figure 7 highlights the notable loss drivers at play across the insurance value chain. Notwithstanding the severity of last year's catastrophes, none of the events were outliers from the perspective of resulting in unprecedented losses. Where there were record losses, these were the result of explainable, and known, risk drivers. The losses were not due to exceptional features of the physical events themselves, but the result of growing exposure values, inflation, insufficient exposure data and other factors. To this end, last year's catastrophe experience reaffirms the challenges the re/insurance industry faces in keeping up with a fast-evolving risk landscape.

Figure 7
Loss drivers at play in 2022

Hazard	Vulnerability	Exposure	Socio-economic effects
▪ Impact of the two large perils: tropical cyclones and severe convective storms ▪ Impact of La Niña (mode of ENSO) ▪ Climate change effects on weather perils	▪ Outdated and/or updated building codes ▪ Inadequate flood protection infrastructure ▪ New types of infrastructure (eg, roof-top solar panels)	▪ Development and capital accumulation in exposed areas ▪ Urbanisation and urban sprawl	▪ High inflation (especially high construction costs) ▪ Misuse of Assignment of Benefits (AOB) rules

Note: ENSO is the El Niño–Southern Oscillation, a recurring climate pattern.
Source: Swiss Re Institute

This chapter covers a selection of 2022 natural catastrophe events, each yielding unique outcomes.

Table 2
2022 events, and lessons learned

Event	Region	Estimated insured loss	Lesson learned
Hurricane Ian	North America	USD 50 to 65bn	All it takes is one storm
Australia floods	APAC	USD 4.3bn	Exposure growth and inflation drive losses higher
South Africa floods	EMEA	USD 1.5bn	Lack of data transparency compromises risk assessment
Severe convective storms	North America	USD 26bn	Rising property losses set to continue
Hailstorms France	EMEA	USD 5bn	A new market return period needed
Winter storms in Europe	EMEA	USD 4.1bn	Bigger storms will come

Source: Swiss Re Institute

North Atlantic hurricanes: all it takes is one storm

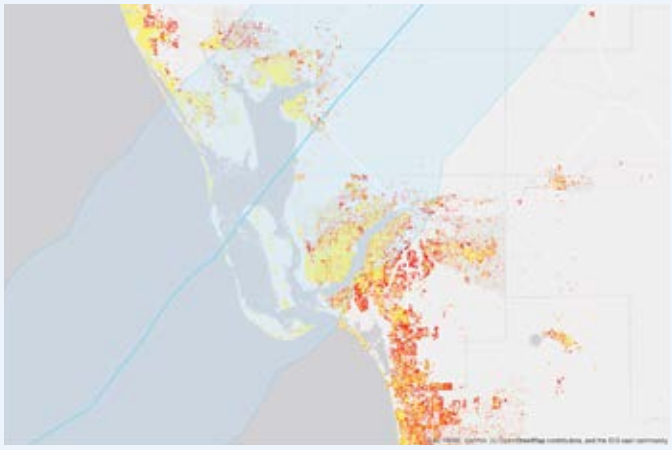
A benign North Atlantic hurricane season was still the third costliest ever.

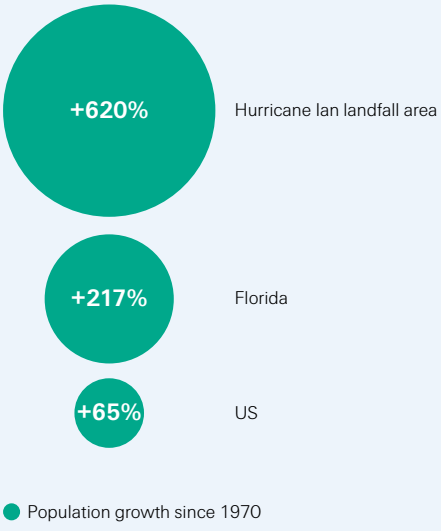
By most measures, the 2022 North Atlantic hurricane season was "average". There were 14 named storms, in line with the average 14.4 annually in the period 1991–2020.[15] With only two major hurricanes (category 3 and higher), insurance-relevant storm activity was below forecast, and also below the historical annual average of 3.2 major storms. Even so, despite being relatively benign activity-wise, the 2022 season was the third most expensive on *sigma* records.

The reason was Hurricane Ian, and where it struck.

Why? Because of Hurricane Ian. Resulting in estimated insured losses of USD 50–65 billion, this one hurricane demonstrates that location of landfall (rather than number of storms) was the main driver of the heavy loss burden. When Ian made landfall in western Florida in late September as a category 4 storm, it hit an area that has seen a rapid population increase, growth in built areas and accumulation of physical assets (see Figure 8). Since 1970, the population where the storm made landfall, the Cape Coral-Fort Meyers metro area, has increased by 620%, exceeding both the population increase in the state of Florida (+217%) and the entire US (+65%). The storm demonstrated the loss potential of an individual major hurricane hitting a densely populated coastline, and the potential risks involved in people settling in regions more exposed to extreme weather events. As Hurricane Ian moved towards Florida, some predictions had put landfall in the Tampa Bay area. If this had happened, the losses would likely have been higher. To this end, the experience is reminiscent to Hurricane Andrew in 1992, which missed Miami by just 20 miles (as opposed to 100 miles for Ian). Had Miami been in Andrew's path, the 1992 losses would also have been up to three times higher than those that transpired.[16]

Figure 8
Changes in built-up land in the Ian landfall area (left) and population growth statistics (right)





Sources: German Aerospace Center, National Hurricane Center, US Census Bureau, Swiss Re Institute

Updated Florida building codes helped newer homes withstand Hurricane Ian…

There was extensive wind damage to buildings in the path of Hurricane Ian. However, losses would have been much worse were it not for revisions to and enforcement of stricter building standards following hurricanes Charley in 2004 and Irma in 2017. In the past two decades, many buildings have been constructed according to the new building standards, and many roofs have been replaced and storm-proofed.

[15] "Atlantic Hurricane Outlook and Summary Archive," in *Background Information: North Atlantic Hurricane Season*, National Weather Service – Climate Prediction Center.
[16] *Hurricane Andrew: The 20 miles that saved Miami, Swiss Re, 10 August 2017.*

…but damages from storm surge were exacerbated by inadequate proofing against high water levels.

The immediate surroundings of Hurricane Ian's landfall location also suffered extensive storm surge. Water levels exceeded 4-5 metres in the Fort Myers Beach area and affected homes up to 0.5 km inland. While many buildings are wind-proofed, there is lack of "proofing" for high waters. The takeaway is that more investments in flood protection and existing infrastructure are needed. In addition, further improvements in flood protection will support adaption to climate change effects, one of which is the heightened risk of coastal flooding (see also Figure 13).

Further, In Florida social inflation has been a major driver of elevated claims in property insurance.

Florida's re/insurance market has been in focus since Hurricane Irma made landfall in 2017 as a category 4 storm, causing significant property damage and high losses. Loss severity in Florida is compounded by a factor other than damage caused by a hurricane: social inflation, driven by the state's litigation environment, particularly Assignment of Benefits (AOB) rules.[17] An AOB is an agreement that transfers insurance rights to a third party, enabling that party to file claims, make repair decisions and collect payments without the involvement of the original policyholder. In the case of Hurricane Irma, AOB rules pushed claims up by 10–20% (see Florida: hurricanes and litigation).[18] The rules have resulted in a stressed property insurance market: homeowner premiums in Florida are 3-times the national average.[19]

Florida: hurricanes and litigation

Assignment of Benefit agreements have ramped up insurance costs…

Social inflation – the increase in claims severity above what would be expected under usual conditions of economic inflation and loss trends – is mainly a feature of liability insurance. It is also a fundamental aspect of Florida's homeowners' insurance market. Primary drivers of social inflation in Florida include AOB, one-way attorney fees (the requirement that insurers pay plaintiffs' legal fees if the carrier loses in court), and a low threshold for roof repairs, which require a full update to the current building code if at least 25% of a non-compliant roof was damaged.[20] These rules allow the use of insurance payouts to fund roof replacements, contributing to higher insurance prices for all and resulting in market dysfunction. In 2021, Florida accounted for 7% of homeowners' claims in the US but 76% of homeowners' lawsuits against insurers.[21]

…and put six insurers in Florida out of business last year.

The fallout from this high level of litigiousness was evident in market dysfunction in Florida before Hurricane Ian. Six insurers declared insolvency in 2022[22] and the number of policies in force at Citizens Property Insurance Corp. – the state's insurer of last resort – more than doubled between year-end 2020 and 2022.[23] It is an indicator that the cost of insurance continues to increase for many policyholders in the state: Citizens' policies are only available if cover in the private market is unavailable or at least 20% more expensive.

AOB rules have been reformed, but proof of results will take some time to show.

The Florida legislature took action in 2019 to mitigate AOB abuse (House Bill 7065) and in 2021 to restructure litigation rules and limit excessive litigation, but additional measures were needed. As a result, the authorities in Florida held two special legislative sessions in 2022. Legislation passed in December 2022 is expected to significantly improve the re/insurance market and legal environment. Among other changes to disincentivise lawsuits, it eliminates AOB and the one-way attorney fee provision entirely in property insurance contracts. However, it will likely take 12–18 months for the full effects of the recent updates to take effect. The reforms will in all probability be challenged in court, and AOB elimination does not apply to policies issued before 1 January 2023.

[17] *Hurricane Irma Dredged Up AOB Issues in Florida: Are Changes Ahead?*, Verisk, 2020.
[18] Ibid.
[19] *Extreme Fraud and Litigation Causing Florida's Homeowners Insurance Market's Demise*, Insurance Information Institute, 23 June 2022.
[20] SB4 in 2022 loosened the requirement, avoiding the full-repair requirement for roofs built in compliance with the requirements of the 2007 Florida Building Code or subsequent versions.
[21] *Property Insurance Stability Report*, Florida Office of Insurance Regulation, 1 January 2023.
[22] "Florida Government Seeks to Repair Property Insurance Market", AM Best, 8 December 2022.
[23] *Policies in Force*, Citizens Property Insurance Corporation

Australia floods: exposure growth and inflation drive losses higher

The February-March floods in Australia were the country's costliest insured loss events ever.

In Australia, three consecutive years of La Ninã weather patterns have increased the risk of flood events through elevated precipitation levels, dams that are full and saturated soils. In February and March 2022, heavy rainfalls on saturated soil led to a series of floods in eastern Australia, resulting in insured losses of USD 4.3 billion.

Flood risk in Australia is strongly driven by urbanisation

The flooding of Brisbane and Sydney are a reminder of the impacts, recurrence and drivers of urban floods. The share of Australia's population living in urbanised areas is among the highest in the world and also advanced economies.[24] Over the last 20 years, the increase in soil sealing in Australia's five biggest cities has been the main contributor to a 7% increase in annual expected losses from floods.[25] Ongoing urbanisation, population growth, inadequate flood protection infrastructure and increased soil sealing will add to an increase in flood-related insured losses.[26]

Inflation impacts drove up claims substantially.

The cost of rebuilding after the floods in February-March 2022 has been higher than expected. Last year's high economic inflation, driven by disruptions to global supply chains and lingering effects from pandemic-related border restrictions, meant that building replacement costs could have risen by more than 20%.[27] Shortages in skilled labour drove costs even higher. There are models to assess local flood risk, but these may not always capture all loss drivers. For instance, flood models in particular should reflect urbanisation and soil sealing effects, and also be forward-looking to account for potential La Niña or other conditions. Elevated inflationary factors, to the extent not captured in exposure data and temporary, should also be factored in.

South Africa floods: lack of data transparency can compromise risk assessment

The loss magnitude from the South Africa floods shows the importance of transparency in exposure data.

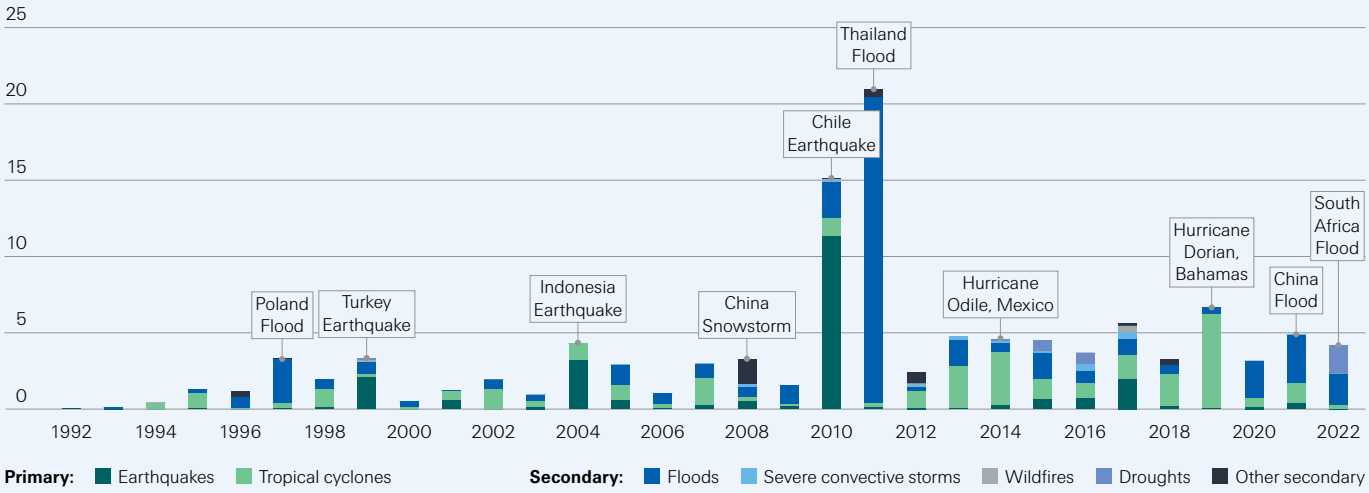
Last year, a storm bringing days of heavy precipitation in the Durban area of South Africa resulted in floods and landslides, and estimated insured losses of USD 1.5 billion. The losses included claims for damage at industrial locations that are part of international supply chains, exposures that had not been taken into consideration. The loss magnitude shows that lack of transparency in exposure data can lead to an underestimation of risks, and unanticipated losses.

Emerging economies are central to global supply chains. Risk assessment should factor in the exposures in these markets.

Insured losses from natural catastrophes in emerging markets can be very large. The biggest loss years on *sigma* records are 2010, when an earthquake in Chile resulting in insured losses of USD 10.7 billion, and 2011, when floods in Thailand caused insured losses of USD 19.5 billion. In both years emerging markets contributed more than 15% of the global insured losses. Today's commercial and industrial operations are global and complex. For accurate risk assessment, re/insurers need full transparency with respect to the assets and international connections within a firm's production sites and internal processes, wherever these may be based. Lack of awareness can lead to underestimation of the risks. Modelling capabilities need to be expanded to cover the growing number of regions involved in global supply chains, and also the different perils those regions are exposed to. Land-use changes also relevant for model updates.

[24] *Urbanization*, Our World in Data, November 2019.
[25] *sigma* 1/2022: Natural catastrophes in 2021: the floodgates are open, Swiss Re Institute.
[26] Ibid.
[27] *Costs of rebuilding a flooded home to climb 20pc – Australian Financial News (afndaily.com.au)*

Figure 9
Natural catastrophe insured losses in emerging markets, in USD billion at 2022 prices



Source: Swiss Re Institute

2022 saw substantial SCS-related losses in the US, again.

Severe convective storms in the US: rising losses set to continue

The cumulative losses from SCS in the US in 2022 were more than USD 25 billion, well above the average of the previous 10 years (inflation adjusted). We expect annual insured losses from SCS in the US to continue rising in line with the annual 5–7% increase in global losses from natural catastrophes.[28] We estimate average SCS losses will likely exceed USD 25 billion annually in the coming years, reaching USD 30 billion before the end of the decade, equivalent to around 7% of projected US property sector premiums.

We expect rising construction costs and vulnerabilities to push SCS-related property claims higher.

SCS in the US currently represent 20–30% of the global natural catastrophe insured losses. Economic growth and urbanisation will increase exposures in the coming years. In addition, building costs rising faster than the rate of overall inflation are expected to push reconstruction costs and claims even higher. Other loss drivers include an increase in the average claims amount due to gains in the insured values of assets vulnerable to SCS, such as roof-mounted solar panels.

There were record hailstorm-induced losses in France last year.

Large hailstorms in France: a new market return period assumption needed

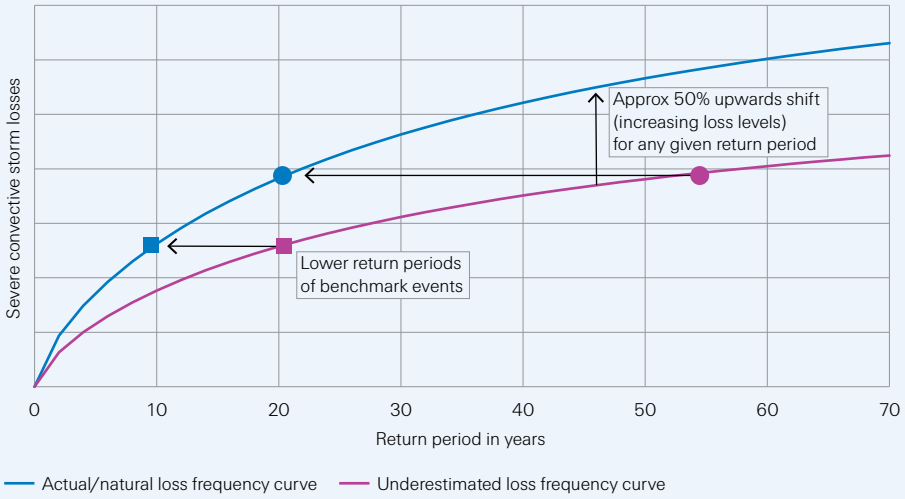
France too was hit by SCS last year, with storms in May and June resulting in insured losses of USD 4.8 billion. Those losses exceeded the previous record year 2014 by 3-4 times when Storm Ela resulted in insured losses of more than USD 1 billion. Since then, Ela is considered the industry benchmark for hailstorms in France, with an assumed market return period of 20 to 50 years. However, with the losses from storms Qiara and Maya in 2022 both exceeding the Ela loss, the benchmark USD 1 billion loss level has been surpassed three times in the past decade. In our view, this justifies a revision of the return period assumption, to below 10 years.

[28] *sigma* 1/2021 – Natural catastrophes in 2020: secondary perils in the spotlight, but don't forget primary-peril risks, Swiss Re Institute.

Hard-to-assess risk drivers and rare event occurrence can lead to underestimation of loss trends.

The larger number of SCS in the US offer a reference point for analysis of the relatively few hail events in Europe. The impact of economic growth and inflation are well understood, but other factors like the increase in built-up land area, vulnerability changes (eg, from solar panels) and social inflation are more difficult to assess. Hidden or hard-to-quantify risk drivers combined with rare event occurrence mean that loss trends can be underestimated over a longer-term period. Data from the US suggest that risk drivers beyond economic growth add a few percentage points to annual losses.[29] A hypothetical example as in Figure 10 illustrates how just a 2% underestimation of annual loss increase over a period of two decades (on account of difficult-to-assess loss drivers) can lead to estimated larger return periods and lower loss levels. For example, an event with a return period of around 10 years can be mistaken as a once in 25-year event. The effect is more pronounced at higher return periods, where a one-in-20-year event is assumed to have a return period of 60-years or more.

Figure 10
Impact of increasing loss levels on loss frequency curve and event return periods



Source: Swiss Re Institute

Models need to reflect all factors relevant to hail exposures.

The 2022 experience illustrates a trend of increasing losses from hailstorms in France. Models need to be updated with the latest understanding of all relevant factors to avoid an underestimation of hail risk.[30] This includes the use of appropriate loss experience windows to determine suitable return periods, and consideration of factors beyond economic growth and urbanisation, such as, changes in land use, assets exposed to hail damage or claims behaviour.

Winter storms Europe: bigger storms will come

2022 European winter storms were a reminder ...

In February last year, a cluster of three winter storms (Eunice, Dudley, Franklin) hit north-western Europe, resulting in combined insured losses of more than USD 4 billion, above the previous 10-year average of winter storms losses of US 2.5 billion. In the decades before, there were larger loss events. For instance, winter storm Kyrill in 2007 resulted in insured losses of USD 5.9 billion. Based on 2022 prices and exposure, we estimate that the same storm would have today resulted in losses of USD 10.6 billion.

... of an important peril that remains largely dormant, for now.

History shows that European winter storm activity is variable on a decadal time scale. Recent storm activity has been below-average. However, it is important that risk modellers and underwriters are not lulled into a false sense of security by assuming lower activity will remain indefinitely. The 2022 losses serve as a timely reminder of the ever-present risk of winter storms. To this end, we concur with the view that European winter storms are a "sleeping giant".[31] Given the natural variability, phases of higher storm activity and/or occurrence clusters of winter storms will re-occur.

[29] Ibid.
[30] *Severe 2022 hail damage in France sets new benchmarks, underscores shift of risk and calls for pricing adjustments*, Swiss Re, November 2022.
[31] *European Windstorm Risk in a Warming World*, SCOR, 23 January 2023.

Lessons for risk assessment and underwriting

There has been significant progress in natural catastrophe risk modelling capabilities over the last decade. That said, there is always room for further enhancements. The insurance loss experience of 2022 offers some pointers as to where and how.

- **Sharing of peril specific, granular exposure data is key:** Comprehensive data on existing exposures is the starting point for any underwriting process. There is room to improve the collection and transmission of exposure data of sufficient granularity, specifically for secondary perils (in particular for floods and hail storms). The re/insurance industry has long monitored primary perils and its modelling capabilities for these are strong. Secondary perils have not received the same attention in terms of peril-specific exposure and the sharing of model results. This has sometimes compromised efforts to underwrite those risks. Insured losses from secondary perils have been on the rise for many years, sometimes reaching the magnitude of losses resulting from medium-size primary peril events. For more complete risk assessment and to capture the large loss potential that secondary perils can inflict, as in the case of the flooding in Durban in South Africa in 2022, it is time the industry affords these exposures the same discipline around the monitoring, and sharing of exposure data and model results as primary peril risks.

- **Up-to-date exposure data matters in times of high inflation:** Another consideration is to ensure that exposure data is updated to capture latest inflation developments. For instance, in the last two years inflation has surged, and this has pushed up the costs of property rebuilds and reconstruction. Inflation effects contributed to the large losses from the floods in Australia in February-March last year. The cost of rebuilding were higher than anticipated by re/insurers because the inflation impacts of lingering disruptions to global supply chains and pandemic-related border restrictions had not been fully factored into risk assessment.

- **Risk assessment to more readily reflect rapidly changing risk landscapes:** Models and risk assessments need to reflect all loss drivers such as soil sealing, construction of new risk mitigation infrastructure assets, updates to building codes, climate change effects and social inflation. It is important to capture changes in all relevant risk drivers, and to do so in a forward-looking manner. When models results are adjusted for temporary effects like (expectations of) higher inflation, underwriting decisions ensure adequate risk assessment.

- **Selection of appropriate observation windows and debiasing of historical data is key:** Past loss experience is a key input for natural catastrophe risk assessment. The chosen observation window should be peril-specific appropriate, both limited to a more recent past and forward-looking to capture important developments such as changes in weather regimes. In addition, historical data points need to be translated to represent the current-day risk environment. A mere adjustment for inflation and economic growth trends can lead to underestimation of the risk levels. More holistic and representative trending/debiasing of historic losses should also take into account that reconstruction and repair costs typically increase faster than consumer price inflation, and that physical asset values increase faster than the rate of economic growth. Consideration of all relevant peril and region-specific loss drivers, including changes in urban development, migration to areas vulnerable to extreme weather events, and enhancements of risk mitigation infrastructure, make for effective debiasing of historical loss data.

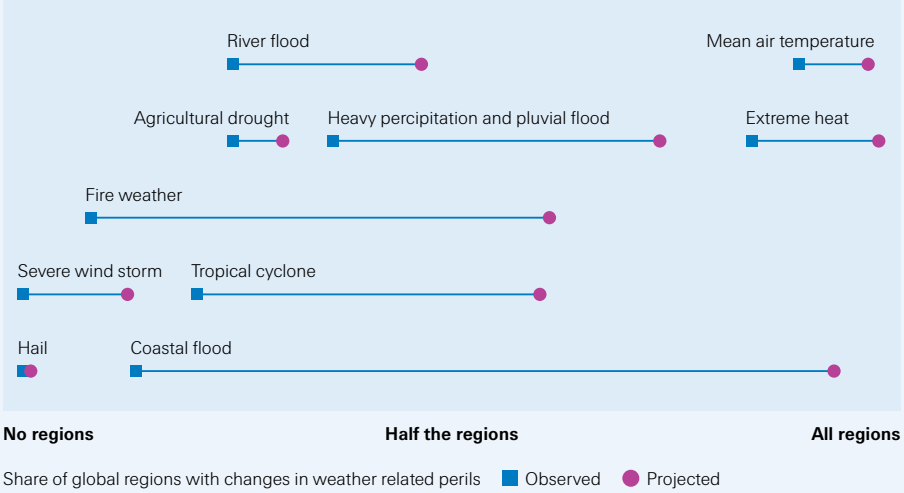
- **Sometimes bold changes are necessary:** Regular model updates lead to a gradual shift of risk perspective. Updates across all model inputs and/or in underwriting decisions are of particular importance for fast evolving secondary perils such as wildfires and SCS. Most natural catastrophe events contain learnings , requiring the industry to incorporate these in its risk assessment practices. Ideally, these learning steps are small and digestible. Sometimes, however, more bold changes can be necessary and appropriate too. For instance, the 2022 loss experience from the hailstorms in France and flooding in Australia warrants a reassessment of the respective return period assumptions.

- **Loss severity of 2022 events driven by other than climate change effects:** The impact of climate change on the 2022 loss events was measured. The scientific attribution of extreme weather events like cyclones or hailstorms to climate change is muted, at best (see What about climate change?). Today, the dominant drivers of rising losses from natural catastrophes are exposure growth, urban concentration in exposed areas, and changing vulnerabilities exacerbated of late, by high levels of inflation. Natural variability of extreme weather is today more significant than an underlying climate change signal. Even so, property underwriters should remain vigilant with respect to climate change effects and to what extent those already manifest are captured in risk models.

What about climate change?

The main drivers of rising losses from natural catastrophes are growth, urbanisation and rising populations in exposed areas, with factors such as social and economic inflation adding upward pressure in recent years. Climate change effects likely play a role also, but are not a primary driver increasing losses, at least not yet. This assertion is supported by observations of climate change effects, as reported by the Intergovermental Panel on Climate Change (IPCC).[32] Figure 11 summarises where, to date, climate change effects in different perils have already been observed (blue squares) across all regions of the world. For example, the figure demonstrates that already today, climate change effects on mean air temperatures and extreme heat have been observed in all regions on the world, putting these two "effects" to the right of the figure. With this context, the occurrence of heatwaves in China, Europe and the Americas last year is not a "surprise" per se.[33]

Figure 11
Extent of observed and projected changes due to climate change in weather related perils



Source: Swiss Re Institute, based on IPCC

[32] *IPCC Sixth Assessment Report*, 2022.
[33] *Provisional State of the Global Climate in 2022*, World Meteorological Organization, WMO, 2022.

As such, the 2022 heat waves in China, Europe and the America were in line with expectations.

Observations of an increase in heavy precipitation are less definite. Some regions (North America, northern Europe, central and eastern Asia) have seen more frequent heavy precipitation events. A case in point is Pakistan, which saw record breaking rainfalls and severe flooding in 2022.[34] In other regions, however, an observable trend is less clear cut. This is more so the case for other weather-related perils such as hail, river flood or tropical cyclone.

But not all weather-related perils show clear climate change effects – yet.

Lack of hard evidence of climate change effects can be the result of infrequent peril occurrence in monitored areas (eg, hailstorms), incomplete understanding of the physical processes of weather events (eg, storm tracks, hail formation), natural variability (tropical cyclones), or the complexity of interlinked physical process (eg, how changes in precipitation patterns translate into river discharges and flooding). That effects have not been widely observed, however, is not a signal of no change.[35] Progress in scientific understanding and observations may, in time, yield different conclusions. Figure 11 also shows the share of regions where changes in weather-related perils are projected for the scenario of a 2°C warming in global temperature by 2050 (purple circles). Hence, for instance, it is expected that sea-level rise and coastal flooding will, over time, affect all regions.

[34] *Pakistan's Monthly Climate Summary*, Pakistan Meteorological Department August 2022.
[35] For more, see *sigma* 2/2020: Natural catastrophes in times of economic accumulation and climate change, Swiss Re Institute.

Market dislocation: Hurricane Ian, inflation and interest rates

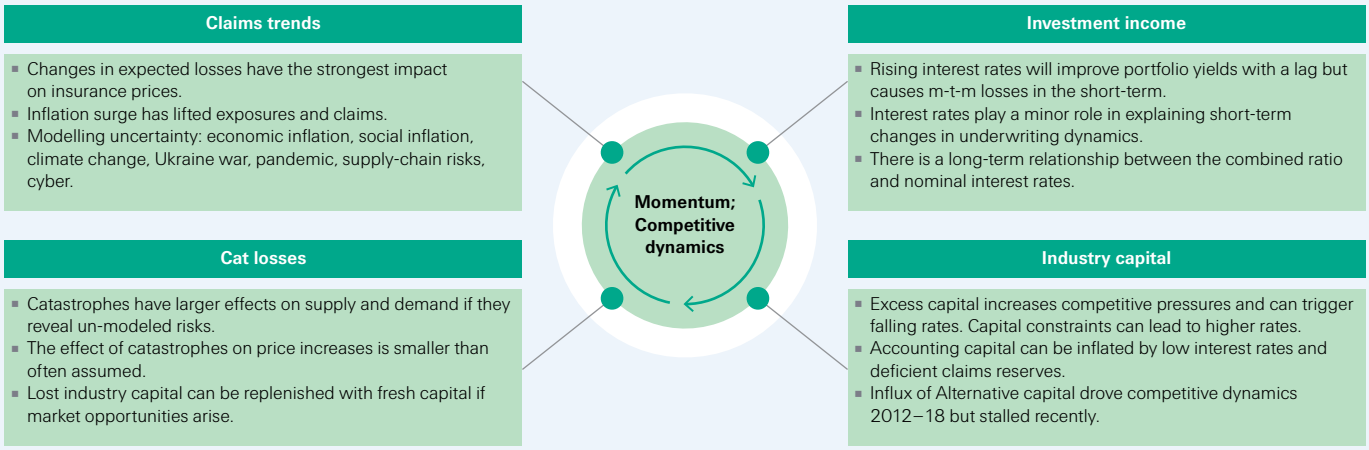
Property reinsurance rates rose significantly at the January 2023 renewals. The losses from Hurricane Ian last year were a contributory factor, but signals for a market correction had already been mounting. The industry has experienced poor underwriting results following the step-up in natural catastrophe loss severity since 2017, new risk drivers and fallouts from the pandemic and war in Ukraine, including inflation raising the value of insured property assets. Uncertainties around modeling discipline and the adequacy of premium levels to deal with increasing loss costs and emerging secondary perils have led to reduced risk appetite on the part of providers of capital. So too have the recent interest rate hikes, which have increased the cost of capital. When higher exposures encounter shrinking risk appetite, rising prices, higher retentions and tighter terms and conditions result. But even with the market reset in January, some reinsurers and investors in the sector will likely wait for signs of improved industry profits before materially replenishing capacity again.

The re/insurance underwriting cycle

Re/insurance rate increases gathered pace at the January 2023 renewals.

Reinsurance rates have been rising since 2018. The momentum picked up at the January 2023 renewals, with global risk-adjusted property catastrophe rates up 20–50% for loss-free portfolios and up to 100% for loss-hit.[36] The re/insurance underwriting cycle is characterised by periods of soft (falling/stable premium rates, coverage readily available) and hard (rising rates, cover less available) market conditions. The driver is re/insurer competition, affected by claims trends, interest rates, industry capital and catastrophe losses (see Figure 12). We attribute most of the current step up in prices to uncertainty around claims trends and the effect of inflation and interest rates on industry capital and demand. Risk appetite and alternative sources of capital affect overall capacity and the speed with which prices adjust to updated risk assessments. Recent underwriting experience affects the supply of existing industry capital and also influences expectations of future profits, both of which affect capacity decisions.

Figure 12
Main drivers of the underwriting cycle



Source: Swiss Re Institute

[36] *1st view: Market Turns*, Gallagher Re, January 2023. Guy Carpenter indicates a rate increase of 27.5% of its *global property CAT XL RoL index*.

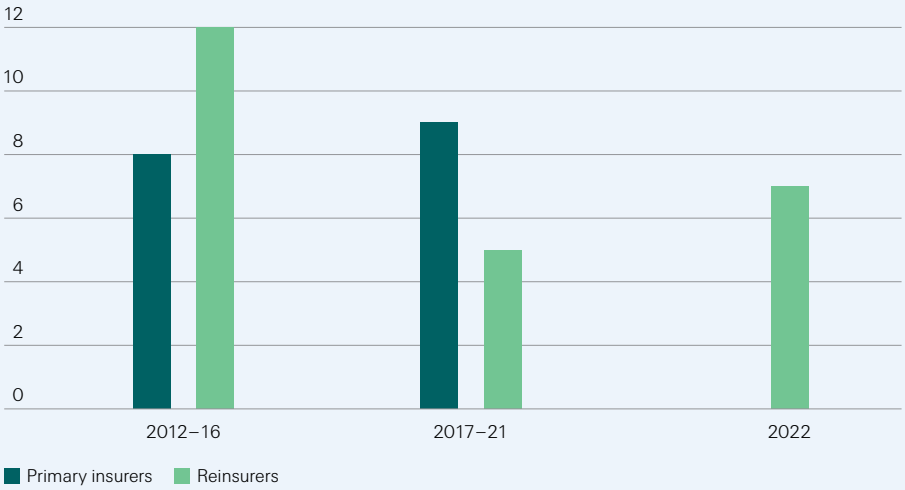
Demand for coverage is high, but in an environment of reduced risk appetite, capital supply is restrained.

The current hard market is a textbook case of shifting demand and supply, with the market seeking a new equilibrium. Demand for coverage had risen on evidence of increased natural catastrophe activity since 2017 and because of higher insurable values of buildings and other fixed assets. At the same time, natural catastrophe claims pay outs have reduced supply of capital. Supply has also fallen in response to rising interest rates and lower financial asset values. Lending further momentum to the supply-demand dynamic, risk appetite has decreased due to poor property re/insurance underwriting results in recent years, and widely held perceptions that risk assessments are underestimating actual loss experience. This is – apart from financial market uncertainty and rising interest rates – leading to hesitation on the part investors in insurance-linked securities (ILS) and traditional reinsurers to commit new funds to replenish industry capital. After six years of weak underwriting results, property re/insurance capacity providers have become more cautious. Some traditional players have reduced cat exposures, and alternative capital providers are waiting for evidence that pricing better aligns with loss experience.

Since 2017, premium income in property catastrophe has lagged exposure growth

Since 2017, the re/insurance industry has paid out USD 650 billion (in 2022 prices) for weather-related natural catastrophes claims. However, premium income has not kept pace with events or exposure growth – whether proxied by GDP or more targeted measures – the result being steadily declining profits (see Figure 13). Natural catastrophe losses affect industry capacity directly; while making societies financially more resilient, the payments to policyholders reduce profitability and capital supply. They also have indirect impact as re/insurers and investors update risk assessments. Perceptions about whether risks are priced adequately is key in determining the supply of capital and capacity available for underwriting. The historically elevated catastrophe and claims activity since 2017 has created doubts on the part of re/insurers and investors, and slowed the capital supply response.

Figure 13
Profitability (return on equity) of primary insurers vs reinsurers, 2012 – 2022



Source: S&P Capital IQ, Swiss Re Institute

Gaps in exposure data have given rise to concerns as to the accuracy of risk assessment models.

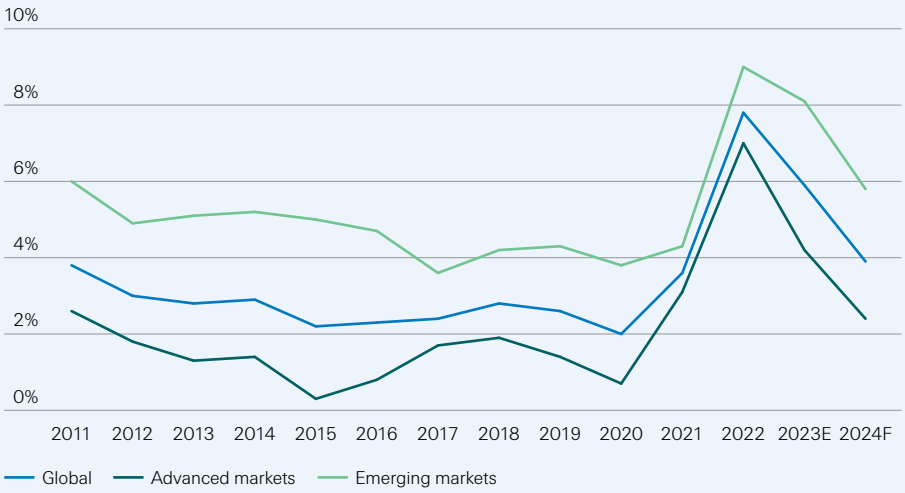
The increases in loss severity in recent years and new risk drivers had a strong impact on the recent renewals. Accurately quantifying and pricing for shifts in the exposure landscape and underlying loss distributions is key to maintaining the insurability of natural catastrophe risks. After six years of elevated losses and with gaps in exposure data, however, there is scepticism that existing models fully capture the risks. The wide range of loss drivers, uncertainties and macroeconomic pressures described in Section 2 must be better understood if the re/insurance industry is to collect sufficient premiums for the risks it assumes. The re-pricing of property risks at the January 2023 renewals is a clear sign that past prices did not capture the recent loss dynamic.

New risk drivers, such as the highest inflation in 40 years in advanced economies, has materially affected exposure values.

The unanticipated surge in economic inflation over the last two year to levels not seen in four decades was a catalyst for the step-up in prices at the latest reinsurance renewals. Inflation has the effect of raising the value of insurable assets and in turn, also claims. After

rarely passing the 2% threshold targeted by most monetary authorities in the previous decade, in 2021 inflation in advanced markets rose to 3.1%, driven by pandemic-related issues such as supply chain disruptions. In 2022, it averaged 7.1%, with the war in Ukraine driving food and energy prices to new highs. In emerging markets, inflation reached 9% last year, also driven by food and energy prices (see Figure 14).

Figure 14
Inflation, 2011–2024



Source: Swiss Re Institute

The value of insurable exposures have grown faster than headline inflation and economic growth.

Since the start of the pandemic, property insurance exposures – the nominal value of buildings, motor vehicles, and other fixed assets that insurers cover – have grown faster than headline inflation and real GDP growth. The fastest rising prices have been in sectors such as construction and vehicle sales, directly impacting claims costs in some of the largest lines of insurance. In the US, for instance, the replacement cost of all privately-owned structures increased by an estimated 40% between year-end 2019 and 2022, well above a near-20% increase in nominal GDP (for more on replacement values, see US property insurance exposure, claims and premiums). Increases in litigation-driven social inflation indicate the applicable inflation rate for claims costs could be even higher than the relevant economic indices.

Rising costs in the construction sector due to supply chain disruptions have led to rising property claims.

One of the first indications of surging inflation was in the construction sector when lumber prices rose in the summer of 2020 because of supply-chain disruptions and rising demand for new homes, renovations and do-it-yourself projects during lockdowns.[37] From May to September 2020, lumber prices in the US were up 57% and they remained volatile over the following two years. They settled at a level around one third higher than before the first price surge. The share of lumber and other materials in property claims varies significantly by line of business, geography and catastrophe exposure, but the overall cost of construction has risen significantly. For instance, today construction materials in the US are more than 40% higher since the beginning of 2020, and 20% higher in Europe.[38] The increase in the cost of materials, components and also labour is driving property replacement costs higher, which in turn feeds through into higher homeowner and commercial property claims.

We expect claims will continue to rise, pushing reinsurance rates higher.

Price inflation in the construction market has caused difficulties for property underwriters, and the general surge in economic inflation of the last two years started by the pandemic has extended uncertainties around risk assessment to more lines of business. Swiss Re Institute forecasts ongoing elevated inflation in cost components relevant for property insurers, and that this could lead to a marked increase in claims in 2023 and, in turn, reinsurance rates. Even if inflation abates in 2024, cost levels will not go back to pre-pandemic times but remain at elevated levels.

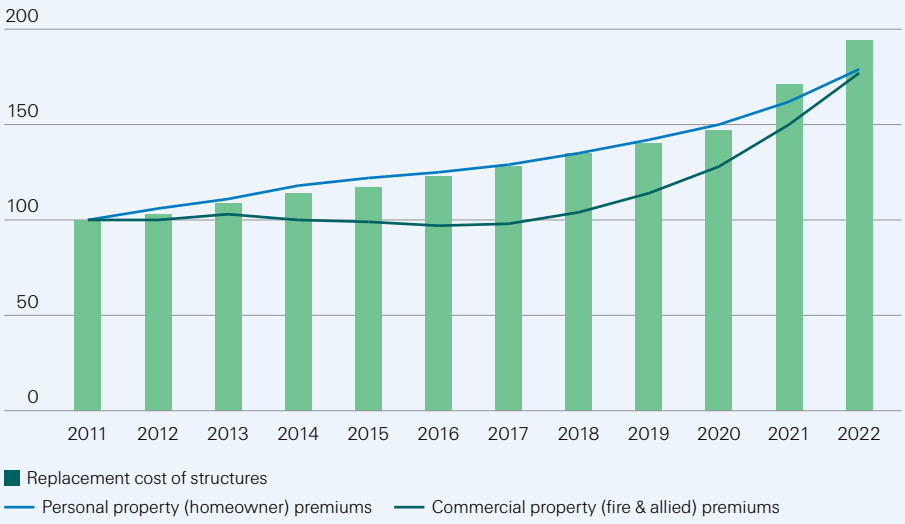
[37] *"Wood Price Spike Caused By Pandemic Finally Starting To Drop"*, NPR, 21 June 2021.
[38] US Bureau of Labor Statistics, Producer Price Index; Eurostat, Construction producer prices

The pandemic-induced surge in inflation has increased replacement costs in US property.

US property insurance exposure, claims and premiums

US property insurance business is under earnings pressure. Annual natural catastrophe property claims averaged USD 83 billion in 2017–2022, a more-than-doubling of average annual pay outs in the previous six years. At the same time, the average share of natural catastrophe-related losses of all property claims rose from 20% to 35%,[39] mainly driven by a step-up in annual loss severity since 2017. Since 2019, so too has been an increase in the replacement value of buildings and equipment sparked by the pandemic-induced surge in inflation. The replacement value of the net stock of private structures in the US was an estimated USD 53.5 trillion in 2022,[40] up around 40% from 2019. Since 2011 the replacement cost of private structures has grown by 6% annually compared to 5% for property lines premiums (see Figure 15). The outcome is that even with market hardening in primary commercial property since 2019, premiums have lagged replacement cost increases.

Figure 15
Exposure and premium growth, US property, 2011 = 100



Source: US Bureau of Economic Analysis, S&P Global Capital IQ Pro, Swiss Re Institute

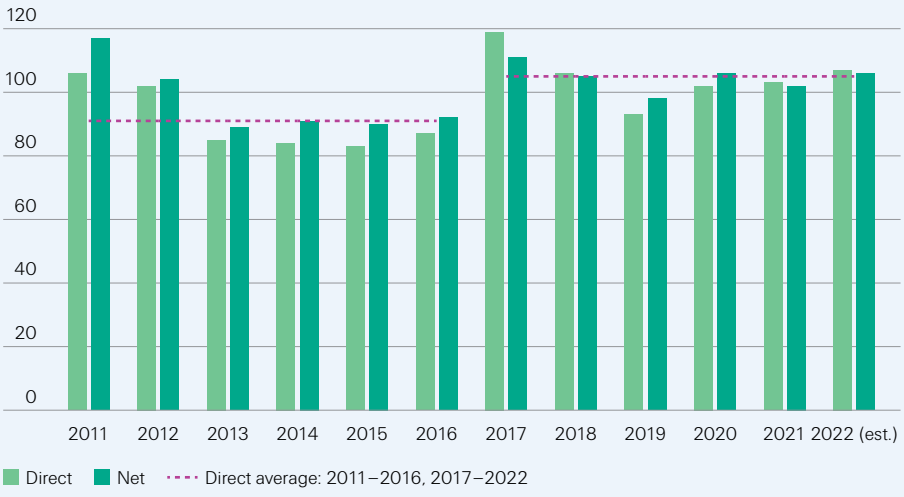
Re/insurance rate gains have lagged increases in insured losses and replacement costs.

Underwriting experience indicates that pricing has also lagged natural catastrophe losses and replacement values. Between 2011 and 2016, the combined ratios for US property lines averaged 91%, while from 2017–2022 they averaged 105% (see Figure 16). Based on 2022 US property premiums of USD 200 billion, the profitability gap amounts to extra annual losses of nearly USD 30 billion, or 3–5% of industry ROE. Returning to underwriting profitability in US property will require continued underwriting discipline alongside a reassessment of the underlying risks.

[39] We classify allied lines (including crop and flood), home- and farm-owners, commercial multi-peril (non-liability), ocean marine, inland marine, and motor physical damage as weather catastrophe-exposed lines.

[40] To estimate the replacement cost of structures at year-end 2022, we adjust the BEA current-cost net stock of private fixed assets at year-end 2021 (USD 47.2 trillion) by the YTD growth through 3Q22 of the current cost basis of residential and nonresidential structures owned by households and non-financial noncorporate business.

Figure 16
Combined ratios, US property lines (Fire, Allied, Homeowners), 2011–2022 (est.)

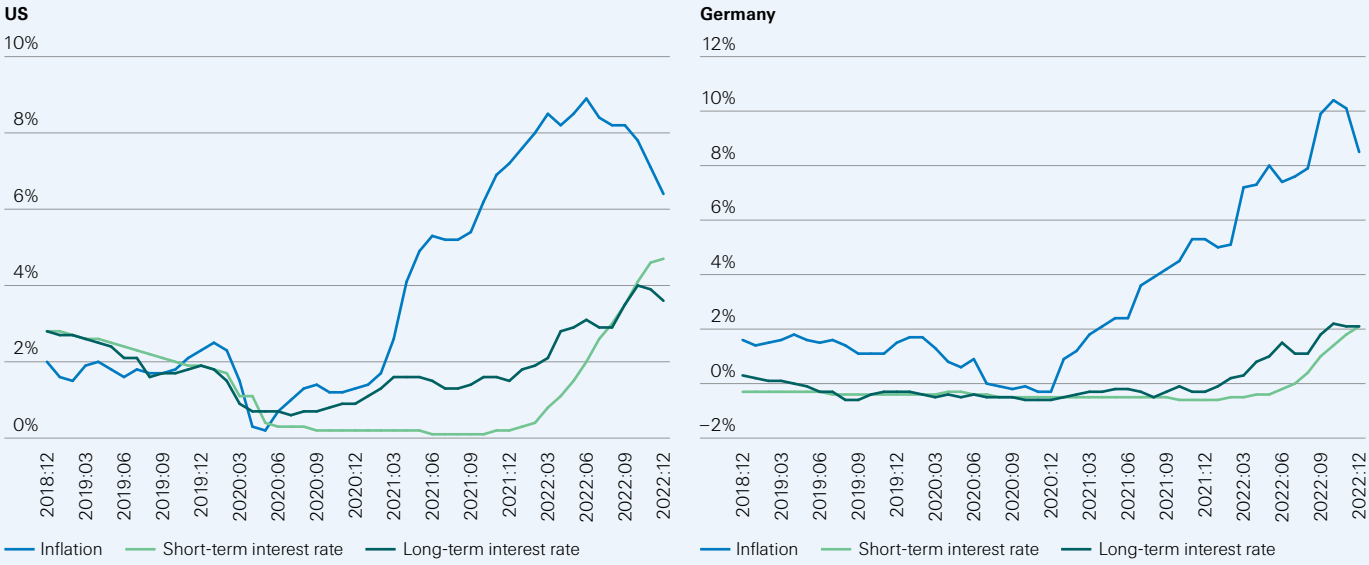


Source: S&P Global Capital IQ Pro, Swiss Re Institute

High inflation has sparked interest rates hikes...

High economic inflation has impacted exposures and demand for coverage directly. The supply-side impact has been indirect. Rising prices led to decisive monetary policy action by the US Federal Reserve (Fed) and many other central banks. In 2022, the Fed, Bank of England (BoE), European Central Bank (ECB) and other central banks raised short-term policy rates from zero (or near-zero) to 4.375% (Fed), 3.5% (BoE) and 2.5% (ECB). Long-term interest rates also moved up considerably.

Figure 17
Inflation and interest rates in the US and Germany, 2019 – 2022, monthly data



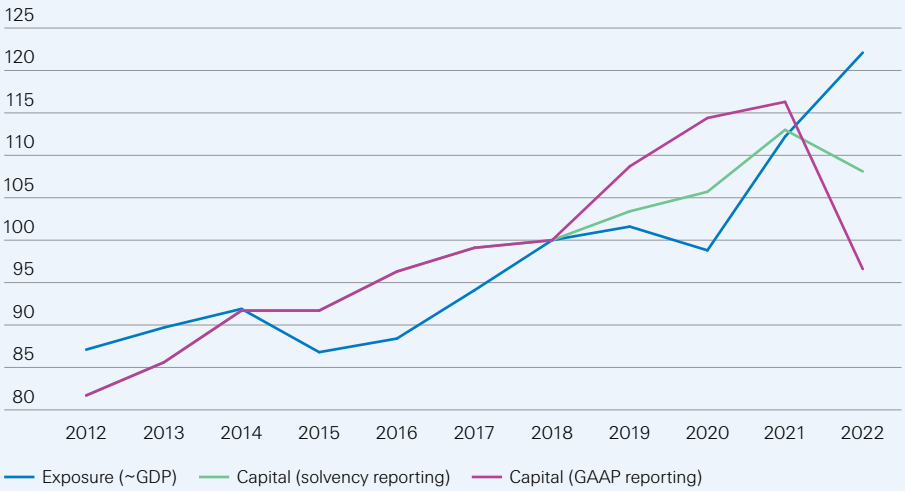
Source: Swiss Re Institute

...materially affecting re/insurance capital by decreasing asset valuations.

One effect of the higher interest rates has been a decline in financial asset values and more specifically shareholder equity. This has had immediate impact on re/insurers, whose fixed income portfolios have suffered significant mark-to-market losses. The global bond index was down 16% in 2022, and global equity markets also declined (the S&P Dow Jones Broad Market Index was down 18% year-on-year). The combined effect on reinsurer balance sheets – where invested assets are typically 3-4 times equity – was significant. By the end of 2022, reinsurance capital (traditional and alternative) had declined by around 20–25% from year-end 2021. After adjusting for the interest rate

impact of mark-to-market losses for fixed income securities, we estimate a decline in capital of around 5%, partly as the result of catastrophe losses. However, exposures (here proxied by GDP) continued to rise fast, hence creating a gap between supply and demand (see Figure 18).

Figure 18
Global reinsurance capital vs exposure growth, 2018 = 100.



Source: AM Best, Swiss Re Institute

Hurricane Ian did not spark a significant influx of capital.

Historically, large catastrophe events have sparked a significant influx of fresh capital. But this did not happen after Hurricane Ian. As of January 2023 an estimated USD 3.3 billion (ie, less than 1% of current reinsurance capital of more than USD 400 billion) of capital had been raised after Hurricane Ian.[41] This is much lower than in 2020, when reinsurers and a few new players raised close to USD 15 billion of capital as prices rose, or the surge of alternative capital (AC) between 2012 and 2018 in the phase of benign natural catastrophe years. ILS and other forms of AC offer a quick supply response and now provide most of the retrocession market. However, growth in AC has stalled since 2018 after the high claims that hurricanes Harvey, Irma and Maria in 2017 sparked, and above-average catastrophe loss years since. ILS structures have become more exposed to loss creep and coverage disputes, and investors are hesitant to commit fresh capital to natural catastrophe risks ahead of what could be another heavy-loss year, with economic inflation adding to valuation and pricing uncertainty.

Reinsurers and investors will likely wait for signs of improved sector profitability before committing more capital.

When higher exposures encounter shrinking risk appetite, the expected outcome is rising prices, higher retentions and tighter terms and conditions. The pricing correction in January 2023 is a source of optimism for the re/insurance industry. However, the prospect of still-elevated catastrophe losses and constrained capacity come as geopolitical, economic and environmental uncertainties remain omnipresent. These include loss uncertainty in specialty lines related to the war in Ukraine, the threat of a systemic cyber event, and the prospect of a renewed surge in COVID-19. With risks still elevated and higher interest rates raising returns elsewhere, we expect some reinsurers and ILS investors will wait to see proof in re/insurance industry profits before materially increasing capacity.

[41] J. Alovisi et al., *The Great Realignment*, Howden, 3 January 2023.

Conclusion

Socio-economic factors will continue to inflate catastrophe loss severity.

The elevated natural catastrophe insured losses of the past six years reaffirm the 5–7% uptrend in average annual losses established over the last 30 years. We expect the trend to continue. The growth has been and will be largely driven by rising loss severity of individual catastrophes. This is the result of rising exposures that comes alongside economic development, urbanisation, and population growth, often in areas exposed to natural hazards.

World circumstances have become more uncertain, beyond evidence of heightened catastrophe activity.

Demand for catastrophe-related insurance has risen on evidence of more peril activity since 2017. This is one factor behind today's hard market in re/insurance. So too are the geopolitical and economic storms the world faces. In particular, fallout from the decade long zero-to-negative interest rate environment, the pandemic, and war in the Ukraine has included high inflation and rising costs in the construction sector in 2022. This has increased the value of insured property assets and associated claims for damage caused by weather and other events. High inflation rates have also had financial market impacts given the need for central banks' to hike policy rates rapidly.

Re/insurance industry assessment of secondary peril risks in particular can be strengthened…

Another factor is a mismatch between the assessment of the risks that natural catastrophes pose and actual exposures. Last year's loss experience indicates that in this regard, the re/insurance industry remains in catch-up mode. All of last year's primary and secondary peril events were driven by known risk factors, yet the industry's valuation of potential losses was below actual outcomes. The mismatch reflects in declining industry profitability over recent years. Since 2017, the re/insurance industry has paid out USD 650 billion for weather-related natural catastrophes claims. However, premium income has not kept pace, contributing to a decline in reinsurance sector profitability, with return on equity down from an annual average of 12% in 2012–2016 to 7% in 2017–2021 (see Figure 13 on page 21). This signals gaps in dealing with several aspects of secondary peril risk assessment in particular, the associated losses of which have been on long-established upward trend. Where the industry has traditionally focused risk assessment on tail exposures and capital threatening events, the recent-years' loss experience underpins the need for as much focus and discipline on the higher frequency end of loss distributions. Against this backdrop, it is time to think of ***all*** perils as primary. That is, rather than maintain a mindset of primary and secondary, for the purposes of risk assessment all perils should be given the same attention and resources as afforded primary hazard exposures.

…with a culture of systematic data collection, updating and sharing.

To this end, there is a need for more discipline around the monitoring of perils and the collection, updating and sharing of exposure and claims data, and also model outcomes. In similar spirit, the historical loss data used as a core benchmark in secondary peril risk assessment needs to be systematically debiased to represent current-day, location-specific loss drivers to capture their compounded and rapid growth. This means accounting for the many evolving variables shaping risk landscapes, such as the impact of inflation on local rebuild costs, social inflation, urbanisation and soil sealing, and migration to exposed areas among others.

And, underwriting discipline needs to be maintained to improve risk pricing.

In addition to risk assessment, commensurate risk pricing is key for efficient market functioning, and sufficient capacity supply. Perceptions around risk assessment accuracy influence the supply of capital and capacity available for underwriting. The January 2023 renewals saw a long overdue re-pricing of risks before the background of increasing challenges to correctly capture the fast-moving risk landscape, capacity constraints and higher hurdle rates in a new interest rate environment. Market discipline is required for pricing to remain oriented to long-term exposure developments. With this, the insurance industry is best placed to fulfil its role as enabler of economic growth and financial resilience.

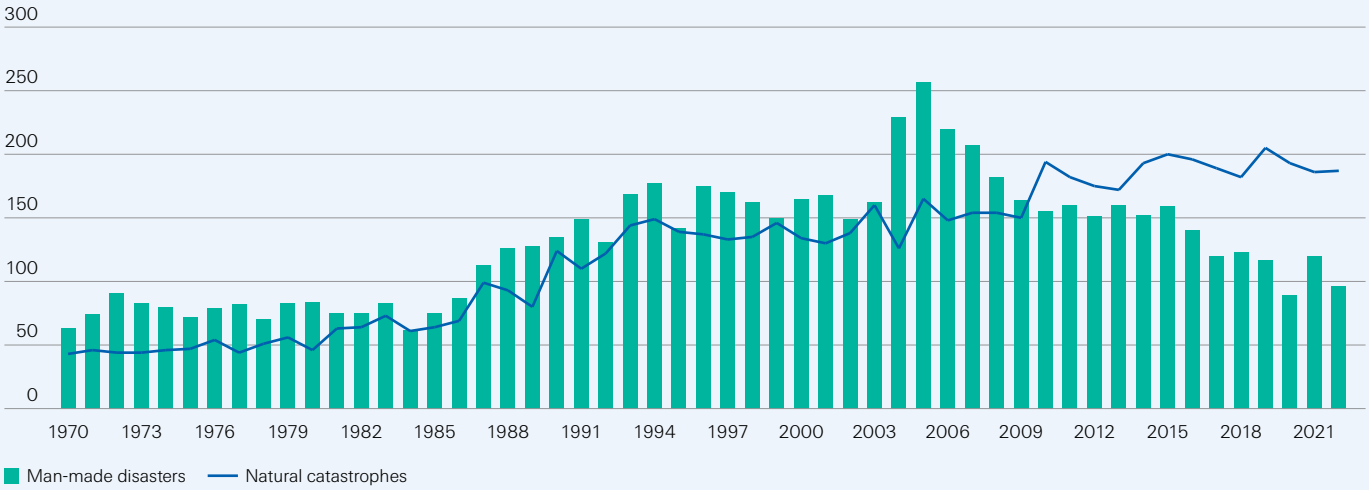
Appendix 1: 2022 – the year in review

Facts and figures

Number of catastrophic events: 285

Based on *sigma* criteria, there were 285 catastrophes worldwide in 2022, down from 306 in 2021. There were 187 natural catastrophes, up from the 186 in 2021, and 98 man-made disasters (down from 120 in 2021).

Figure 19
Number of catastrophic events, 1970–2022

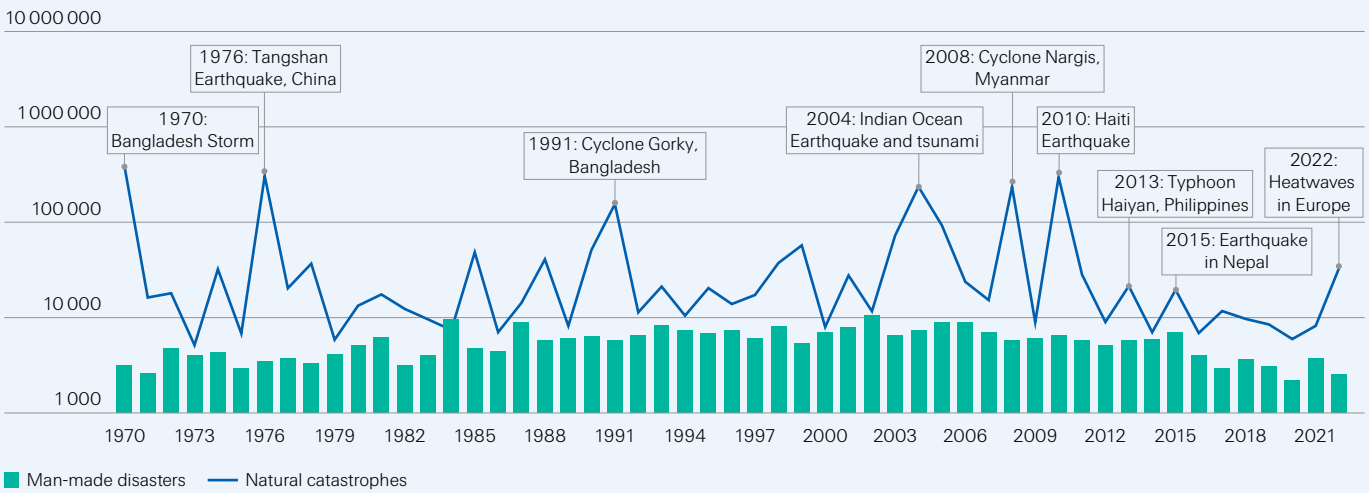


Source: Swiss Re Institute

Number of victims: more than 35 000

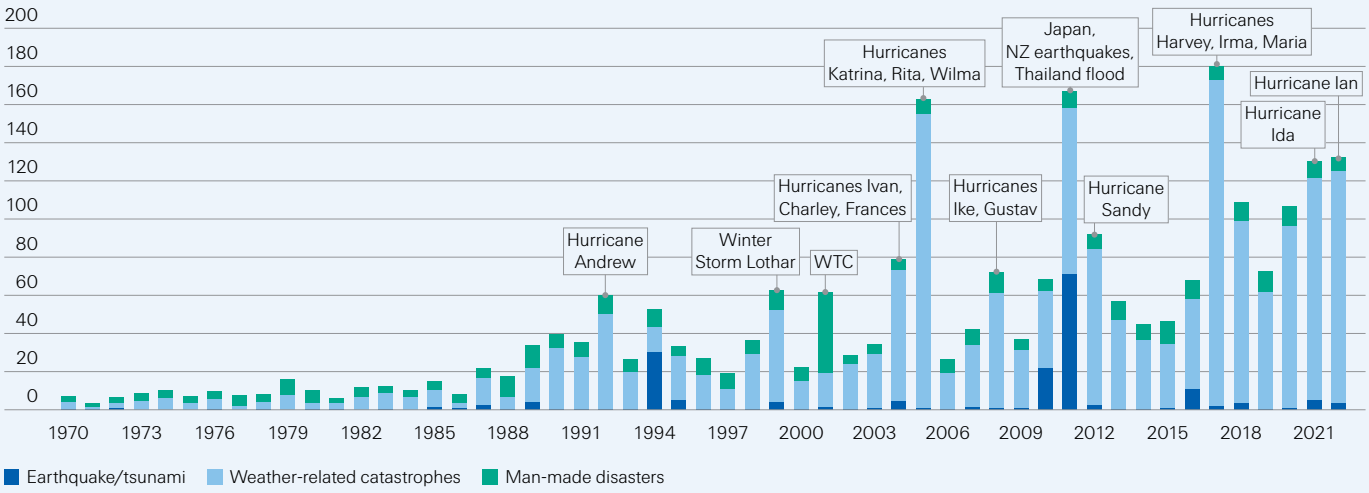
Worldwide, 35 157 people are believed to have died or gone missing in disaster events in 2022. Natural catastrophes claimed over 32 600 victims, and man-made disasters over 2500.

Figure 20
Number of victims, 1970–2022



Note: Scale is logarithmic: the number of victims increases tenfold per band. Source: Swiss Re Institute

Figure 21
Insured catastrophe losses, 1970–2022, in USD billion at 2022 prices

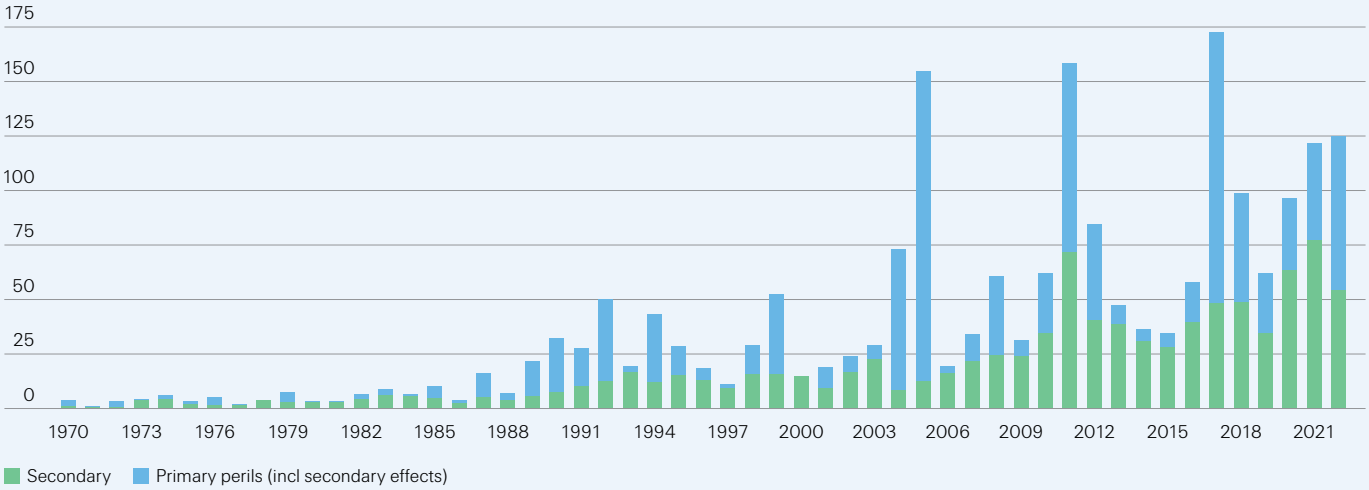


Source: Swiss Re Institute

Primary and secondary perils

Hurricane Ian brought the share of insured losses from primary perils to 57% in 2022, from a previous 10-year average of 37%.

Figure 22
Global insured losses from primary and secondary perils in USD billion at 2022 prices



Source: Swiss Re Institute

Total economic losses: USD 284 billion

Total economic losses from disasters across the globe were an estimated USD 284 billion in 2022, down from USD 303 in 2021. Around USD 275 billion resulted from natural catastrophes and the remainder from man-made events.

Table 3
Economic losses, in USD billion and as a % of global GDP, 2022

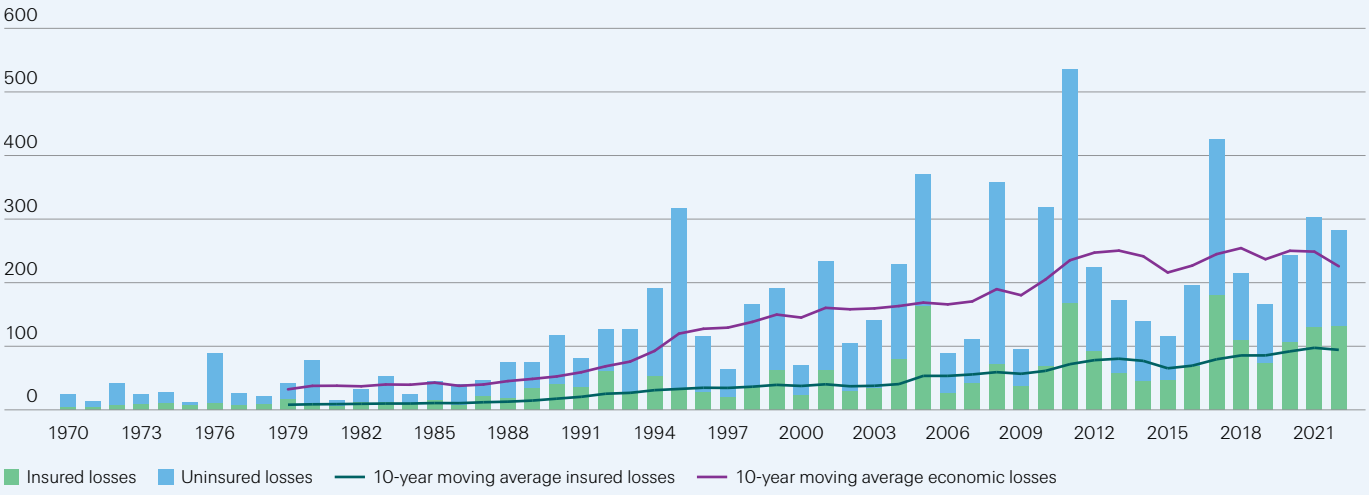
Regions	in USD bn*	in % of GDP
North America	176	0.64%
Latin America & Caribbean	17	0.31%
Europe	21	0.09%
Africa	8	0.27%
Asia	51	0.13%
Oceania/Australia	10	0.50%
Total	**284**	**0.27%**
World total		
10-year average**	220	0.27%

*rounded numbers
**inflation adjusted
Source: Swiss Re Institute

Global catastrophe protection gap: USD 151 billion

Figure 23 shows global economic and insured losses over time. This highlights the insurance protection gap, ie the financial loss generated by catastrophes not covered by insurance. In 2022, the global protection gap, uninsured losses, was around USD 151 billion, down from 173 in 2021 and up from the previous 10-year average of USD 130 billion. The protection gap was 53% of the total economic losses, down from the previous 10y average of 59%.

Figure 23
Insured vs uninsured losses, 1970 – 2022, in USD billion at 2022 prices



Economic losses = insured + uninsured losses. Source: Swiss Re Institute
Source: Swiss Re Institute

Regional loss overview

Insured and economic losses were highest in North America, driven by Hurricane Ian.

Table 4

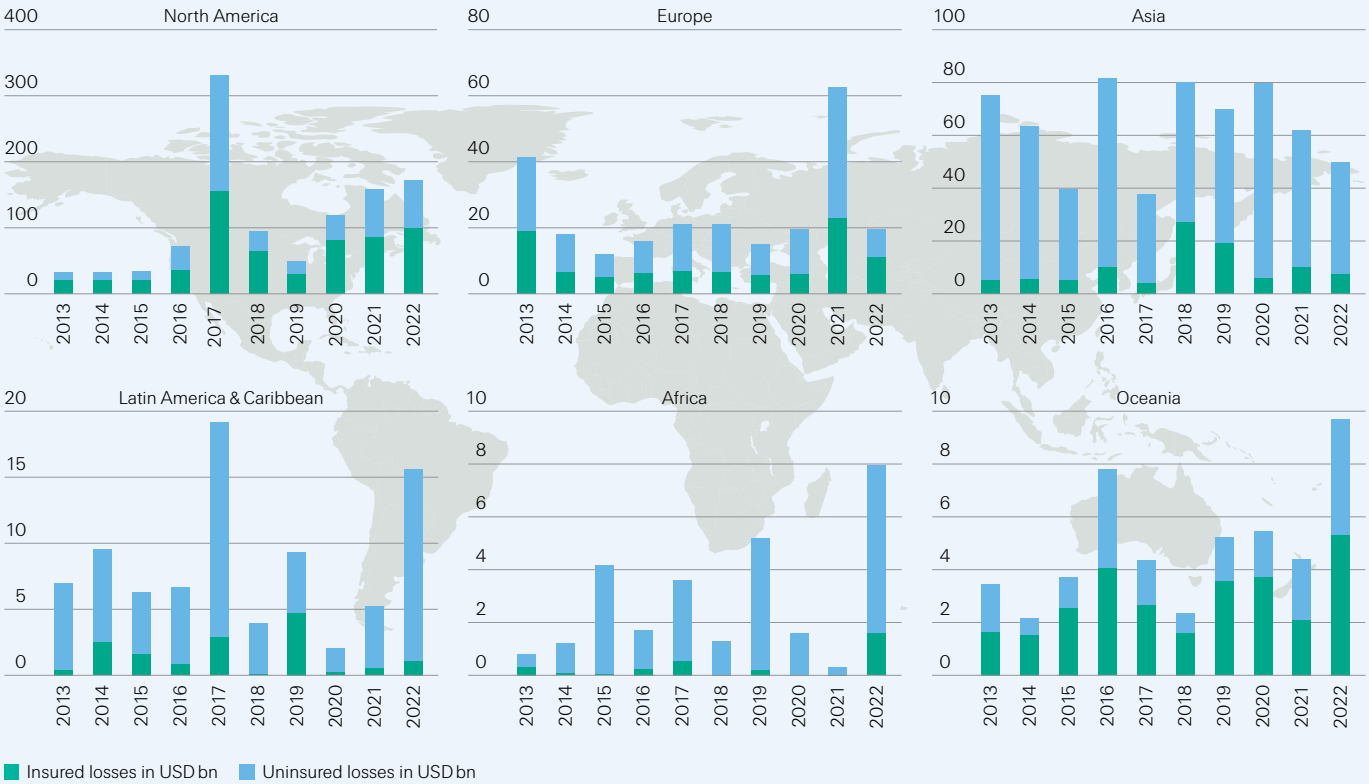
Number of events, victims, economic and insured losses by region, 2022

Regions	Number	Victims	in %	Insured losses (USD bn)	in %	Economic losses (USD bn)	in %
North America	84	510	1.5%	102.8	77.6%	176.0	62.1%
Latin America & Caribbean	20	906	2.6%	1.9	1.5%	17.4	6.1%
Europe	37	23 864	67.9%	12.2	9.2%	21.0	7.4%
Africa	43	3 044	8.7%	1.6	1.2%	8.0	2.8%
Asia	92	6 804	19.4%	8.4	6.3%	51.2	18.1%
Oceania/Australia	7	29	0.1%	5.3	4.0%	9.7	3.4%
Space	2			0.3	0.2%	0.3	0.1%
World total	**285**	**35 157**	**100.0%**	**132.5**	**100.0%**	**283.7**	**100.0%**

Note: some percentages may not add up to 100 due to rounding.
Source: Swiss Re Institute

Figure 24

Natural catastrophes protection gap by region 2013–2022, in USD billion at 2022 prices



Source: Swiss Re Institute

Appendix 2

Definition of terms

Natural catastrophes

The term "natural catastrophe" refers to an event caused by natural forces. Such an event generally results in a large number of individual losses involving many insurance policies. The scale of the losses resulting from a catastrophe depends not only on the severity of the natural forces concerned, but also on man-made factors, such as building design or the efficiency of disaster control in the afflicted region. In this *sigma* study, natural catastrophes are subdivided into the following categories: floods, storms, earthquakes, droughts/forest fires/heat waves, cold waves/frost, hail, tsunamis, and other natural catastrophes.

Man-made disasters

This study categorises major events associated with human activities as "man-made" or "technical" disasters. Generally, a large object in a very limited space is affected, which is covered by a small number of insurance policies. War, civil war, and war-like events are excluded. *sigma* subdivides man-made disasters into the following categories: major fires and explosions, aviation and space disasters, shipping disasters, rail disasters, mining accidents, collapse of buildings/bridges, and miscellaneous (including terrorism).

Primary and secondary perils

Swiss Re Institute categorises natural catastrophes as primary and secondary perils. A key differentiator is the sophistication of insurance industry modelling for different perils with respect to the rigour of data collection, submission and underwriting consideration. Table 4 shows the distinction.

Table 5

Swiss Re Institute classification of primary and secondary perils

	Event type	Re/insurance industry status	Examples
Primary perils	▪ Natural catastrophes that tend to happen less frequently, but which have high loss potential. ▪ Include secondary effects.	▪ Traditionally well-monitored and managed risks in developed re/insurance markets. ▪ **Secondary effects are** not always explicitly modelled alongside the originating primary peril, less rigorous monitoring.	▪ Tropical cyclones (including tropical cyclone-induced inland flooding and storm surge); earthquakes (including tsunamis, liquefaction and fires following earthquakes); European winter storms
Secondary perils	▪ Natural catastrophes that can happen relatively frequently, and typically generate low- to medium-sized losses. ▪ Refer to independent secondary perils only.	▪ Less rigour in the industry monitoring and modelling than for primary perils. Weaker exposure data capture and claims tracking.	▪ Severe convective storms (including thunderstorms, hail and tornadoes); floods, droughts, wildfires, landslides, snow, freeze.

Source: Swiss Re Institute

Economic losses

For the purposes of the present *sigma* study, economic losses are all the financial losses directly attributable to a major event, ie damage to buildings, infrastructure, vehicles etc. The term also includes losses due to business interruption as a direct consequence of the property damage. Insured losses are gross of any reinsurance, be it provided by commercial or government schemes. A figure identified as "total damage" or "economic loss" includes all damage, insured and uninsured. Total loss figures do not include indirect financial losses – ie loss of earnings by suppliers due to disabled businesses, estimated shortfalls in GDP and non-economic losses, such as loss of reputation or impaired quality of life.

Generally, total (or economic) losses are estimated and communicated in very different ways. As a result, they are not directly comparable and should be seen only as an indication of the general order of magnitude.

Insured losses

"Losses" refer to all insured losses except liability. Leaving aside liability losses, on one hand, allows a relatively swift assessment of the insurance year; on the other hand, however, it tends to understate the cost of man-made disasters. Life insurance losses are also not included.

Adjustment for inflation

sigma converts all losses for the occurrence year not given in USD into USD using the end-of-year exchange rate. To adjust for inflation, these USD values are extrapolated using the US consumer price index to give current (2022) values.

For the 2022 reporting year, the lower loss thresholds were set as follows:

***sigma* thresholds for 2022**	
Insured losses (threshold in USD m)	
Maritime disasters	25.2
Aviation	50.4
Other losses	62.5
or Total economic losses (threshold in USD m)	120.6
or Casualties	
Dead or missing	20
Injured	50
Homeless	2000

If changes to the loss amounts of previously published events become known, *sigma* takes these into account in its database, but Swiss Re is under no obligation to publicly revise or update this *sigma* study.

Sources

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Explore and visualise *sigma* data on natural catastrophes and the world insurance markets at *www.sigma-explorer.com*

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