

October 22, 2021

Dear Karl,

Thanks for the open letter. You raise a series of comments that I should respond to. I am afraid my response is very long so I could address all of your comments. So, before I start, I'll summarise my key points:

1. I have not commented or criticised anyone's capacity to assess current risk. I have not commented on any specific company (e.g. XDI) in anything I have written.
2. It seems to me that any assessment of future risk at a city, postcode or property level should provide full and auditable detailing of the uncertainty implicit in the assessment such that any user of the data are confident that their decisions are well informed.
3. As a climate science academic I have a responsibility to promote the appropriate use of future climate information. Any commercial company claiming to be able to guide users on future climate risk at a city, postcode or property level should provide evidence in support of their methodology. A company proving they can robustly assess future climate risk is presumably at an advantage in the market relative to those who cannot.
4. Any organisation using any information concerning *future* climate related or climate-change informed risks should understand the detail of the products they are using. There should be clear and robust uncertainty estimates and full disclosure of uncertainties; these are material aspects for the users. Otherwise, decisions by, for example, company boards may not withstand legal action or formal audits.

So, my challenge to any provider of future climate risk information at a city, postcode or property level is to demonstrate that the sign of the change in each element of material risk is robust, or include a full disclosure of the uncertainty in the estimates so that no customer is misled. In the following, your original text is in black, and my responses are in red.

I am compelled to respond to your comments on LinkedIn and in the media regarding the recent study released by the Reserve Bank of Australia (RBA), and regarding the Australian Prudential Regulation Authority's (APRA) work to guide climate-related financial disclosure. Overall, your comments directly undermine work being done to identify communities at high risk from extreme weather and climate change.

I would contest any suggestion that my work or comments undermines work being done to identify communities at high risk from extreme weather and climate. What I have done is commented, in several fora including peer-reviewed literature, that some methods being used by some companies misrepresent future risk. If my comments undermine any group misrepresenting future risk then I am sure we would agree that is an appropriate contribution. I would comment that I have not spoken to the media about the APRA work. I wrote a letter to APRA that they released under FoI and I did not speak to the journalist.

To propose that "if you live in one of the areas mentioned don't stress" is, I believe, grossly irresponsible and highly misinformed. I would ask you to reconsider these comments.

I have reconsidered those comments and I stand by them. The piece being referred to was in the Sydney Morning Herald – see <https://www.smh.com.au/politics/federal/climate-change-to-deliver-suburban-house-price-pain-rba-20210920-p58t5v.html>. Some reading this would have a nuanced

view of the information content in the associated RBA report, others would not. The following is a figure from the report:



From:

<https://www.rba.gov.au/publications/bulletin/2021/sep/pdf/climate-change-risks-to-australian-banks.pdf>.

There is no *climate* related risk that maps onto Sydney in this way. The large area north of the harbour is at higher risk from bush fire than some other suburbs, but only at the bush-urban interface (not across this whole region) . If I owned a property in some parts of this area I might be stressed about the existing risk but if I lived in the large areas shown in grey my stress levels about climate change would be similar. Evidence that the identified area is at risk from *future* changes in meteorological hazards is very limited. In short, my statement that if you are living in this area do not stress about the RBA report is founded in the lack of robust climate science that informs us of changes in climate related risks at this scale moving forward. I would be far more worried if I lived in some of the grey areas near a river, near the ocean, in far Western Sydney and so on relative to most of the area shown as orange in the figure.

If this figure was an academic exercise I would not comment, but the suggestion is that this might lead to higher insurance or “lower house prices”. What would stress me would if insurance companies used this analysis to adjust policies in most of the areas identified in orange. Fortunately, insurance companies have a more nuanced understanding of risk than implied in the RBA report.

In reading the report noted above, I could not see how uncertainty in the estimates were propagated through the analysis. If this was an academic paper I would ask the authors to prove the figure was robust to assumptions, future climate risk estimates and so on and I would expect those uncertainties to be clearly discussed. I accept that may be different in an RBA report but that does not stop me asking, or querying the methodology.

Last summer 34 Australians died in bushfires, thousands were left with damaged homes and many financially ruined by flooding because they were unable to afford insurance. The areas affected are in fact highly consistent with high-risk areas identified by XDI and Climate Valuation (and used by RBA).

My comments were around the ability to project future risk associated with climate change in the RBA report, not around *current* risk. Since it is not clear if the extreme dryness associated with the very high fire risk during the 2019/20 Black Summer was associated with climate change raising the emotive issue of these fires is not relevant. I would also note that my memory does not suggest that the areas identified by the RBA report, built using XDI and Climate Valuation, corresponds at all to the areas that were affected by fire. There was no fires across the north shore of Sydney in that fire season at a significant scale.

So, in the context of my comments it is *simply not true* to assert that the high risk areas identified by XDI corresponded to recent fires. Other work by XDI may have clearly identified those areas that did burn as at high risk, but that information is not something I have seen and so I cannot comment.

Evidently, we do have insightful data on location specific risk.

You may well have insight into some risks in some locations, but you do not have robust data into future risk as it relates to most drivers of future climate risk. No company or indeed scientist knows the direction of future risk *at a location*, or the magnitude of risk *at a location* for most meteorological risks (I would generally exclude some statistics of heat and sea level rise) .

More importantly, as professionals working in the field of climate change, I believe we have a moral obligation to use what we know to warn people, communities, business and governments about the risks they currently face – many of which may be worsening with climate change.

That is a legitimate perspective where one knows the direction (the sign) of the changing risk at the spatial detail you purport to offer. For some risks (sea level rise, fire in close proximity to forests, direct risk of heat) we know the sign of the change and have ideas around the magnitude. For some risks (associated with rainfall, flood, hail, wind, lightning strike etc) we do not know the *sign of the change* at the *level of a location*. In my view, providing warnings to people of a change when one does not know the direction of the change is not informing them of emerging risk.

I would also note that any company misrepresenting future risk, and adding to concerns and stresses of home owners and the mental health of communities might reflect on “moral obligations”.

Finally, I would note I have been engaging with Boards, businesses etc for decades communicating climate risk, what we know and do not know and how we might link climate science and business. I communicate without fear or favour and would suggest that my moral compass is well calibrated.

I find your comments surprising since your organisation has received \$30m for research “to make Australia more resilient to climate extremes and minimise risks from climate extremes to the Australian environment, society and economy”. Our work is to the same end, as are APRA’s draft guidelines for climate risk reporting.

Agreed, but this comment is a little misleading. My group strives for understanding and the application of knowledge to the extent possible. XDI are a commercial company that seeks profit. I am not sure therefore our work is necessarily “to the same ends”.

My group has indeed been funded to do the science to enable these goals. This (rather strongly) suggests that the science community does not think that is currently possible (in general) . So, one can suggest that the funding of a research centre in this area is clear evidence that new understanding is required.

A critical question is, where does one invest the adaptation dollar to reduce risk. If one invests it in the wrong place one has (a) wasted that investment and (b) not invested where adaptation was required. This is not an academic issue – investment pathways are changing as a consequence of perceptions around changing climate risk. I have a moral obligation to confront any misuse of climate information that leads to erroneous estimates of risk.

Your specific concerns about the extent to which downscaling can be meaningful are insightful and worthy of proper consideration, which I will address below. But I believe it is entirely misleading to use it as a pretext to dismiss a large body of engineering and hazard-based risk analysis. Our methods, data and software have been in continuous development for over 10 years and I am unconvinced you have the breadth of knowledge to critique the full extent of the work that physical risk analysis entails.

I do not dismiss the large body of (excellent) engineering and hazard-based risk assessment that has been done for many decades. My comments are how one takes existing methods and moves them into assessing future risk in a non-stationary climate.

While atmospheric physicists like yourself may not be able to generate property-level insights, our cross-disciplinary team can and does.

I am a long way from being an atmospheric physicist! But thanks for the compliment.

I contest the statement your team can generate property-level insights *in the context of future climate risk*. I completely agree your team can provide property-level insights *for the current climate*.

Of course, you can generate *precise* information at the property level. However, the models I use can provide information that is precise to 30 or more significant figures. That does not make that precision *accurate*. So, I agree you can provide “property level insights” but what you cannot know is how good those insights are under a future climate.

The team that produced the data on which the RBA based its analysis includes engineers, geologists, hydrologists, mathematicians, statisticians, climate scientists and financial analysts. The same team works with some of the world’s leading banks in Europe and Asia, as well as with governments and institutional investors, to build resilience in critical infrastructure and the global economy.

That may be the case but none of this makes the case that you can provide accurate property level risk assessments in the context of a *changing climate*. Again, I make no inference on your capacity to assess risk in the present.

This has been driven by the global movement toward climate risk reporting following the international Financial Stability Board’s Taskforce for Climate Related Financial Disclosure (TCFD) guidelines.

Agreed. The fact that there is a “global movement” around reporting is welcome. My concern is what is being reported and whether any of these processes properly assess future climate related risk.

The TCFD initiative and the resulting wave of regulatory pressure (such as APRA’s draft guidelines) is one of the most significant moves of recent times to stem runaway climate change. It’s a powerful and positive catalyst for corporate climate action globally, and it’s gaining momentum. It is therefore critical that analysts use the best available information to influence decision making at the highest levels of industry and government.

I fully and unambiguously agree – and would nuance your comment that “analysts use the best available information” with “analysts use the best available information to the extent that it is reliable and fit for purpose”.

We applaud APRA’s and the Bank of England’s leadership, and the actions of the French, New Zealand and Canadian governments toward mandatory reporting. We look forward to being part of the robust reporting solutions that enable other governments to do the same.

I also applauded APRA’s steps in this direction. I wrote to support APRA’s leadership. It is not *what they are doing*, rather it is *how they are doing it* that I would question.

Climate risk analysis needs more than climate science

In the interests of bridging the gap of understanding between your work and ours, I'd like to take a moment to dispel any incorrect understandings about property level acuity, because this issue is very important. It is at the level of individual homes and businesses that real people are at risk, and equally where we have the opportunity to help get these people out of harm's way.

I fully agree.

The fundamental flaw in your assertion that climate change modelling data cannot be used for asset or address level risk analysis is that climate data is at the centre of the analysis.

I have read widely on the methods used, to the extent that these are available without signing commercial in confidence agreements. I do not think there is a "fundamental flaw" in any of my comments. I obviously understand that the climate data is not the foundation of the methods used.

If it were, I would agree that the spatial limits, uncertainty and 'noise' of limited data sets would be overwhelming. Instead, it is necessary to call on other data sets, other fields of knowledge and other mathematical techniques to build a solid foundation of present-day exposure and vulnerability to physical hazards. On this foundation our team then applies climate modelling to provide additional insights.

Agreed. The question is whether the addition of climate information adds "additional insights" or adds "misleading, or potentially misleading information".

To undertake robust asset level physical risk analysis there must be an understanding of three factors: the vulnerabilities of the asset; the hazards to which it is exposed; and how those may change in the future due to climate change.

And one would add "the capacity of an agent to manage vulnerability but happy to leave that dimension for a moment.

Vulnerability analysis is primarily an engineering skill set which considers the materials from which properties are constructed and the design specifications used to bring these together.

A large body of social science would not agree but happy to leave this for now.

Hazard analysis can draw on hydrology, geology and satellite mapping of the biosphere and requires the accumulation and management of large data sets. Hazard data is often highly localised and needs to be. For example, the technology exists to tell the difference between the side of a street that gets flooded when a river overflows and the side that does not.

Yes - agreed

By bringing existing vulnerability and hazard information together in our computational system ("Climate Risk Engines") we are able to compute baseline levels of risk.

To a degree, based on the richness and reliability of the data you have at the level of granularity you use. So you can calculate a wide range of "baseline levels of risk" with uncertainties of course. This

is, of course, about the present day risk. I do not think I have ever criticised the capacity of any organisation to calculate risk *in the present*.

The Risk Engines can test if a wall is made from concrete and therefore impervious to flooding or lined in plasterboard and ruined by water. We can test to see if a property is likely to get inundated by high seas or is sufficiently elevated to avoid inundation. We know that a property built in the 1970s will not withstand a cyclone like a property built-in 2010. In this way we can identify properties that are at risk from a range of extreme weather events.

Yes – sure, but this is about calculating the risk *now*, in the *present*, and not in the future.

Dealing with uncertainty

Then and only then do we consider if climate change impacts may worsen the current risks. As you know, Global Circulation Models operate at the 100s of kilometre scale, while Regional Climate Models can only achieve resolutions down to 10s of kilometres. You correctly point out that the reliability of downscaling has to be questioned and managed. Sometimes, a long-term trend can be identified, e.g.: an increase in heatwaves, more frequent severe rainfall events or a rise in fire weather conditions. This can be used to provide a forward outlook which includes climate change exacerbation. Sometimes no trend is clear, the variability is large, or perhaps hazards even appear to diminish. Often different models have different outcomes. All of these issues have to be managed and communicated. We see our job as understanding the ‘risk envelope’ from these models, so that decision-makers can plan for all possibilities.

Agreed – but the issue is mis-stated here.

Take situation X where the risk to a property is defined well by existing vulnerability at the asset level and via existing hazards and no change in climate eventuates at the property level. Here, adding any climate change surface from the models reduces your skill.

Take situation Y where the risk to a property is defined by existing vulnerability at the asset level and by existing hazards and a change in climate eventuates at the property level. Here, adding any climate change surface from the models affects your skill – improving it where the models are right, and reducing the skill elsewhere. So, adding the climate change signal will improve your assessment in some areas, and degrade it in others and you do not know which is which.

In short, I have no issues with the assessment of *current risk*. However, when adding the change in risk associated with climate change you have two scenarios:

(a) you know the sign of the change. True of temperature and temperature extremes, and sea level and you can manage the magnitude of the change via scenarios. I suspect how you add climate change to your system adds value here.

(b) you do not know the sign of the change. Take rainfall. For an event of a given size, climate change would increase the intensity of that event *all things being equal*. Of course, “all things are not equal” and so in some places changes in synoptic (or weather scale) phenomenon will reduce the risk of a severe rain event, and in some places enhance it. This is not robust in any climate projections because the models do not simulate weather scales. Downscaling these climate projections do not overcome those limitations. In these situations (and this is true of wind, rain, hail, lightning strikes, flooding, possibly bush fire risk adding climate change to your system will potentially mislead.

In short, for most meteorological hazards, at the property (suburb or city) scale it is not merely the magnitude of the change which is uncertain, it is the *sign of the change* in the future that is uncertain.

In practice, that means that we start with a baseline position of risk which we assume provides a 'risk floor' for each hazard, then we look at the highest levels for driving parameters from the climate data as far as 2100, which provides 'risk ceiling'. We communicate to decision-makers that this is the range of futures we can see so far.

Except you do not know if this ceiling is appropriate – you do not know if it's too low you're your data encourages future vulnerability, or too high and lead to maladaptation and over-investment. You do not know if the future change is robust *at the property (suburb or city) level*. Of course, it is trivial to calculate a ceiling but calculating an appropriate ceiling that reflects both risk and the uncertainty in any assessment of risk in a future climate is not possible *at the property (suburb or city) level*.

I have hear it said that “some information is better than nothing” [not by you – by others]. I suggest, in the context of *property (suburb or city) level risk associated with climate change* this is profoundly wrong. The uncertainty is so high at the *property (suburb or city) level* that it has no information content and if used to help decision making, pricing of risk or similar things there is too high a risk of perverse outcomes and fundamentally wrong decisions.

We are aware of the limits of climate data and are contributing to research to understand uncertainties and increase efficacy. We are currently embarking on an internal project to use 'spatialisation' to increase the amount of climate data to inform trends for a given location. We have also sponsored a Ph.D. in statistics and data science at the University of Newcastle to investigate uncertainty in the processes of computing extreme weather and climate risk.

All very welcome

But while we strive to constantly progress the state-of-the-art in physical risk modelling, we remain committed to using what we have available now to drive better decisions in the face of climate risk.

Yes. Agreed. It is your assertion that your methodology adds value at the property (or suburb or city) level in the future that I contest. It is my assertion that we do not know the sign of the change in most extreme events at the property level and therefore you might be adding risk where it is not needed, and hiding risk where it is real and you do not know which is which.

This does not matter in an academic sense. However, it matters a great deal when it leads to different decisions on managing future risk. It leads not to “better decision making”, but rather it adds the high likelihood of maladaptation to risk and a failure to manage material risk in most locations.

It takes many actors to change the world

While I understand the importance of your work in fundamental climate science, our work to get this science into a form people can use is equally important. This year our team has undertaken analysis on nearly 37 million assets around the world. Every month we provide hundreds of free reports to homeowners wanting to check their risks from flooding, high seas and forest fire. It was our team that undertook the climate heat-stress analysis referenced by Federal Court Justice Bromberg in this year's landmark court case deciding that the Minister for the Environment has a

duty of care toward Australia's children. In many instances we have made this data available at no cost.

This is not relevant. The question is whether the 37 million assessments are reliable, or add value and do not mislead decision makers. It is not relevant if people use your data, or believe your data. What matters to me is whether the data is reliable or robust.

I have greatly appreciated your work and leadership on climate science in Australia. But as the world sprints toward dangerous climate change this is no time for turf warfare or taking aim at those institutions working with critical sectors of our economy to mitigate impacts to people's safety and financial security.

There is no turf war. I have nothing to sell, I am not in competition with you. I provide no commercial product. I see major needs for exactly the same as you – mitigating risk to people's safety. The question is, at a property (or suburb or city) level, whether there is information on future extremes that provides any useful characterisation of that future risk in most instances.

I am sure you would agree that if I see misrepresentation of future risk I should call it out. I am sure you would agree that those institutions you note above should be aware of limitations to commercial products and that it the responsibility of people like me to highlight those.

As a climate scientist I seek to see science used appropriately and to the extent possible. To the degree that any business uses climate model data appropriately I have nothing for admiration for their innovation. However, I am a scientist and I will call out misuse of climate model data where ever I see it. This is not a "turf war" – this is what scientists do and my assumption is any group planning on using any future climate risk product would undertake rigorous examination of the information content of that product.

So, it is not clear to me why there is an issue with my comments. If any commercial organisation is undertaking scientifically robust analyses, they should be able to demonstrate this explicitly and reproducibly and counter my comments to any customer.

Any commercial supplier able to demonstrate the robustness of their methods benefits in the market as a consequence of my comments. They can demonstrate that their methods are rigorous and add value and those companies that cannot presumably are out-competed.

So, given you would assert that XDI are rigorous and do add value are my comments not useful in ensuring customers ask the right questions so you can demonstrate this, and some competitors cannot? I hope your customers are asking you challenging questions, looking under the hood so to speak and challenging your methods. Surely, you would welcome this?

Ultimately, a company will be responsible for decisions they take. They might be audited. They may face legal action that stems from decisions taken using estimates of future climate risk. All I have asserted, really, is "buyer beware", "due diligence" and make sure you understand exactly what you are getting and what its value is. I am not sure that this is anything other than good practice.

Instead, I firmly believe our community of scientists must use the time we have to work together, play to one another's strengths, constructively fill gaps and weakness, and support those who can use our skills – from the CEO of the RBA, to a person living out their senior years in a caravan park.

Agreed. “Play to each other’s strengths”, and freely criticise where anyone misuses or misrepresents each other’s strengths.

I hope this note has dispelled some myths, better informed people who follow your comments about what companies like XDI and Climate Valuation do and why, and perhaps provided some pause for thought about the importance of how we all manage our differences.

Not sure it has I’m afraid. I would assert that I did not raise any myths for you to dispel. You have made a series of statements that I strongly agree with of course but are not associated with anything I wrote. Most of your open letter points to how you assess *current risk* and I have never commented on that.

I reiterate that my comments have not targeted any specific business. I know that many businesses seek to understand climate risk, how this might change, to strive to connect the physical climate science to customers etc – in many cases because the climate science community has not done this.

The climate science community has typically not done this because their assessment is that it is premature. Internationally, the science community is striving for weather resolving climate models – running at resolutions that capture the interactions between synoptic systems, fronts, the formation of key phenomenon and so forth. Why are there massive programs in Europe and the USA for weather resolving climate models? Because we *know our existing models fail to do this and fail to capture the extremes that threaten systems*. The science community is not doing this for mere scientific inquiry – it is doing it *because we know our models are fit for some purposes and not for others*. To the degree that any business uses climate model-based data to assess property (suburb, city) scale risk I would ask them why the science community is striving to deliver first estimates for how extremes might change at this scale when some businesses have miraculously managed to do it already.

I look forward to ongoing discussions as we strive to do the best we can to solve the greatest challenge of our time.

No problem. I note I have raised all of these issues with you in person and as you note above “we remain committed to using what we have available”.

I respect the need for business to head down particular lines for its own commercial interests. Equally, business needs to respect scientifically well informed voices that open lines of discussion on these issues. The fact that one *can* process data and provide a product does not mean one should. I fully accept that you will “remain committed to using what we have available” and I hope you will understand that I will do my best to align the use of climate change information towards what it is fit for, and contest those areas where anyone is using it for purposes that it is not fit for.

Best wishes,

Andy Pitman