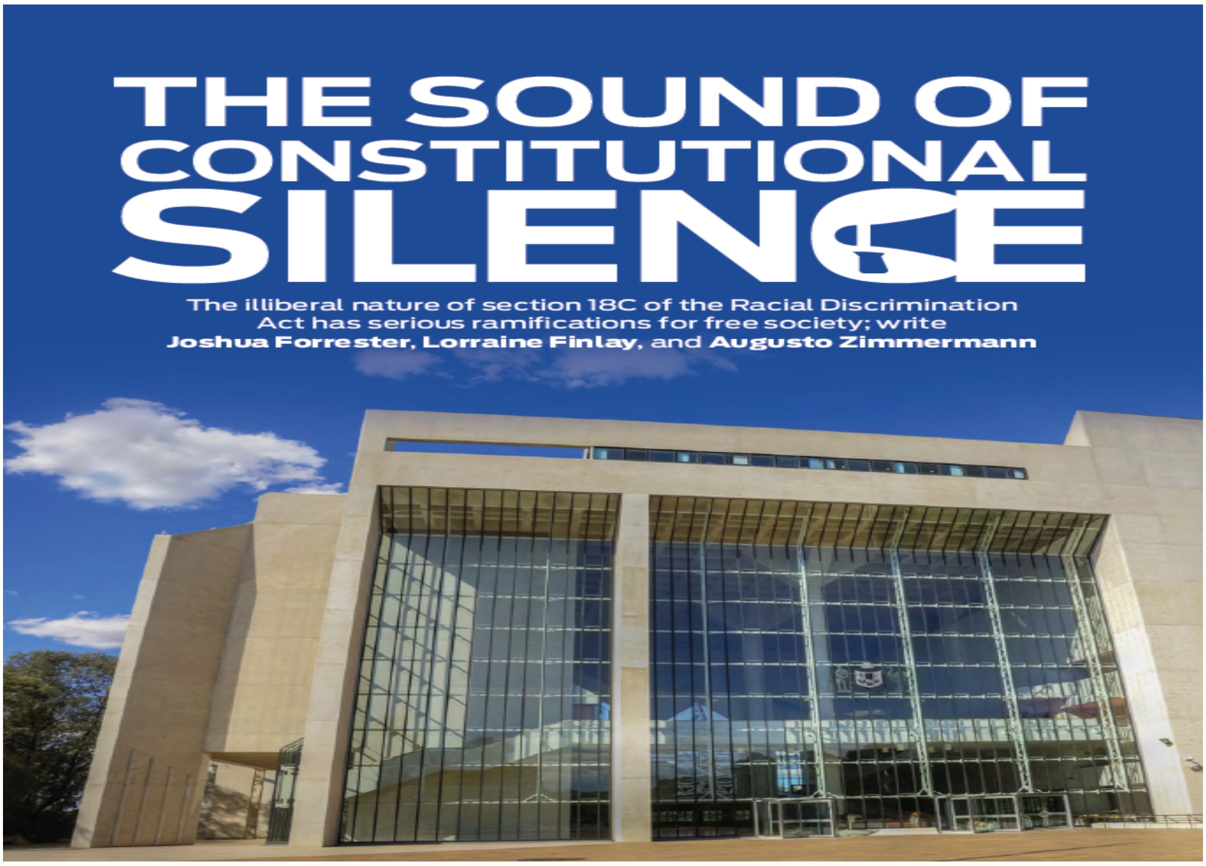

Climate Change After a Fashion

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Despite increased understanding of natural multi-decadal climate variability,climate scientists have by and large ignored this in their public commentaries, writes Professor Stewart Franks

Over the last few years we have witnessed widespread flood events and flash flooding across eastern Australia, particularly in Queensland and northern New South Wales. Given the continued warnings of anthropogenic climate change by climate scientists, perhaps the public could be forgiven for assuming that these events represent climate change and that the climate scientists have been right all along. Such perceptions are understandable however analyses of historic climate and flood risk, published in international scientific literature, have been pointing to the return of frequent widespread flooding for some time.

One of the greatest challenges of estimating flood risk in eastern Australia is that the frequency of floods (and droughts for that matter) does not follow the typical engineering assumptions for estimating risk and the probability of event occurrence.

Typical engineering analysis is based on the assumption of a static climate. In other words, the actual risk of an event of a given magnitude is assumed to be the same each and every year. For instance, if one has a hundred years of flood peak data, then the largest flood in that series, more or less, represents the hundred year flood—the level of flood that would, on average, occur every 100 years and that the risk of this happening is the same each year. The assumption of a 'static climate' serves planning requirements reasonably well in regions where floods are randomly distributed in time. Unfortunately for eastern Australia this is not the case.

Eastern Australia has some of the most extreme climate variability worldwide. This is largely due to being highly coupled to the quasi-global El Nino Southern Oscillation (ENSO) phenomenon. When El Nino occurs, the tropical convergence zone that brings monsoonal rains to northern Australia is pushed away from our shores and consequently, eastern Australia receives a deficit of rainfall. When La Nina eventuates, the opposite occurs—we get more of the monsoonal type weather penetrating further south across Eastern Australia. This typically leads to intense 'tropical' rainfalls, sodden catchments and widespread floods.

El Nino and La Nina events however are not random. If they were truly random then the assumption of static risk would be fulfilled and engineering flood risk estimation in eastern Australia would be robust. Instead, El Nino and La Nina events show a strong and statistically significant tendency to cluster on 20-40 year timescales. This has been shown to be associated with changes in the mid-latitudes of the Pacific Ocean which show warm anomalies when El Nino dominates and cool anomalies when La Nina dominates. Incidentally, given that the Pacific Ocean covers some 30% of the planet's surface, these 20-40 year periods are also correlated to global periods of warming and cooling.

This can be clearly seen in the 20th century record, where El Nino and drought dominated whilst the world warmed (1910-1945), La Nina and floods dominated whilst the global temperatures stabilised or even cooled (1945-1975), and then El Nino and drought dominated once more whilst global temperatures returned to a warming phase (1975-2001). Since then we have seen the global temperature stagnate, a cluster of recent La Nina events and mid-latitude ocean indicators pointing to a return to conditions last seen between 1945 and 1975—A time of extreme flood entirely unrelated to CO_2 emissions.

The multi-decadal processes of climate variability that are so important to Australian climate have been the subject of research both here and in the US for well over a decade. Dr Scott Power and colleagues at the Bureau of Meteorology and the UK Met Office published a key paper in 1999 where they showed that the Inter-decadal Pacific Oscillation (IPO) affected the predictability of the impacts of El Nino and La Nina on eastern Australian climate.

Much of the published studies are from US researchers who termed the phenomenon the Pacific Decadal Oscillation (PDO), but represents in essence the same thing as the IPO. US researchers have demonstrated how it impacts on the west coast of the US as well as affecting Pacific salmon fisheries.

The upshot of this simple observation is that eastern Australia exhibits decades where floods are sparse and droughts dominate, only to be followed by decades where floods dominate with only occasional short-lived periods of drought. This observation has marked consequences for flood risk estimation in Australia. Under the traditional engineering assumption of a static climate risk, it does not matter what period in time the flood data are drawn from to estimate flood risk.

Under the IPO/PDO La Nina-driven flood risk model, the period from which flood data is drawn becomes all important. For instance, if 30 years of flood observations are drawn from an El Nino or drought dominated period (as occurred between 1975 and 2001), then the true 100 year flood risk might be underestimated by anything up to a factor of three.

New Zealand researchers further added to our understanding of the climate mechanism by which the IPO/PDO impacts our region—they showed that the IPO/PDO independently of La Nina caused a southern shift in the tropical convergence zone. This observation goes some way to explain why even when a La Nina event is not present in the Pacific, the synoptic scale weather patterns are such that even the neutral years carry an elevated risk of flooding compared to other periods.

Despite increased understanding of natural multi-decadal climate variability, climate scientists have by and large ignored this in their public commentaries. For example, following two recent summer seasons (2010-2012) of widespread flooding the Bureau of Meteorology published a document highlighting the climatological causes of the flooding. The document quite naturally focussed on the back-to-back occurrence of La Nina events as the primary causal factor, but also raised a range of other climate mechanisms that might have had at best a minor influence. These include the Indian Ocean Dipole, the Southern Annular Mode and, of note, slightly warmer sea surface temperatures to the west of Australia.

Somewhat surprisingly no mention of the IPO/PDO was present despite the wealth of journal articles documenting many aspects of the phenomenon, all published in the leading international literature including a number from the Bureau itself. This is despite the fact that the observation-based IPO/PDO model perfectly explains the recent observations of enhanced and frequent La Nina events without speculative recourse to anthropogenic climate change via warmer temperatures.

It is worthwhile to note that many researchers base their view of future climate on notions of anthropogenic climate change largely driven by the output of climate models. Despite years of development, the current climate models are deficit in a number of key areas. Of relevance to eastern Australia and the issues raised here, their failings include the inability to simulate the behaviour and impacts of El Nino and La Nina events, in particular the observed clustering of El Nino and La Nina on multi-decadal timescales, the IPO/PDO phenomenon itself, and the associated multi-decadal periods of warming and cooling that are so evident in the instrumental global temperature data.

It has been noted that global temperatures are showing a plateau since the end of the 20th century. Observational analyses of the data tells us that such changes in temperature are associated with the IPO/PDO and that in the current phase of the IPO/PDO we should expect more frequent and harder hitting La Nina events. Even when La Nina is not present, observational analyses tell us that such neutral years represent elevated flood risk. How long this may last is at best informed speculation but it could be decades.

Could it be that such analyses do not figure in many climate scientist's assessments and public pronouncements because they do not fit the assumed model of anthropogenic climate change? If this is the case then we clearly have a problem. After all, when one prefers the model to the observations, we are not doing science anymore; we are living in a virtual scientific reality.

Given the uncertainties there may well be valid reason for concern over CO2 emissions, but there is no validity in claiming climate extremes, nor their clustering locally or globally, as evidence of anthropogenic climate change.