MANAGING CLIMATE CHANGE PHYSICAL RISK IN AUSTRALASIA-OCEANIA

Climate change and extreme weather are increasingly important for multiple stakeholders, including regulators, rating agencies, investors and risk managers. This briefing examines how climate change affects physical risks posed to insurers with exposure in Australia, New Zealand, Papua New Guinea and the Pacific Islands, and the evolution of regulation associated with this risk.

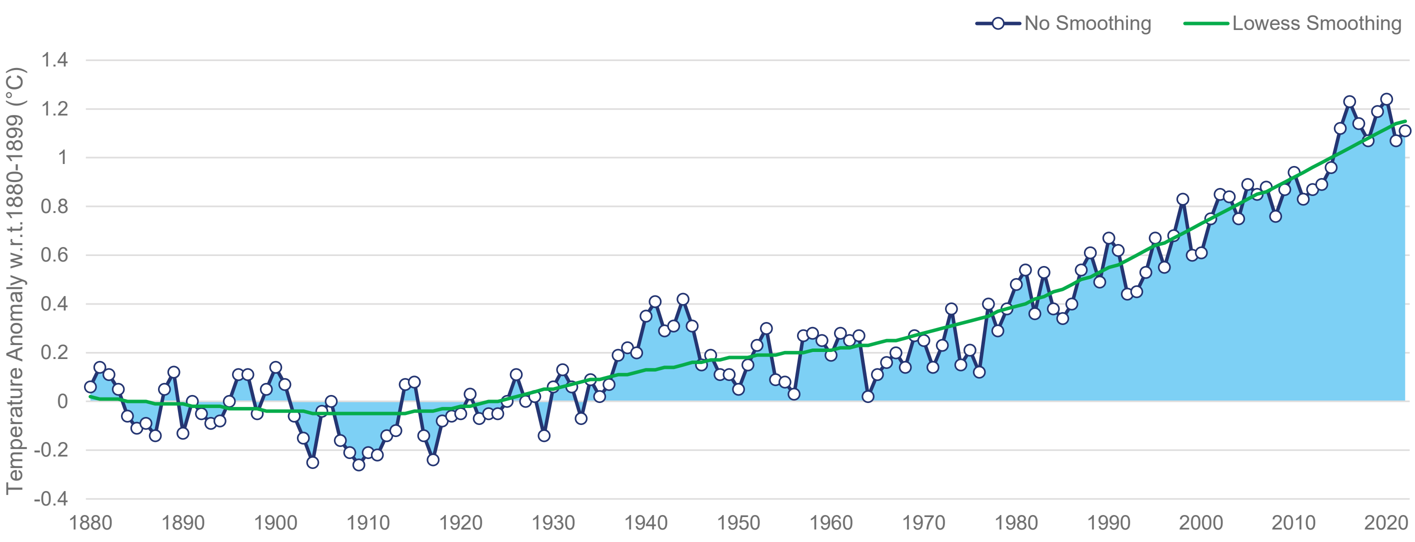
Introduction

There is increasing pressure on insurers to understand climate change's impacts on damaging weather. The National Aeronautics and Space Administration (NASA) reported that 2022 was the fifth-warmest year on record, with the average surface temperature 1.11°C warmer than pre-industrial times (Figure 1).

The increase in global temperature is projected to reach 1.5°C around 2030 without a radical reduction in emissions. These seemingly small increases in temperature can have a large non-linear impact on a wide range of perils, from drought to tropical cyclone storm surge. If there are no reductions in emissions in the medium term, then 3°C of warming is likely before the end of the century, which would bring more severe consequences.

Recent events, such as the bushfires in Australia (2019-2020) and the flooding associated with Cyclone Gabrielle in New Zealand (February 2023), have been partially attributed to climate change. (Re)insurers can avoid unexpected losses—and help achieve long-term growth and profitability—by quantifying their exposure to the physical risk of climate change.

Figure 1: Land-Ocean Global Surface Temperature Anomaly.



Source: GISTEMP Team, 2023: GISS Surface Temperature Analysis (GISTEMP), version 4. NASA Goddard Institute for Space Studies. Dataset accessed 2023-02-09 at data.giss.nasa.gov/gistemp/.

Regulation

Climate change presents 2 key forms of financial risk: those associated with a transition to a lower-carbon economy, and those related to the physical impacts of climate change. The physical impacts can be assessed and reported as either chronic or acute. Chronic physical risks are gradual changes in weather patterns, such as rising sea levels, droughts and extreme temperatures. Acute physical risks are sudden and severe events that can cause significant damage to property and infrastructure, such as hurricanes, floods, wildfires and storms. Mandatory reporting of these risks, often aligned with the recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD), has come into effect in several jurisdictions. Scenario analysis has also emerged as a key forward-looking tool to assess and disclose the potential impact of climate risks.

In Australia, the Australian Prudential Regulation Authority (APRA) released guidance on managing climate change physical risks and opportunities in November 2021 (CPG 229). The APRA climate risk self-assessment survey, released in March 2022, provided insight into how (re)-insurers are aligning their practices to the guidance. Key observations from the survey indicate that the use of more advanced quantitative risk metrics, including forward-looking exposure to physical risk, was limited and is a key area for development. Given the uncertainties of these risks, APRA expects responses to be proportionate to the size, nature and complexity of the business, improving over time.

In New Zealand, the government has legislated for mandatory reporting of climate risks. The disclosure regime, being developed and overseen by the External Reporting Board (XRB), applies to licensed insurers with greater than NZD 1 billion in total assets or annual premium income greater than NZD 250 million. The initial NZ CS 1 Climate-related Disclosures framework is applicable from 1 January 2023, with the first reports expected as part of year-end reporting on 31 December 2023. Through ongoing consultations, the Reserve Bank of New Zealand (RBNZ) is keen to facilitate reliable and timely climate-related risk disclosure as well as improving capabilities in climate scenario analysis and stress testing.

Specific guidelines and requirements for climate change physical risk analysis are highlighted in Table 1.

Table 1: Regulation for the assessment of physical climate change risk for (re)insurers in the Australasia-Oceania region.

Country	Australia	New Zealand
Regulator	Australian Prudential Regulation Authority (APRA).	External Reporting Board (XRB) on climate together with Reserve Bank of New Zealand (RBNZ).
TCFD reporting	Prudential Practice Guide CPG 229 (November 2021) provides TCFD-aligned guidance on managing climate change financial risks and opportunities.	Mandatory reporting in line with TCFD recommendations for all licensed insurers with greater than NZD 1 billion in total assets or annual premium income > NZD 250 million.
Stress Tests	2022 Climate Vulnerability Assessment on the banking sector and voluntary climate risk self-assessment conducted across the banking, insurance and superannuation industries in March 2022.	Stress testing on sensitivity of property values associated with increased frequency and severity of flood events through the channels of declining insurability and the values of at-risk properties. There are ongoing consultations on managing climate risk, including through improving stress-testing capabilities.
Scenario Analysis	Should include future temperature rise of ≥3˚C and ≤2˚C by 2100. Use of scenario analysis should be proportionate to an institution's size, business mix and complexity.	Should include at least a 1.5˚C, ≥3˚C, and a third climate-related scenario. Recommended that sectors coordinate to develop sectoral climate-related scenarios to achieve consistency and comparability.

Source: Guy Carpenter

MANDATORY REPORTING OF CLIMATE-RELATED RISKS HAS COME INTO EFFECT IN SEVERAL JURISDICTIONS.

Evolving Risk Landscape

The frequency and severity of natural catastrophes are expected to increase due to climate change. The subsequent impact on insured loss is highly dependent on the peril and region of interest and is described in the section "**Climate Change Impact by Peril**" on page 4.

Climate change is not the only factor influencing how the financial catastrophic risk to re(insurers) changes from year to year. Climate change generally changes the risk gradually over time, although the financial impact may only be realised when a significant event occurs. In contrast, other factors can lead to more abrupt changes in risk, such as the impact of inflation in rebuilding costs or the implementation of flood defences. These other factors will often have a larger impact than climate change, and we compare examples of them and climate change in Table 2 below.

Table 2: Factors influencing insured catastrophic risk.

Factors	Examples
Climate change	Warming air can hold more moisture, resulting in increased flash flooding.
Natural variability	El Niño causes hot and dry conditions in Australia, increasing the bushfire risk.
Population growth	Increases in the number of insured properties.
Population migration	Urbanisation; increases in the proportion of people living in coastal regions.
Adaptation	Improved flood defences; updated building codes.
Insured value	New buildings; increases in insurance penetration.
Economic conditions	Inflation in rebuilding costs.

Source: Guy Carpenter

THE FREQUENCY AND SEVERITY OF NATURAL CATASTROPHES ARE EXPECTED TO INCREASE DUE TO CLIMATE CHANGE.

Case Studies

Scientists have recently developed methods for establishing the role of climate change in the occurrence of significant events. Here we examine the attribution science for 2 significant events.

Bushfires in Australia

The devastating Australian bushfire season of 2019-2020 caused widespread loss and at least 33 fatalities. PERILS reports the peak industry event loss from 30 December 2019 through 5 January 2020 was AUD 1.866 billion.

A scientific attribution study found climate change increased the likelihood of the event occurring from a fire weather index and extreme heat perspective. However, the study did not link the drought conditions to climate change, and notes that the Indian Ocean Dipole and Southern Annual Mode also played a role. Further details on how climate change impacts fire weather is outlined in Table 4.

Cyclone Gabrielle

The North Island of New Zealand was subject to extreme rainfall and strong winds as Tropical Cyclone Gabrielle bypassed the island in February 2023. The damage was substantial. PERILS' first estimate of the industry loss for the event was NZD 1.543 billion.

Several factors caused the high losses associated with Gabrielle:

- The rare occurrence of a tropical cyclone in the vicinity of New Zealand.
- The exceptionally heavy rainfall associated with the cyclone.
- The arrival of the storm just 2 weeks after significant flooding in Auckland.

Climate change has a different impact on each of these factors:

- There is no strong evidence to suggest the frequency of tropical cyclones affecting New Zealand will increase. There is evidence that cyclones will be able to survive further south, but this is counteracted by an expected decrease in the overall frequency of tropical cyclones (see Table 6).
- The exceptionally high rainfall associated with Gabrielle has become more likely as a result of climate change, and will continue to become more likely (see Table 3).
- The close proximity in the timing of the cyclone and Auckland flooding was an unfortunate coincidence and unrelated to climate change.

Climate Change Impact by Peril

We evaluate the impact of climate change on a peril based on observations, climate models and our understanding of the physical drivers. In cases where we have a consistent view—a long observational record, high-resolution climate model output and a good understanding of the physical drivers—then we will have high confidence in our assessment. Conversely, there are many reasons why we would have lower confidence, for example, if an observational record is short or unreliable, or if there is disagreement between different climate models.

Here we summarise the climate change impact on floods, bushfires, severe convective storms, tropical cyclones (TCs) and low pressure systems (excluding TCs). Note that climate change does have a significant impact on a wide range of other perils, including drought and heat stress, but these typically have lower insured losses associated with them in Australasia-Oceania.

Climate Change Impacts on Flooding

The impact of climate change on flood is complex. Intense rainfall has a relatively direct link to surface water flooding and therefore the climate change impact is generally well understood. In contrast, the response of riverine flooding to precipitation is dependent on a large number of factors, including soil moisture, temperature, snowmelt and catchment characteristics, and therefore changes are harder to predict and highly regional.

Table 3: Summary of climate change impacts on flood.

Flood Characteristic	Climate Change Impact	Scientific Confidence	Impact on Loss
Flash flooding—intense rainfall, including rainfall associated with TCs	An increase in the moisture-holding capacity of the atmosphere leads to increases in extreme rainfall of ~7%/˚C and above.	High confidence	Significant increase in surface water flood losses for most regions.
Riverine flooding—total rainfall and evaporation	Intensification of the hydrological cycle results in a global increase of rainfall of 2-3%/°C, leading to increases in most regions. Notable exceptions include the eastern, southern and western coasts of Australia and northern New Zealand. Evaporation is expected to increase, resulting in lower soil moisture levels and decreased flooding.	High confidence in global increase in rainfall Moderate confidence associated with regional impacts	Highly regional changes are expected, with both increases and decreases in river flood.
Storm surge from TCs	Rising sea levels and a potential for enhanced risk from a higher proportion of category 4-5 TCs.	High confidence	Higher losses for any storm-surge-exposed region, and the possibility of new areas at risk.

Source: Guy Carpenter

Climate Change Impacts on Fire Weather

Bushfire risk changes are driven primarily by projected trends in temperature and precipitation. However, this peril is unique in that there are significant human factors, including ignition, suppression, mitigation and various levels of built-in property resilience. We focus on the changes to fire weather in a changing climate but caution that sufficiently strong fire-suppression efforts can potentially outweigh increases in fire weather.

Table 4: Summary of climate change impacts on fire weather.

Fire Weather Characteristic	Climate Change Impact	Scientific Confidence	Impact on Loss
Frequency and severity	Increasing temperature and decreasing vegetation moisture. Rainfall, relative humidity and wind speed are also projected to change having a regional impact.	High confidence that hotter, drier conditions will increase bushfire risk.	Increased loss
Seasonality	Fire season extends further into spring.	Medium confidence	Increased loss

Source: Guy Carpenter

Climate Change Impacts on Severe Convective Storm

Severe convective storms include the sub-perils of hail, tornadoes and straight-line winds. All of these sub-perils need convective energy to develop—a source of moisture and heat at lower levels of the atmosphere. They also require wind shear—a difference in wind at upper and lower levels—to set up a storm of severity sufficient to produce hail or damaging winds. Finally, for hail specifically, the melting level—the height at which water freezes—needs to be sufficiently low for the convective cell to penetrate it and for hail to form. Climate change has a different impact on each of these drivers of severe convective storms, and they are explored below.

Table 5: Summary of climate change impacts on severe convective storm

Severe Convective Storm Characteristic	Climate Change Impact	Scientific Confidence	Impact on Loss
Severity—size of hailstone, strength of tornado/ straight-line wind	Convective energy will increase, as a result of a warmer atmosphere with moisture, acting to increase severity of storms.	Medium confidence	Increase in the loss for the most extreme events
Frequency	Convective energy increases are expected to be at least partially offset by decreases in wind shear, and in the case of hail, an increase in melting height.	Low confidence, with some scientific studies showing an increase in frequency and others a decrease	Uncertain

Source: Guy Carpenter

Climate Change Impacts on Tropical Cyclones

Climate change affects the frequency, severity and location of TCs in the southeastern Indian and southwestern Pacific oceans, as outlined in Table 6. The impacts are wide-ranging, as the energy source of TCs (the ocean), the winds that inhibit their growth (wind shear) and the large-scale circulation pattern that steers them are all affected. There are also implications for the precipitation and coastal flooding associated with TCs, included in Table 3.

Table 6: Summary of climate change impacts on tropical cyclones (TCs).

TC Characteristic	Climate Change Impact	Scientific Confidence	Impact on Loss
Overall frequency	Reduction in total number of TCs	Medium confidence	Possibility of lower loss
Proportion of intense TCs (category 4-5)	Warmer oceans provide additional fuel for TCs increasing the proportion of the most intense storms.	Medium confidence for southeastern Indian Ocean Low confidence for southwestern Pacific Ocean, where the majority of climate models do not project an increase in the frequency of category 4-5 storms.	Increase in the loss for the most severe events
Areas affected	Changes in large scale circulation and higher sea surface temperatures mean TCs can survive further south.	Medium confidence	Increased risk further south—for example, southeast Queensland and northern New South Wales.

Source: Guy Carpenter

Climate Change Impacts on Low Pressure Systems

Low pressure systems, excluding TCs, include extratropical cyclones and cut-off lows, and are often referred to as east coast lows when they affect southeastern Australia. These systems also affect New Zealand. They can cause flooding, and the climate change impact on this aspect is included in Table 3. Strong and damaging winds also can be associated with these systems.

Table 7: Summary of climate change impacts on low pressure systems (excluding TCs).

Low Pressure System Characteristic	Climate Change Impact	Scientific Confidence	Impact on Loss
Frequency and location	A poleward shift in mid-latitude cyclones is projected, which will decrease the frequency of storms impacting Australia while potentially increasing the frequency of storms impacting New Zealand.	Medium confidence	Possibility of lower loss in Australia and higher loss in New Zealand.
Severity—wind	There are insufficient scientific studies for a consensus view.	Low confidence	Unclear

Source: Guy Carpenter

Quantifying your Climate Change Physical Risk

There are a growing number of reasons for quantifying your climate change risk:

- Responding to regulatory requests.
- Representation of risk to third parties, for example credit rating agencies, investors or reinsurers.
- Making a TCFD-aligned climate disclosure.
- Incorporating climate change into risk management, pricing and capital decisions.

The type of risk assessment to carry out will be dependent on the use case. Important questions to consider before making any climate change assessment include the following:

- Is a qualitative or quantitative assessment required?
- What scenarios are of interest? This could be a specific emissions pathway and time horizon, for example RCP-4.5 in 2050, or instead a global warming level scenario, for example 1.5°C.
- Do you require an assessment on whether existing climate change is adequately represented in your current view of risk?
- What form of data is required to embed the climate change assessment in your existing decision-making processes?

Guy Carpenter is helping our clients address these questions and quantify their climate change physical risk through a variety of methods. For the quantification of the risk, Guy Carpenter has developed proprietary tools ranging from underwriting and accumulation layers, to adjustments to third-party catastrophe models and in-house probabilistic models developed for climate change. Furthermore, we have a broad overview of market practices that can help clients benchmark their own activities.

For Australia, we have data layers that enable you to assess your storm surge risk for a range of climate change scenarios. We also have inland flood and tropical cyclone catastrophe model adjustments that provide a fully probabilistic climate change assessment.

Conclusions

An improved scientific understanding of how perils are changing and the fact that an increasing number of regulators are exploring climate-related disclosures means quantifying your climate change risk has never been more important. Doing so may also help avoid unexpected loss from evolving tropical cyclones and flood risk. It is also important to be aware that climate change may not be the most significant driver of changes in loss for your portfolio. Other factors, such as natural variability and inflation, should be properly considered to inform risk management, pricing and capital decisions.