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The IPCC Special Report on Global Warming: The Great Divider

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Twenty-eight years on from the First Assessment Report in 1990, the IPCC's most recent *Special Report on Global Warming* delivers an urgent warning to policymakers that we are reaching the point of no return for mitigating anthropogenic impacts on global warming and associated climate change. The report has divided opinion in Australia and further highlights the polarising power of climate change across government, academia and industry.

The report finds that limiting global warming to 1.5 °C, although "possible within the laws of chemistry and physics", would now require rapid and unprecedented change in all aspects of society. Global net human-caused emissions of CO_2 would need to fall by approximately 45 percent from 2010 levels by 2030, reaching 'net zero' around 2050. This means that any remaining emissions would need to be balanced by utilising as-yet under-developed technologies to remove CO_2 from the air.

The report also highlights that we are already seeing the consequences of 1 °C of global warming through more extreme weather, rising sea levels and diminishing Arctic sea ice. One of the difficulties in communicating the impacts of seemingly small increases in mean temperatures is related to how this affects extreme weather events. The immediate reaction of many to "a 1 °C temperature increase" is to imagine oneself lying on a beach at 24 °C and then at 25 °C with global warming. Not that bad, right?

The key notion is that a small increase in the mean temperature also shifts the tails of the distribution, meaning the probability of extreme weather events increases just as much – and sometime more (depending on the shape of the distribution) – as the shift in the mean temperature (Figure 1). Prof Andy Pittman, the director of the ARC Centre of Excellence for Climate Extremes at the University of New South Wales, describes this nicely in an anecdote to BBC News back in January:

"the probability works a bit like if you stand at sea level and throw a ball in the air, and then gradually make your way up a mountain and throw the ball in the air again. The chances of the ball going higher increases dramatically. That's what we're doing with temperature."

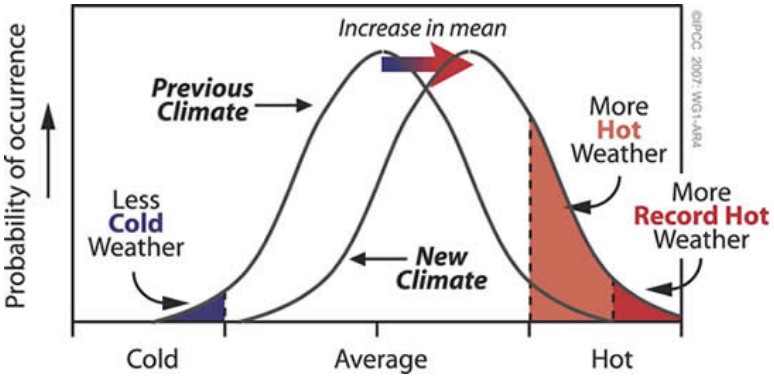

Figure 1 Small changes in the averages of many key climate variables can correspond to large changes in weather. Source: Solomon et al. (2007).

What the report says

Abridged findings from the report that have high confidence (80 % chance) are:

1. Global warming is likely to reach 1.5 °C between 2030 and 2052 if temperatures continue to increase at the current rate (Figure 2);
2. There are robust differences in climate model projections of regional climate characteristics between present-day and global warming of 1.5 °C and between 1.5 °C and 2 °C, most notably sea level rise and extreme heat;
3. Most climate change adaptation needs will be lower for global warming of 1.5 °C compared to 2 °C;
4. Estimates of the global emissions outcomes of current nationally stated mitigation ambitions as per the Paris Agreement would not limit warming to 1.5 °C, even if supplemented by challenging emissions reductions after 2030.

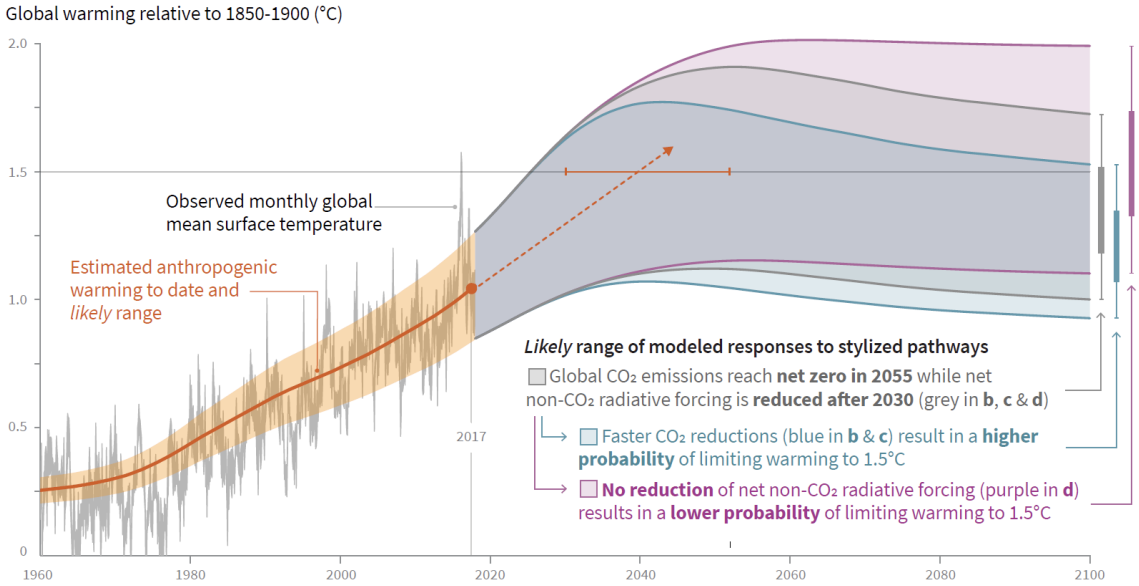

Figure 2 Observed monthly global mean surface temperature change and likely modelled responses to anthropogenic emission and forcing pathways relative to the 1.5 ° C threshold, extending to 2.0 ° C. Source: Figure SPM.1 in IPCC (2018).

The report advocates for anthropogenic climate change to be limited to 1.5 °C, and cites considerable additional impacts for land, energy, industry, buildings and transport in a "2° C world". The marine world is singled out for particular impacts under a 2° C scenario, with modelling and observations suggesting the large-scale die-out of tropical coral reefs including, of course, the Great Barrier Reef (GBR).

Changes to the GBR not only have direct impacts for marine biodiversity, but also for cyclone risk along the adjacent mainland coast, which would potentially experience higher storm surge and wave exposure under a combination of rising sea levels and reduced energy dissipation by coral reefs.

The backdrop

The report is published at a time of international discord on climate mitigation, with most scientists acknowledging that the likelihood of achieving a plateau at the proposed 1.5 °C is very small. This is essentially a reflection on the myopic nature of global political institutions, and the opposing long-term nature of the problem at hand.

It also highlights the divisive nature of climate change in Australia. As elsewhere, it has become entangled with political agendas, class, energy and living standards. However, unlike elsewhere, adaptation to climate change has yet to occupy a central role in government policy as it has done, for example, in Europe. It has exposed an interesting divide between sectors that have come to the fore in recent years – with banking, insurance and industry at large leading the charge in understanding climate change risk and exposures, and the federal government lagging.

The righteous indignation of some in the public eye too often overshadows the high standards of objectivity, self-imposed on the science community, in delivering the most robust findings possible. This was highlighted last week by the coincidental media release of an 'audit' of climate data used by climate models, undertaken as part of a PhD at James Cook University, with the apparent intention of undermining the IPCC's report.

The audit claims that the underlying data used by Global Climate Models (GCM) is unfit for purpose, citing concerns around temperature anomalies, coverage and sample size, and that GCM predictions cannot be relied on as a result.

While the audit was undertaken as part of a high-quality PhD thesis (McLean, 2017), it is as yet unpublished in the peer-reviewed scientific literature. The concerns over observational data coverage and sample size in years prior to the satellite era are well known and this is why climate reanalysis data should be handled with care – particularly in the Southern Hemisphere.

The assertion that a limited number of spurious temperature anomalies in observational records would distort the global suite of ensemble climate model output is difficult to prove, given the strict uncertainty estimates and sampling checks climate institutions such as the Bureau of Meteorology and the UK Met Office undertake. However, it is still important that end-users understand the multiple layers of uncertainty inherent in climate modelling.

By comparison, the IPCC's report included the contributions of 91 climate experts from 40 different countries and draws on over 6,000 cited references. The simultaneous reporting of both the climate audit and the IPCC report in the media gives equal weighting to the two and undermines the climate science, at an important juncture for climate politics internationally.

The implications

The global impasse on mitigation efforts only serves to highlight the importance of climate change adaptation planning and risk management in Australia, as we transition to a period in which we look to accommodate climate change impacts rather than reduce them, or indeed to utilize a combination of the two.

It also suggests (fascinatingly, from a data science perspective) that, as anthropogenic warming proceeds, we may no longer be able to apply the near-past to predict near-future climate risk as relationships between climate variables in the short-term past become no longer valid.

References

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