Newsletter

Volume 17, Issue 1
August, 2017

A Natural Hazard Building Loss Profile for Australia: 1900-2015

J McAneney[1,2], N Madappatt[1], L Coates[1,2], R Crompton[1,2], R D'Arcy[1] and R Blong[1]

[1]Risk Frontiers, Macquarie University, NSW 2019
[2]Bushfire &Natural Hazards Cooperative Research Centre

This study examined building damage as recorded in PerilAUS (e.g. Coates et al. (2014)) to determine the national profile of natural peril impacts and frequencies. The analysis employed Risk Frontiers' Damage Index based on a House Equivalent (HE) loss metric introduced by Blong (2003); a simple normalisation correction based on Crompton et al. (2010) and a lower bound event threshold of 25 normalised HE. The latter is equivalent to a monetary loss of around $10m in 2015-16. Normalisation

Risk Frontiers' Annual Seminar: A Provisional Programme

Thursday 12th October, 2017, commencing 2.00pm at the Museum of Sydney, cnr Phillip & Bridge Streets, Sydney

And on the menu:

Long-term natural records of tropical cyclones

This year's guest speaker, Professor Jonathon Nott, is a geoscientist who, inter alia, has reconstructed long term records of extreme storm surge events on the Australian coastline. Come and learn how representative is the recent satellite era of the longer-term history of landfalling cyclones.

Synthesis of Risk Frontiers' social research findings

Andrew Gissing distils key learnings in context of fire, flood, heatwave and tropical cyclone events.

Vignettes de recherche

Listen to Lucinda Coates on our updated PerilAUS record of deaths from natural hazard events and Tahiry Rabehaja on how to update the updating of PerilAUS. Thomas Mortlock will talk about coastal erosion and TC Debbie while Mingzhu Wang explains how machine-learning techniques are improving FireAUS.

Seasonal drivers of bushfire weather risks in SE Australia

Stuart Browning goes back to 1851 and further still to develop a long-term history of bushfire climate risks.

And did I mention it? There are drinks as well!!

Invitations will be distributed shortly and are also available on our website: riskfrontiers.com.au

In this issue:

Sponsors

- Aon Benfield
- Guy Carpenter
- IAG Insurance
- QBE
- Suncorp Group
- Swiss Re

puts historical events on a common footing with losses that would be incurred given 2015 societal and demographic conditions; it answers the question: what would be the losses if historic events were to recur today?

While more analysis remains to be done to validate the HE calculations and the spatial distribution of losses across States and Territories, we find that there have been on average 5.85 events per year causing losses in excess of 25 normalised HE (Figure 1). This frequency exhibits no statistically significant change since 1900. The mean loss per event is $118m with a standard deviation of $430m. The absence of a trend over time is insensitive to the threshold HE employed.

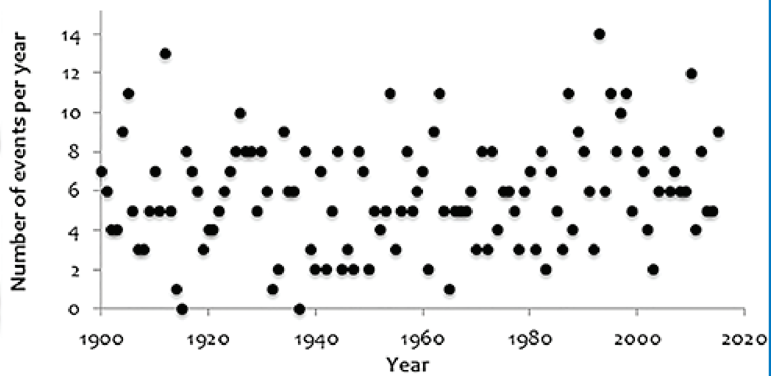


Figure 1: Number of events per financial year (July 1 to June 30) causing normalised building losses in excess of $10m. Events are grouped by financial year to discriminate between Southern Hemisphere summers when many weather-dependent events occur.

The most costly event in terms of building damage is the 1999 Sydney hailstorm, which was also the most expensive insured loss. The losses broadly follow a Pareto distribution in which 20% of events account for 80% of the aggregated normalised building losses and the top 20 are responsible for 50% of those losses. We can expect natural disaster events as costly as the 1999 Sydney hailstorm to occur about once per century, events like the Brisbane floods once every 30 to 40 years and that of the Hobart Bushfires about once a decade.

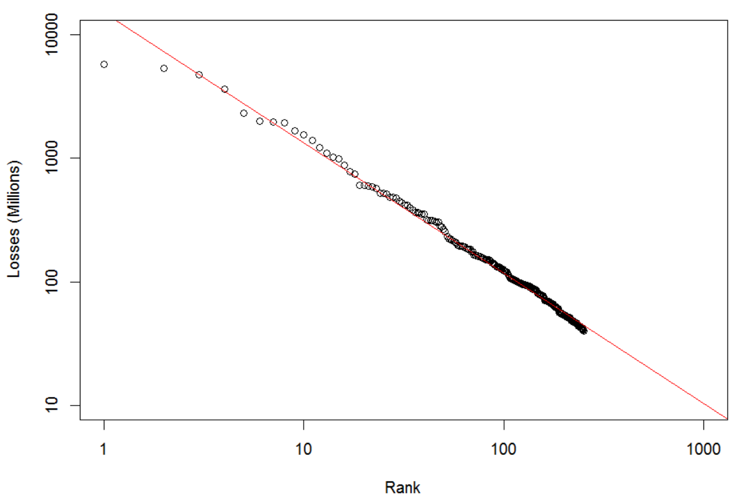


Figure 2: The top 300 normalised losses against rank. The straight line shows a Pareto (power law) distribution.

The pattern of losses shown in Figure 2 demonstrates the 'heavy-tailed' character of the natural peril losses where there is always the possibility of event losses far in excess of the historical mean. This may occur because of an event of higher intensity or larger footprint, that footprint impacting an area of higher-valued exposure, or all of these together.

A preliminary breakdown of damage by perils shows tropical cyclones to have been most destructive and responsible for 30% of the national building damage since 1900. Bushfires, floods and hail have all been similarly costly each accounting for another 18% of building losses, although when hailstorms are combined with other storm events (excluding cyclones), thunderstorms similarly contribute 30% of the losses. Compared with meteorological hazards, geophysical perils have had a minor influence on building damage over the last 116 years with earthquake losses dominated by a single event -- the 1989 Newcastle earthquake. However this time period is too short to predict the frequency of damaging seismic events and, in the case of this peril, as with some others, the spatial pattern of losses shown here could be overturned by another extreme event loss.

While we believe the above results to be robust, further validation of the House Equivalent calculations is required with particular scrutiny on Central Damage Value estimates by peril. Ongoing work will undertake a comparison with the normalised ICA Disaster List (Crompton and McAneney 2008) once this has been updated by Risk Frontiers later this year and with insurance claims information for key events.

References

Blong RJ (2003) A new damage index, *Natural Hazards*, 30, 1-23.

Coates L, Haynes KA, O'Brien J, McAneney KJ and Dimer de Oliveira F (2014) Exploring 167 years of vulnerability: An examination of extreme heat events in Australia 1844-2010, *Environmental Science and Policy,* 42, 33-44. DOI: 10.1016/j.envsci.2014.05.003.

Crompton RP and McAneney KJ (2008) Normalised Australian insured losses from meteorological hazards: 1967-2006 *Environ, Science & Policy* 11 (5), 371-378.

Crompton RP, McAneney KJ, Chen K, Pielke Jr RA and Haynes KA (2010) Influence of location, population, and climate on building damage and fatalities due to Australian bushfire: 1925-2009, *Weather, Climate and Society*, 2, 300-310.

Weather-related Natural Disasters: Should we be concerned about a reversion to the mean?

Professor Roger Pielke Jr (University of Colorado, Boulder)

The world is presently in an era of unusually low weather disasters. This holds for the weather phenomena that have historically caused the most damage: tropical cyclones, floods, tornadoes and drought. Given how weather events have become politicized in debates over climate change, some find this hard to believe. Fortunately, government and IPCC (Intergovernmental Panel on Climate Change) analysis allow such claims to be adjudicated based on science, and not politics. Here I briefly summarize recent relevant data.

Every six months Munich Re publishes a tally of the costs of disasters around the world for the past half year. This is an excellent resource for tracking disaster costs over time. The data allows us to compare disaster costs to global GDP, to get a sense of the magnitude of these costs in the context of economic activity. Using data from the UN, Figure 1 shows how that data looks since 1990, when we have determined that data is most reliable and complete.

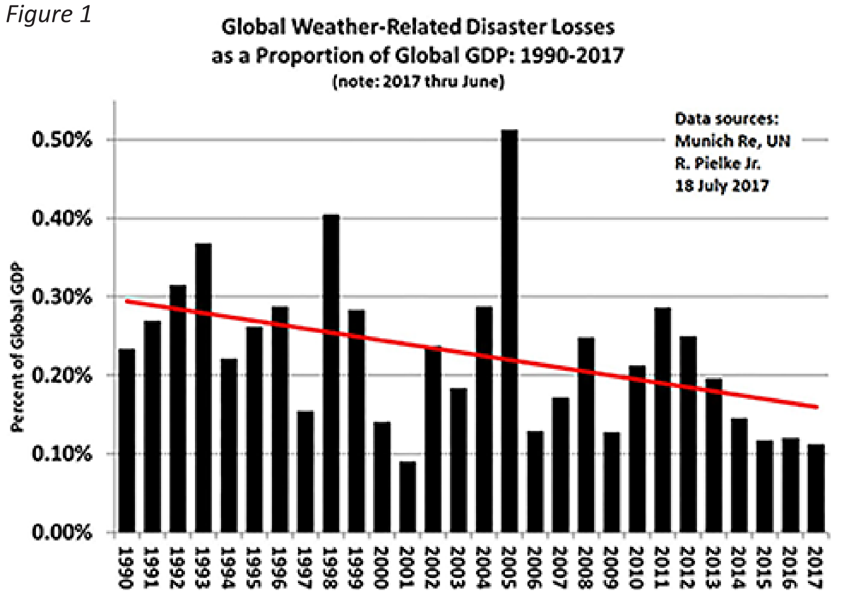
The data shows that since 2005 the world has had a remarkable streak of good luck when it comes to big weather disasters, specifically:

- From 2006 to present there have been 7/11 years with weather disasters costing less than 0.20% of global GDP.
- The previous 11 years saw 6 with more than 0.20% of global GDP.
- From 2006 to present there has been zero years with losses greater than 0.30% of global GDP.
- The previous 11 years had 2, as did the 6 years before that, or about once every 4 years.
- According to a simple linear trend over this time period, global disasters are 50% what they were 27 years ago, as a proportion of GDP.

Why has this occurred? Is it good luck, climate change or something else?

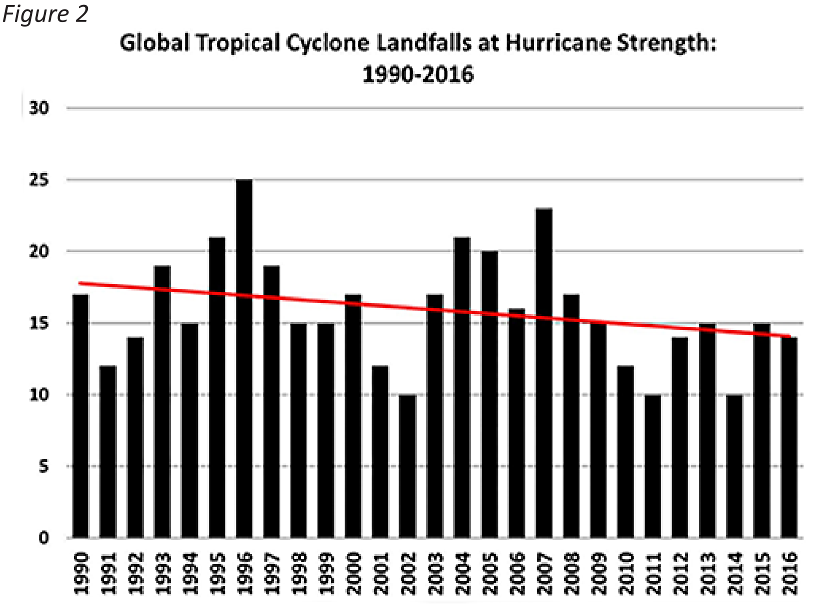
By disaggregating the data phenomenon by phenomenon we can get a better sense of why it is that disaster costs are, as a proportion of global GDP, so low in recent years.

Figure 1



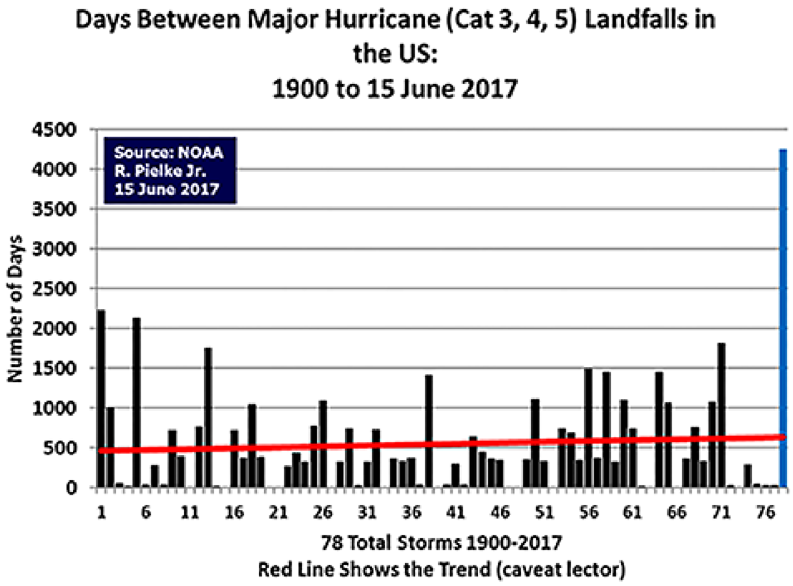
A good place to start is with tropical cyclones, given that they are often the most costly weather events to occur each year. Figure 2 shows global tropical cyclone landfalls from 1990 through 2016. These are the storms that cause the overwhelming majority of property damage. Since 1990 there has been a reduction of about 3 landfalling storms per year (from ~17 to ~14), which certainly helps to explain why disaster losses are somewhat depressed.

Figure 2



Even more striking is the extended period in the United States, which has the most exposure to tropical cyclone damage, without the landfall of an intense hurricane. Figure 3 shows the number of days between each landfall of a Category 3+ hurricane in the US, starting in 1900. As of this writing the tally is approaching 4500 days, which is a streak of good fortune not seen in the historical record.

Figure 3



A very conservative estimate of the effects of this "intense hurricane drought" is that the United States is some $70 billion in arrears with respect to expected hurricane damage since 2006. In fact, it is not widely appreciated but the US has seen a decrease of about 20% in both hurricane frequency and intensity at landfall since 1900. I urge caution placing too much significance on linear trends, as they are quite sensitive to start and end dates, but there is very little to indicate that tropical cyclones are either more frequent or intense.

Data on floods, droughts and tornadoes are similar in that they show little to no indication of becoming more severe or frequent. The IPCC concludes:

- "There continues to be a lack of evidence and thus low confidence regarding the sign of trend in the magnitude and/or frequency of floods on a global scale."
- "There is low confidence in observed trends in small spatial-scale phenomena such as tornadoes and hail."
- "There is low confidence in detection and attribution of changes in drought over global land areas since the mid-20th century."

Thus, it is fair to conclude that the costs of disasters worldwide is depressed because, as the global economy has grown, disaster costs have not grown at the same rate. Thus, disaster costs as a proportion of GDP have decreased. One important reason for this is a lack of increase in the weather events that cause disasters, most notably, tropical cyclones worldwide and especially hurricanes in the United States.

Climate change, of course, is all too real and has a significant human component. The IPCC has concluded that there is evidence indicating that heatwaves have become more common as too has extreme rainfall in some parts of the world. Projections for the future suggest that some other types of extremes – including tropical cyclones, floods, drought and tornadoes – may yet become more intense or frequent. However, there is great uncertainty about how extremes will evolve in the climate future.

But we don't need climate scenarios to be worried about more disasters. To the extent that people believe that we are presently in an era of large or unusual disasters, many will be in for a shock when large weather disasters again occur. And they will. A simple regression to the mean would imply disasters of a scale not seen worldwide in more than a decade.

Consider that 2005 saw weather disasters totaling 0.5% of global GDP. In 2017, if the world economy totaled $90 trillion (in a round number), then an equivalent amount of 2017 disaster losses to the proportional costs to 2005 GDP would be about $450 billion. That is about equivalent to Hurricane Katrina, Superstorm Sandy, Hurricane Andrew, the 2011 Thailand floods, the 1998 Yangtze floods all occurring in one year plus about $100 billion more in other disaster losses. And there is no reason why we should consider 0.5% of GDP to be an upper limit. Think about that.

The world has had a run of good luck when it comes to weather disasters. That will inevitably come to an end. Understanding loss potential in the context of inexorable global development and long term climate patterns is hard enough. It is made even more difficult with the politicized overlay that often accompanies the climate issue. Fortunately, there is good science and solid data available to help cut through the noise. Bigger disasters are coming - will you be ready?

Sources

Mohleji S, & Pielke Jr R (2014). Reconciliation of trends in global and regional economic losses from weather events: 1980–2008. *Natural Hazards Review,* 15(4), 04014009.

Munich Re (2017) Natural catastrophe review for the first half of 2017 https://www.munichre.com/en/media-relations/publications/press-releases/2017/2017-07-18-press-release/index.html

Murray V, & Ebi KL (2012). IPCC special report on managing the risks of extreme events and disasters to advance climate change adaptation (SREX).

Pielke Jr R (2014) The rightful place of science: disasters and climate change. (CSPO: ASU)

Stocker TF, et al. (2013) IPCC, 2013: climate change 2013: the physical science basis. Contribution of working group I to the fifth assessment report of the intergovernmental panel on climate change.

Weinkle J, Maue R, & Pielke Jr, R. (2012) Historical global tropical cyclone landfalls. *Journal of Climate*, 25:4729-4735.