The Impact of Climate Change on Insurance against Catastrophes

Tony Coleman – Chief Risk Officer & Group Actuary,
Insurance Australia Group

Introduction

Weather and climate are "core business" for the insurance industry. At its most basic, insurers underwrite weather-related catastrophes by calculating, pricing and spreading the risk and then meeting claims when they arise. A changing, less predictable climate has the potential to reduce our capacity to calculate, price and spread this weather-related risk.

Insurance Australia Group (IAG) believes that human-induced climate change is now a reality and that it must be addressed with appropriate urgency. We base this assessment on a combination of the science of climate change presented by the Intergovernmental Panel on Climate Change (IPCC) and associated modelling, work done by the re-insurance sector (Swiss re and Munich Re), and on our own modelling, research and claims experience. Figure 1 shows the global average surface temperatures record for the period 1861-2000. Temperatures rose by 0.6 ºC over the last century with the 1990's the warmest decade and 1998 the warmest year since instrumental records began in 1861 (IPCC, 2001).

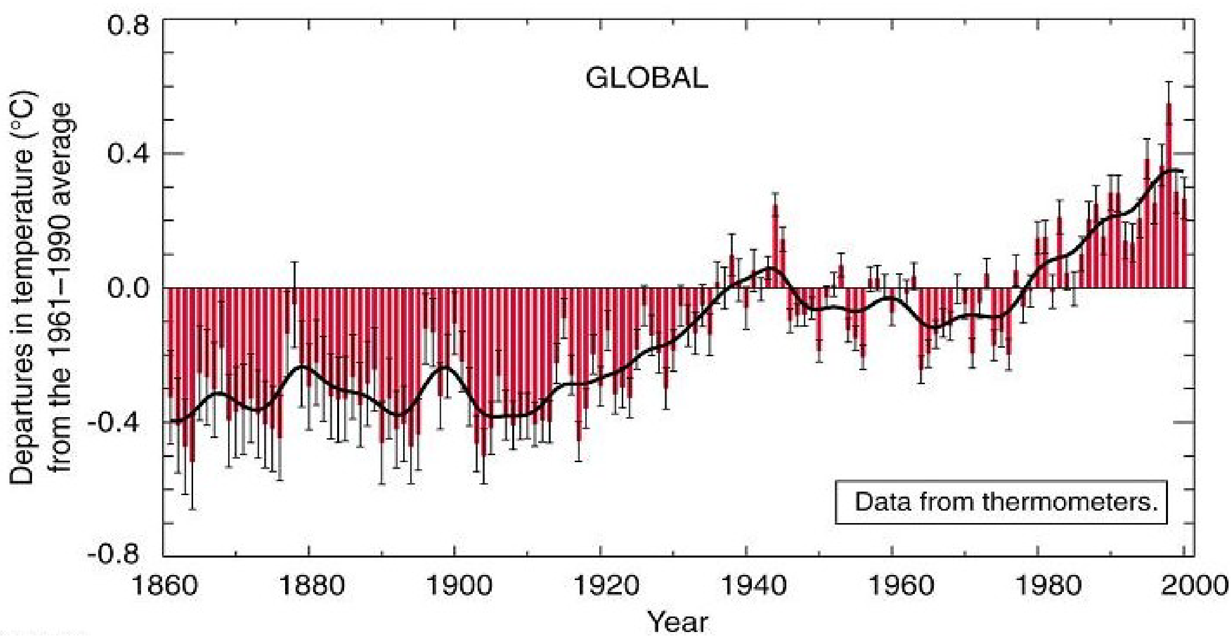

Figure 1: Variations of the Earth's average surface temperature for the period 1861-2000 (IPCC, 2001).

There is now enough momentum in the climate system, born from past energy and land use practices, to inflict further warming (IPCC, 2001, p17). Although the implementation of global mitigation strategies could significantly reduce the amount of warming, some changes to our future climate are inevitable. This scenario, according to the IPCC, will lead to more intense and/or more frequent extreme climate and weather events. For this reason, the insurance industry has a strong interest in the issue of climate change.

The role of insurance in underwriting weather-related risk is an important component of the national economy. Any reduction in the industry's ability to underwrite weather-related risk will have serious ramifications for the economies of those vulnerable regions where climate and weather risk is greatest.

Features of Weather-Related Losses

Of the 8,820 natural catastrophes analysed worldwide between 1960 and 1999, 85% were weather-related, as were 75% of the economic losses and 87% of the insured losses (Munich Re, 2000). The proportion of losses from natural disasters in Australia also shows similar trends with around 87% of economic losses caused by weather–related events, as shown in Table 1.

Table 1: Average cost of Australian natural disasters by State and Territory for the period1967-1999 (excluding death and injury costs) (BTE, 2001).

Average Annual Cost ($ million)

State	Flood	Severe Storms	Cyclones	Earthquakes	Bushfires	Landslide	Total
NSW	128.4	195.8	0.5	141.2	16.8	1.2	484.1
QLD	111.7	37.3	89.8	0.0	0.4	0.0	239.2
NT	8.1	0.0	134.2	0.3	0.0	0.0	142.6
VIC	38.5	22.8	0.0	0.0	32.4	0.0	93.6
WA	2.6	11.1	41.6	3.0	4.5	0.0	62.7
SA	18.1	16.2	0.0	0.0	11.9	0.0	46.2
TAS	6.7	1.1	0.0	0.0	11.2	0.0	18.9
ACT	0.0	0.1	0.0	0.0	0.0	0.0	0.2
Total	314.0	284.4	266.2	144.5	77.2	1.2	1087.5
Proportion of total (%)	28.9	26.2	24.5	13.3	7.1	0.1	100.0

Note Figures may not add to totals due to rounding.

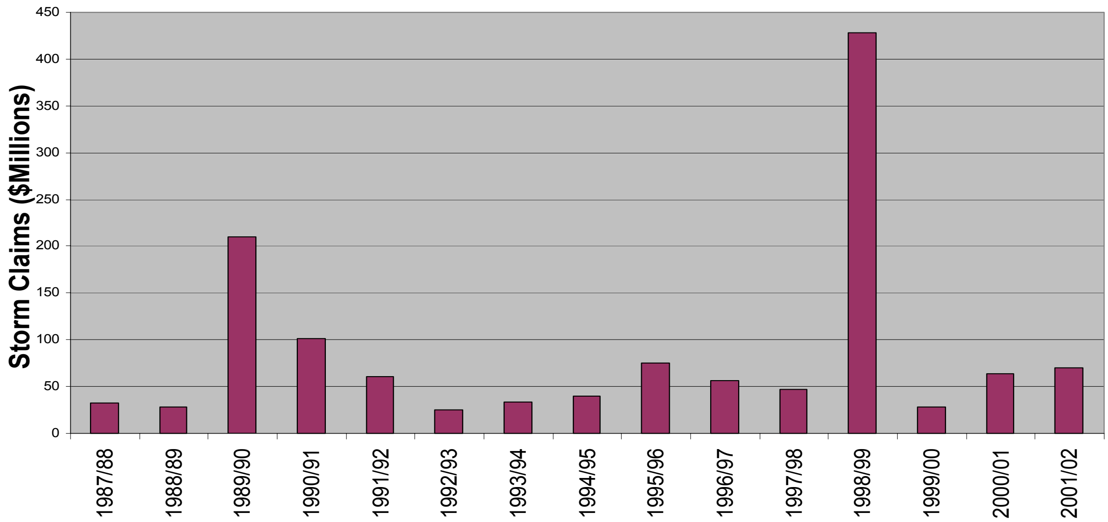

Figure 2: Weather-related Home & Motor insurance claims (including Bushfires) paid by IAG in NSW since June 1987

Over the past 15 years in NSW IAG has paid over $1,300 million in weather-related Home and Motor insurance claims (Figure 2). Due to the non-uniform concentration of populations throughout Australia and the localised nature of weather events, losses from storm to storm and year to year are highly volatile. Severe storms that have tracked over densely populated areas make up a disproportionate amount of the overall storm claims total (Figure 3). The Sydney hailstorm that occurred on the 14th April 1999 contributed around 25% of IAG's 15-year total weather-related claims in NSW. Therefore changes to the nature of these extreme events could appreciably alter the risk to people and property, and ultimately impact on the price and availability of insurance.

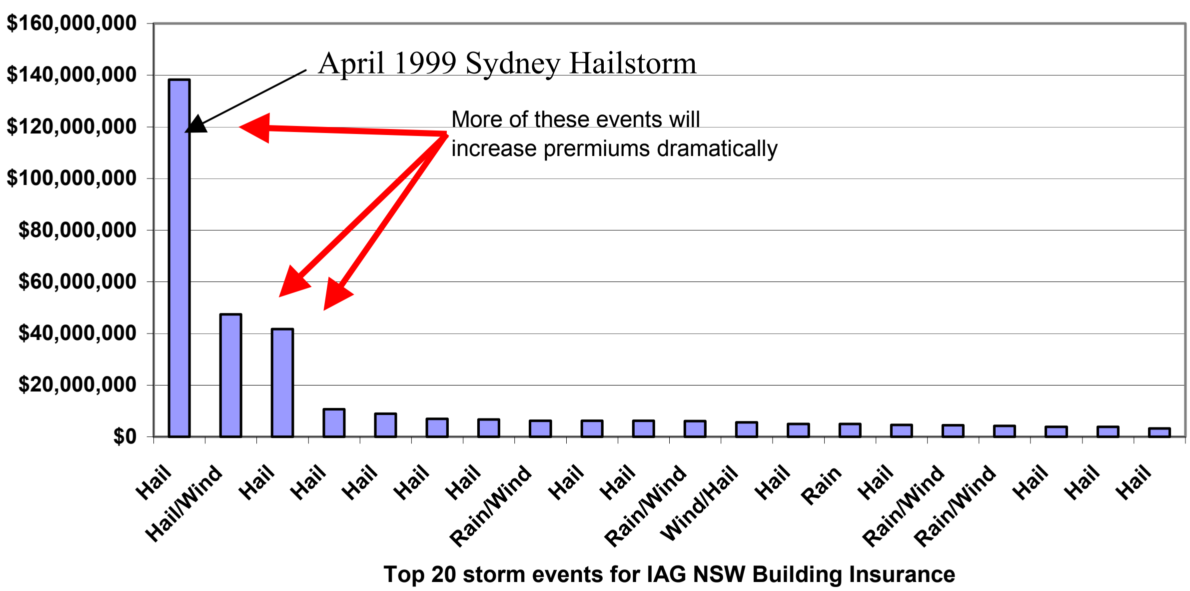

Figure 3: IAG's top 20 most costly storm events for NSW building insurance since June1987

The IPCC's third assessment report (2001), projects that the behaviour of extreme events could be affected significantly by small increases to the global mean temperature. Increases in intensity and/or frequency of tropical cyclones, floods and bushfires caused by a projected 1.4 – 5.8 ºC global mean temperature increase by 2100, are all likely to be part of our future climate.

From a meteorological point of view, a storm which is classed as an extreme event may not be much more severe than a level of storm intensity that occurs regularly each year. However they can achieve huge increases in damages through the breaking of critical thresholds. Insurance industry experience shows that even small increases in event severity (< 10%) can cause multiple increases in damages (UNEP FI, 2002). IAG's own experience shows that a 25% increase in peak wind gust strength can generate a 6.5-fold increase in building claims (Figure 4).

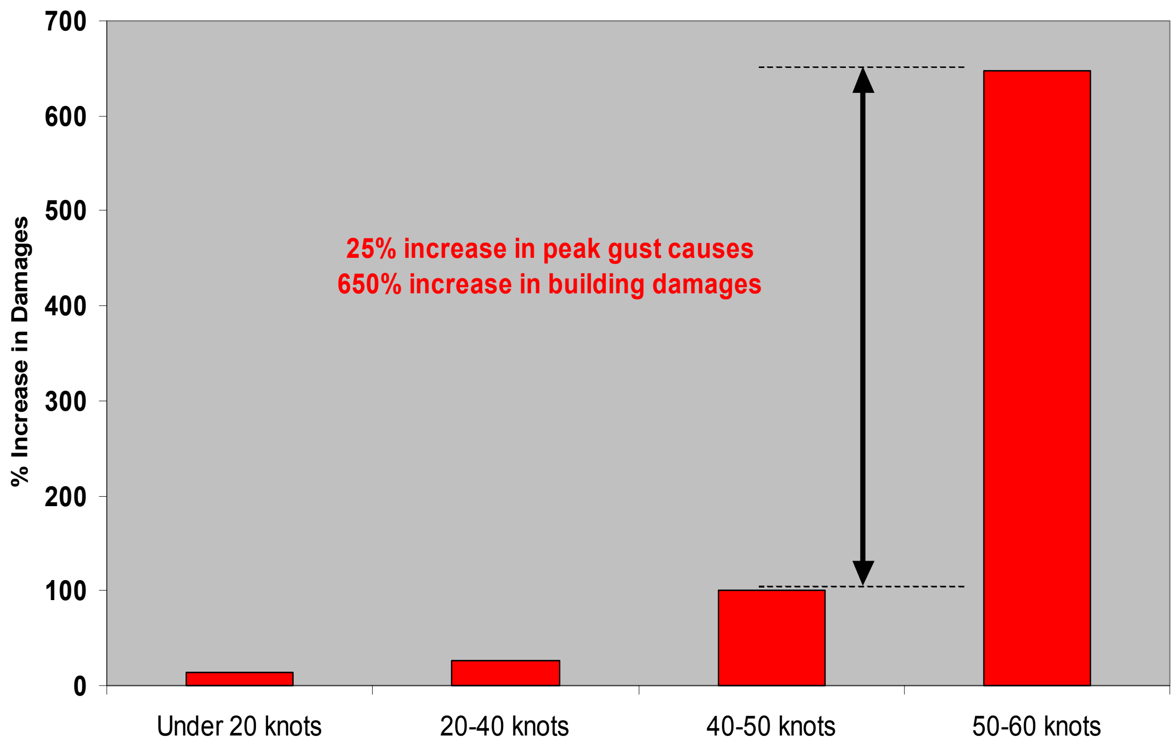

Figure 4: IAG Building claims versus peak gust speed showing disproportionate increase in claims cost from small increases in peak gust speed.

IAG claims data also shows that once wind gusts reach a certain level, entire roof sections are blown off, or additional damages are caused by falling trees. Yet below this level damage may be minimal. Similarly, hailstones below a certain size do not damage car panels but above this size, damage increases abruptly. This is supported further in Table 2 where evidence from global observations or modelling studies highlight that small changes to mean climate conditions can have disproportionate changes in damage and losses.

Table 2: Some of the disproportionate changes in extremes in comparison with changes in averages. More detail and references are found in Mills et al, (2001) page 72.

Hazard	Cause Of Change In Hazard	Resulting Change In Damage/Loss
Windstorm	Doubling of windspeed	Four-fold increase in damages
	2.2 °C mean temperature increase	Increase of 5-10% in hurricane wind speeds
Extreme temperature episodes	1 °C mean temperature increase	300-year temperature events occur every 10 years
Floods	25% increase in 30 minute precipitation	Flooding return period reduced from 100 years to 17 years
Bushfire	1 °C mean summer temperature increase	17-28% increase wildfires
	Doubling of CO_2	143% increase in catastrophic wildfires

There are also some socio-economic trends that amplify weather-related losses. The increasing populations in marginal, more vulnerable areas will exacerbate future losses from these events, a trend that is mirrored in the United States. Between 1991 and 1996 25% of Australia's population growth occurred within 3 km of the coastline, predominantly in the Northern NSW and Southern Queensland region. Thus there are an increasing number of communities exposed to extreme events such as tropical cyclones, storm surges and flooding of coastal rivers (CSIRO, 2002). The IPCC has confirmed that "the combined effect of increasingly severe climatic events and underlying socio-economic trends (such as population growth and unplanned urbanisation) have the potential to undermine the value of business assets, diminish investment viability and stress insurers, reinsurers, and banks to the point of impaired profitability and even insolvency" (UNEP FI, 2002). Within the insurance sector, there is potential for market erosion of insurance cover. Affected communities will then have to deal with both the hardships of the events and problems associated with the ability to safeguard properties by rising or unavailable premiums.

Having a good understanding of changes to weather-related risk is central to the insurance sector's business and bottom line. However, assessing risk in a rapidly changing climate becomes increasingly arduous, when knowledge of our past weather events becomes an unreliable guide to the behaviour of future weather events. The biggest question we then need to address is how much the changing climate will affect us and our biggest challenge lies in minimising the additional risk associated with human-induced climate change. Therefore, as part of an overall climate change strategy, IAG has begun to:

- Invest in research to learn more about the problem and its expected impact
- Consider possible adaptation strategies to minimise vulnerability
- Investigate strategies that minimise IAG's and our customer's contribution to climate change.

A Case Study - Hailstorms

Globally, the most costly weather related insurance losses are caused by tropical cyclones (also known as hurricanes or typhoons in other parts of the world) and winter storms (Munich Re, 2000). However in Australia, whilst losses from tropical cyclones feature amongst the worst insurance losses between 1967 and 2001, losses from hailstorms, bushfires and floods also contribute substantially to the overall total (Figure 5).

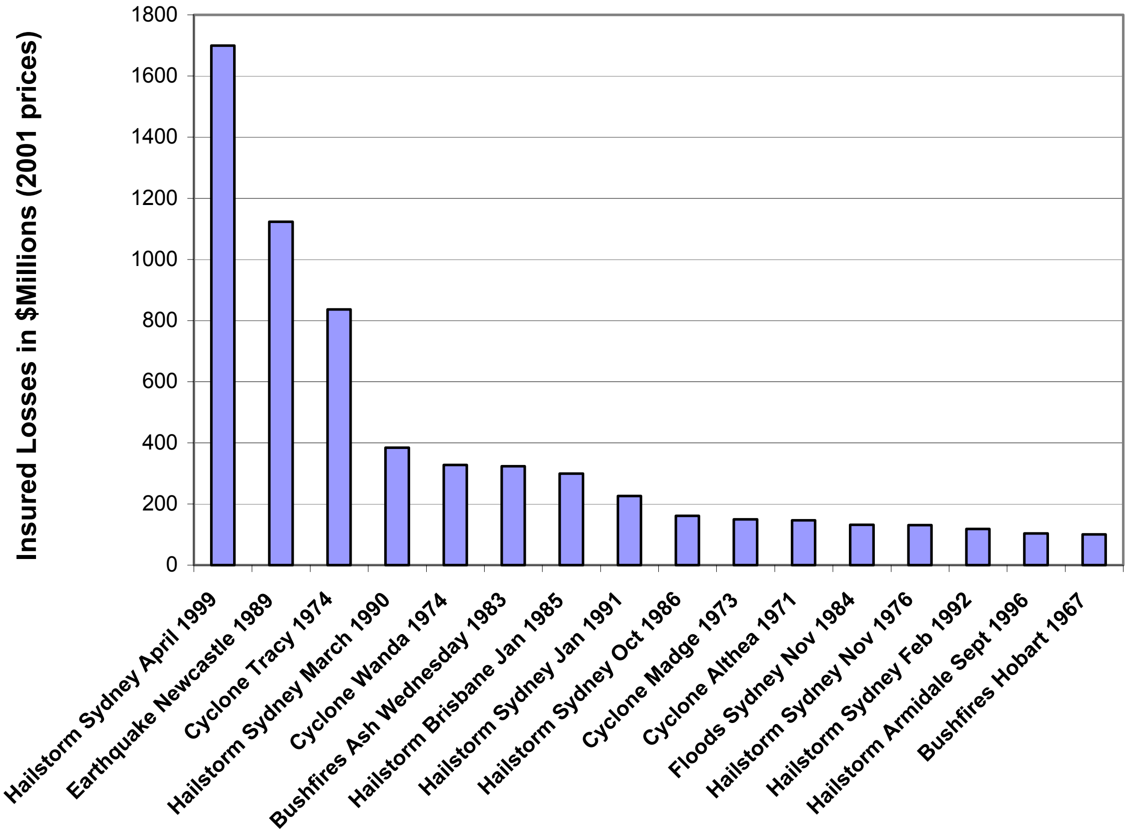

Figure 5: Australia's most costly natural disasters in terms of estimated insurance losses for June1967 – August 2001. Reconstructed from the IDRO (Insurance Disaster Relief Organisation) Major Disasters since 1967.

These trends may be partly due to the localised nature of storms and population distribution mentioned earlier and also that most of our past and present population resides in non-cyclone prone areas. The Sydney hailstorms of April 1999 and March 1990 caused insurance losses of $1,700m and $384m respectively. Tropical Cyclones Tracy and Wanda caused insurance losses of $837m and $328m respectively, the bushfires in Tasmania 1967 and Ash Wednesday 1983 caused insurance losses of $101m and $324m and the Sydney floods of November 1984 and August 1986 caused insurance losses of $132m and $53m.

Studies have shown that most of these events are likely to change for the worse with increased concentrations of CO_2, the main product of fossil fuel burning. For example:

- The peak wind and rainfall intensities from tropical cyclones and associated storm surge are predicted to increase throughout most tropical regions (IPCC, 2001). A separate study by the CSIRO (unpublished) focusing on storm surge in the Cairns region from the top 5% of tropical cyclones (based on intensity), predicts a doubling of the area inundated, including much of the CBD by 2050.
- Studies by Williams et al. (2001) show that: the general impact of increased concentrations of greenhouse gases is to increase bushfire danger at various sites throughout Australia, by increasing the number of days of very high and extreme fire danger.
- Cut-off Lows, an intense low-pressure system that affects the east coast of Australia with flooding rains and damaging winds, have been shown to increase in intensity with climate change modelling studies (Katzfey and McInnes, 1996). In a separate study on flooding in the Hawkesbury/Nepean catchment, an area with an estimated 35,000 properties at risk from flooding (Gillespie et al, 2002), the return period for the 1-in-100-year flood event could be reduced to a 1-in-36-year event with the projected changes to climate (Schreider et al, 2000). This could increase average annual damages four-fold (Smith, 1998).

While there is much global research into the likely changes to the behaviour of extreme events, few studies specifically look at how the nature of severe hailstorms will be affected by the projected climate change. This is of great concern to IAG because the April 1999 Sydney Hailstorm was IAG's most costly natural event with incurred claims totalling well over $300m. However, due to recent advances in computing power and scientific expertise, detailed research into such storms is now possible. To learn more about the April 1999 storm, in light of the fact that it occurred in conjunction with warmer than normal sea surface temperatures (SST) off the NSW coast (Buckley pers. com., 2002), IAG commissioned a sensitivity study based on the April 1999 storm. Warmer SST associated with "global warming" is clearly a likely consequence of future climate change. This is cutting-edge research. The modelling methodology involves simulating changes to a storm's intensity, duration, track and physical nature as key climate parameters are systematically adjusted within realistic thresholds. Once the most sensitive parameters are identified, changes to their characteristics using projected changes to the climate can be modelled.

The early results based on the April 1999 hailstorm are potentially significant. They indicate that storm development is extremely sensitive to small changes to atmospheric and oceanic parameters. Small adjustments of key parameters created a model "megastorm" that would potentially dwarf the original hailstorm of April 1999 in both intensity and scale. Apart from an unprecedented insurance loss, a storm of this magnitude could have far reaching implications to personal safety, disaster relief management and the local and national economy through business disruption. Clearly, we have to treat these initial results with considerable caution and currently this analysis is being followed up by additional sensitivity studies involving numerous other storms in order to gain more confidence in these early results. But we cannot ignore the increasing possibility that small changes to climate parameters could have affects on the intensity and incidence of storms that would be disastrous for the communities in which we all live. This is a key message formed from the consensus of global scientific opinion regarding future climate change.

Climate Change and Australia's Physical Assets

Australia has enormous potential to suffer from impending climate change. More than 80% of its population resides within 50 km of the coast with increasing concentrations in regions already vulnerable to weather hazards (CSIRO, 2002). This could be the main reason why the number of natural catastrophes causing more than $10m each appears to be increasing since 1967.

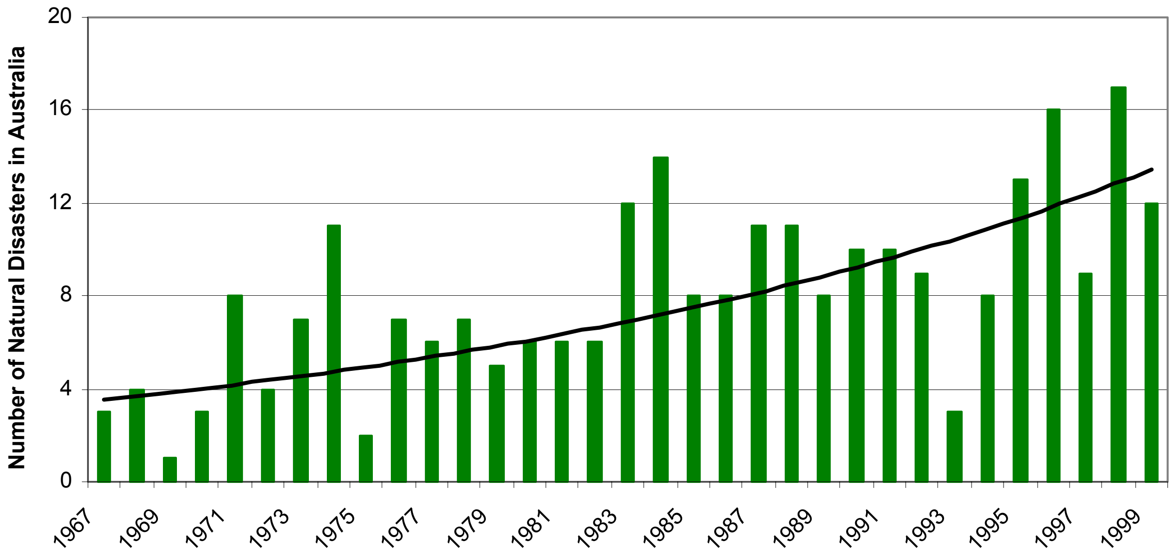

Figure 6: Number of Natural Disasters in Australia 1967-1999.

Reconstructed from the Bureau Transport Economics analysis of Emergency Management Australia. {Note: Definition of Natural Disaster: Economic costs greater than $10m (in 1999 prices, Includes costs of deaths and injuries)}

In addition, $1,500 billion of Australia's wealth is locked up in homes, commercial buildings, ports and other physical assets (ABS, 2002). This is equivalent to nine times the current national budget or twice our gross domestic product. The insurance industry currently underwrites the risk to the bulk of these assets from weather events but climate change threatens its ability to do so as effectively in the future. Therefore the affect to Australia from climate change is quickly becoming a social, economic and political issue.

Climate Change is a Global Problem

The insurance industry in Australia, like many other countries, is also vulnerable to other catastrophic events occurring worldwide through its interconnection with reinsurance. Both natural and manmade disasters trigger a sequence of financial events for insurers and reinsurers. Large and unanticipated losses lead to large insurance payouts, which reduce insurers' and reinsurers' capital reserves and heighten their uncertainty about losses from future events. As the supply of reinsurance dwindles, sometimes simultaneously with an increase in demand, prices climb. Figure 7 illustrates how the price of reinsurance worldwide nearly doubled following Hurricane Andrew in the United States and did not start to decline until 1995 (CBO, 2002). The cost of insurance will then increase in local markets, regardless of whether changes to the nature of local catastrophes occur.

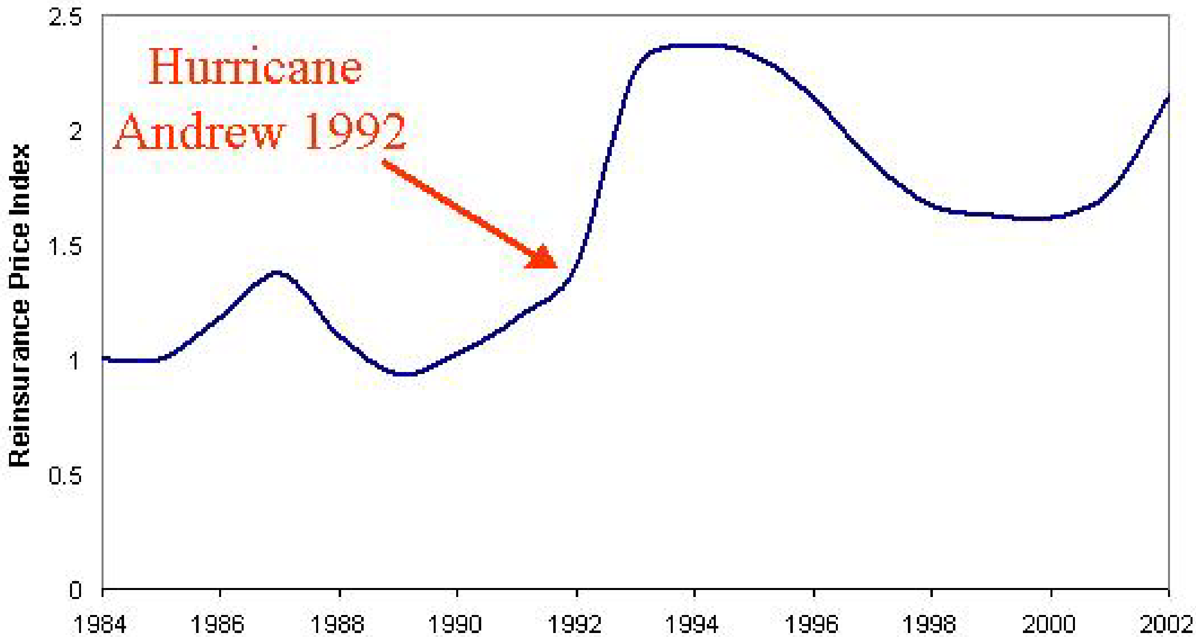

Figure 7: Catastrophe reinsurance price index
Source: CBO (Congressional Budget Office), Sept. 2002. Federal Insurance for Disasters (USA)

Note: The index shows changes in the price of catastrophe reinsurance relative to a base of one. Data points are from January of each year. In July 1994, the index reached its peak of 2.47.

Current trends show that worldwide economic losses from catastrophes (Figure 8) are doubling every 10 years and if trends continue annual losses will reach US$150Billion in the next decade (UNEP FI, 2002). A number of factors contribute to the increase in losses including economic and demographic trends, market factors and changes to the nature of natural disasters themselves (Mills et al, 2001). It is unclear how much climate change has contributed to these past losses, but it is expected that further climate change will amplify losses from natural catastrophes. Worldwide the insurance industry can therefore expect costs and therefore premiums to continue to rise unless a coordinated global effort focussed on mitigating against the causes of past, current and predicted loss trends is employed.

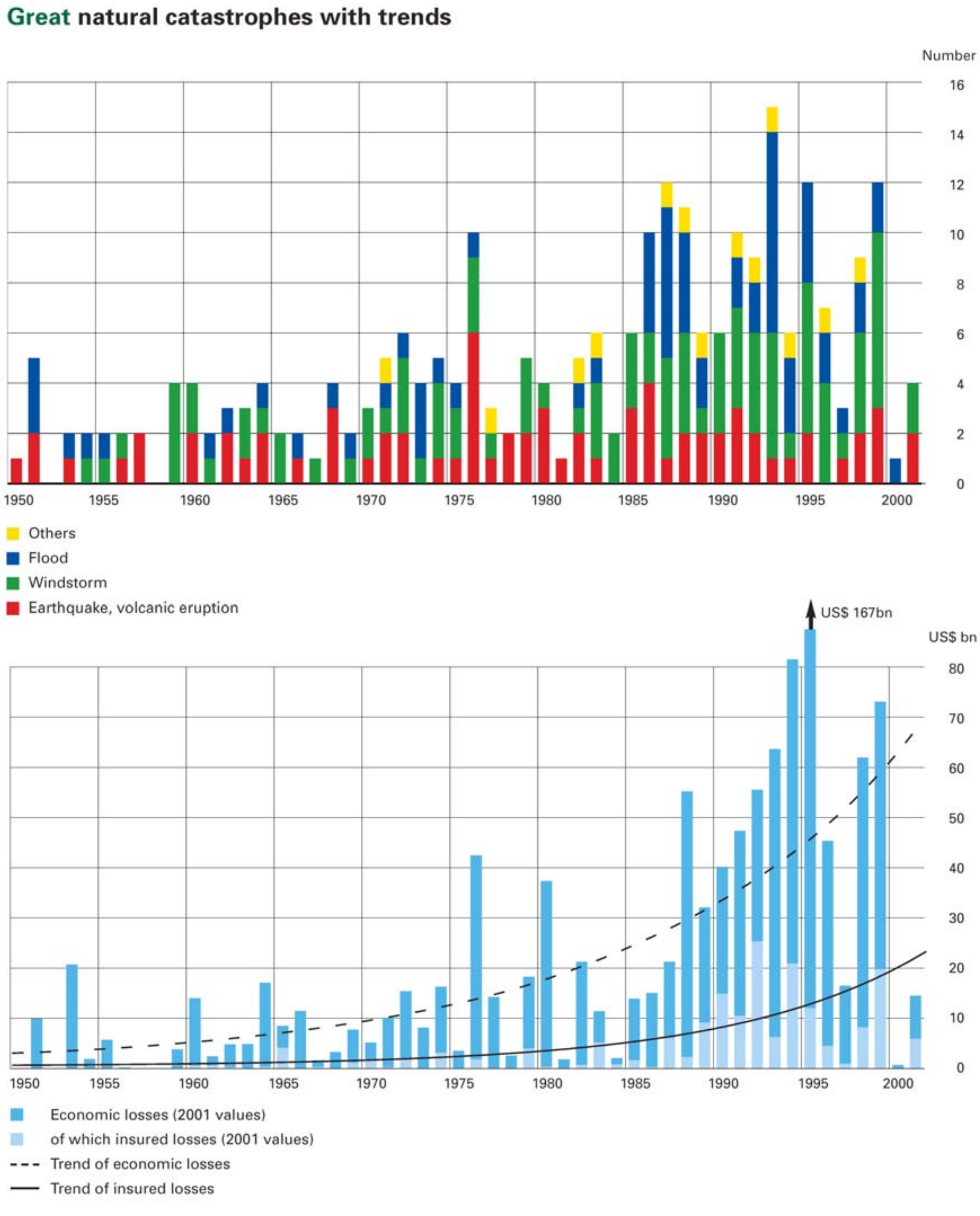

Figure 8: From "Natural Catastrophes 2001", Munich Re.

IAG's Response

From the industry's perspective the question then arises - "What is the role of insurers in minimising the risks arising from climate change? " It could be argued that without intervention, the industry may not be viable in the future. Frank Nutter, President of the Reinsurance Association of America has stated that the insurance industry is the first in line to be affected by climate change and that global warming could bankrupt the industry (Mills et al., 2001, p91). Climate change threatens the insurance industry's core business. Due to the momentum already in the climate system, the insurance industry can wait no longer - it must be proactive and it must start now.

IAG believes that there are opportunities for new business strategies, which create value, encourage sustainable behaviour in society and mitigate against further climate change. We are currently researching adaptation strategies whereby vulnerability to more frequent or more intense events is minimised. We can drive public awareness programs that identify vulnerable areas, such as the IAG-sponsored education program following the Wollongong floods in 1998 where many properties were found to have been developed on flood-prone land. We can lobby governments to change or enforce building codes. According to the Insurance Information Institute (2000), 70% of the losses associated with Hurricane Alicia and up to 40% of the losses associated with Hurricane Andrew were due to poor building code enforcement. We can also adopt mitigation strategies whereby we effectively seek to reduce the extent of possible climate change through appropriate products or policies aimed at reducing greenhouse gas emissions. Products or policies that aim to reduce car emissions by offering cheaper insurance premiums for lower usage and support for the public transport system could have multi-faceted benefits. The most obvious is the reduction of emissions and pollutants while easing road congestion. Lower congestion rates would reduce aggressive driving, a factor that is responsible for half of all accidents in the USA (Mills et al., 2001, p98).

At present IAG is continuing its pioneering hailstorm modelling work and keeping abreast of any advances in scientific understanding of extreme events and climate change. Significant investment in research will lead to improved understanding of the changing risk and will help to maintain a viable industry. We are collaborating with the Bureau of Meteorology on research into storm damage potential using weather radar, and sponsoring other research into building material vulnerability due to severe storms. We are also incorporating climate change considerations into all of our business processes and we are exploring ways to use our purchasing power to promote, for example, more energy efficient white goods and appliances.

At the level of its own environmental footprint, IAG has calculated that our greenhouse gas emissions are about 8.6 tonnes of CO_2-equivalent for each employee each year. The company is now working to reduce this progressively through initiatives including recycling, green power purchases, reviewing fuel usage and other areas.

Conclusion

What IAG can unquestionably do is use its claims data and new research like the hailstorm work to drive action towards both adaptation and mitigation. IAG can do this by helping people to understand the risks that more frequent and more intense extreme weather events pose to their everyday lives – their houses, their cars and even personal safety.

Taking action within IAG itself and helping others to understand the threat that climate change poses is central to managing current and future risk from weather-related events. IAG, however, still has a long way to go on exploring how it can help reduce greenhouse emissions through innovating around products, processes and business models and by encouraging others to do the same.

But insurance companies acting alone or even collectively will have limited positive impact because whole-of-global-economy action is required. Climate change makes a compelling case for the need for business, governments and community groups to work together to find sustainable solutions to 21st century challenges.

References

ABS (Australian Bureau of Statistics), 2002. Australian System of National Accounts, 2001-2002, Nov 2002.

Buckley, B.2002. Bureau of Meteorology Perth (Personal Communication on 12/12/2002).

BTE (Bureau of Transport Economics), 2001. Economic costs of natural disasters in Australia. Aust. Journal of Emergency Management, Autumn 2001, 38-43.

CBO (Congressional Budget Office), Sept. 2002. Federal Insurance for Disasters. http://www.cbo.gov

CSIRO, 2002. Climate Change and Australia's coastal communities. CSIRO Atmospheric Research, Aspendale Victoria.

CSIRO, 2001. Climate Change : projections for Australia. CSIRO Atmospheric Research, Aspendale Victoria.

Gillespie, C, Grech, P and D. Bewsher, 2002. Reconciling Development with Flood Risk: the Hawkesbury-Nepean dilemma. Aust. Journal of Emergency Management, Autumn 2002, 27-32.

Insurance Information Institute, 2000. Catastrophes Background. New York.

IPCC (Intergovernmental Panel on Climate Change), 2001. Climate Change 2001: The Scientific Basis – Contribution of Working Group 1 to the third assessment report of the IPCC. Cambridge.

Katzfey, J. and K. McInnes, 1996. GCM Simulations of Eastern Australian Cutoff Lows, Journal of Climate, 9, 2337-2355.

McInnes, K.L, Walsh, K.J.E., Hubbert, G. D., and T. Beer (unpublished), Impact of Sea-level Rise and Storm Surges on a Coastal Community. Submitted for publication in Natural Hazards special edition. 2003

Mills, E., E. Lecomte and A. Peara, 2001. US Insurance Industry Perspectives on Climate Change, February 2001, US Dept of Energy, Berkeley, California.

Munich Re, 2000. Review of natural disasters 1999, Munich Re, Report No. 2946-M-e.

Schreider S.Y. , Smith D.I. and A. Jakeman, 2000, Cliamte Change Impacts on Urban Flooding. Climatic Change, 47, 91-115.

Smith, D. I., 1998. Urban flood damage under greenhouse conditions: what does it mean for policy, Aust. Journal of Emergency Management, Winter 1998, 56-61.

UNEP FI, 2002. Climate Change and the Financial Services Industry. United Nations Environment Programme Finance Initiatives Climate Change Working Group. http://www.unepfi.net

Williams, A., D. Karoly and N. Tapper, 2001. The sensitivity of Australian fire danger to climate change. Climatic Change, 49, 171-191.