Response to Productivity Commission's draft report:

"Barriers to Effective Climate Change Adaption"

Risk Frontiers

Macquarie University

Contact: **Professor John McAneney**
Ryan Crompton

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Summary

This submission is written at the request of the Productivity Commission in response to their draft release of 27 April 2012. We broadly concur with the Commission's recommendations and priorities and thus limit this discussion to those areas where our experience is most relevant.

Risk Frontiers was created in 1994 to undertake research on natural hazards in Australia and to create tools and databases to enable the pricing of their impacts on communities for the insurance and reinsurance sectors. The views given here are drawn from that experience which comprises both the study and modelling of the impacts of natural hazards, as well as observations from numerous rapid-deployment reconnaissance missions following natural disasters both in Australia and overseas.

As a point of departure, we accept that the planet is warming and that this will eventually have measurable impacts on extreme weather. Our interest is in those events likely to cause property damage.

Nonetheless the trajectory of extreme weather under a warming climate is highly uncertain as is the timescale at which these changes might be detectable. This being the case, any measures that reduce risk in respect to weather-related perils – bushfires, storms including hailstorms, tropical cyclones and floods – under the current climate would result in immediate benefits to Australians and put us in good stead for an uncertain future. This is a strong argument for better risk-informed landuse planning and for hazard resilient building practices.

In further support of this view – that the government's emphasis should be on making Australian more resilient to extremes in the current climate – we have summarised analyses of long-term trends in insurance or economic disaster loss histories and find that disaster losses are rising in concert with increasing population, wealth and inflation. The corollary is that after adjusting historical losses for changes in these variables, no trend remains and thus no role can yet be attributed to anthropogenic climate change. This is the case for multiple natural perils and across different jurisdictions. Despite running counter to popular belief, the research on this point is unequivocal and anyone arguing the contrary now has a mountain of referred scientific literature to confront. In short, the reason for the growing cost of weather-related natural disasters is that we now have more people living in dangerous places with more to lose.

If no role for anthropogenic climate change can yet be determined in disaster losses, the next logical question is how long will it take before such a signal can be observed? Recent

studies on US tropical cyclone losses suggests that we may be more than a century away from detecting an anthropogenic climate change signal in disaster losses (e.g. Crompton et al. 2011). For this reason, the statement by the Presiding Commissioner of the Productivity Commission, Dr Wendy Craik, makes perfect sense to us:

> *The reform priority should be to enable better risk management in the current climate. Reforms to barriers to managing risks in an uncertain future climate should be a lower priority because the costs and benefits are also uncertain.*

The second issue we deal with is the availability of data for the public that would enable them to assess their individual exposure to natural hazards. Risk Frontiers already has national databases of natural peril profiles for individual street addresses for the likelihood of hail, earthquake ground shaking intensity and soil conditions, tropical cyclone peak gust speeds, bushfire exposure, and river flood risk. These databases are widely used by the insurance industry.

Thus the capability to provide hazard information to the public, and governments, already exists. And so it is completely incomprehensible that the government should fund Geoscience Australia to the tune of $12 million dollars just to collate flood risk information from around the country. Except for a very few recalcitrant councils, Risk Frontiers and Willis Re have not only accumulated this information already, but have processed it in a manner suitable to enable risk-informed decisions. It is not risk information that is lacking, it is the political will to engage in mitigation and encouraging risk-reducing behaviours.

While an individual homeowner is concerned about the risk to his or her home, an insurer or reinsurer has to deal with the totality of losses that in the case floods may encompass many communities over several different catchments. Today, in addition to life safety issues, much more consideration needs to be given to the economic impacts of natural disasters. From a government perspective, priorities for adaptation or mitigation – used here in its traditional emergency management context – should be given to events likely to cause damage to the national economy. All Australians ended up paying for the recovery and reconstruction after the Queensland floods. It is no secret where these events are likely to occur: in large concentrations of exposure that exist in our capital cities.

Finding ways to incentivise local councils, which have the ultimate responsibility for land-use planning decisions, to engage in risk-informed planning practices, is the key to ensuring that the risks do not continue to rise in concert with population. Making publically funded flood hazard information publically available would be a good first step.

The views expressed are those of Risk Frontiers and should in no way be considered as reflecting those of our sponsor companies or those of the Insurance Council of Australia or other Risk Frontiers' clients such as State Emergency Services.

Risk Frontiers

Risk Frontiers is an independent research centre sponsored by the insurance industry to aid better understanding and pricing of natural hazard risks in the Asia-Pacific region. It was founded in 1994 to service the specialised needs of its sponsors in the local insurance and international reinsurance markets. Its aims were to:

- undertake risk assessment and research into natural hazards,
- develop databases of natural hazards and their impacts on communities and insured assets, and
- develop loss models to improve the pricing of natural hazard catastrophe risks.

These activities remain the core business of Risk Frontiers today, although we now undertake studies on a much wider range of risk-related problems and for a client base that extends well beyond the insurance sector. For example, Risk Frontiers is the preferred provider of research to the NSW State Emergency Service, and also has interests in public policy in respect to the management of natural hazard risks.

Risk Frontiers' research and model developments are geared towards providing:

1. databases and tools to promote risk-informed underwriting in relation to natural perils,
2. applications of advanced geospatial and image analysis tools,
3. multi-peril Probable Maximum Loss (PML) modelling, and
4. promoting risk-informed decision-making and the responsible management of risk.

Risk Frontiers is based at Macquarie University where it enjoys close collaborative links with a number of key academics. The Centre is self-funded and its staff are devoted to research, real-world problem solving and software development; it has no formal teaching commitments although the Centre does train post-graduate students who undertake research to advance our understanding of natural perils and their impacts on communities.

Risk Frontiers also works for and collaborates with a wide range of non-sponsor insurance companies and non-insurance entities located in Australasia, Europe, South-east Asia and Bermuda.

Recent Relevant Assignments by Risk Frontiers

1. Development of a Flood Exclusion Database (FEZ™) database identifying Australian addresses that lie beyond the extent of the Probable Maximum Flood (Australian Innovation Patent Application 2012100867 and an Australian Provisional Patent Application 2012902377).

2. Street-address natural hazard profiles for all addresses in Australia — bushfire vulnerability, frequency of damaging hail, flood status, earthquake peak ground acceleration and seismic soil conditions, peak wind gust speeds, distance to coast, etc.

3. Development of an Australian Multi-Peril Loss modelling platform to allow insurers and reinsurers to price risks due to riverine flood, hail, bushfire, tropical cyclone and earthquake, either individually or in combination. Some corporate clients are also finding these tools useful.

4. Post-event reconnaissance surveys and interviews with victims after the 2009 Victorian bushfires, the 2010 and 2011 Christchurch earthquakes, the 2011 Queensland and Victorian floods and 2011 Cyclone Yasi (e.g. Bird et al. (2012)).

5. Joint development (with Willis Re Australia[1]) of the National Flood Information Database (NFID) for the Insurance Council of Australia.

6. Nationally consistent database of coastal vulnerability of population by distance and elevation from the coast (Chen and McAneney, 2006).

7. Normalising the Insurance Council of Australia's (ICA) Natural Disaster Database of insured market losses for changes in inflation, wealth and population, and in Tropical Cyclone-prone parts of the country, changes in construction standards in order to estimate likely losses if historical disaster events were to recur under today's societal conditions (Crompton and McAneney, 2008; Crompton, 2011).

[1] Willis Re is an international reinsurance intermediary with skills is assessing flood risk.

8. Cost benefit investment analysis and risk assessment of remedial engineering works related to flood levee failure in an Australian city.

9. Valuing the benefits arising from regulations mandating improvements in construction standards for residential dwellings in cyclone-prone areas of Australia (McAneney et al., 2007).

10. Estimating the time scale at which an anthropogenic climate change signal may emerge in US hurricane loss data and implications of this for other disaster databases (Crompton et al., 2011).

11. Normalised bushfire building damage and fatalities from 1925 – 2009 and implications for land-use planning (Crompton et al. 2010).

12. Invited submissions to the Royal Commission into the 2009 Victorian bushfires in respect to (a) circumstances surrounding all bushfire-related deaths since 1900 (Haynes et al., 2009) and (b) the vulnerability of homes as a function of their distance from bushland (Chen and McAneney, 2004 and 2010).

13. Representation on the Australian Building Codes Board Flood Committee.

14. Database of historic heat wave fatalities.

Barriers to Effective Climate Change

Risk Frontiers is in broad agreement with the key points and priorities as listed in Productivity Commission's media releases in respect to their Draft Report on *Barriers to Effective Climate Change* (http://www.pc.gov.au/projects/inquiry/climate-change-adaptation/draft/key-points). While the planet is warming, the uncertainty of the modelled projections must be explicitly acknowledged. This is especially true of those extreme weather events likely to cause property damage, our main interest here. And given that the trajectory of extreme weather under a warming climate is uncertain, a risk management or insurance approach to dealing with this uncertainty is required.

In respect of weather-related perils – bushfires, storms including hailstorms, tropical cyclones and floods – any actions taken to reduce risk will result in immediate benefits to Australians and put us in good stead for anything that global climate change may throw our way. In support of this contention – that the emphasis should be on making Australian more resilient to extremes in the current climate – our report begins by reviewing scholarship analysing long-term trends in insurance or economic disaster loss histories. These sections draw heavily upon a recent study undertaken for the National Climate Change Adaptation Research Facility (Crompton et al., 2012). The report concludes by addressing issues pertaining to the availability of data and hazard mapping that would enable homeowners and communities to better understand and personalise their exposure to natural hazards. As a rule Governments in Australia seem reluctant to trust the public with such information.

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Loss normalisation studies

Before comparisons between the impacts of past and recent natural hazard events can be made, various societal factors known to influence the magnitude of losses over time must be accounted for. This adjustment process is known as *loss normalisation* (Pielke and Landsea, 1998).

Normalising losses to a common base year is undertaken for two reasons: first, to estimate the losses that might be sustained if historic events were to recur under identical (current) societal conditions, and secondly, to examine long term trends in disaster loss records with a view to exploring what portion of any trend remains after taking societal factors into account. Such trends might be attributed to other factors including climate change, be it natural variability or anthropogenic causes.

Climate-related influences stem from changes in the frequency and/or intensity of natural perils whereas socio-economic factors comprise changes in the vulnerability and exposure to a natural hazard. Socio-economic adjustments have largely been limited to accounting for changes in exposure, although Crompton and McAneney (2008) adjusted Australian tropical cyclone losses for the influence of improved building standards introduced around the early 1980s (Mason et al., 2012). The authors emphasise the success of improved building standards in reducing vulnerability and thus tropical cyclone wind-induced losses. Figures 1a and b show the annual aggregate losses and the annual aggregate normalised losses (2011/12 values) for Australian weather-related events in the ICA Disaster List. These figures are updated from Crompton and McAneney (2008) using a refined methodology described in Crompton (2012).

Bouwer (2011) provides a comprehensive and international review of loss normalisation studies (Table 1). The key conclusions from the 21 weather-related disaster loss studies are that economic losses have increased around the globe but no trends remain after adjusting historical losses for changes in population, wealth and inflation. In other words, no role in these increasing losses can yet be attributed to anthropogenic climate change.

Studies published since the Bouwer (2011) review support his key findings. Two of these studies - Neumayer and Barthel (2011) and Barthel and Neumayer (2012) – were funded by the global reinsurer Munich Re and utilise their NatCatSERVICE natural disaster loss database. Neumayer and Barthel (2011) found substantial increases in losses in their global analysis of the economic losses from natural disasters during 1980-2009. However, they found no significant upward trend once losses were normalised, and this was the case globally, for specific disasters or for specific disasters in specific regions.

Barthel and Neumayer (2012) undertook trend analyses of normalised insured losses due to different natural perils including tropical cyclones at the global scale over the period 1990 to 2008, for West Germany for the period 1980 to 2008 and for the US from 1973 to 2008. Within these limited time frames, they found no significant trends at the global level, but claimed statistical significance for upward trends for all non-geophysical hazards as well as specific disaster types in the US and West Germany. However, the authors themselves warn against taking the findings for the US and Germany as conclusive evidence that climate change has already caused more frequent and/or more intensive natural disasters. They refer to well-documented issues confounding the statistical analysis of loss data over short time series (e.g. the Hohenkammer consensus (Hoppe and Pielke Jr, 2006)). Importantly and echoing many other studies, they conclude:

> *Climate change neither is nor should be the main concern for the insurance industry. Accumulation of wealth in disaster prone areas is and will always remain by far the most important driver of future economic disaster damage.*

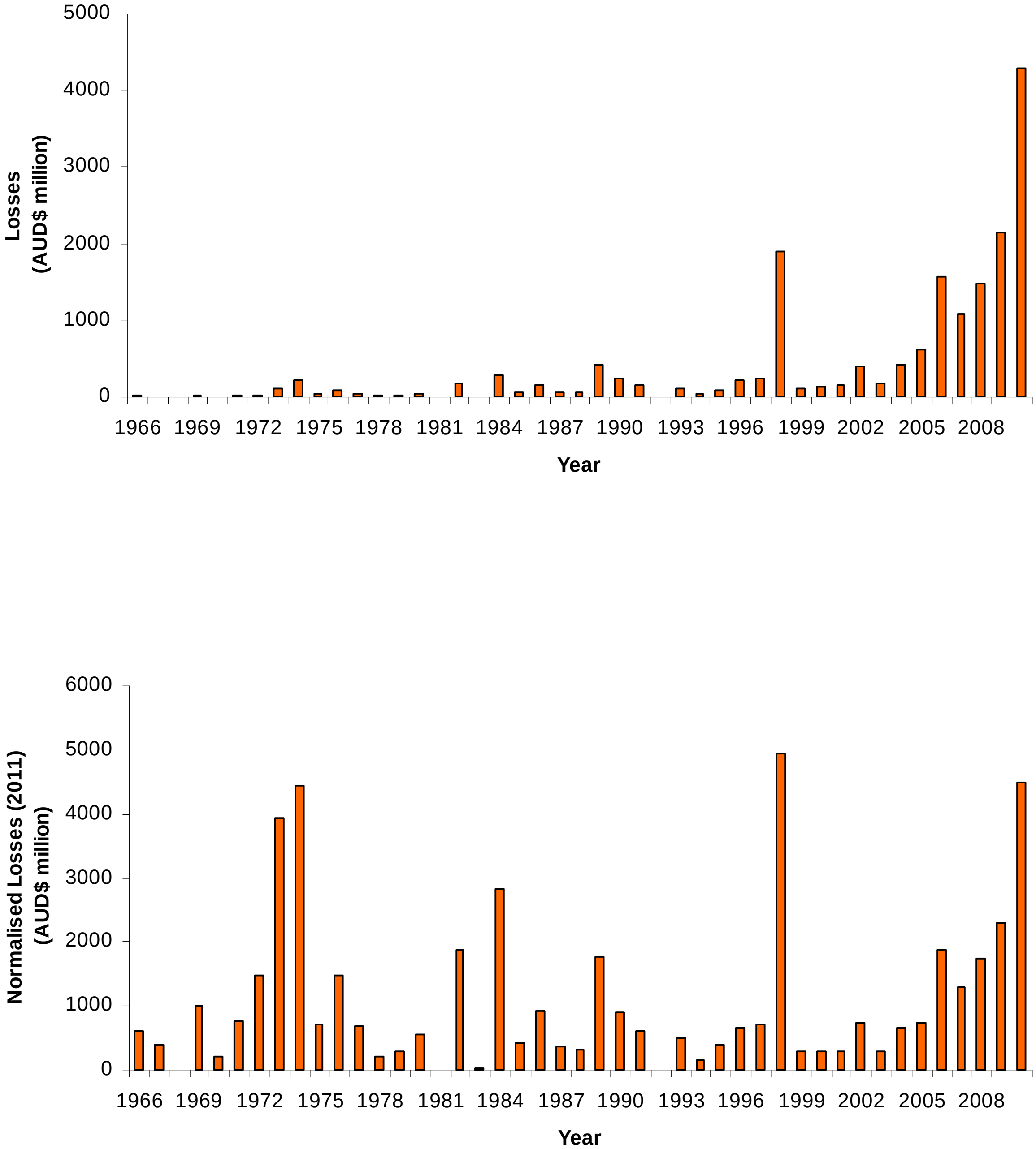

Figure 1: (a) annual aggregate insured losses (AUD$ million) for weather-related events in the ICA Disaster List for years beginning 1 July; (b) as in (a) but with losses normalised to 2011/12 values (source: Crompton (2011)).

Other analyses that reported no trend in normalised losses that could be attributed to anthropogenic climate change include: Zhang et al. (2011) – economic losses in China due to tropical cyclones over the period 1984-2008; Barredo et al. (2012) – insured losses from floods in Spain between 1971 and 2008, and Simmons et al. (2012) – US tornado economic damage from 1950-2011.

The recently released Special Report of the Intergovernmental Panel on Climate Change (IPCC) 'Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation' (SREX) (IPCC, 2012) also offers an up-to-date consensus on the science of extreme events and disasters. It supports the findings previously discussed:

> *Increasing exposure of people and economic assets has been the major cause of long-term increases in economic losses from weather- and climate-related disasters (high confidence). Long-term trends in economic disaster losses adjusted for wealth and population increases have not been attributed to climate change, but a role for climate change has not been excluded (high agreement, medium evidence) (IPCC, 2012).*

Following the large loss of life and building damage in the 2009 bushfire in Victoria, Australia, Crompton et al. (2010) examined the history of fatalities and property damage since 1925. Once the loss data was adjusted for increases in population and dwelling numbers respectively, no residual trends were found that could be attributed to global climate change. The authors emphasise the large proportion of buildings destroyed in Marysville and Kinglake were within or in close proximity to bushlands (60% of destroyed buildings were situated within 10 m of bushland, and 25% within 1 m, i.e. effectively part of the fuel load). The extent of home destruction under these extreme conditions was entirely unsurprising and points to a failure of land-use planning. These same conclusions were presented by Chen and McAneney (2010) in an invited submission to the 2009 Victorian Bushfire Royal Commission.

The absence of an anthropogenic signal in the loss data to this point in time does not solely rest on normalisation studies: those by Di Baldassarre et al. (2010) and Van der Vink et al. (1998) also point to societal factors being the driving forces behind rising disaster losses. Based on the results of both continental and at-site analyses, Di Baldassarre et al. (2010) found that the magnitude of African floods has not significantly increased during the 20th Century, and that climate has not been a consequential factor in the observed increase in flood damage. They conclude that:

> *. . . the intensive and unplanned urbanization in Africa and the related increase of people living in floodplains has led to an increase in the potential adverse consequences of floods and, in particular, of the most serious and irreversible type of*

consequence, namely the loss of human lives . . . It can be seen that most of the recent deadly floods have happened where the population has increased more.

Studies such as those by Weinkle et al. (2011) add further confidence to the findings of tropical cyclone loss normalisation studies. They created a homogenised dataset of global tropical cyclone landfalls and found no long-period global or individual basin trends in the frequency or intensity of landfalling tropical cyclones of minor or major hurricane strength. This supports the conclusion that increasing tropical cyclone losses around the globe can be explained by increasing population and wealth. Chen and McAneney (2006) and others reached similar conclusions in respect to the North Atlantic basin.

The conclusions presented above are hardly new: Van der Vink et al. (1998) argued that the US was becoming more vulnerable to natural disasters because more property was being placed in harm's way. They state that:

In many ways the trends [in losses] seem paradoxical. After all, most natural disasters occur in areas of known high risk such as barrier islands, flood plains, and fault lines. Over time, one would expect that the costs of natural disasters would create economic pressures to encourage responsible land use in such areas.

. . . the economic incentives for responsible land use have been stifled by legislated insurance rates and federal aid programs that effectively subsidize development in hazardous areas. And while there will always be great political pressure to provide economic relief after a disaster, there has been little political interest in requiring pre-disaster mitigation.

Many of the above statements hold true for Australia.

Table 1: Loss normalisation studies (source: Bouwer (2011)).

Hazard	Location	Period	Normalisation	Normalised loss	Reference
Bushfire	Australia	1925-2009	Dwellings	No trend	Crompton et al. 2010
Earthquake	USA	1900-2005	Wealth, population	No trend	Vranes & Pielke 2009
Flood	USA	1926-2000	Wealth, population	No trend	Downton et al. 2005
Flood	China	1950-2001	GDP	Increase since 1987	Fengqing et al. 2005
Flood	Europe	1970-2006	Wealth, population	No trend	Barredo 2009
Flood	Korea	1971-2005	Population	Increase since 1971	Chang et al. 2009
Flood & Landslide	Switzerland	1972-2007	None	No trend	Hilker et al. 2009

Hail	USA	1951-2006	Property, insurance market values	Increase since 1992	Changnon 2009a
Windstorm	USA	1952-2006	Property, insurance market values	Increase since 1952	Changnon 2009b
Windstorm	Europe	1970-2008	Wealth, population	No trend	Barredo 2010
Thunderstorm	USA	1949-1998	Insurance coverage, population	Increase since 1974	Changnon 2001
Tornado	USA	1890-1999	Wealth	No trend	Brooks & Doswell 2001
Tornado	USA	1900-2000	None	No trend	Boruff et al. 2003
Tropical storm	Latin America	1944-1999	Wealth, population	No trend	Pielke et al. 2003

Tropical storm	India	1977-1998	Income, population	No trend	Raghavan & Rajesh 2003
Tropical storm	USA	1900-2005	Wealth, population	No trend	Pielke et al. 2008
Tropical storm	USA	1950-2005	Asset values	Increase since 1970; No trend since 1950	Schmidt et al. 2009
Tropical storm	China	1983-2006	GDP	No trend	Zhang et al. 2009
Tropical storm	USA	1900-2008	GDP	Increase since 1900	Nordhaus 2010
Weather	Australia	1967-2006	Dwellings, dwelling values	No trend	Crompton & McAneney 2008
Weather	USA	1951-1997	Wealth, population	No trend	Choi & Fisher 2003

Weather	World	1950-2005	GDP, population	Increase since 1970; No trend since 1950	Miller et al. 2008

[1]Gross domestic product (GDP) is a measure of a country's overall official economic output. It is the market value of all final goods and services produced in a country in a given year.

Timescale at which an anthropogenic climate change signal might be observed in US tropical cyclone loss data

A study by Crompton et al. (2011) examined this question. Their starting point was that research to date had been unable to detect an anthropogenic climate change influence on Atlantic tropical cyclone behaviour and concomitant damage, though such an influence is projected in the future (Knutson et al., 2010). They then ask - if changes in storm characteristics occur as projected, on what timescale might we expect to detect the effects of those changes in damage data?

Crompton et al. (2011) use the Bender et al. (2010) Atlantic storm projections published in *Science* and the Pielke et al. (2008) normalised loss data to show that anthropogenic signals are very unlikely to emerge in a time series of normalised US tropical cyclone economic losses at timescales of less than a century. Their results were dependent on the global climate model(s) underpinning the projection with emergence timescales ranging between 120 and 550 years. It took 260 years for an 18-model ensemble-based signal to emerge.

From projections analysed, it will be considerable time before it can be said with any level of confidence that anthropogenic climate change is influencing US tropical cyclone losses. Crompton et al. (2011) extended this caution more generally to global weather-related natural disaster losses. They pointed out that short term variability is not 'climate change', which the IPCC defines on timescales of 30-50 years or longer, and that their results argue very strongly against using abnormally large losses from individual Atlantic hurricanes or seasons as evidence of anthropogenic climate change.

Emanuel (2011) implemented an alternative methodology to Crompton et al. (2011) to assess under various scenarios when the signal of human-caused climate change would be detectable in the damage record of Atlantic hurricanes. He looked at four different models, three of which showed increasing losses and one a small decrease. Of the three models that showed increasing losses, the time until detection is 40, 113 and 170 years. This time to detection is shorter than that which Crompton et al. (2011) determined and there are a number of possible reasons for this. Regardless of these differences, both studies are in agreement that the time to detection of a signal of human-caused climate change, assuming that recent projections are correct, is a very long time.

Availability of hazard Information

In the wake of the 2011 Queensland and Victorian floods and the National Disaster Insurance Review, a sum of $12 million (over four years) was allocated to Geoscience Australia to create *inter alia* a portal to hold flood study information. Our understanding is that this information is to be provided to Geoscience Australia on a voluntary basis by councils and state governments.

The decision is curious: Risk Frontiers has been collecting this data since the late 1990s as the base information for creating hazard registers or databases for individual street address locations. It undertook this work for a number of insurance companies and since December 2008, Risk Frontiers and Willis Re have compiled and analysed such information for about 90% of flood-prone properties in the country as part of the development of the National Flood Information Database (NFID). Only a few recalcitrant councils remain antipathetic to providing such data.

Not only has the flood hazard information been collected for most flood-prone areas in Australia, but has been processed at a street address level in a manner appropriate for insurance applications or homeowner needs. The same processed data could be made available to emergency services or to the public at a cost much less than the sum given to Geoscience Australia to fund a paltry component of what has already been achieved.

If the government were serious about informing people of their exposure to flooding and ALL other significant natural hazards, then nationally-consistent street address-based information on tropical cyclone peak wind gusts, earthquake shaking, coastal inundation, vulnerability to bushfire and hail should be compiled and disseminated. Risk Frontiers has done this already and could make the information available in a matter of months. Funding a government department to redevelop databases developed over decades by the private sector is hardly cost effective and is to misunderstand what could be achieved.

Risk Frontiers has also developed the *PerilAUS* database. It is the authorative database of Australian natural hazard events focusing on those that have caused either property damage or fatalities. The first entry is from 1791, a hailstorm in Sydney, and the database is considered complete since 1900. While it is expected that any event that resulted in significant building damage and numbers of fatalities has been already catalogued, the database is constantly being improved and revalidated. Early data entries were derived mainly from archival searches of the *Sydney Gazette* and *Sydney Morning Herald* (dating from 1803 and 1831, respectively) and cross-referenced against other local newspapers or official documents in other States or Territories (Coates 1996; Blong 2004; Haynes et al. 2010).

The National Flood Information Database (NFID)

Rather than describe all the above databases in detail, we focus only on NFID in order to exemplify the information that already exists on natural hazard risks. We remind the reader that Risk Frontiers has similar data on other hazards available at street address level in a nationally consistent form.

NFID was jointly developed by Risk Frontiers and Willis Re Australia for the Insurance Council of Australia. The NFID comprises a database of flood hazard information – flood height as a function of Average Recurrence Interval - at street address resolution for communities across Australia with significant numbers of residential properties at risk to riverine flood. Its development has been underwritten by the insurance sector and represents a significant commitment to dealing with the risk posed by riverine flood.

NFID is derived from the best quality available data (that is, flood modelling/mapping, Digital Terrain Models (DTM), and address location data). No hydrological or hydraulic flow modelling is undertaken by Risk Frontiers or Willis Re[2]; in this respect, the starting point for NFID is the output of modelling studies by specialist hydraulic and hydrological engineers in the form of maps, flood surfaces, flood study reports, etc. The flood data are processed and combined with DTMs and geo-located address data to estimate the frequency and depth of flooding for each address point.

The decision to use City or Local Council flood information was made expressly to avoid inconsistencies between flood maps used for land-use planning decisions and those used for underwriting purposes.

For those catchments where only the 1-in-100 year flood extent is available – this is the case for many catchments in Victoria – addresses are rated as being either within or outside of this flood extent.

A confidence rating is attached to each address entry based on age and resolution of the DTM and flood studies and type of flood data available: flood extents, flood depths at one or several Average Recurrence Intervals.

NFID is being delivered in several stages and has an ongoing maintenance program to incorporate changes in property exposures, new and revised flood information and improved digital terrain or street address datasets.

[2] Some modelling decisions are peer reviewed by third-party consulting engineers

Figure 2 shows the breakdown of addresses covered by NFID and FEZ™ as at August 2012.

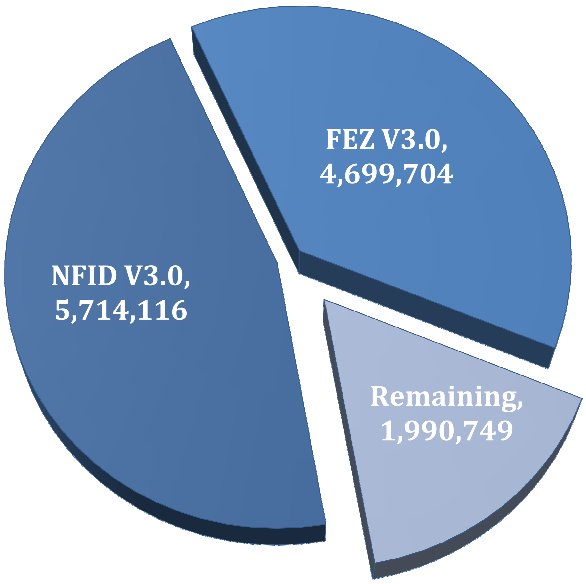

Figure 2: The number of addresses in NFID, FEZ and the remaining (no flood risk information) subset. FEZ™ identifies addresses beyond the extent of flooding in a Maximum Possible Flood (PMF). On-going research is reducing the remaining addresses.

The collection of flood information underlying NFID has been ongoing since the late 1990s. Most State or Local Governments bodies and/or Flood Plain Management Authorities have been forthcoming in their provision of flood information with a view to encouraging the availability of riverine flood insurance. A few councils have refused to provide information for a litany of reasons. Nonetheless we believe NFID already captures more than 80% of the flood-prone properties in the country.

Risk Frontiers also maintains its own proprietary dataset of flood information for the major catchments on the eastern seaboard. For our purposes here, this database can be considered a subset of NFID.

Validation of NFID

Whenever possible, Risk Frontiers validates NFID. In the case of flooding, the 2011 inundation in Brisbane and Ipswich offered such an opportunity. Figure 2 compares the extent of the January 2011 flooding and the January 1974 flooding with the NFID flood surfaces interpolated to match the height of flooding at the Brisbane River City Gauge (4.46 m above AHD). The height of the flood in 2011 at the Brisbane City Gauge was 1 m lower than in 1974. Close agreement between the observed flood extent and modelled boundaries is gratifying especially as the flood surface data used here was some *30 years old*[3].

Although no two floods are identical, the pattern of rainfall in 1974 was different than in 2011, and there is also the questionable management of the Wivenhoe Dam (van den Honert and McAneney, 2011), the extent of flooding downstream was *grosso modo* the same. The agreement of the flood extent in the 1974 flood and the 2011 flood also brings home the truth of the statement made by Van der Vink et al. (1998) that we know where the most at risk areas are already. The lack of appetite for pre-disaster mitigation in this country cannot be sheeted home to a lack of knowledge.

In our view, most current riverine flood mapping data and digital terrain mapping is adequate for insurance, emergency management and public safety applications. Of course better data and in some cases a fuller range of flood surfaces for different Average Recurrence Intervals would be welcomed; however in the short term, compelling local councils to release existing data would provide an immediate solution. Having been paid for with public monies, these data should be accessible to all. More transparency is needed.

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[3] Note that in the most recent NFID release (Version 3.0) this data has since been updated by more recent flood modelling undertaken in 2009 by the Brisbane City Council.

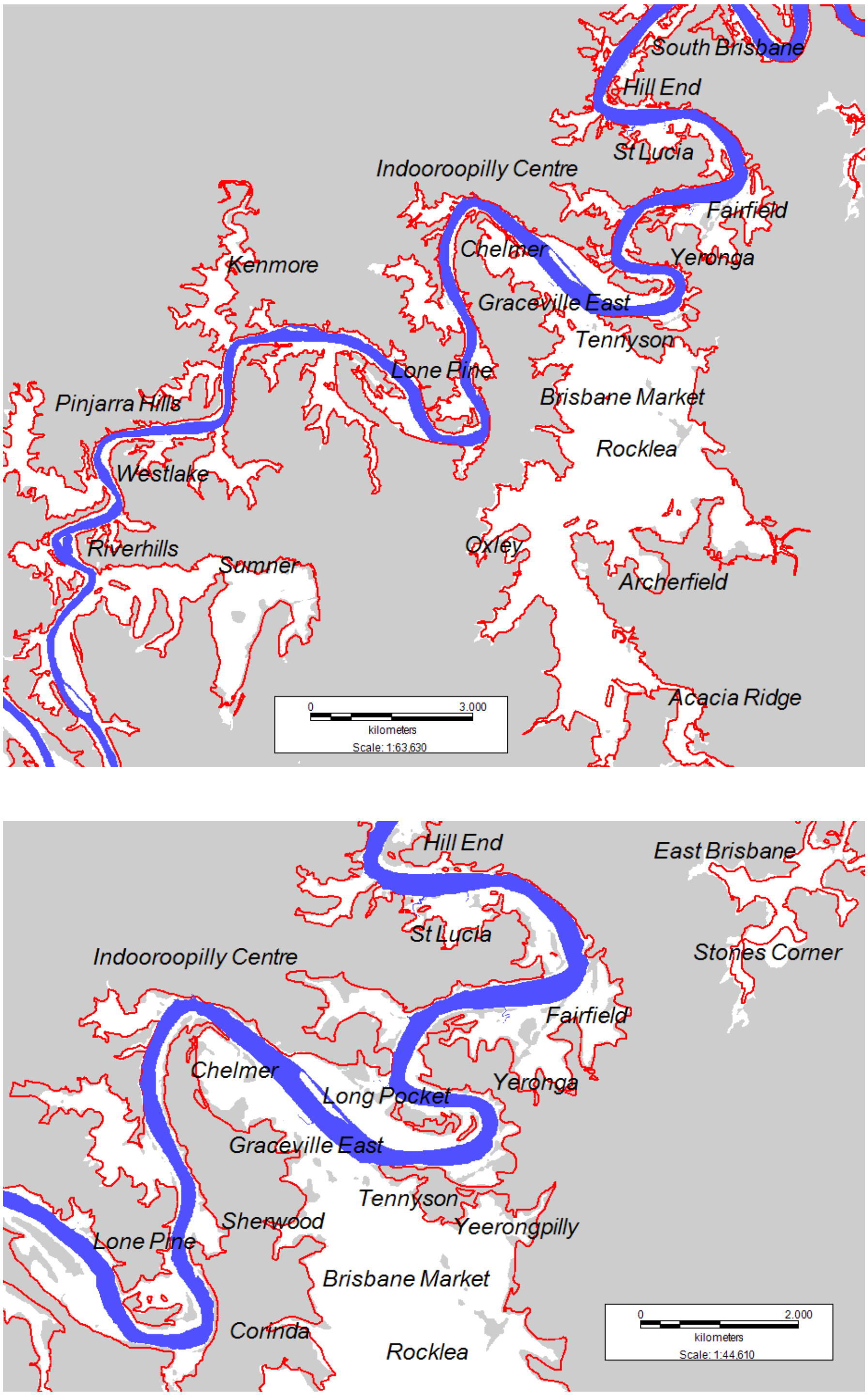

Figure 3: Comparison between actual extents of flooding in January 2011 (Top, red line) and January 1974 (Bottom, red line) as released by the Brisbane City Council and that indicated by NFID (Version 2.4 and earlier) (white area) after water levels were matched at the Brisbane River City Gauge for the January 2011 flood. Dark blue depicts the normal channel when the river is not in flood.

Very roughly we estimate the national numbers of homes at high risk – say exposed to over ground flooding in a 1-in 100 year event – to be around 150,000 addresses. Many of the land-use planning decisions that allowed these homes to be built were made before the availability of modern flood mapping and for reasons that at the time made perfect sense. However, there can be little excuse now for the continued development of the floodplain in ways that do not consider the latent risk. Nor can there be any excuse for either not making flood hazard information available or only available in ways that do not allow homeowners to personalise their exposure. Knowing that your home is located within the 1-in-100 year flood extent, for example, doesn't tell you much about how deep the water might be and what might happen in less or more frequent floods. Insurers also need such information: knowing whether or not a home lies within the flood extent of a 1-in-100 year flood is not a measure of risk!

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