Sessional Meeting
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Climate Change

Questionnaire Analysis

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Executive Summary

The profession was invited to respond to a questionnaire on the implications of climate change on actuarial work, which was emailed to members in October 2007. In all 1,140 members responded; indicating a strong interest in the subject. The findings of the survey are as follows:

- Nearly 60% of members surveyed thought that climate change is likely to have some impact on their work. Less than 5% thought that global warming was not happening.

- Two thirds of those responding indicated that climate change will have some impact on investment allocation decisions. Nearly half of respondents indicated that stock selection would be a problem. More respondents indicated that there would be an overall threat to portfolios than thought that it could be ignored.

- A majority of respondents thought that non-life models may need modification, with a significant minority believing we will need new models. However, 85% have not considered the potential increase in the level of natural catastrophes on their clients.

- 45% of those responding thought that it is a matter for trustees to decide whether pension funds engage with companies they invest in on climate change. Interestingly nearly three times as many members thought that it should be standard practice than thought that it was contrary to fiduciary duties.

- The majority of respondents (57%) thought that the profession should provide leadership in promoting the study of the impact of climate change.

- Two thirds of respondents believe that the general insurance industry should be more active in promoting risk prevention amongst policyholders, but 94% had not heard of the ABI's Climate Wise initiative, formulated to do so.

- More than half (56%) thought that there are plausible scenarios that could lead to large losses under some financial products.

Introduction

In actuaries' role as long-term risk managers, climate change may have a considerable impact on some of our work. However, the impact that it might have is not obvious, and so to help move to a view on the implications, the profession surveyed the membership on the issue; this short paper describes the result of that survey.

There is now universal consensus that the world is warming up and will continue to do so – even the so-called "sceptics" agree on this (they are sceptical about the cause). However, the impact on society and the economy is subject to a great deal of uncertainty. We need to ascertain the risks; what they are, the degree of uncertainty, the potential magnitude and the time frame.

Risks that are known can be managed; the question is how? There is no doubt our minds that climate change is a major problem that will affect vast portions of the ecosystem and the global economy. However, for individual companies, or roles within companies, the impact of climate change may be:

- None at all
- Possible impact; but treated no differently than any other risk category
- Unique risk, requiring new solutions.

From the questionnaire responses there are actuaries who believe each of these responses. We find it hard to see how the first could apply, since most companies have investments or pension funds that will be affected by general climate impacts on the economy; such companies or roles may also be impacted by operational issues such as lack of water supply in summer or inability to get to work due to impacts on transportation and finally the fact that they are part of the wider financial services industry that *is* being affected. As an example of the second type a health insurer may wish to monitor new diseases and their predicted increase prevalence, but use traditional techniques to manage the risk. In the third case an insurer of sea side holiday properties may face an aggregation of risk requiring innovative risk management tools in the longer term

Climate change represents an impact on the future well-being of our society. Perhaps the most important question is, do we wish to use our influence, through the assets that pension and insurance funds hold, to affect behaviour and bring about increased awareness, adaptation and mitigation of this serious problem? It is interesting to note that CalPERS, the largest US pension fund has recently used its influence[1] to call for much more climate related impact information from the companies in which they invest. As you'll see a large number of members think this is the right thing to do too, and so do we.

[1] http://www.businessinsurance.com/cgi-bin/news.pl?newsId=11473

The questionnaire

The profession was invited to respond to a questionnaire which was emailed to members in October 2007. In all 1,140 members responded; indicating a strong interest in the subject. The questionnaire consisted of 11 questions with multiple choice answers. Members were also invited to comment anonymously of which 110 chose to do, some responders choosing to reveal their identities.

A selection of comments are quoted in the appendix and in full on http://climatechange.pbwiki.com/questionnaire. By far the majority of the comments were positive about the questionnaire and generally supportive of the need for more research and action in this field.

Most responders chose to answer all the questions: 1137 answered the first question, between 860 and 890 answered all the other questions, except question 7 which was answered by 834 members.

We would like to thank all participants for taking part in the questionnaire.

1. Do you think that, during your career, climate change will have any effect on your work?

	Response Percent	Response Count
No – climate change is a media myth	4.5%	51
No – climate change is real but will have no impact on my work	24.8%	282
Yes – it is likely to have some impact on my work	**57.8%**	**657**
Don't know – need more information	12.9%	147
answered question		**1137**
skipped question		3

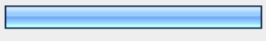
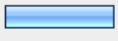
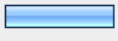
This question was intended as an overall picture of the professions' view; and also to filter out people who would not want to participate in the remainder of the questionnaire.

A higher percentage believed that climate change is real than in the population as a whole. The few who believe climate change is a media myth were disproportionately represented in the comments, for example:

> "Whilst climate change may be a media myth, I believe that the financial impact of the myth will be considerable. Not caused by climate itself, but the population's reaction to constant eco-pressure."

Interestingly, even this comment implies that the phenomena of climate change will still impact actuarial work.

There was a strong positive response, 57.5%, that climate change is likely to have some impact. Practically everyone who completed the questionnaire responded to this question. The other responses must be viewed in the light of this; people who answered subsequent questions are likely to be made up predominantly of those who responded positively to this question.

2. How might investment allocation decisions be changed because of climate change?			
		Response Percent	Response Count
Not at all – it is just one of the many risks faced by investors		14.9%	131
Certain stocks should be treated with caution		**46.8%**	413
It represents an overall threat to investment portfolios		19.2%	169
Don't know – need more information		19.2%	169
		answered question	**882**
		skipped question	**258**

This question was intended to gauge the views of the impact on investments.

Increased natural hazards are likely to have a direct impact on property and certain classes of equity. Other classes may be affected by increased regulation, for example airlines, electric utilities, and large power users, whilst some companies, such as the oil majors, might face reputation damage and legal action macro-economic disruptions, caused by increased water scarcity in many parts of the world, may cause economic disruption, which could affect assets in general.

The economy is currently powered predominantly by hydro-carbons. The required change in energy mix into alternative energy sources will create large winners and losers, of which financial institutions need to be aware.

The consensus on this issue is large; with two thirds of respondents indicating that it will have some impact. Nearly half of respondents indicated that stock selection would be a problem. More respondents indicated that there would be an overall threat than it could be ignored.

3. How might climate change be taken into account in pricing and reserving non-life products?

	Response Percent	Response Count
Not at all – it is just one of the many risks faced by insurers	5.9%	52
Model assumptions may need to be modified	**51.5%**	**454**
It represents a unique risk which cannot be dealt with by existing models	14.2%	125
Don't know – need more information	28.4%	250
answered question		**881**
skipped question		**259**

A majority of you believe that models may need modification. Presumably that means that professionally we are not sure that the models are currently pricing things correctly? It would be interesting to capture how much additional capital is held in this respect. Allowance for parameter and model risk is explicitly required by the FSA. If they don't already, perhaps the next round of ICA submissions will contain a discussion of these factors?

It is interesting that a significant minority believe we will need new models. We'd be interested to know whether your firms are putting pressure on the Catastrophe model builders to create these? Or are they being constructed in-house?

Just prior to the second Iraq war the prices of equity options became very high. Why was this? We believe it was because there were much uncertainty in the investment markets; and uncertainty is priced in financial markets. Surely the same should be true within insurance? It is possible (though the converse is also possible) that climate change has already had an impact on several natural hazards (hurricanes, flood risk and wild fires in particular); in the past we assumed these were stationary processes; now there is a significant risk that they aren't. Isn't it a mathematical fact that the market price of these risks should now be priced higher?

4. Should pension funds engage with the companies they invest in on this issue?

	Response Percent	Response Count
No – it is contrary to the fiduciary duties of trustees	10.4%	91
Yes – if trustees or members wish to	45.1%	395
Yes – it should be standard practice	27.1%	237
Don't know – need more information	17.4%	152
answered question		875
skipped question		265

This question was formulated against the background of the debate whether it was in trustees' fiduciary duty to engage on this issue. On the one hand, it could be argued that trustees have a fiduciary duty to look after the narrowly defined financial interest of pension funds, and it would therefore be wrong to engage on this issue. The other side of the argument is that trustees' fiduciary duty includes beneficiaries long-term interests in a wider sense; pension funds as universal investors should engage on issues, such as climate change, which have externalities on the economy as a whole.

Many felt that it is a matter for trustees to decide (45%). Interestingly nearly three times as many members thought that it should be standard practice than thought that it was contrary to fiduciary duties.

For those seeking more information this paper from Mercers might be of interest. http://www.mercer.com/summary.jhtml?idContent=1189970

5. The Stern Review projects that climate change could reduce global GDP by 20%. To what extent should this be taken into account in your work?		
	Response Percent	Response Count
Not at all	12.9%	113
To some extent	43.1%	379
Fully	8.0%	70
Don't know - need more information	36.1%	317
answered question		879
skipped question		261

Probably the most authorative source on the economic consequence of climate change is the Treasury's Stern Review[2], which I recommend anyone interested to read. The headline conclusion of the review is that climate change could reduce global GDP by 20%. By far the largest group (43%) thought that it should be taken into account in projections. There next largest group requested more information.

[2] http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm

6. Do you think that there should be more leadership from the profession in promoting the study of the impact which climate change will have on our clients?

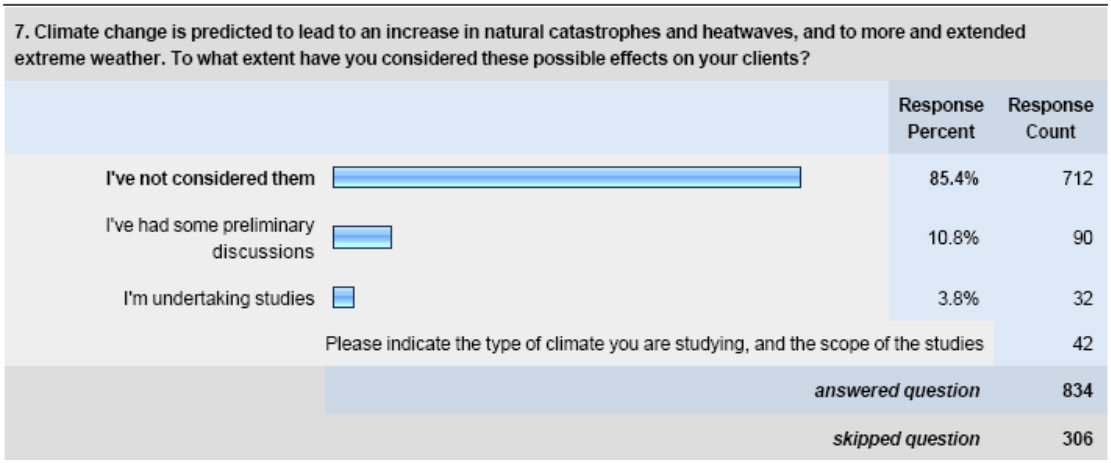
	Response Percent	Response Count
No	12.9%	114
Yes	56.6%	499
Undecided	30.4%	268
Any other comments		99
answered question		**881**
skipped question		**259**

The majority of respondents think that the profession should give more leadership on climate change. Many of the comments concerned this question, for example:

"We have to look at climate change from two different angles.

1. *how it will affect the risks that we deal with -- mortality, morbidity, property insurance, etc, including its effect on the economy in general.*
2. *How we as a Profession handle the ethical side of it. Actuaries are expected to be responsible, and to act for the public good, not just in the fiduciary interests of their clients. We should look at the wider effects of what we do. Wouldn't it be great if the profession could provide a lead to other professions on this, showing that we really are up to date and embracing change. I fear this won't happen, though."*

There was also some concern that the profession should not be seen as jumping on a "bandwagon." The majority of responders clearly think that this is not the case.



7. Climate change is predicted to lead to an increase in natural catastrophes and heatwaves, and to more and extended extreme weather. To what extent have you considered these possible effects on your clients?

	Response Percent	Response Count
I've not considered them	85.4%	712
I've had some preliminary discussions	10.8%	90
I'm undertaking studies	3.8%	32
Please indicate the type of climate you are studying, and the scope of the studies		42
answered question		834
skipped question		306

Its great that respondents were so honest! We believe that a profession that claims to make financial sense of the future ought really to have a view on such an important topic; as should its individual members. Perhaps this is a symptom of the ever growing list of legislation and regulation that removes the time for real risk management?

Many respondents have commented that they "need more information", we hope that the links we have provided for you in this note will help you so that in the near future you will have been able to form a view. As a start why not take a look at the climate change working party wiki:

http://climatechange.pbwiki.com

In our experience, colleagues that have been able to look into this issue have quickly been convinced of the enormity and seriousness of the problem. Graham Fulcher spoke at GIRO and made this point.

8. To what extent do you consider that milder winters and the increase in heatwaves may alter mortality and morbidity rates?

	Response Percent	Response Count
No effect at all	2.1%	18
Small effect which will not be significant	**62.8%**	537
Significant effect which should be further investigated	35.1%	300
answered question		855
skipped question		285

A changing climate will have a possibly unknowable impact on mortality and morbidity. Some diseases will become more prevalent with others reducing. In the UK there may be an increase in deaths from summer heatwaves, and also a reduction in pensioner deaths from less cold winters. A changing climate could also lead to lifestyle changes which may affect mortality and morbidity.

The respondents mainly though that the effect would not be significant (63%), with a large minority (35%) indicating further research is required. Interestingly a number of comments were on this question, for example:

> *"The subject has been discussed in two local U3A groups (Science and Geography) that I attend. There are some differences of opinion between whether recent changes are just the most recent periodic fluctuation, but I think the majority view (which I share)is that it should be taken seriously. The current trend of increasing human longevity is of most concern to pension schemes and other providers of annuities. However, life and health insurers should be aware that the effects of climate change (and associated political conflicts) could lead to future significant increases in mortality and morbidity, and general insurers should be alert to increasing claims (including coastal flooding). All my comments above are instant responses without any research or investigation."*

> *"The impact of climate change on mortality and morbidity is still not seriously appreciated by life actuaries."*

9. Do you believe that the general insurance industry should be more active in promoting risk prevention amongst policyholders?	Response Percent	Response Count
No	7.4%	63
Yes	**66.2%**	565
Undecided	26.5%	226
answered question		**854**
skipped question		**260**

It's great to see so many of you supporting this idea. The climateWise principles have this concept at their heart: that insurers, the public and governments are in partnership to manage risk. We'll speak more about those principles when we analyse question 10 however here is an excerpt which is relevant to this question:

> **"*Support climate awareness amongst our customers***
> - *Inform our customers of climate risk and provide support and tools **so that they can assess their own levels of risk**.*
> - ***Encourage our customers to adapt** to climate change and reduce their greenhouse gas emissions through insurance products and services.*
>
> ***Inform public policy making***
> - *Work with policy makers nationally and internationally to **help them develop and maintain an economy that is resilient to climate risk**.*
> - *Promote and actively engage in public debate on climate change and **the need for action**.*
> - *Support Government action, including regulation, that will **enhance the resilience** and reduce the environmental impact **of infrastructure and communities**."*

A responder made an interesting comment relating to this question:

> *"Re. Question 9 - a significant part of the problem is that construction companies build on flood plains because the land is cheaper. One possibility is for insurers to warn prospective purchasers that if they invest in such houses they will get no insurance - or to warn builders of this and for legislation to require construction companies to advise prospective purchasers that they will get no insurance."*

We'd agree with this statement, though it is politically charged, and would be interested in others' views.

10. Do you agree with the principles set out in the ABI's Climate Wise initiative?		
	Response Percent	Response Count
No	0.8%	7
Yes	5.0%	43
Don't know - need more information	94.2%	805
answered question		855
skipped question		259

The climateWise principles were launched on 13 September 2007. It appears that currently their profile within the actuarial profession is not very high. The principles are a set of statements which companies within the insurance industry can sign up to. So far some 40 companies have signed up including general insurers, life assurers, brokers and asset managers. We've provided a list below. Do you work for one of those companies? If so then your company has signed up to the principles and have said that they will comply with them; they will publish a set of statements annual demonstrating their compliance; you might be involved in preparing these? The high level themes within the climateWise principles are:

- Lead in risk analysis
- Inform public policy making
- Support climate awareness amongst our customers
- Incorporate climate change into our investment strategies
- Reduce the environmental impact of our business
- Report and be accountable

Under each of these themes are a set of bullets which further clarify the actions required. For example under "lead in risk analysis" they have the bullet "Use research and improve data quality to inform levels of pricing, capital and reserves to match changing risks"; an area in which we imagine actuaries will get involved. The climateWise principles can be found at the following website, why not take a look?

www.climatewise.org.uk

The companies that have currently signed up to climateWise are:

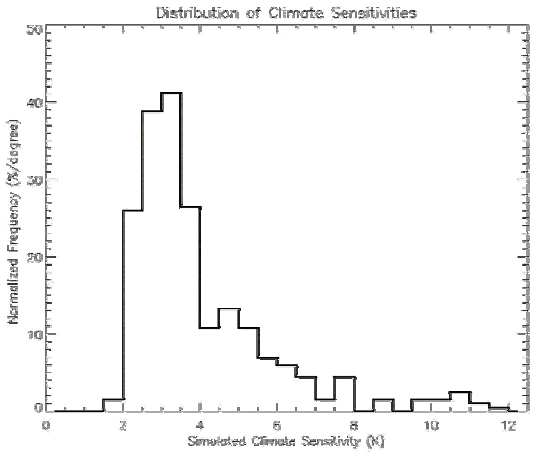
ABI
ACE
AIG
Allianz
Amlin
Ark
Aviva
AXA
Beazley
Benfield
BIBA
Catlin
Chaucer
CIS
Diagonal
Equity
F&C
Friends Provident
Hardy
HBOS
Hiscox
Kiln
Legal and General
Lloyd's
Lloyds TSB
Marketform
Munich Re
Navigators
NFU Mutual
Prudential
QBE European Operations
RBS
RMS
RSA
Standard Life
Swiss Re
UNUM
XL
Zurich

11. Climate change is one of a number of macro-trends which may have a large impact on future economic growth prospects. Others include energy security, political instability and the ageing population. Are current financial products sufficiently robust to withstand future uncertainty?

	Response Percent	Response Count
The future is no more uncertain than the past was	36.3%	307
The future is more uncertain but products are sufficiently robust	7.6%	64
There are plausible scenarios that could lead to large losses under some products	**56.1%**	474
answered question		**845**
skipped question		**269**

Clearly opinions are divided here. A majority feel that some climate change scenarios could lead to large losses; but a significant minority do not believe the future is more uncertain than it was in the past. Personally we wonder whether the current suite of insurance products; particularly those of life insurance and pensions are robust enough. Annuities which guarantee both interest rates and mortality for perhaps 40 years in some cases suggest a confidence which, we believe, is unwarranted. In order for insurers to remain strong into the future we believe that such long guarantee products should be redesigned to give life assurers the opportunity to adapt terms and conditions to reflect changing circumstances in the same way that general insurance does.

Climate scientists at www.climateprediction.net have run global climate models with a large number of perturbed initial conditions. Actuaries are no stranger to this concept as we have long considered the parameter sensitivity of our models. We are also urged to see such model and parameter uncertainty as part of the range of possible future outcomes and to hold capital to allow for these. The shocking fact arising from the climate modellers' work is that there is a very wide range of possible climate sensitivity to a doubling of CO_2 levels. Whilst unlikely, it is possible that a temperature rise of 9-10 degrees centigrade could be observed by the end of this century. This is around the 99.5%ile of the modelled outcomes. The insurance industry is required to hold capital against losses at this level of probability, so as actuaries we are accustomed to considering extreme outcomes like this. Shouldn't governments and politicians also look at the consequences of such extremes and plan to avoid them? We think they should. **It may shock you to realise that a temperature rise of this magnitude is likely to result in the end of society as we know it and possibly the human race**. We are not claiming this is the most likely outcome. But it is a possibility that we should be acting to avoid at all costs. Even a 5 degree temperature risk is pretty horrific and from the probability density above you'd be a brave person to bet against that. It also shows that a two degree rise, or above, is almost certain and that this the EU's *target* level; it seems highly unlikely that this target will be met. For these reasons (and many others) we believe the future is less certain than past generations have enjoyed at least in terms of possible extreme events.



Appendix: Comments on your comments….

A large number of comments were made on the survey, these are available at:

http://climatechange.pbwiki.com/questionnaire

We've picked out a few below to give you a flavour and we have responded to some.

"*We should try our best to mitigate the effects of climate change before it's too late."*

"We should do more to limit our profession's negative impact on the environment, especially with regard to our buildings, communications, travel, choice of conference venues, exam centres and so on. Having an overall neutral effect should be a minimum and we should aim to have a positive effect."

It was great to hear at GIRO this year that (including this years' conference) such events will be carbon neutral in future. We hope the profession follows suit for all its events.

"Would be good if Profession could also liaise with other professional bodies like Accountants, architects, as well as commercial bodies such as Inst. of Directors, to raise awareness of climate change effects in (if possible) concerted ways."

"We need to do more as a profession"

Note there were many comments along these lines; its good to see actuaries recognising this as an important topic. But, surely *we* are "the profession"?. Individuals must make the time to research this subject, and it would be great to see more working parties springing up on specific topics related to climate change. It would also be good to see the profession addressing its own carbon footprint as discussed above.

"'It is worth investigating the financial effect of the political and environmental scaremongering and any subsequent legislation. However, there is no definitive scientific evidence to prove the climate is changing any more now than it ever has so I do not think it appropriate to allow for it in hazard rates such as mortality until such time as any sufficient evidence of climate change can be produced."

We believe this comment is incorrect on 2 counts. Firstly, there is a huge amount of evidence that the climate is changing. The scientific evidence is collated by the Intergovernmental Panel on Climate Change (IPCC)[3], and we have produced a report from an actuaries' perspective[4]. However, we are employed as risk managers dealing with an uncertain future. So it might be the author's personal belief that there is no scientific evidence for climate change, and he/she might have good reasons for this belief. However, it would be incorrect not investigate the possible impact of climate change, as the author must accept that there is a non-zero probability that his/her beliefs are wrong and that most of the world's scientific community is correct.

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[3] See www.ipcc.ch

[4] http://climatechange.pbwiki.com/GiRo07RefuteSkeptics-

"Q8 is a loaded question. Who says that we are really experiencing milder winters or heatwaves to a greater extent than previously experienced? When? In the last 100 years, possibly. But in the last 1,000 years? Last 10,000 years?.....[comment truncated]"
To quote Lloyd's paper "adapt or bust"[5]: "*It is generally agreed that the 1990s was the warmest decade, and 2005 the warmest year, in a millennium….The projected rate of increase in global temperatures for the 21st century is likely to be the fastest of any century in the past 10,000 years.*" These comments were made after consulting leading climate scientists and were based on published peer reviewed work.

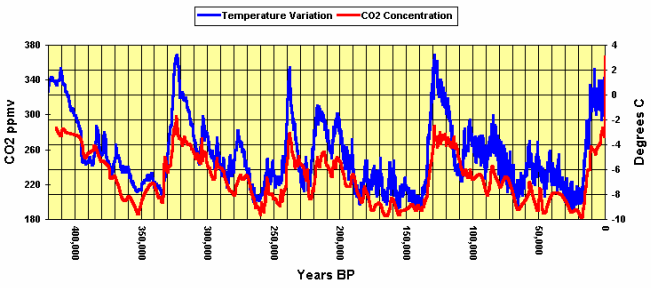
"'I am surprised that so much emphasis is on climate change, rather than the other less controversial effects of consuming the world's finite resources."
We agree that there are other very important factors in the future that must not be overlooked such as peak oil, and most crucially population growth. All these factors interact as well. This comment was made by another respondent too…
"I think there are other issues that are also worth exploring such as the impact of increasing demand for resources (peak oil, high commodity prices etc.). It seems to me that we cannot necessarily assume a broadly linear continuation of long-term historic trends in inflation and economic growth. I think a lot of this ties together with climate change through the impact of increasing number of humans on the planet."

"'Genuine issue, but currently at the height of fashion, so only commit the profession if there is a genuine long-term case for doing so. There's a "bandwagon" risk here."
There were a number of comments to this affect. We think that some in the media would have people believe that there is a "bandwagon". Whilst that may be true in terms of pop concerts held to raise awareness of the subject it is, sadly, not true of the fundamental problem. This is generally agreed to be a long term problem of unprecedented size in human history. Furthermore, as risk managers we must examine the problem and come to a rational decision on if and how it might affect our work.

"'Should we be modelling the affect of rising sea levels on property investments?"
Absolutely. And temperature increase, other flood risk, fire risk (in some regions), extreme wind risk (in some regions). Will the properties held as investments hold their value when tenants can't use them for some periods in a year? How expensive will retrofitting buildings with air-conditioning etc be? Can tenants be found if you don't? What would happen to the value of city property portfolios if the water systems fail in summer (in a heat wave)? These are all being serious considered by the GLA for example (see http://www.london.gov.uk/climatechangepartnership/business-usual.jsp)

[5] http://www.lloyds.com/News_Centre/Features_from_Lloyds/Climate_change_adapt_or_bust.htm

"Climate change is clearly happening. I'm sceptical about the causes. Not convinced that human CO2 production is the root cause. The evidence of the past is very different (temperature rises came first THEN CO2 rises, not the other way round). We need to know more about the causes before we can implement effective solutions."



It is generally accepted by the IPCC that human CO_2 is the primary cause. But your point about CO_2 lagging temperature in the past is well made. In fact it appears from ice cores that there are feedback loops going on: sometimes CO_2 leads and sometimes it lags. It may be that in the past the temperature rose initially (possibly caused by large scale fluctuations in the earths orbit and axis tilt) causing the first increases in CO_2 then leading to more temperature rise and so on. The frightening thing this time is that we have done nature's job for it. We have started the cycle and temperature change is occurring already, this is at a time when we should be going back into an ice age, if normal climate cycles were operating. So we are entering uncharted territory now, at least within the timeframes that human's have experienced.

"Models rarely give results people do not want....."

Good point. Though I have to say we don't want the temperature to globally increase by 5 degrees and this is a distinct possibility; so models tell us. If anything some scientists and certainly the consensus building approach of IPCC have been ruling out some of the more extreme possibilities; rather than overstating them.

"Thank you for taking the time to ask our views."

It's our pleasure! Thanks all of you for taking the time to respond.