Actuaries Institute

Wider Fields and Broader Horizons

Climate change, carbon and environmental challenges

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27 Nov 2012

Agenda

- Climate change and carbon – related risks and opportunities
- Broader environmental issues
- Actuarial involvement
- Final thoughts

A new challenge to the actuarial profession

- Environmental issues include climate change, resource depletion, scarcity or sharply increasing costs of commodities such as oil, food or medicines
- Environmental factors increase uncertainty and may entail discontinuities rather than incremental adjustments in some of the assumptions that we derive from past experience
- These changes are likely to be pervasive and affect actuaries working in all areas be it life or non-life insurance, investment or funds management, pensions and social security, health or Enterprise Risk Management.
- We need to understand, analyse and draw consequences to adapt our methodologies and assumptions in order to provide high quality advice
- As a profession, our role is to help our society and decision makers to become aware of the need for changes and contribute to the optimisation of public policy options

- International Actuarial Association

Actuaries Institute

INTERNATIONAL ACTUARIAL ASSOCIATION
ASSOCIATION ACTUARIELLE INTERNATIONALE

Moving the Profession Forward Internationally

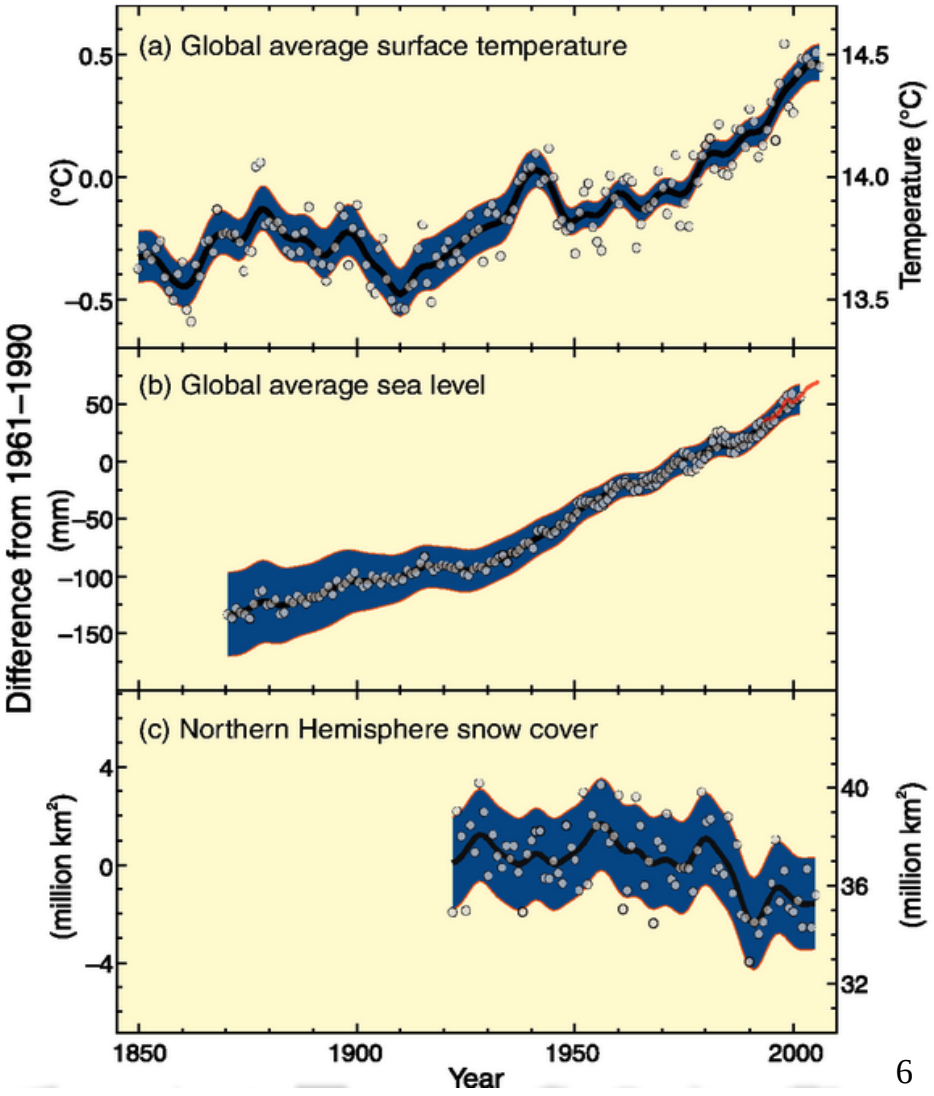
Created in 1895. 63 Full Member Associations and 26 Associate Member Associations, regrouping over 55,000 actuaries in more than 100 countries

IAA Environment Work Group and website set up to

- facilitate collection and exchange of information.
- Make all actuaries aware of multi-dimensionality of challenge and need to recognize future impacts.
- Develop infrastructure to support development of data and analyses, methodologies, guidance and best practices in a timely manner to enhance the capacity to serve the public interest and the quality of professional services

IPCC – Climate Change Update

"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level "



Contributing authors of the 2007 IPCC report included an Australian actuary. Actuarial contributions included impact analysis of extreme weather events on business and local economies.

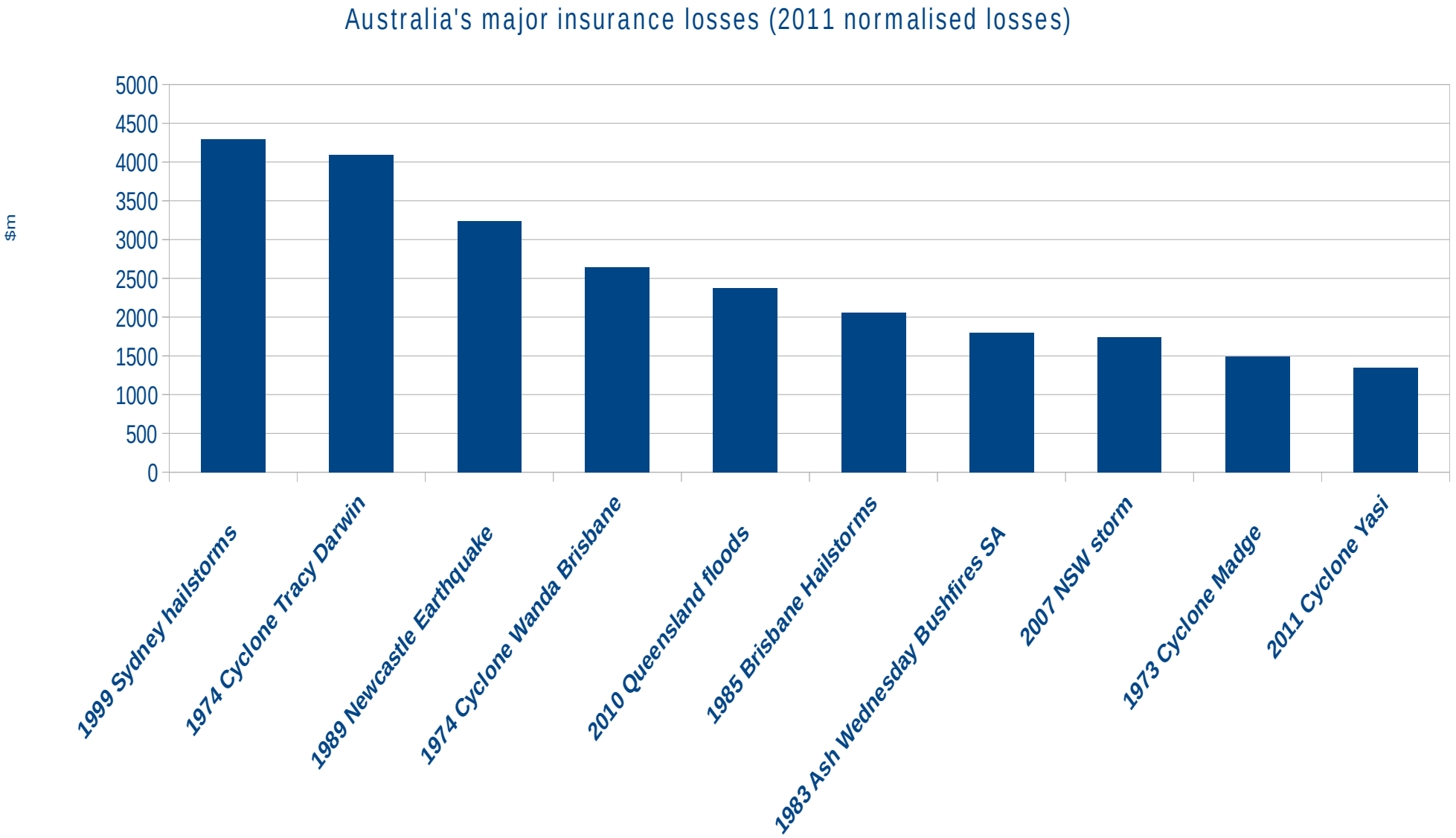
Intergovernmental Panel on Climate Change - 1500 Authors & 1000 reviewers

UK: Assessing risks of climate change

Temperature Change	2°C	4°C	6°C
Increase in average annual insured loss (AAL)	8% £47m	14% £80m	25% £138m
Increase in insured loss from 1-in-100 year events	18% £769m	30% £1240m	56% £2353m
Increase in insured loss from 1-in-200 year events	14% £832m	32% £1920m	73% £4346m
Theoretical Impact on Insurance Pricing* (based on AAL)	**16%**	**27%**	**47%**
Additional minimum capital required for 1-in-200 year flood*	**£1,065m**	**£2,457m**	**£5,565m**

Source - Assessing risks of climate change. Association of British Insurers 2009

Weather and climate core business for insurance

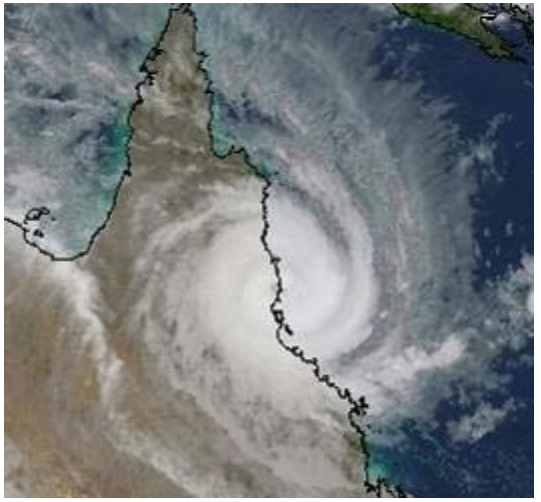


Source: Insurance council of Australia

Australian Climate Modeling

Sydney April ‘99 hailstorm (hail size 9cm+) that cost $1.7bn could become twice as frequent

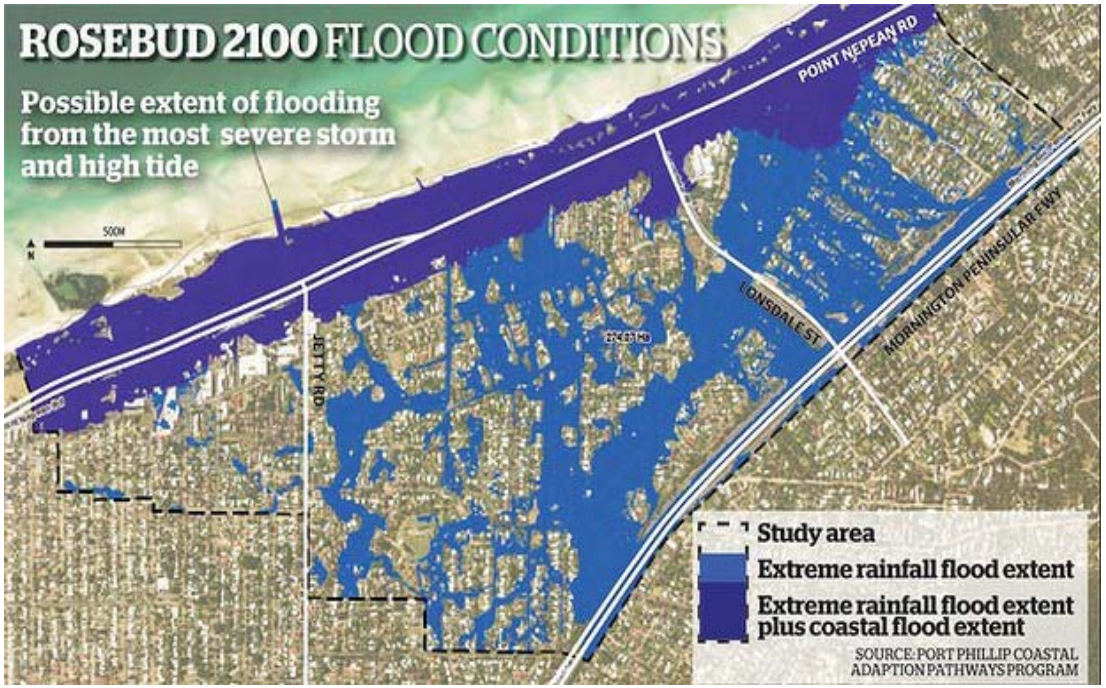
Severe Australian Tropical Cyclones are expected to become more intense & move further south



Double the people exposed to flooding in Australia and New Zealand with 1°C increase

Source: Insurance Australia Group

Forecast Australian Impacts



Waterfront communities from Southbank to the Mornington Peninsula face a damage bill of more than $1 billion from severe storms and rising sea levels over the next 90 yrs, according to confidential climate change report.

Research warn riverfront properties at Southbank are at greatest risk from flooding, with annual cost of damage expected to increase from about $3 mil in 2011 to $20 mil by 2100.

Source: The Age October 21 2012

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general insurance seminar

Tides of Change

12-13 November 2012
Sofitel Sydney Wentworth

Actuaries Institute

The Natural Environment

- **Gaining the Upper Hand on the Weather** - *Tim Andrews, Rashi Bansal*
- **Weather Cycles – What's in it for Insurers** - *Tim Andrews, Sean West*
- **Are You Climate-Proof?** - *Evelyn Chow*
- **How Seismic Activity Changes the Actuarial Landscape** - *Adrian Korbel*

Impact on losses in individual insurance

Hazards	Timeframe	Property (individual and commercial lines)	Engineering (EAR, CAR*)	Marine	Agricultural (crop and livestock)	Motor own damage	Aviation and space	Contingency risks (cancellation of event)	Life and health	Liability
Floods, storm surge	5-10 years	slightly negative	fairly negative	slightly negative	slightly negative	slightly negative	slightly negative	fairly negative	slightly negative	fairly negative
	10-30 years	fairly negative	highly negative	fairly negative	fairly negative	fairly negative	slightly negative	highly negative	slightly negative	highly negative
Storms, flash floods	5-10 years	fairly negative	fairly negative	fairly negative	slightly negative	fairly negative	slightly negative	fairly negative	slightly negative	slightly negative
	10-30 years	highly negative	highly negative	highly negative	fairly negative	highly negative	fairly negative	highly negative	slightly negative	fairly negative
Heatwaves and drought	5-10 years	slightly negative	slightly negative	slightly negative	fairly negative	slightly negative	slightly negative	slightly negative	slightly negative	slightly negative
	10-30 years	slightly negative	fairly negative	slightly negative	highly negative	slightly negative	fairly negative	fairly negative	fairly negative	fairly negative
Less frost and cold weather	5-10 years	generally positive	generally positive	generally positive	generally positive	generally positive	no	fairly negative	generally positive	no
	10-30 years	generally positive	generally positive	generally positive	generally positive	generally positive	no	highly negative	generally positive	no
Rising sea levels	5-10 years	slightly negative	slightly negative	no	no	no	no	no	no	fairly negative
	10-30 years	fairly negative	fairly negative	slightly negative	slightly negative	no	no	no	no	highly negative
Tropical cyclones	5-10 years	fairly negative	fairly negative	slightly negative	slightly negative	slightly negative	slightly negative	fairly negative	no	fairly negative
	10-30 years	highly negative	highly negative	slightly negative	fairly negative	slightly negative	slightly negative	highly negative	no	highly negative
Extratropical storms	5-10 years	fairly negative	slightly negative	no	slightly negative	slightly negative	no	slightly negative	no	slightly negative
	10-30 years	highly negative	fairly negative	slightly negative	slightly negative	slightly negative	no	fairly negative	no	fairly negative
Melting of polar icecaps	5-10 years	no	no	highly negative	slightly negative	no	no	no	no	slightly negative
	10-30 years	slightly negative	slightly negative	highly negative	slightly negative	no	no	no	no	fairly negative

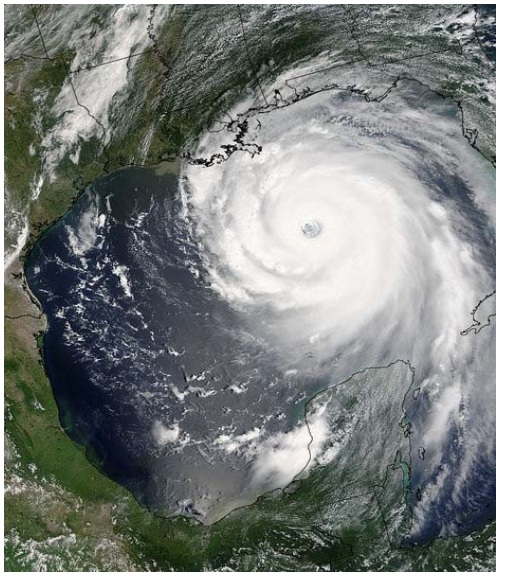
generally positive
no
slightly negative
fairly negative
highly negative

Source: ”Globe of Natural Hazards”, Munich Re, 2009

2005 Hurricane Katrina: Cost of inaction

In 2001 US Federal Emergency Management Agency listed a major hurricane hitting New Orleans as 1 of 3 most serious threats to nation.

Estimated cost of improving levees to reduce threat US $1b over 20 yrs -> Actual cost of Katrina US$150bn (insured loss $45bn)



Hurricane Katrina
Source: NASA

Widespread impacts

- **Floods -** 80% of New Orleans city flooded
- **Deaths –** 1,800 people killed by storm
- **Social** – widespread crime and tens of thousands homeless
- **Oil –**International oil prices UK +3% & wholesale +5% (6/9/05)
- **Taxes -** Mississippi lost US$640k each day casinos closed
- **Jobs -** Approximately 600,000 jobs in New Orleans
- **Reinsurance –** Global reinsurance prices increase

Will the rebuild after Hurricane Sandy adapt appropriately to the changing risks?

Economic framework for the analysis of climate change adaptation options

Methodolody developed bridges the gap between climate science and effective decision making in an uncertain environment

Economic framework enables costs and benefits of each adaptation option to be assessed against other options and the cost of inaction. The frameworking outputs suggest preferred timing of if/when to implement adaptation options for the case studies investigated.

Source:www.climatechange.gov.au/media/publications/adaptation/econonomic-framework-options-20120817-pdf.pdf

Adaptation

Zurich General Insurance's climate risk training for brokers was a finalist in a prestigious national climate adaption awards.

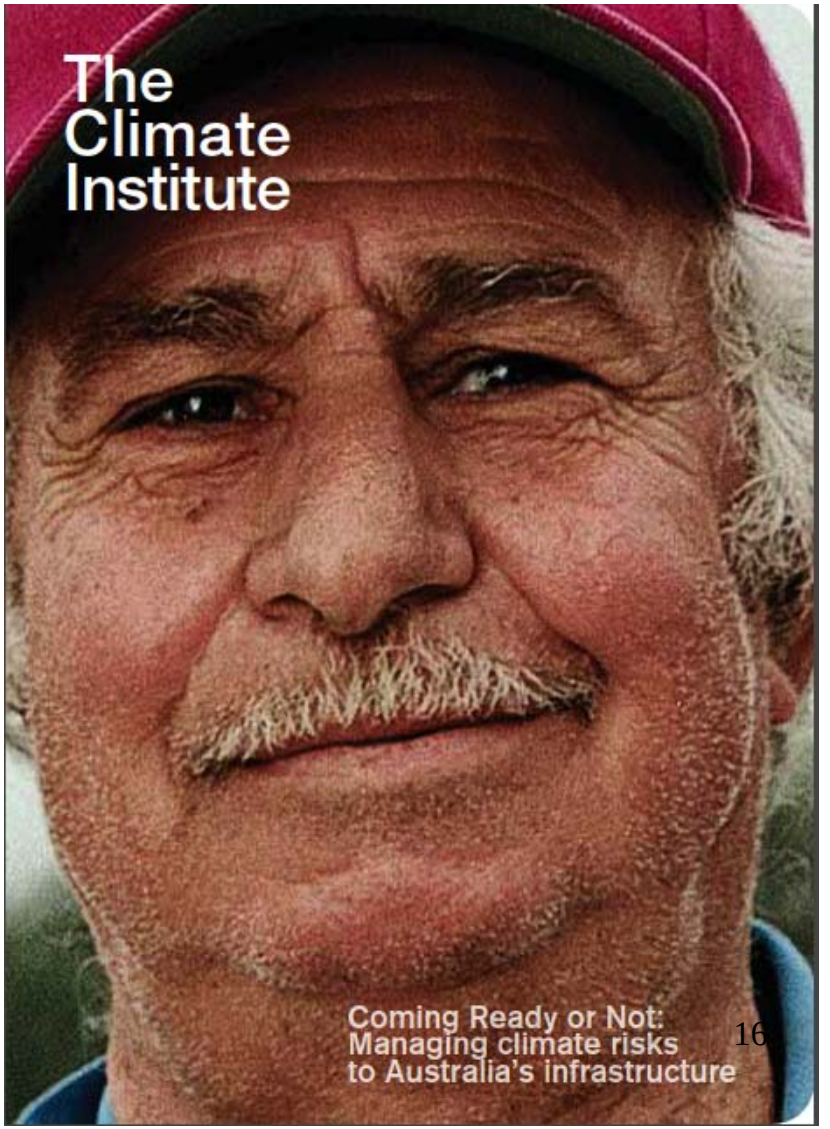
CANUTE THE SEA LEVEL CALCULATOR

ACE CRC ANTARCTIC CLIMATE & ECOSYSTEMS COOPERATIVE RESEARCH CENTRE
Climate Science for Australia's Future

Scientists developed webtool sea level calculator that can guide coastal planners on the height and positioning necessary for infrastructure to avoid inundation and erosion as sea levels rise.

Coming Ready or Not: managing climate risk to Australia's infrastructure

WATER	Systems stressed by flooding Supply risks for water users	Coordinated action taking place Sector-wide collaboration on modelling impacts and responses Investigation of interdependencies with electricity and telecommunications	**RELATIVELY ADVANCED PREPARATION**
PROPERTY	Damage and destruction of property by flood, bushfire Degradation of foundations Impaired health and productivity	Widespread examples of early action but uncoordinated at industry and government levels Regulation and planning suffers from gaps, inconsistency, conflict across and within jurisdictions	**EARLY PREPARATION**
ELECTRICITY	Damage from flood/fire Strain/collapse in heatwaves Impaired health and productivity	Action is at early stages. Examples of cooperation among networks Regulatory framework an obstacle to action.	**UNDERPREPARED**
ROAD + RAIL	Flood-induced washouts Heat induced rail buckling, road cracking Impaired transportation of people and goods	Action is at early stages. Fragmentation of responsibility an obstacle Regulation and planning suffers from gaps, inconsistency across & within jurisdictions	**UNDERPREPARED**
FINANCIAL SERVICES	Insurers directly exposed to increasing costs of extreme events Investors exposed to impacts on assets	Action is at early stages Action not yet translated into market signals	**UNDERPREPARED**



Australian National Disaster Insurance Review -Availability and affordability of insurance

Key recommendations

- Govt agency created to manage national coordination of flood risk management and to operate a system of premium discounts and a flood risk reinsurance facility
- All home insurance policies include flood cover (with "opt – out" option)
- A system of premium discounts be introduced in order that most purchasers of policies in areas subject to flood risk be eligible for discounts against the full cost of flood insurance.

Acknowledging adoption of the recommendations could have significant implications, the Government have said they will consider further the recommendations after consulting with relevant stakeholders.

Gold Coast, Qld © Google Maps 2008

NSW and QLD Government recent changes on adaptation

NSW to revise sea level rise planning rules

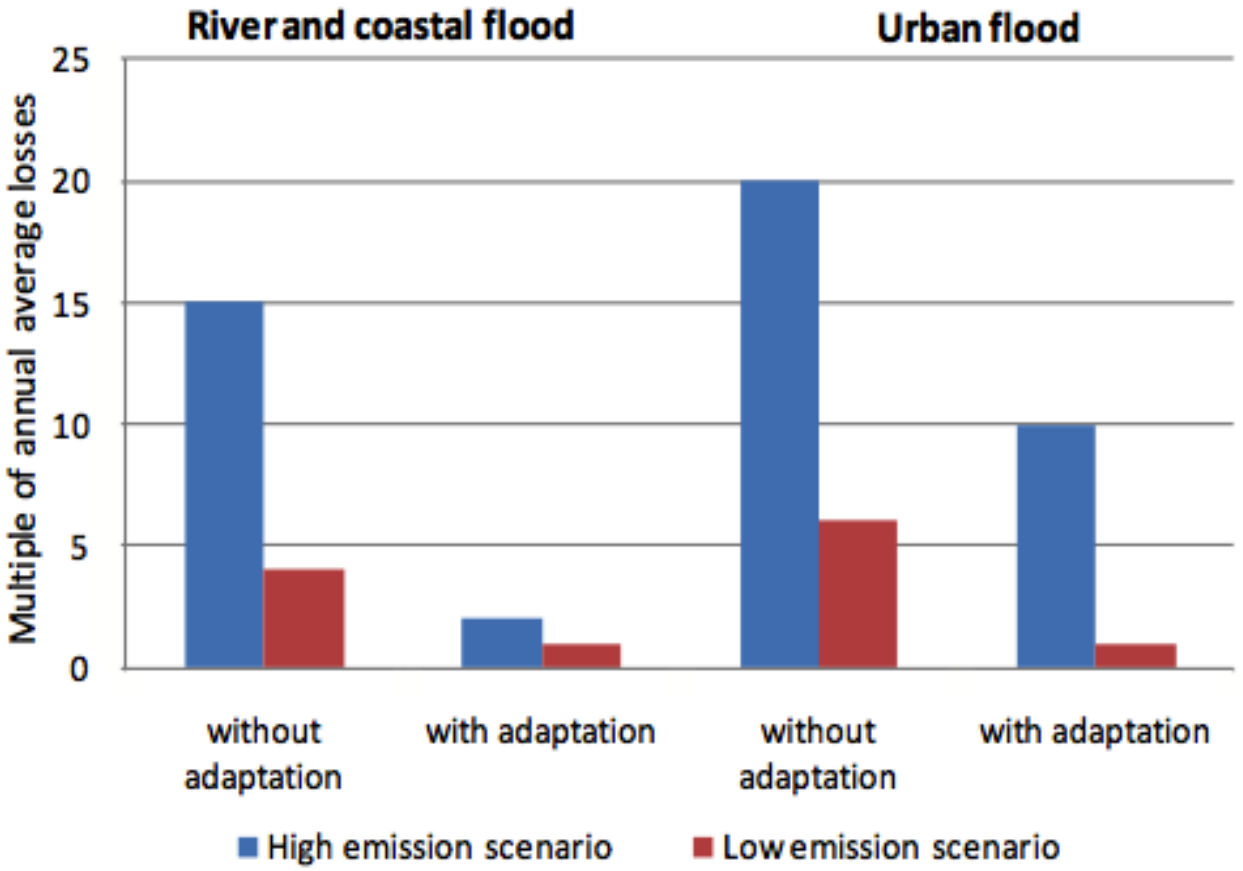
Changes flagged by the NSW Government mean coastal property buyers are less likely to be informed of potential sea level rise risks and council planning will no longer have to be based on statewide benchmarks for sea level rise.

Qld Government suspends need to prepare adaptation strategies

Previously local government authorities had to prepare adaptation strategies suitable to deal with coastal hazards anticipated to 2100 (e.g sea-level rise of 0.8 metres by 2100 and a 10% increase in the maximum cyclone intensity) and to appropriately reflect these in their planning schemes within five years.

UK: Assessing risks of climate change

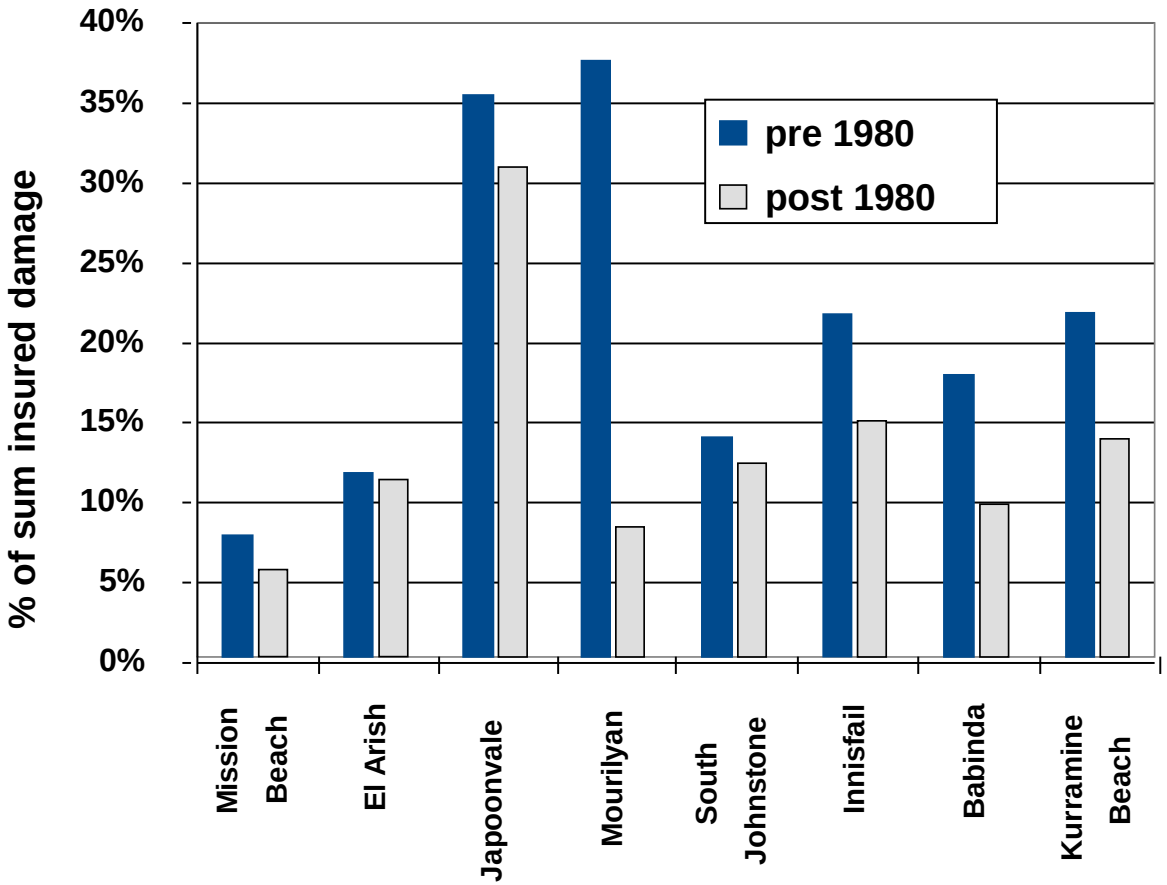
Effects of mitigation and adaptation on economic losses



Source: CEA Adapted from “Financial risks of climate change”, Association of British Insurers, 2005, based on estimates for the UK around the 2080s

Australian adaptation: Building codes can help

Cyclone Larry post-event analysis:
building codes make *some* difference



Source IAG

Recommendation: further enhance building standards to cost effectively protect the property itself and its owner's financial interest

Investments – Strong support for action

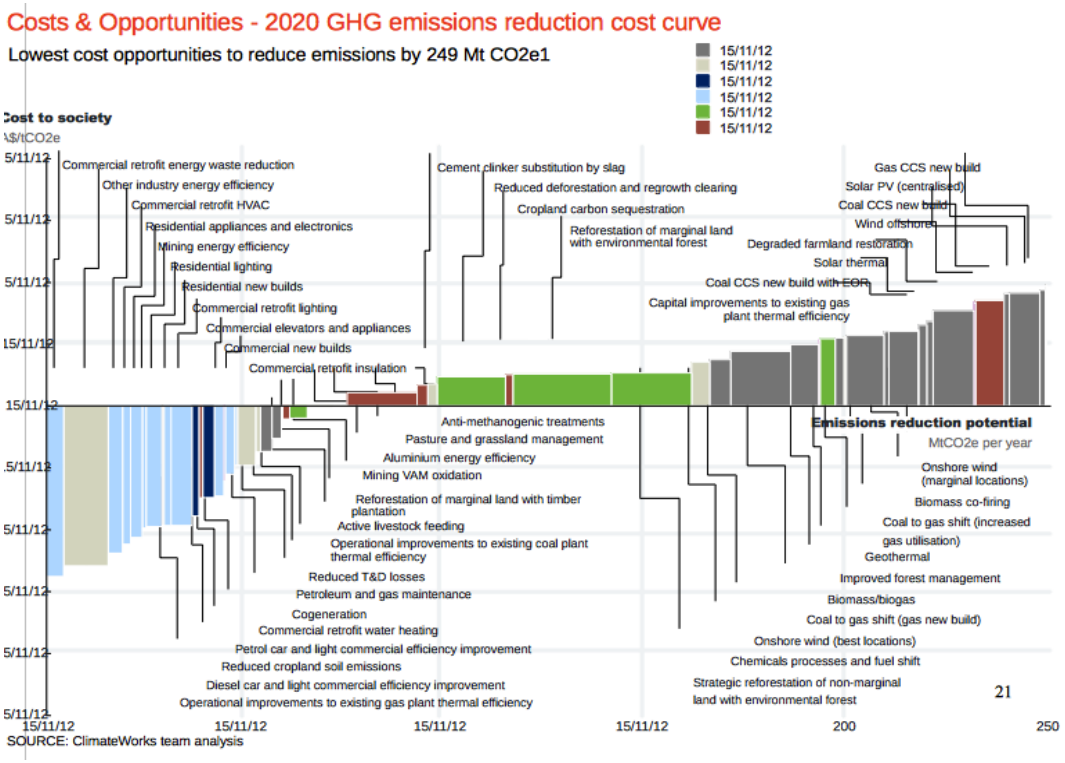
2011 Global Investor Statement on Climate Change
supported by 285 investors representing US$20 trillion assets

- Major long-term risk to global economy and assets in which we invest
- Well designed and effectively implemented long-term policy will not only present significant opportunities for investors but will also yield substantial economic benefits
- Private investment can and must play a critical role however it will only flow at the scale and pace necessary if it is supported by appropriate policy frameworks that shift the balance in favour of low-carbon investment opportunities.

Low Carbon Australia

- Provides financial solutions and advice on energy efficiency projects so as to deliver cost-effective carbon emission reductions
- Operates government backed accreditation for carbon neutral products and organisations
- Funded by Australian government A$100 million (=US$106 million)

- One actuary on Low Carbon Board and another actuary employed full–time in project analysis role (total staff of 29)



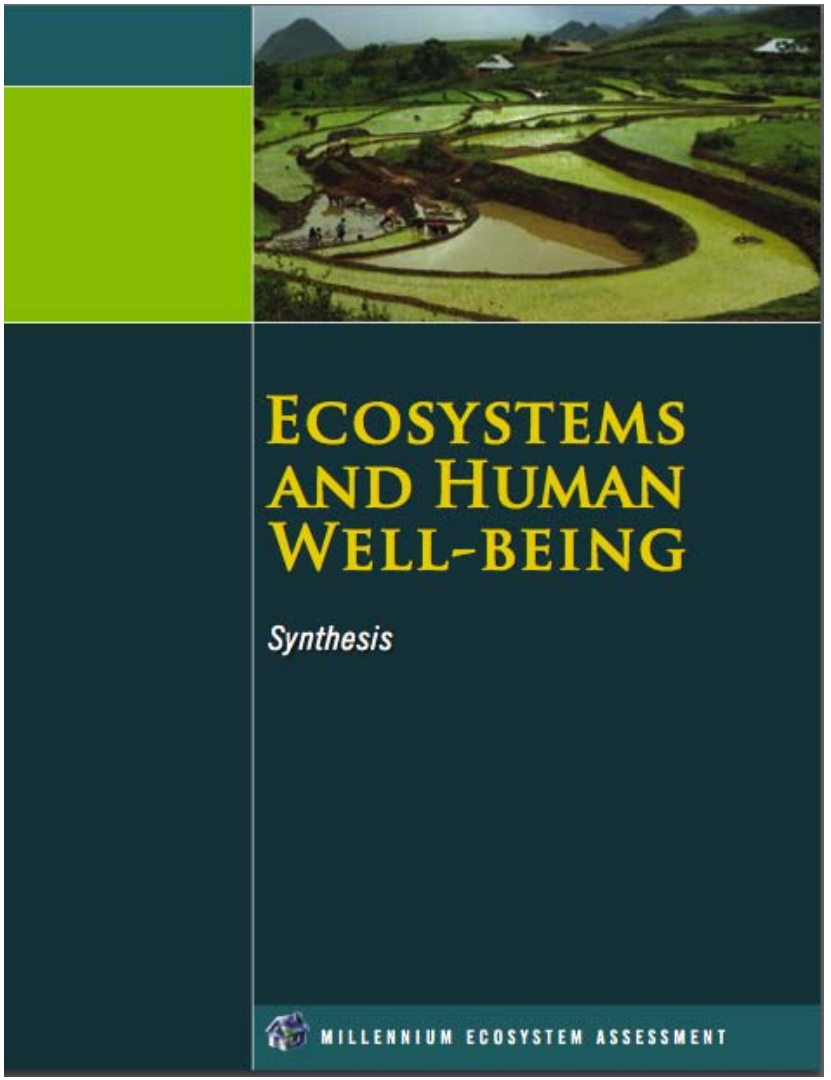
Carbon bubble - stranded assets ?

- 50 yr 2ºC global carbon budget – 886 Gt CO2
- Already used 1/3rd in 10 yrs which leaves 565 Gt CO2 (2010 - 2050)
- But proven global carbon reserves (Co's and Govt) are five times that size 2,795 Gt CO2
- This means only 20% can be used leaving 80% of assets technically unburnable and therefore stranded
- Top listed companies represent around 25% of these reserves so what happens to their value if only 20% of their assets can be used

Source www.carbontracker.org.

Earth treated as business in liquidation

- Millennium ecosystem assessment report (UN) reviewed current status of global ecosystem services and how past and future changes may affect human wellbeing
- Findings
  - 2/3rds of world's ecosystems (that we rely on for food, air and water) are either degraded or being used unsustainably
  - Policy development required to ensure that the environment is used sustainably. Expertise required in science, economics, sociology and engineering
- Earth's balance sheet has to be strong and healthy



UK Actuarial paper – Limits to growth research project

- We face many challenges in 21st century - Climate change, biodiversity loss, oil depletion and other resource depletion. All of these problems are driven by increasing human consumption, caused by population and economic growth.
- The UK Profession has commissioned a research project to determine whether there are limits to growth, and if there are, what might be the impact on financial markets and actuarial advice.

Limits to Growth Research Project
The Kaya Identity

$$I = P \times A \times T$$

I = Impact
P = Population
A = Affluence (consumption per capita)
T = Technology (environmental impact per unit of consumption)

Taking a systems view of the natural and social (human) capitals what do scarce resources potentially mean for the system flows in a global economy and in particular to financial capital? Availability of Energy, Food, Water, Land, Commodities and Social mobility (including migration, equity, health and wellbeing)

Project due to be launched in January 2013.

Source: Dr Aled Jones International Actuarial conference 2012

North America Actuarial Associations

Research project to develop a climate change index

(Phase 1 Sep 2011)

- Educate actuaries, governments, businesses, and public
- A resource in developing predictive loss models as well as for risk management strategies
- To utilise the data and measures of the indicators and index in evaluating the potential risks of climate related changes

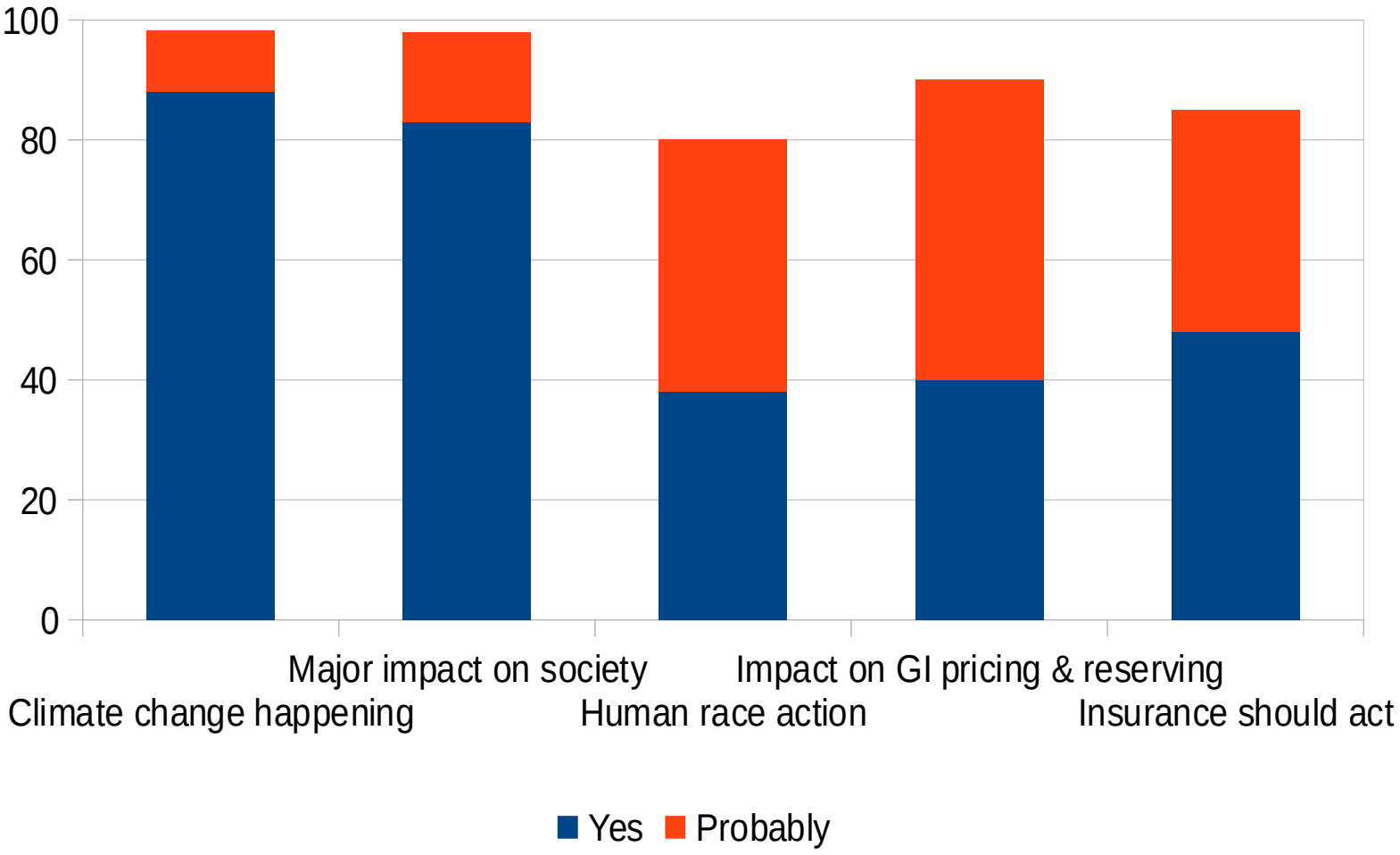
Index would highlight

Hurricane | **Arctic Ice Cover Melting Glaciers** | **Wild Fires** | **Floods** | **Droughts & extreme** | **Intensity ºC**





Survey of Hong Kong Actuaries



Source Actuarial Society Hong Kong Newsletter April 2009

Actuaries involvement ……..

- Energy sector
- Investment and Finance
- Insurance sector
- Input to public policy consultations
- Risk management in long-term contract pricing
- Forestry schemes – permits and pooling/insurance

Final thoughts

The world has a number of serious challenges to deal with.

Actuaries are well equipped to deal with risks, uncertainties and long term effects and can assist in quantifying policy options and optimising responses.

What part might you play in the solution?

Thank you

"The subprime risk was something we should have known about, But we ignored it. We know about the risk of climate change. The risk from climate change is substantially larger than the subprime risk. Continuing to ignore it will bring us a crisis much greater than we are dealing with now."

Mindy Lubber, president of Ceres, a US-based coalition of institutional investors.

"The financial crisis is surely a very powerful lesson that the longer you ignore risk, the more difficult the consequences. People had a cavalier attitude to risk in general for the last 10 years. Let's hope they start taking all aspects of risk a little bit more seriously – and particularly the risks of postponing action [on emissions]."

Lord Nicholas Stern,Former World Bank Chief Economist

Source: Financial Times, The heat is on by Fiona Harvey 2008