Reply and Discussion on Anomalous climate points made by Craig Kelly MHR.

Murray Scott 2019 April 10

Craig Kelly MHR ,

Following my emails to you on climate change and fish kills, you replied in January with a lengthy dossier on “Anomalous Climate”. Committed to travel away, I shared this with two friends, ex-workmates who stepped in to contribute to these comments. By way of introduction, these are not global warming scientists, but rather researchers (retired) with very long publication lists in several other research fields, viz nuclear and astrophysics, body composition, neutron interactions, fusion reactors.

We would like to thank you for sharing your ideas and data with us. Much of that data however we found misleading and it took us some time in search of original sources to understand the differences.

As scientists, we are trained in the scientific method to determine the truth of a proposal by examination of the experimental evidence. But we are not specialists in global warming and reliant on background reading in this field:

Background to response on points raised by Craig Kelly:

It is readily shown that, without any atmosphere at all, the surface temperature of the Earth (averaged over the entire Earth and over all seasons) would be about -15 degrees C compared with its actual surface temperature of about +15 degrees C (i.e. about 30 degrees C lower than the actual surface temperature)! This difference is attributable to the heating effect of the so-called green-house gases which absorb some of the outgoing infra-red radiation from the Earth and re-radiates some of this energy back to Earth (in effect reducing the efficiency of heat-loss from the Earth), thus causing the surface temperature to rise above its “no-atmosphere” value.

This was first recognised by the great French mathematician Jean Baptiste Fourier in the 1820s. Unable to find any alternate explanation for the additional heating required, he concluded that the atmosphere was acting as some form of blanket and drew parallels with the measured temperature rise observed in a closed vessel with a glass top exposed to sunlight. However, he did not know which component of the atmosphere was responsible for this effect and did not use the term “greenhouse effect”. [“*Remarques Generales sur les Temperatures du Globe Terrestre et des Espace Planetaires*”, Annales de Chimie et de Physique, Vol 27, pp 136-167, 1824]

In 1859, Irish scientist James Tyndall determined experimentally the atmospheric gases responsible for this heat-trapping effect. He found that the main components (nitrogen and oxygen) had little effect. He concluded that only water vapour, carbon dioxide (CO_2), methane (CH_4) and a few other trace gases were the principal contributors (even though they constitute less than 1% of the atmosphere).

Scientists in the 19th Century were chiefly interested in the possibility that a *lower level* of atmospheric carbon dioxide might explain ice ages, though they were unable to find a credible explanation for the required natural decrease in CO_2. In 1896, Svante Arrhenius in Stockholm investigated this effect. He also made a calculation for doubling the CO_2 in the atmosphere, estimating it would raise the Earth’s temperature by a few degrees, though he believed that it would take millenia of human activity to reach such a level.

Nobody took much interest in the hypothetical future warming caused by human industry.

In the 1930s, during a period of particularly hot summers in Europe, Guy Stewart Callendar (a British engineer specializing in steam technology) using records from 147 weather stations around the world, concluded that the world was gradually getting warmer. He also showed that CO_2 concentrations had increased over the same period. He published his results in 1938. Shortly afterwards, Europe underwent a prolonged cold spell, so nobody took any notice.

After World War II, US scientists enjoyed massively increased government funding, notably from military agencies and aimed at pressing military needs. Almost anything that happened in the atmosphere and oceans could be important for national security (including infra-red absorption). In 1955, using improved equipment, US researcher Gilbert Plass performed a detailed analysis of infra-red absorption of various gases. He concluded that doubling CO_2 concentrations would increase temperatures by 3 - 4 degrees C.

In 1957, US oceanographer Roger Revelle and chemist Hans Suess (Scripps Institution of Oceanography in La Jolla, California) showed that seawater will not absorb all of the additional CO_2 entering the atmosphere, as many had assumed.

In 1958, Charles David Keeling began systematic measurements of atmospheric CO_2 concentrations at Mauna Loa in Hawaii and in Antarctica. The Mauna Loa measurements continue to the present day and prove unequivocally that CO_2 levels are rising.

From the 1960s onwards, climate change has received ever-increasing attention with more and more measurements of both the current and past historical climates and the development of increasingly sophisticated climate models.

In 1988, the Intergovernmental Panel on Climate Change (IPCC) was established to collate and assess evidence on climate change.

In 1989, the UK Prime Minister Margaret Thatcher (who had a chemistry degree) warned in a speech to the UN that “We are seeing a vast increase in the amount of carbon dioxide reaching the atmosphere....The result is that change in future is likely to be more fundamental and more widespread than anything we have known hitherto”. She called for a global treaty on climate change.

Today there is no argument about the reality of the Greenhouse Gas effect or its importance. The controversy revolves around the degree to which human activity is contributing to the atmospheric concentration of greenhouse gases and its consequence.

I will examine each of your questions **1** to **9**, and examples, numbered **1** to **13,**

With kind regards
Murray Scott (BSc).

The assistance of Barry Allen (PhD, DSc, AO) and Geoff Durance (PhD) in researching these issues is gratefully acknowledged and much of their contributions remain embedded in this document which has been progressively revised with further study. Due to pressure of other commitments however my colleagues could not keep up with repeated corrections of the draft and offered to withdraw from authorship of this reply.

Craig’s Challenge Questions, With Replies:

1. ”How much of this warming is attributable to natural factors?”

Although many natural factors have been widely investigated, none show a credible correlation with the current-rate of warming.

In 1920, the Serbian astrophysicist Milutin Milankovic hypothesised that periodic changes in the Earth’s rotational motion around the sun (orbital eccentricity, axial tilt and axial precession) might explain past ice ages. Subsequent studies do show a degree of correlation for the timing of ice ages with Milankovic cycles, however these cycles predict that the Earth is currently in a long-tern “cooling trend”(that will continue for the next 23,000 years.

Similarly, the 11-year solar cycle (with changes in sun-spots, flares and other manifestations) does not explain the observed temperature results.

2. ”How much of this warming is attributable to man’s activities ?”

Supporting increasingly detailed theories of infrared radiation transmission through the atmosphere, the measured increase in the Earth’s surface temperature correlates well with the increase in CO_2 concentrations, and these concentrations correlate well with man-made CO_2 emissions.

3. ”How much is attributable to increases in CO_2?”

There are a number of “heat-trapping” gases i.e. gases that absorb infrared radiation, mainly outgoing, and then re-emit in all directions including downward, adding to the energy absorbed at earth’s surface from direct sunlight.

On average, CO_2 remains in the atmosphere for over 100 years. This means that the concentration of CO_2 will increase over time as further CO_2 is emitted.

Although water vapour is the most abundant “heat trapping” gas, it has a relatively short residence-time in the atmosphere (about 10 days on average) before it precipitates out. Thus it does not build-up in the atmosphere over a long timescale. As temperatures rise, more water is evaporated. But as water vapour increases, more clouds can form that also act as reflectors of the incoming solar energy, thus complicating the picture.

Other gases, such as methane, have more potent “heat trapping” ability per molecule, but they are simply far less abundant in the atmosphere and generally have a smaller residence-time. In aggregating the effect of such greenhouse gases , the term “CO_2 equivalent” (CO_2 e) is used.

The measured increase in atmospheric CO_2 concentration shows close correlation with the observed increase in the Earth’s surface temperature. Thus it is CO_2 that puts us at the greatest risk of irreversible changes if it continues to accumulate unabated in the atmosphere. CO_2 emitted today will determine the climate that our children and grand-children will inherit.

As increasing amounts of CO_2 are emitted into the atmosphere, the Earth’s temperature rises, and more water evaporates, thus providing additional “heat trapping” and competing albedo reflection. But overall the short residence-time of water vapour means that its effect is transitory.

Additional empirical evidence for the effects of CO_2 and other greenhouse gases is provided by high-resolution Fourier-Transform Infrared Spectroscopy (FTIR). This shows **increases** in incoming radiation at the Earth’s surface at the specific wavelengths of the greenhouse gas emissions. Conversely, satellite measurements over the period 1970 to 1996 have shown **decreases** in the outgoing radiation escaping into space at these same wavelengths.

The changing contributions to greenhouse forcing from atmospheric gases are complicated, as discussed in: https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_I_chapter_02.pdf from p47, and summarised in table 2.6 of that document, as follows (note: 1765 is baseline year for each period) :

Table 2.6: *Forcing in Wm^{-2} due to changes in trace gas concentrations in Table 2.5. All values are for changes in forcing from 1765 concentrations. The change due to stratospheric water vapour is an indirect effect of changes in methane concentration (see text)*

YEAR	SUM	CO_2	CH_4 direct	Strat H_2O	N_2O	CFC-11	CFC-12	Other CFCs
1765 1900	0.53	0.37	0.10	0.034	0.027	0.0	0.0	0.0
1765 1960	1.17	0.79	0.24	0.082	0.045	0.004	0.008	0.005
1765 1970	1.48	0.96	0.30	0.10	0.054	0.014	0.034	0.021
1765 1980	1.91	1.20	0.36	0.12	0.068	0.035	0.076	0.048
1765 1990	2.45	1.50	0.42	0.14	0.10	0.062	0.14	0.085

Radiation Forcing values quoted for these and less significant gases are also affected by regionally variable masking effects, as explained in https://www.pnas.org/content/115/52/13192
Other, non-gasseous, troposphere pollutants, particularly “black carbon” from diesel exhaust, bushfires and woodstoves etc., are also reckoned to contribute significantly to global warming but local variation in particle size, concentration, composition, humidity, altitude and residence time make modelling of global forcing of BC difficult to compare with CO2. https://en.wikipedia.org/wiki/Black_carbon

4. ”Would the temperatures be any different if Australia had built a fleet of nuclear power stations in the 1960s instead of using coal to generate electricity ?”

Building a “fleet of nuclear power stations” within a decade would have bankrupted Australia. ”By 1960 there was already 5GW of coal or gas fired electric generating capacity in Australia and half completion of the Snowy Mountains Scheme that would eventually deliver 3.7GW capacity including pump storage. www.ewh.ieee.org/r10/nsw/subpages/history/electricity_in_australia.pdf Following that investment, the option for a “fleet of nuclear power stations in the 1960’s” was dead.

Adding nuclear power since the 1960s may have progressively reduced Australia’s CO_2 emissions from electricity generators, now comprising approx 30% of current greenhouse emissions. The impact on temperatures in Australia would however have been minimal without global action to reduce greenhouse gasses.

5. ”Has this warming been good, bad or indifferent ?”

The degree of present warming (of about 1 degree Celsius) is clearly evident but probably only now beginning to have an measurable impact on severe weather events. But that is not the issue! If the global economy is locked into continued exponential rise in greenhouse gas emissions so the warming trend accelerates unabated, then dire consequences can be expected, some predictable but doubtless delivering many surprises.

6. ”Could we do anything in Australia to stop the warming ?”

Emissions reduction efforts in Australia alone, will not stop the warming trend. However, if we are to avoid catastrophic effects, then all countries must accept a share of responsibility by reducing their carbon emissions. Australia’s current emissions on a per-capita basis are among the highest in the world and our coal and gas exports further promote increased global emissions, undermining our influence on diplomatic progress.

7. ”And if so, by how much could we stop the warming ?”

The later example 12 explores this question. There is an onus upon Australia to do at least our per-capita share of CO_2 reduction through the upscaled COP commitments. How can we expect larger countries to reduce their emissions if we sell them fossil fuels and are not prepared to reduce our own emissions?

8. “How much would this cost ?”

The cost, in money and suffering, is projected to be much greater if Australia and the rest of the world ignore the problem.

9. “Would we be best to use our limited resources to adapt to a warmer climate or to use them to try and stop the climate changing ?”

If warming was guaranteed to be mild and brief, humankind could adapt. Local changes in climate such as drought, flooding and extreme weather changes can be partly mitigated by appropriate planning, resource allocation, or mass migration. At the current rates of action and warming we’ll experience all of these. The political difficulty of managing such adaptation is evident from the current local problems of lobbying by fossil fuel companies and water buy-back in the Murray-Darling basin, agriculture being one of many vulnerable sectors currently adapting to climate change.

The current climate change is measurably accelerating, with scientifically robust links to physical processes that only humans can halt and reverse. When humankind finds itself in a such a hole, first move is to stop digging.

To reduce the costs of adaptation and to protect fragile ecosystems, Australia must play its part in reducing global greenhouse gas emissions and encouraging other countries to do likewise asap. Global mitigation and adaptation hang on the slender threads of diplomacy, in which Rio, Kyoto, Stockholm and Paris were crucial but insufficient steps. That means phasing out the extraction of coal, oil and gas, reducing exploitation of minerals that require fossil fuels for processing, and developing alternatives. That will take time, government funding, technology and socially responsible redeployment of labour.

That’s adaptation.

Craig's Examples.

The following analyses are in response to your set of of examples that tend to deny or question the basis of anthropogenic climate change, often referred to as global warming.

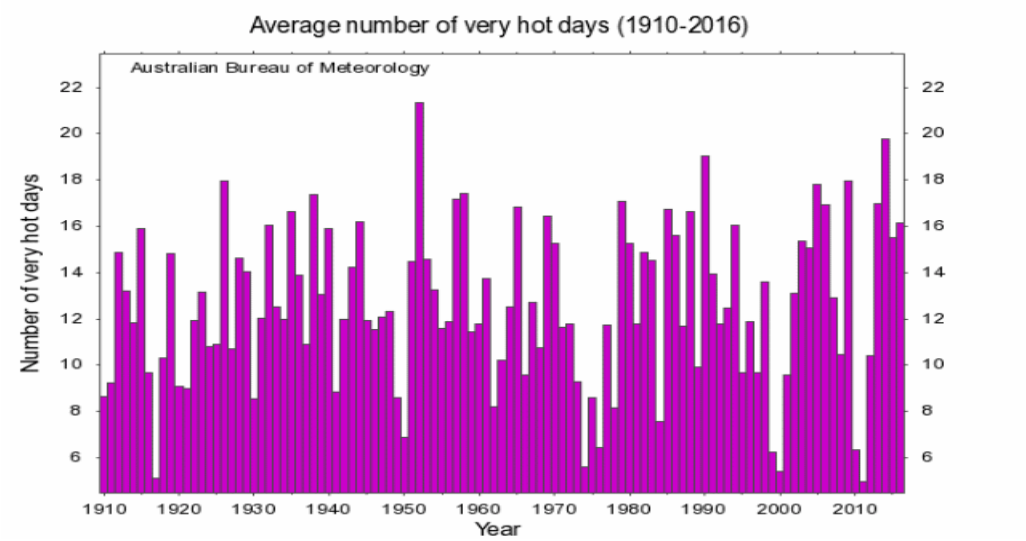
The analyses separate into:

a) primary data, ie, a single climate change variable is tested, eg temperature, coral bleaching or ice cover over the north pole.
b) secondary data, which could be indicative of climate change but where multiple parameters confuse the issue
c) non-data where impressions are tested for scientific validity.

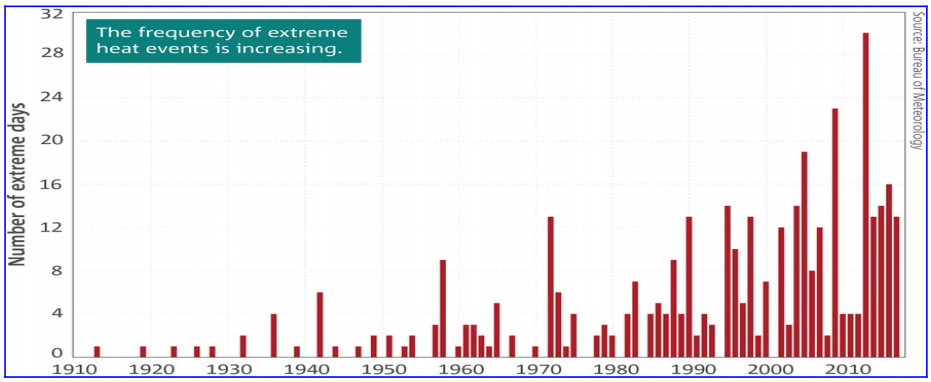
Each figure is analysed in these terms and a classification is given as follows regarding the validity of primary data, the complexity of secondary data and the rejection of non-data.

Craig's Examples with Comments.

1. "The average number of very hot days is NOT increasing. In fact we had more very hot days in 1954. It also should be noted that this data excludes pre-1910 when extreme temperatures occurred that have not since been exceeded."

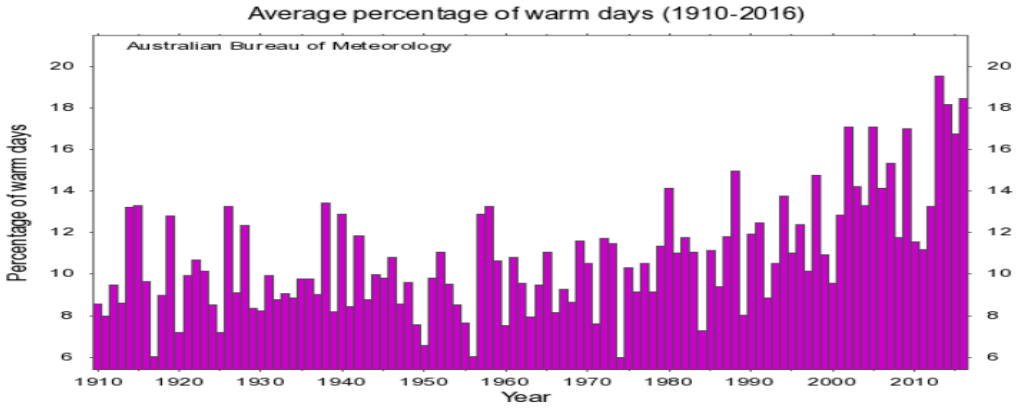


Current data shown by BOM shows a different story.
http://www.bom.gov.au/state-of-the-climate/australias-changing-climate.shtml

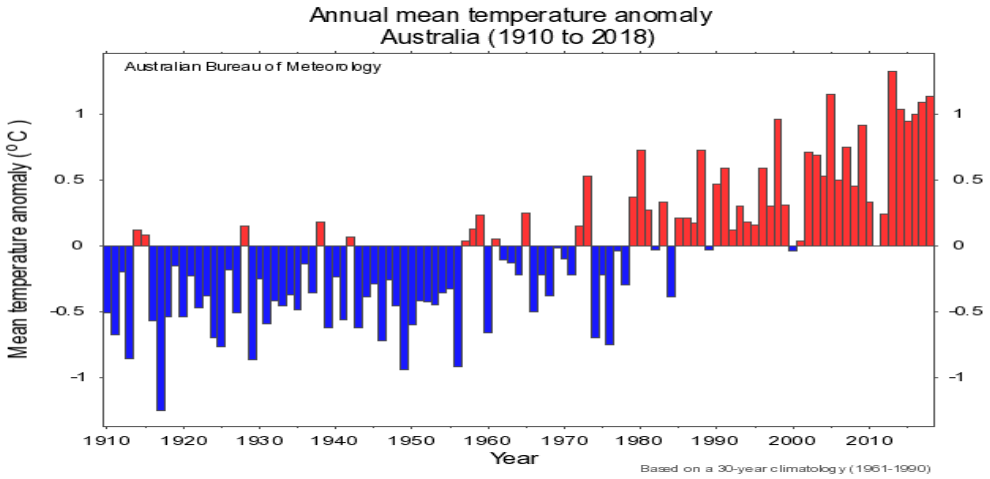


Number of days each year where the Australian area-averaged daily mean temperature is extreme. Extreme days are those above the 99th percentile of each month from the years 1910–2017. These extreme daily events typically occur over a large area, with generally more than 40 per cent of Australia experiencing temperatures in the warmest 10 per cent for that month.

The contrast between this graph and Craig's data (above) on "hot days" and corresponding graph for "warm days" below illustrates the complexity of climate statistics in which slight changes in category boundaries (extreme, hot, warm) produce very different distributions:



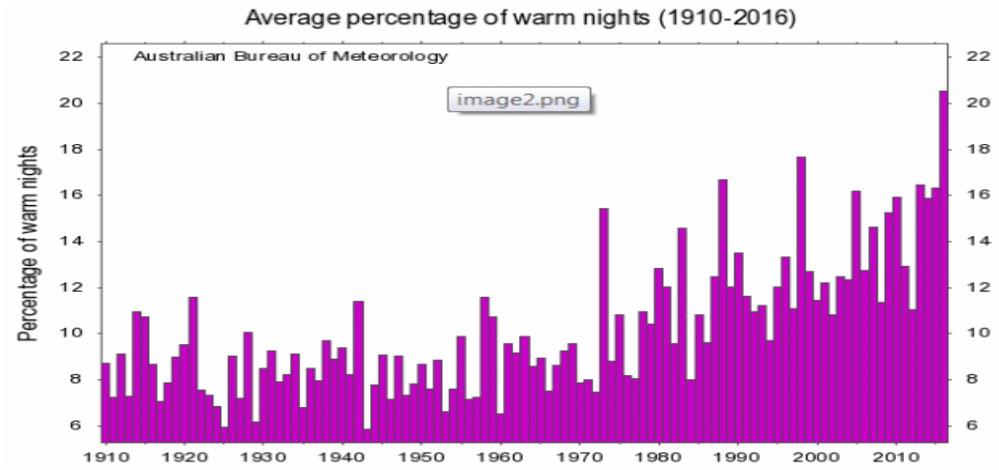
Since climate change is expected to impact on *all temperatures* throughout the year, it is more informative to look at BOM's "annual mean temperature anomaly" for the same period. This figure unambiguously shows evidence of "warming".



Note also that BoM has produced datasets merged with pre-1910 data, showing **no pre-1910 temperature extremes that exceed recent Tmax data.** See reply to Example 5 below.

Annual mean temps are increasing as shown in the figure above by the Bureau of Meteorology (BoM). This integrates daily changes over a year. A large increase in annual temperature is seen from ~1980 to the present.

2 "It's the nighttime temperatures that are increasing, and this has pushed the average up."

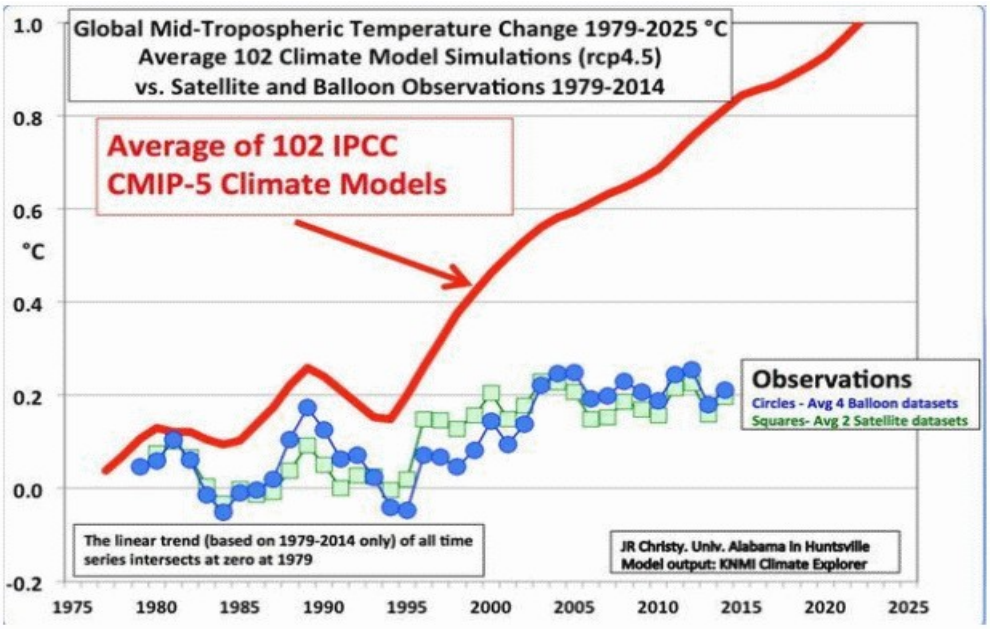


No surprise there. Night-time cooling is due to infrared radiation escape.

3 Temperature changes; calculation vs data: big over-calculation.

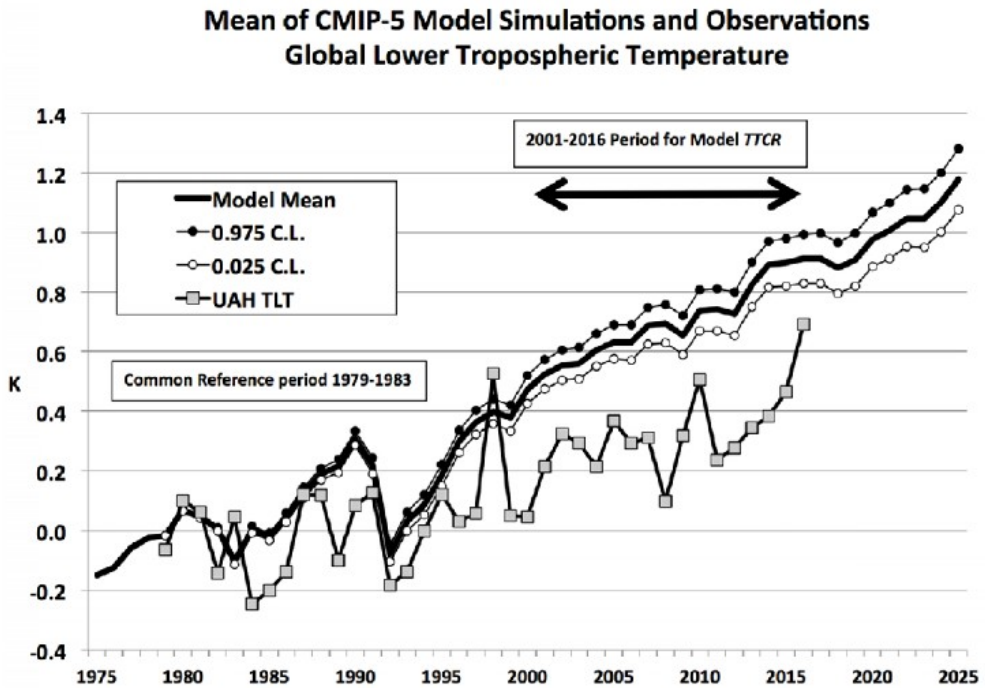
"And although the slight warming is happening, it's not warming to the extent the models predicted."

The data Craig provides below was prepared by John Christy et al of the University of Alabama, Huntsville (UAH) and continues to be presented by climate-change deniers, though it has never to our knowledge been published in a recognised peer-reviewed journal. See https://www.tineye.com/search/e1b9b5dc82fd767eafc8a187f98a99d8477e1ef5/?page=17&sort=score&order=desc
Christy focused on atmospheric temperatures in the mid-troposphere (i.e. at altitudes up to about 15 km), deriving temperatures from satellite and balloon microwave measurements.



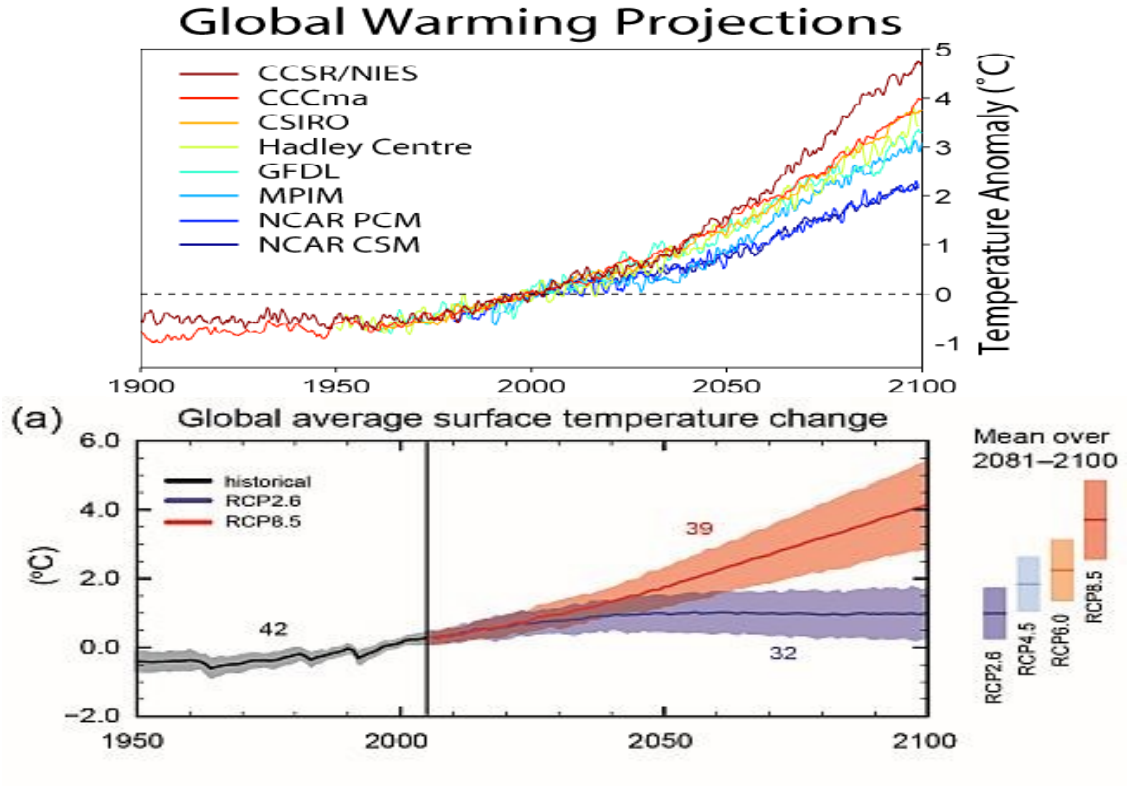
These data are now recognised as being affected by cooling of the lower stratosphere.
https://journals.ametsoc.org/doi/full/10.1175/JCLI-D-16-0333.1

In Christy and McNider's subsequent paper https://www.sealevel.info/christymcnider2017.pdf under the heading "Conclusions", they show a UAH calculation approximately tracking the IPCC-modelled **Lower**-Tropospheric-Temperature data at 0.7 C/decade.



Further, under subheading *"c. Discussion of observational and model differences in TTCR"* in that paper, Christy et al suggest also that the discrepancy in their Mid-Troposphere-Temperature from the models may be explained by various real-world processes transferring more heat to surface and oceans from the troposphere than previously assumed.

Predictive models are developed for a range of input assumptions. Comparison with subsequent measurements provides feedback on the validity of those assumptions.



Notwithstanding the Low-Mid Troposphere question, the complexities of corrections-upon-corrections in the microwave datasets and the resulting arguments are difficult to follow for non-specialists.

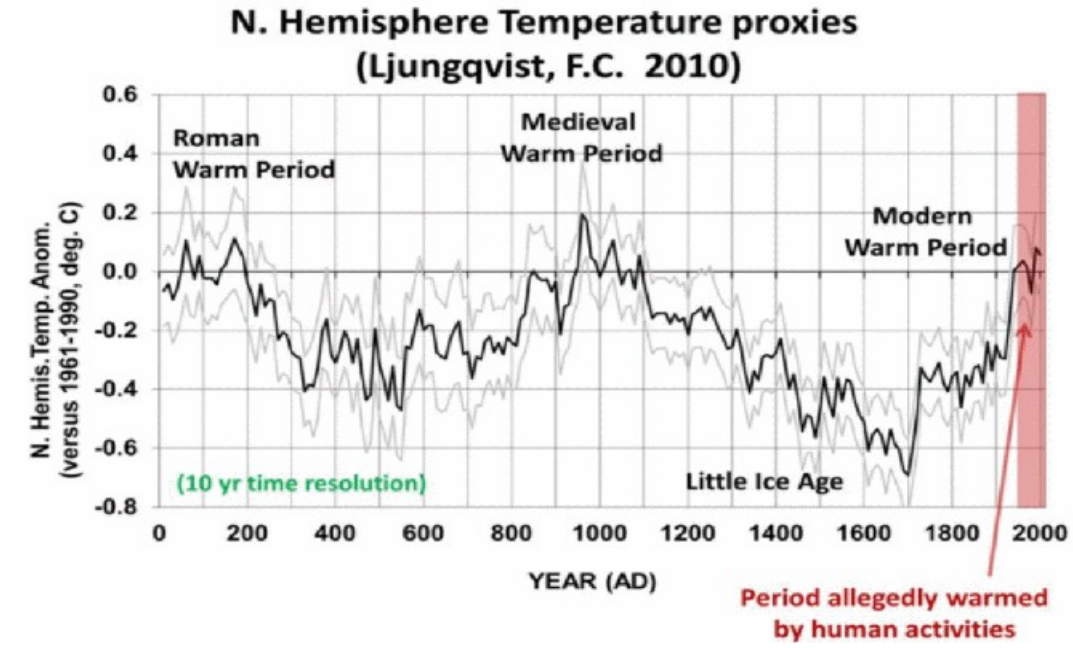
Until Mid-Tropospheric temperature data are clarified, we prefer to provisionally assume, with Christy, that direct surface and Low Troposphere temperature measurements, being closer to the weather we actually experience, are more reliable indicators of global warming and more consistent with relevant IPCC models. And these are not reassuring.

Footnote to Claim 3:
Suppose, hypothetically, that the Christy's data IS correct to the extent that Low-Troposphere temperatures HAVE risen, approximating IPCC projections, but Mid-Troposphere temperatures HAVE NOT. That would mean that Greenhouse heat-trapping in the low troposphere is now STRONGER than the models suggested, resulting in a new, steeper drop of temperature with altitude, ie steeper "normal lapse-rate", that would **increase convective instability**.

https://www.britannica.com/science/lapse-rate explains:

> *"The difference between the normal lapse rate in the atmosphere and the dry and moist adiabatic lapse rates determines the vertical stability of the atmosphere—that is, the tendency of an air particle to return to its original position or to accelerate away from its original position after being given a slight vertical displacement. For this reason, the lapse rate is of prime importance to meteorologists in forecasting certain types of cloud formations, the incidence of thunderstorms, and the intensity of atmospheric turbulence."*

4. “And if we look back further in time, we can put the current warming in some context “



Ljungqvist undertook to create a 2000-year temperature-history of the extra-tropical portion of the Northern Hemisphere (latitudes 30-90 degrees) based on 30 proxy records such as tree rings, pollen in sediments etc. He was able to replicate the Roman Warm Period (1-300 AD), the Dark Age Cold Period (300-800 AD), the Medieval Warm Period (800-1300 AD), and the Little Ice Age (1300-1900 AD). Because of the methodology used including decadel-averaging, his reconstruction did not include recent data from the 21st Century.

Overall, his results are very similar to those of Moberg et al (2005) and Mann et al (2008), despite their use of different methodologies and data coverage. However, there is one notable difference insofar as these other studies extended their results into the early-years of the 21st Century and indicated a very sharp and significant increase in temperature from the end of the 20th Century to the present.

Sceptics have seized upon Ljungqvist results claiming that they prove that there is no global warming, and that temperatures during the peak of the Medieval Warm Period are higher than today. That ignores Ljungqvist’s own statement in his published paper that ”The temperature of the last two decades, however, is possibly higher than during any previous time in the past millenium, although this is only seen in the instrumental temperature data and not in the multi-proxy reconstruction itself”.

Nevertheless, the steeper fin-de-ciecle rise is acknowledged in Ljungqvist’s 2010 paper
https://agbjarn.blog.is/users/fa/agbjarn/files/ljungquist-temp-reconstruction-2000-years.pdf

A NEW RECONSTRUCTION OF TEMPERATURE VARIABILITY IN THE EXTRA-TROPICAL NORTHERN HEMISPHERE

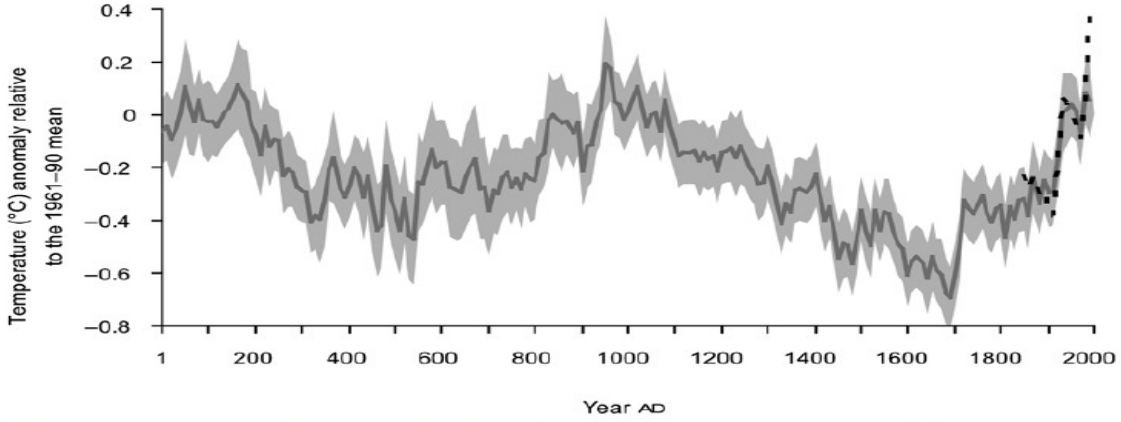
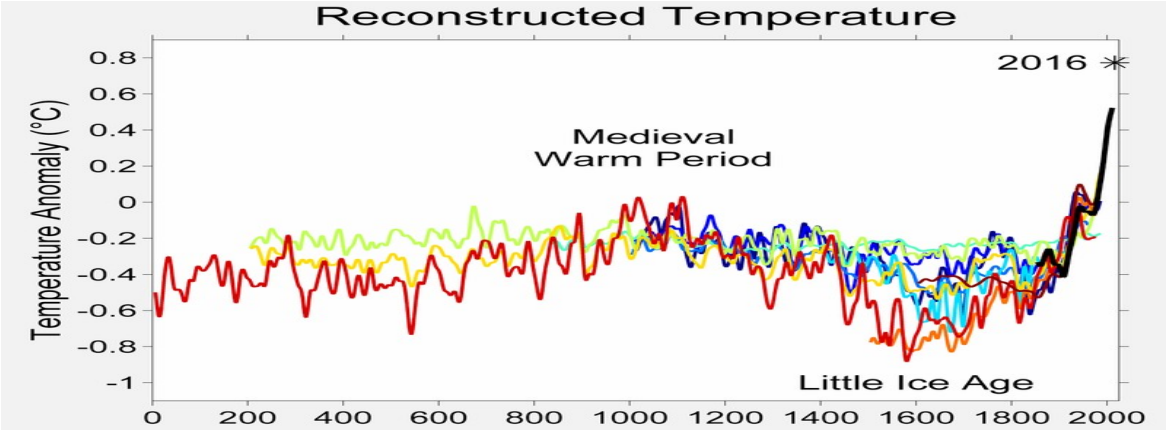


Fig. 3. Estimations of extra-tropical Northern Hemisphere (90–30°N) decadal mean temperature variations (dark grey line) AD 1–1999 relative to the 1961–1990 mean instrumental temperature from the variance adjusted CRUTEM3+HadSST2 90–30°N record (black dotted line showing decadal mean values AD 1850–1999) with 2 standard deviation error bars (light grey shading).

Direct surface temperature measurements have shown a rapid rise to the present level of around 1 degree C (above pre-industrial temperatures).

The test in science is whether findings can be replicated using different data and methods. More than two dozen reconstructions, using various statistical methods and combinations of proxy records, have supported the broad consensus shown in the original 1998 hockey-stick graph, with variations in how flat the pre-20th century "shaft" appears.[1]

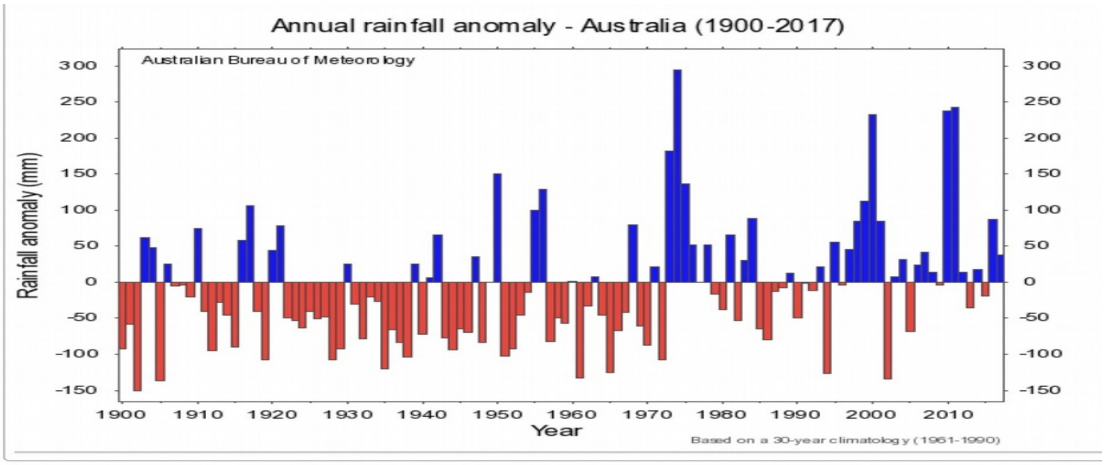
The 2007 IPCC Fourth Assessment Report cited 14 reconstructions, 10 of which covered 1,000 years or longer, to support its strengthened conclusion that it was likely that Northern Hemisphere temperatures during the late 20th century were the highest in at least the past 1,300 years.



The presented primary temperature data by Ljungqvist, being limited in time scale, imply an invalid conclusion. The more recent data validate the rapid temperature increase ascribed to man-induced global warming.

5 "Australian rainfall anomaly: more rain recently, less rain before 1970".

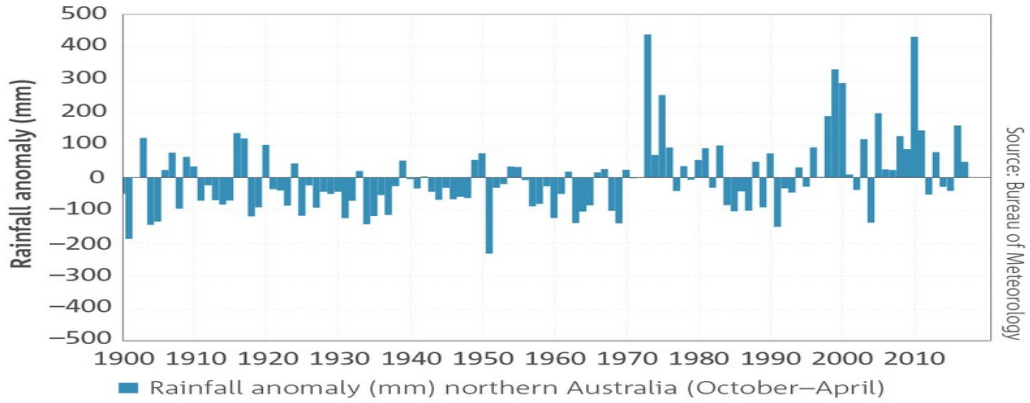
Craig presented this BoM graph showing **increasing** nationwide rainfall:



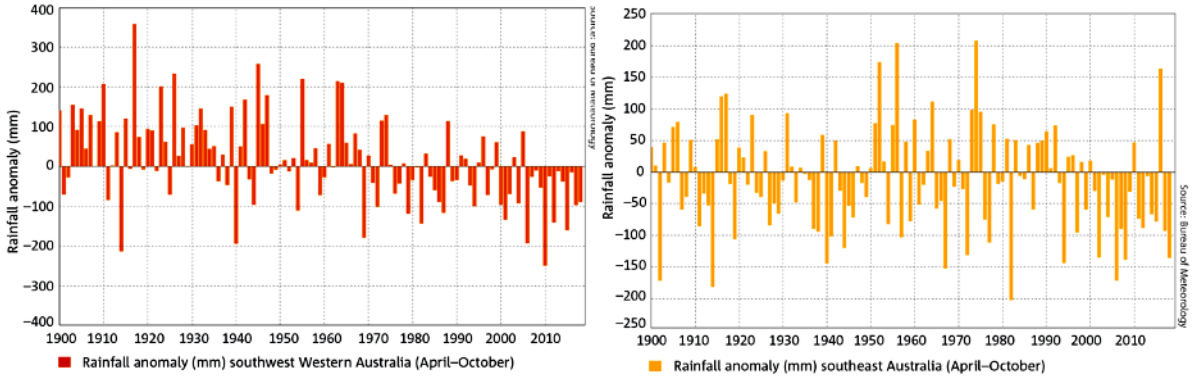
Rainfall in Australia is highly variable over location and time ("droughts and flooding rains"). Northern Australia has become wetter across all seasons, offset by drier conditions across SW and SE Australia., as per graphs below. Both are strongly influenced by phenomena such as El Nino, La Nina and the Indian Ocean Dipole.

Clouds have both a cooling-effect by reflecting the incoming sunlight and a heating-effect by absorbing and re-emitting the infra-red radiation emitted from the earth. Global warming will increase evaporation-rates and lead to increased cloud formation. However clouds vary with location due to changes in atmospheric circulation and other regional influences, thus locally changing their net effect on rainfall.

The BoM charts below illustrate that variability in Australia:

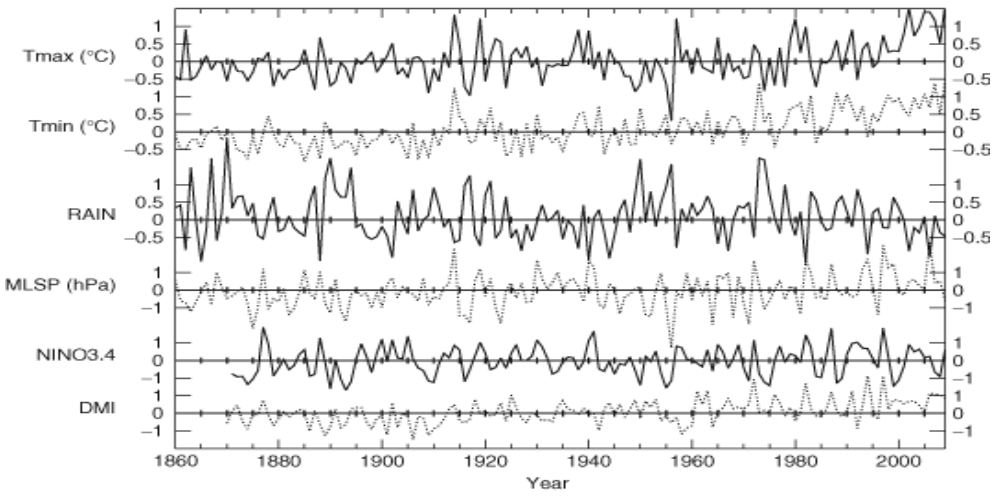


Anomalies of October to April rainfall for northern Australia (north of 26° S inclusive). Anomalies are calculated with respect to the 1961 to 1990 average.



Anomalies of April to October rainfall for southwestern (southwest of the line joining the points 30° S, 115° E and 35° S, 120° E) and southeastern (south of 33° S, east of 135° E inclusive) Australia. Anomalies are calculated with respect to 1961 to 1990 averages.

Furthermore, BoM states that "The drying in recent decades across southern Australia is the most sustained large-scale change in rainfall since national records began in 1900".
http://www.bom.gov.au/state-of-the-climate/australias-changing-climate.shtml and even earlier:
http://www.bom.gov.au/climate/data/acorn-sat/#tabs=Early-data
which is extended pre-1910 for southern Australia by merging with historic data :



"Annual Tmax (maximum temperature; °C), Tmin (minimum temperature; °C), RAIN (normalised rainfall anomalies) and MSLP (mean sea level pressure; hPa) **across south-eastern Australia** as well as NINO3.4 and the DMI (normalised sea surface temperature difference) for 1860–2009. All anomalies have been calculated with respect to the 1910–1950 base period. "

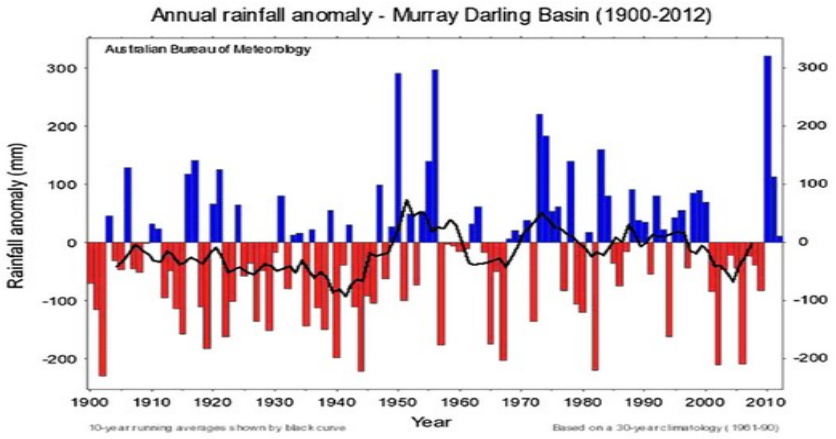
The rainfall for **Southern** Australia, where most of us live, is here shown as *decreasing* since ~1980, while day and night temps have been increasing as have the sea surface temps .

The presented primary data are of limited value. The extended BoM data confirm the post-1980 increase in land and sea surface temperatures and progressively altered rainfall patterns for southern Australia, reflecting climate change.

6 "The dry Murray river indicates a past drought in 1915."

"And although this current drought is severe, fortunately we don't see images like the following today."

A 4-year drought is indeed evident in the Murray Darling Basin data before 1915 but less so in the national data (see point 5): Despite the length of the Murray-Darling River system and its vast catchment area, it has great annual variability in its flow.



A major contributing factor however was over-zealous water extraction for irrigation. The following is taken from a report in "The Land" newspaper (16 May 2018) based on the work of Dr Martin Mallen-Cooper (Charles Sturt University) and available on the internet
https://www.theland.com.au/story/5403621/drought-myth-holds-murray-darling-back/

> "During the colonial period under natural conditions, the River Murray was low in late-summer with typical flow-rates of 1000-2000 ML/day. The extraction of water for irrigation using large steam-pumps increased rapidly during the 1880s, and soon reached an extraction capacity comparable to this low flow-rate."
>
> "In 1889 NSW Parliament reported that pumps could divert more than 1800 ML/day and predicted that there could be periods of no-flow downstream." (Up to this point there had been no confirmed reports of the river not flowing.)

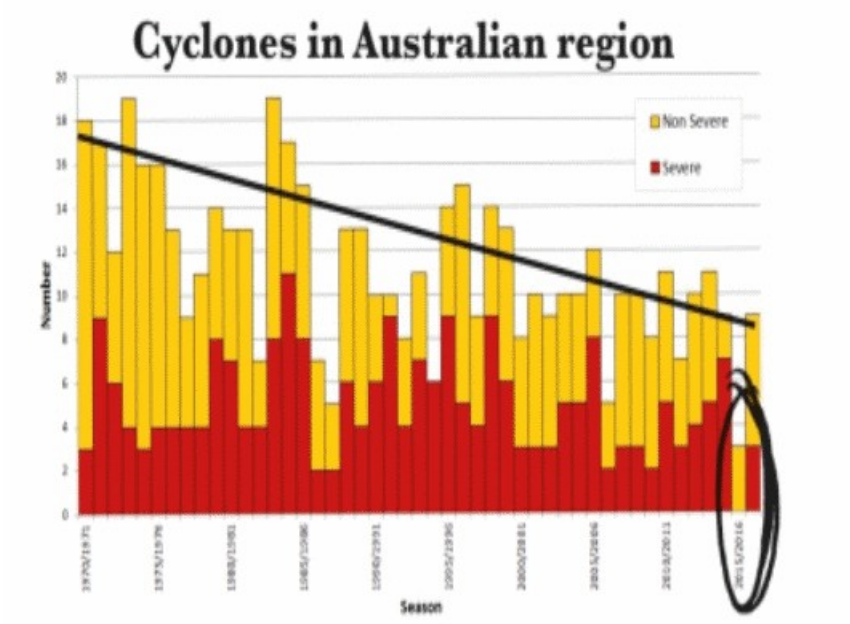
All of the photographs and newspaper reports of the Murray River with no flow come from the three years 1901, 1915 and 1923, and from three locations that were all downstream of major irrigation areas that were busy pumping-out water during droughts.

The fact that *irrigation* was the main cause of the almost dry river bed shown in photographs above, was well-reported in newspapers and government documents at the time, but now appears to have been largely forgotten. Indeed in 1915, the governments of the day were sufficiently concerned to agree to a pumping schedule so that settlements downstream could get water. Sure enough, when the pumping stopped, the river flowed downstream once again.

Although drought was a contributing factor, the Murray River photographs do not fulfil the requirements of a primary or secondary data source.

6. "The number of cyclones in Australia, severe or not, has decreased, especially in the last few years."

"Some good news on cyclones - the trend is a declining one. In fact the 2015/16 season was the first year on record without a single severe cyclone hitting Australia."



The diagram showing the number of severe and non-severe tropical cyclones from 1970-2017 has been taken from the Bureau of Meteorology (BOM) website. However, the accompanying BOM text should be taken into account.

"Tropical cyclones in the Australian region are influenced by a number of factors such as variations in the El Nino - Southern Oscillation. In general, more tropical cyclones cross the coast during La Nina years, and fewer during El Nino years."

and

".....there was a change to the definition for tropical cyclones in 1978 which led to some systems which would previously have been classified as tropical cyclones instead being considered sub-tropical systems. This contributes somewhat to the apparent decline in numbers."

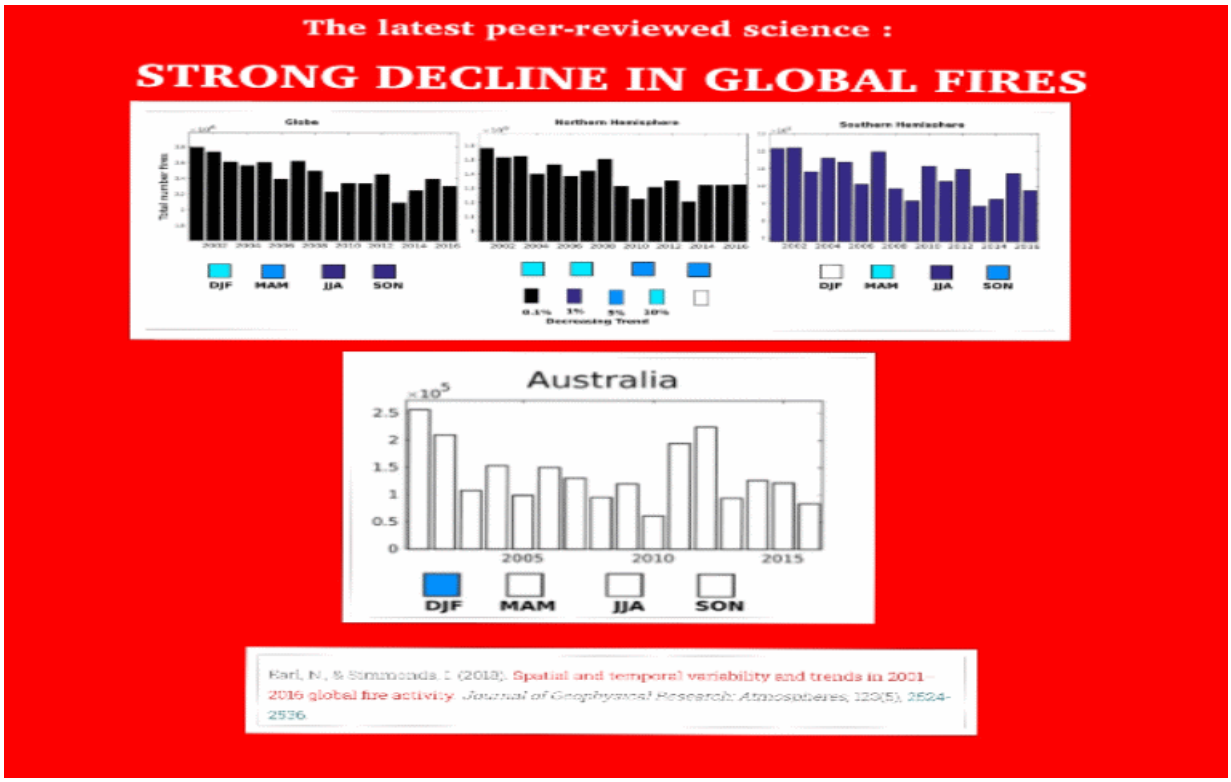
and

"there remains uncertainty in the future change in tropical cyclone frequency projected by climate change models, with a general tendency for models to project *fewer* tropical cyclones in the Australian region in the future climate and a *greater* proportion of the high intensity storms (stronger wind speeds and heavier rainfall)".

As such, the cyclone data do not fulfil the requirements to be a primary data source. However, it could have value over time as a secondary source.

8 "The number of world bush fires per annum is decreasing."

"The number of bushfires is decreasing in Australia, as it is elsewhere in the world."



This diagram appears to be a paste-up of plots for individual countries from Earl and Simmonds quoted in: https://notrickszone.com/2018/08/13/climate-alarm-flames-out-as-scientists-find-global-fires-burned-area-has-sharply-declined-since-1910s/ (The original paper by Earl and Simmonds is inaccessible behind a paywall.)

The decrease in the number of fires globally (during 2001 to 2016) is attributed mainly to:

> "an increase in net primary productivity observed in northern Africa, along with global agricultural expansion and intensification, which generally reduces fire activity."

In Australia, the Rural Fire Service has noted that, over this period, the "fire season" is commencing earlier and its duration is longer. Reduced fire frequency appears due to developments in fire prevention measures (control-burning, etc), forest management (clearing of combustibles from the forest floor, etc) and fire suppression (aerial water drop and Remote Area Firefighting Teams (RAFT) working in remote, rugged areas that cannot be accessed by firefighting tankers.).

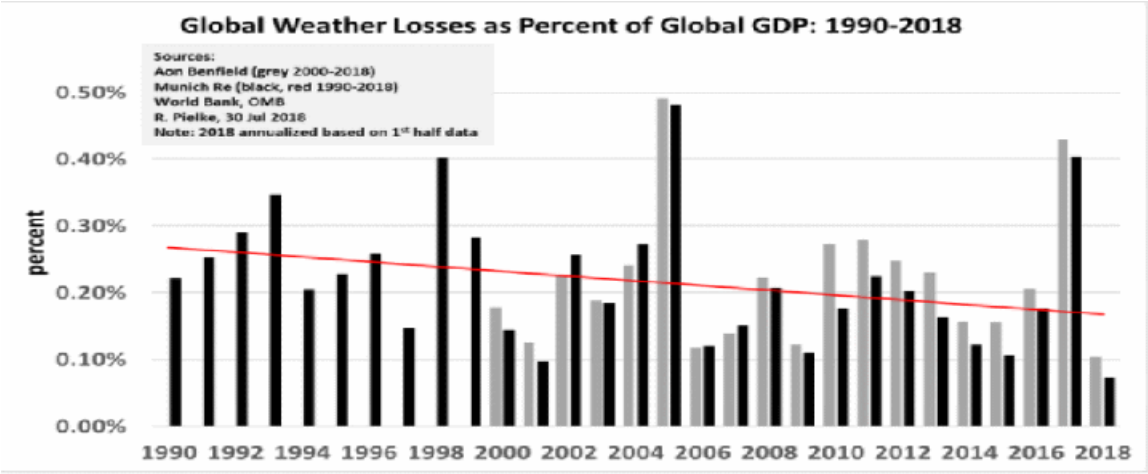
Earl and Simmonds note:

> "Fire regimes across the globe have great spatial and temporal variability, and these are influenced by many factors including anthropogenic management, climate, and vegetation types. Here we utilize the satellite-based "active fire" product, from Moderate Resolution Imaging Spectroradiometer (MODIS) sensors, to statistically analyze variability and trends in fire activity from the global to regional scales."

Presumably the MODIS spectrum band used by Earl and Simmonds for fire detection is #31 or #32, sensitive to "Surface/Cloud Temperature". With global scans every 2 days at spatial resolution of 1km, fires suppressed quickly would thus often not register.

While reduced wildfire frequency has both adverse and beneficial effects on natural ecosystems, in promoting plant sequestration of carbon and reducing CO_2 and Black Carbon emissions, it is a welcome trend in slowing climate change.

8. “And global weather losses continued their downward trend in 2018. More good news.”



Commenting on this graph:

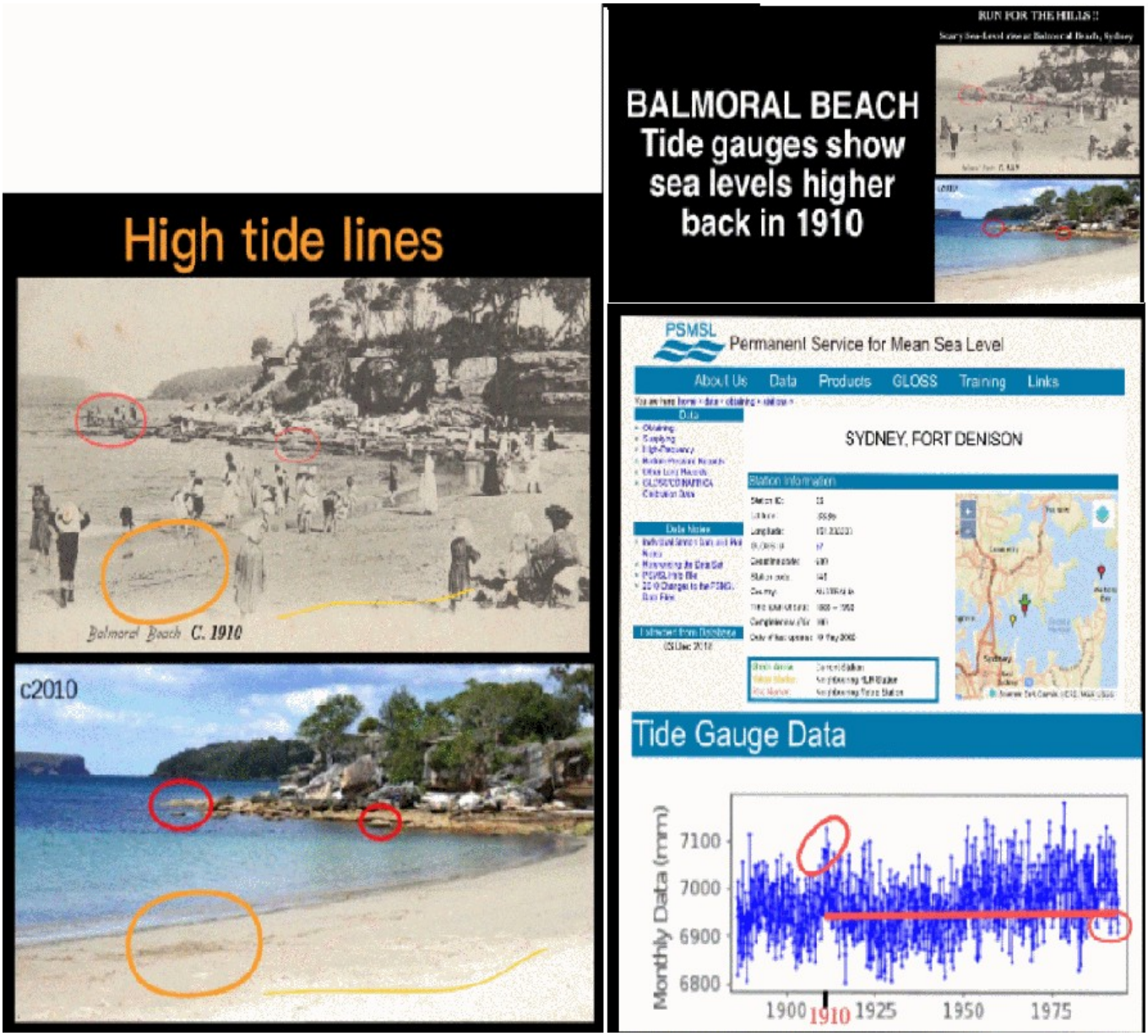
https://www.tandfonline.com/doi/abs/10.1080/17477891.2018.1540343?journalCode=tenh20 states

> “In constant 2017 US dollars, both weather-related and non-weather related catastrophe losses have **increased, with a 74% increase in the former and 182% increase in the latter since 1990.** However, since 1990 both overall and weather/climate losses have decreased as proportion of global GDP”

That result is thus due to improved management rather than reduced bad weather events.

This is a secondary, derived result and too uncertain for use but may have long term value.

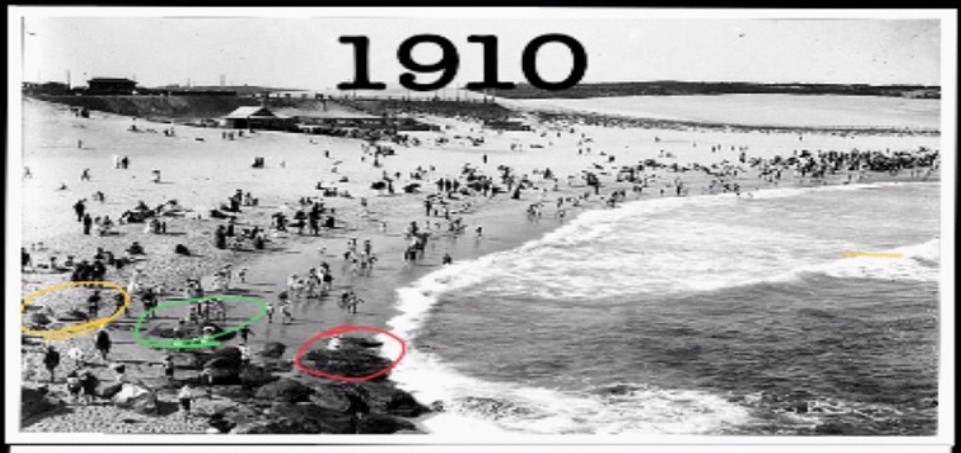
9. Historic photos and the long running tide gauge at Fort Dennison shows we have little to worry about sea level rise.

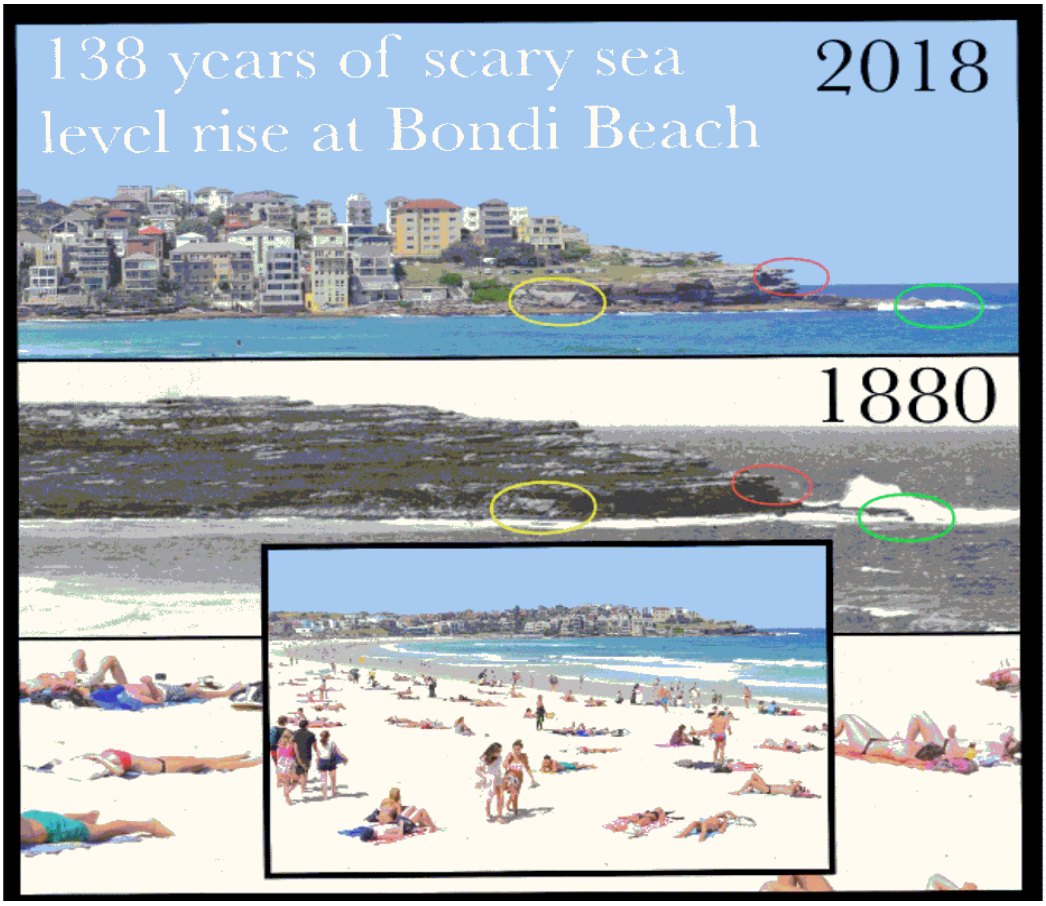


Selective reading of the Tide Guage Data graph is not evidence of change; rather the figure shows the large fluctuations that occur over time. Presumably these readings were all taken at the same time of tide, eg full tide, but at various points in the lunar cycle. Averaging over these data would eliminate the fluctuations and would show very little change over time.

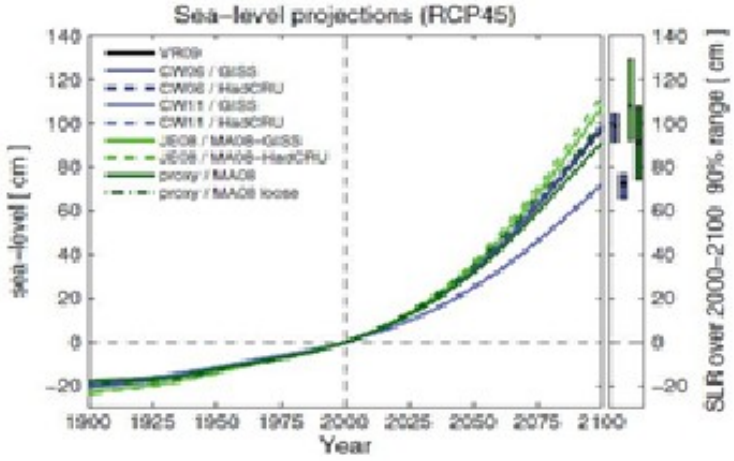
Craig provided the following additional photographs supporting the constancy of sea levels:

A century of scary sea level rise at Bondi Beach




138 years of scary sea level rise at Bondi Beach
2018
1880

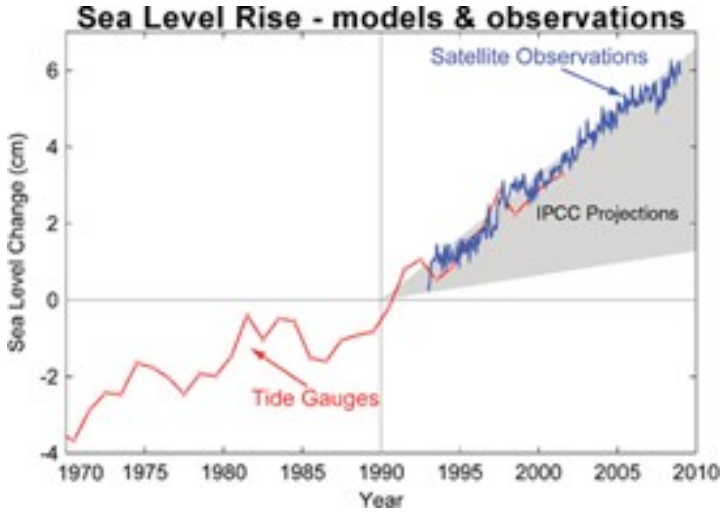
The reported increase in global sea level over the past 100 years is ~ 20 cm, as shown in the figure below. This is so small that it could not possibly be measured by the Balmoral photographs. The same argument applies to Bondi photos, (in which the second set and insets afford evidence only of climate-related bikini shrinkage). Of course, these data show that there has not been a 1-2m increase in sea level but that is **not** what models predict for the present. It could however apply by the end of this century.



Further, for meaningful comparison, the tides must be at exactly at the same phase for each photo. Tides vary by ~2 m around Sydney. The more accurate satellite observations are in good agreement with predictions over the last 15 years and are providing primary data on sea levels.

https://www.researchgate.net/figure/Observed-sea-level-rise-1970-2010-from-tide-gauge-data-red-and-satellite-measurements_fig4_328413289 referring to:

"What Lies Beneath". THE UNDERSTATEMENT OF EXISTENTIAL CLIMATE RISK
BY DAVID SPRATT & IAN DUNLOP | FOREWORD BY HANS JOACHIM SCHELLNHUBER

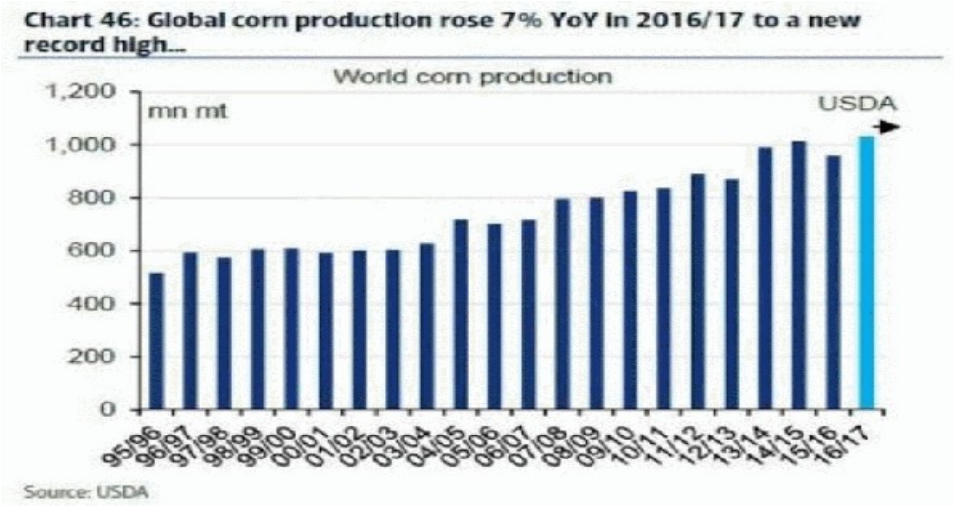


As such, the non-data of these photographs is rejected.

10. Crop yields

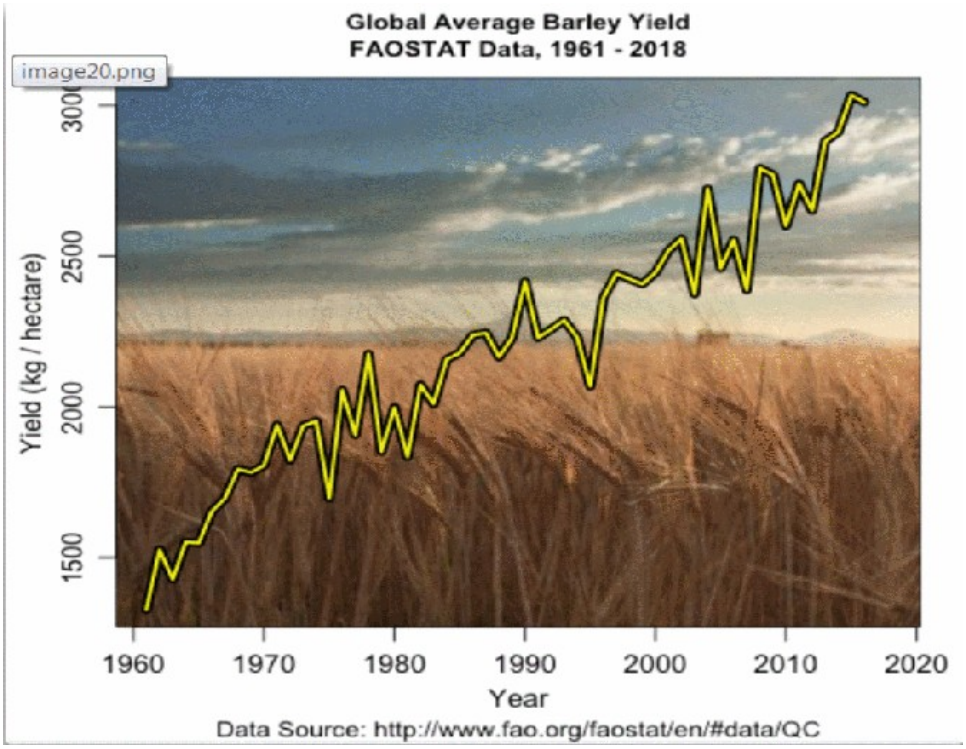
“For farmers there are always good and bad years, however overall crop yields continue their remarkable upward trend, which is great news for farmers and for the world, as more crop can be produced on less land.”

10 a & b “Crop yields. “



The impressive increase plotted in corn (maize) yield is technologically driven but may not continue : https://www.pri.org/stories/2018-07-15/global-corn-crop-vulnerable-effects-climate-change

Global Average Barley yield 1961-2018
Barley is one of the most widely-produced cereal crops in the world;



The global average barley yield is 2497 kg/ha. however yields vary enormously. For 2006, the UN Food & Agriculture Organisation reported the following average yields:

5956 kg/ha in Western Europe, (near ideal climate, high inputs of fertilisers and pesticides)
2715 kg/ha in drier Southern Europe
4253 kg/ha in the cooler and wetter Northern Europe
3550 kg/ha in the Nordic countries
1045 kg/ha at high altitudes in Bolivia and Peru

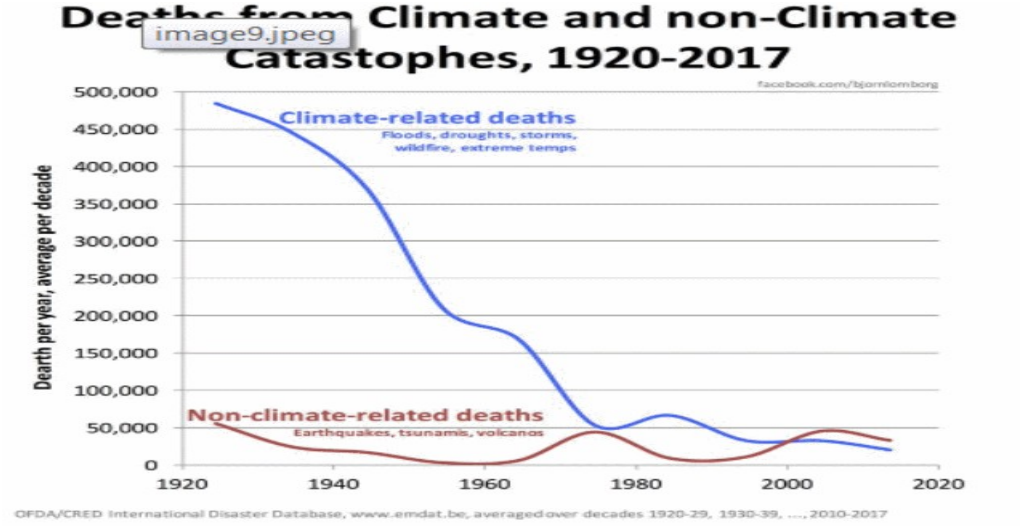
By way of comparison, Australia's barley yield for that year was described as "climate limited" and poor at 2100 kg/ha (while the average for the UK was 7100 kg/ha). Studies of the impact of climate change on barley yields indicate that yields are likely to *decrease* as temperatures rise

Corn (maize) and barley **production** have been increasing with global population, largely achieved by pressing more land into service. **Yields** are more closely related to climate effects, and have also been improved through the use of fertilisers, irrigation, pesticides and new strains that are less sensitive to disease. As yields vary markedly around the planet, only the "weighted average" (with average-national-yields weighted by the national land-area under crop cultivation) has any significance.
This is secondary, derived data that can be influenced by economic and technological factors.

It is not a relevant measure of climate change.

11 "Climate related deaths "

"But the really great news is the remarkable decline in deaths from bad weather that has occurred over past decades."



"

This diagram appears 9 times on the web, 7 of which are from Twitter (including from Lomberg) and 2 from Foxnews. The original site quoted here (www.emdat.be) is currently unavailable but is also cited by: https://ourworldindata.org/ofdacred-international-disaster-data which does not show the graph but a table:

Annual global number of deaths from natural catastrophes per decade, 1900–2015[1]

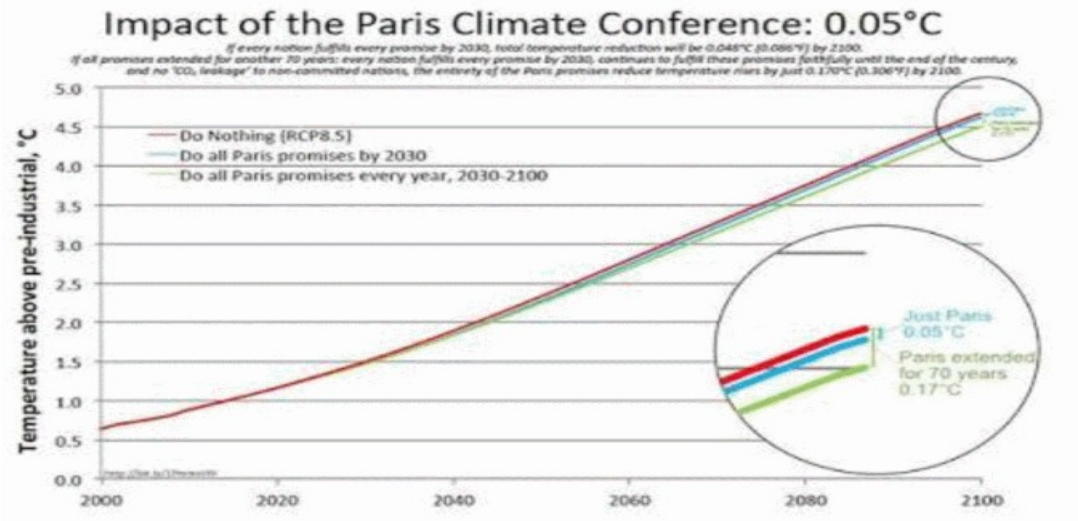
Yearly average global annual deaths from natural disasters, by decade	Drought	Earthquake	Extreme temperature	Flood	Impact	Landslide	Mass movement (dry)	Storm	Volcanic activity	Wildfire
1900s	130000	17302	0	63	0	5	13	1801	4494	0
1910s	8500	6280	0	10138	0	0	12	5995	648	107
1920s	472400	54935	0	428	0	43	0	11999	514	10
1930s	0	23770	169	436147	0	103	4	9384	318	7
1940s	345000	16187	0	10103	0	1753	0	12712	213	25
1950s	0	2093	150	205830	0	215	0	3126	510	1
1960s	150865	5236	113	3239	0	504	218	13393	324	7
1970s	11908	44022	155	5078	0	738	7	35734	53	1
1980s	55727	6015	534	5155	0	623	127	4667	2400	40
1990s	311	10359	932	9549	0	833	87	21115	97	86
2000s	115	45364	9106	5401	0	772	28	17213	24	63
2010s	3339	43302	11644	5811	0	1069	13	3177	71	52

"Climate Related" events appear to be represented here by the categories "Extreme Temperature" , "Drought", "Flood", "Storm", "Wildfire" and perhaps "Landslide". Some of these have varied erratically but extreme temperatures (unspecified whether hot or cold) are shown to have intensified steadily by 2 orders of magnitude since the 1950s. None have shown the steep, progressive reduction shown in the EMDAT graph. Factors such as organisation, equipment, training, communication, preparedness, and strategies of emergency services across the world would be expected to *reduce* the number of deaths from wildfires, floods, storms, droughts, and extreme temperatures.

The graph is secondary data that can be influenced by many societal and technological factors not attributable to climate change.

2 "Limited impact of global emissions reduction."

"And finally, the peer-reviewed science tells us that if every nation meets its Paris targets, it's estimated that the world will save 1/20th of degree by the year 2100."



Craig's figure headed "Impact of the Paris Climate Conference: 0.05ºC" shows minimal, insignificant effect from intervention. Derived from Lomborg eg. https://www.heartland.org/Center-Climate-Environment/bringing-climate-realism-to-paris-at-cop-21/, this paper has been described as fundamentally flawed, eg. in http://www.lse.ac.uk/GranthamInstitute/news/bjorn-lomborgs-lukewarmer-misinformation-about-climate-change-and-poverty/

Similar conclusions of negligible effect (0.2ºC)were presented by scientists at the Massachusetts Institute of Technology (MIT) in 2014 and published in 2015 (prior to the Paris agreement). Misinterpretation of their data has been clarified by the MIT team in terms relevant also Lomberg's document : http://news.mit.edu/2017/mit-issues-statement-research-paris-agreement-0602 with the statement:

> "The researchers in MIT's Joint Program on the Science and Policy of Global Change who led the relevant analysis find this statement to be misleading, for two reasons.
>
> First, the 0.2 degree-figure used in the talking point reflects the incremental impact of the Paris Agreement compared with the earlier Copenhagen agreement. If you instead compare the impact of the Paris Agreement to no climate policy, then the temperature reduction is much larger, on the order of 1 degree Celsius — 1.8 degrees Fahrenheit — by 2100. This would be a significant reduction in the global temperature rise, though much more is needed if the world is to achieve its goal of limiting warming to 2 degrees Celsius or less.
>
> Second, the analysis accounts only for countries' pledges under the Paris Agreement, assuming no further strengthening of the commitments in years after 2030. The Paris Agreement is a milestone of the ongoing UN Framework Convention on Climate Change, which is committed to ongoing annual meetings to regularly revisit and ratchet up nations' climate goals, making them more ambitious over time.

The relevant MIT researchers believe that the Paris Agreement is an unprecedented and vital effort by nearly 200 countries to respond to the urgent threat of global climate change."

The message from this Point 12 is that international diplomacy is crucial in protecting and extending the steps of the Paris Agreement on which the future depends, particularly for Australia.

The primary data, being incomplete, are rejected.

13 "Dead fish in the Darling river."

"And finally, on the fish in the Murray and Darling Rivers, this is terrible to see, but it's not the first time it's happened in our history."

1861 - 1954) / Sat 1 Feb 1930

The Herald (Melbourne, Vic.

WHAT IS KILLING MURRAY FISH?

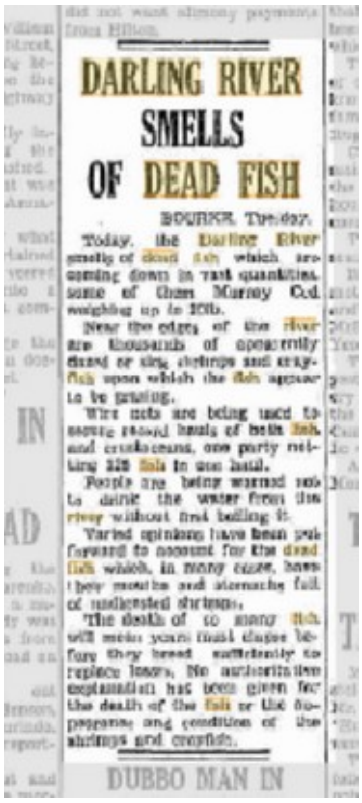
Green Slime in Water Blamed

Differences of opinion exist concerning the cause of the large numbers of dead Murray fish discovered in the river. Mr O. J. Lawson, who has a fruit farm near Pericoota station, said today that the fish were dying in thousands owing to the state of the water. The Chief Inspector of Fisheries (Mr F. Lewis), however, holds that the green slime in the water could not kill the fish; they may have been killed by fishermen blasting.

Mr Lewis said that he had had no official report of fish dying in large numbers in the Murray. There was a vegetable growth in the water which made it unsuitable for domestic purposes, but that would not have any effect on the life of the fish. He had inspected the areas where fish were reported to be dying last November, and had found the reports to be greatly exaggerated. One of his inspectors had recently returned from the Murray area, and had not reported anything unusual.

RIVER NOT LOW

Mr Lawson said that the fish were coming to the surface in large numbers for miles near his property. The river was not low, because it was banked up by the Torrumbarry Weir. He estimated the width at 100 yards, and the depth at 20ft. Crayfish, usually plentiful in that district, were crawling out of the water and dying on the bank. Any fish he took out



DARLING RIVER SMELLS OF DEAD FISH

BOURKE, Tuesday.

Today, the Darling River smells of dead fish which are coming down in vast quantities, some of them Murray Cod weighing up to 20lb.

Near the edges of the river are thousands of apparently dead or dying shrimps and crayfish upon which the fish appear to be feeding.

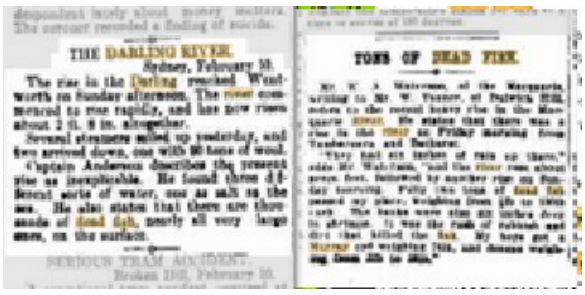
Wire nets are being used to secure [illegible] loads of both fish and crustaceans, one party netting 2[illegible] fish in one haul.

People are being warned not to drink the water from the river without first boiling it.

Varied opinions have been put forward to account for the dead fish which, in many cases, have their mouths and stomachs full of undigested shrimps.

The death of so many fish will make years must elapse before they breed sufficiently to replace losses. No authoritative explanation has been given for the death of the fish or the disappearance and condition of the shrimps and crayfish.

DUBBO MAN IN



THE DARLING RIVER.

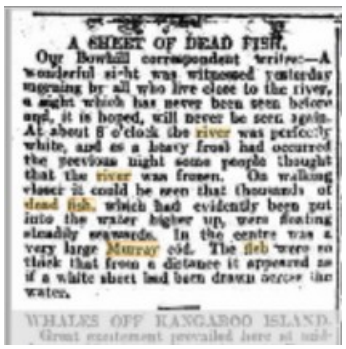
Sydney, February 10.

The rise in the Darling reached Wentworth on Sunday afternoon. The river commenced to rise rapidly, and has now risen about 2 ft. 6 in. altogether.

Several steamers sailed up yesterday, and two arrived down, one with 80 bales of wool.

Captain Anderson describes the present rise as inexplicable. He found three different sorts of water, one as salt as the sea. He also states that there are thousands of dead fish, nearly all very large ones, on the surface.

TONS OF DEAD FISH.



A SHEET OF DEAD FISH.

Our Bowhill correspondent writes:—A wonderful sight was witnessed yesterday morning by all who live close to the river, a sight which has never been seen before and, it is hoped, will never be seen again. At about 8 o'clock the river was perfectly white, and as a heavy frost had occurred the previous night some people thought that the river was frozen. On walking closer it could be seen that thousands of dead fish, which had evidently been put into the water higher up, were floating steadily seawards. In the centre was a very large Murray cod. The fish were so thick that from a distance it appeared as if a white sheet had been drawn across the water.

WHALES OFF KANGAROO ISLAND.

Great excitement prevailed here at mid-

This has occurred before. However, its relation to global warming is indirect, as river management eg. by weirs and water extraction upstream can cause reduced flows and toxic water in drought conditions (see item 6).

The observation is non-data, not even secondary data, and is rejected as evidence.

Conclusion:

This review of the presented data shows no convincing refutation of the anthropogenic global warming now occurring. Data for some claims is irrelevant or non-data, other secondary data is too dependent on multiple parameters. In some cases inappropriate or incomplete primary data are compared, like "production" with "yield", which give false facts. In many cases considerable effort was required pursuing the original source of the data.

What at first glance, looks like an argument against anthropogenic global warming, is found on critical review, to support the prevailing scientific view. This topic is multifaceted and open to misinformation. As such, only a thorough scientific review can have any hope of penetrating the evidence to find the real truths underlying climate change and global warming in Australia. Neither I, nor my contributing advisors below, are qualified in the many specialities required to perform such a review.

I am indebted to Craig Kelly for the challenge presented in his "Anomalous Climate" document which has prompted me and my colleagues to extensive reading and fresh understanding of the climate problem, aspects of which are constantly emerging in reliable news sources. I hope this reply will similarly stimulate his study of these issues.

These comments submitted by:
Murray Scott (BSc).

Any errors in this document are the sole responsibility of the author Murray Scott, but I gratefully acknowledge the advice and contributions of Barry Allen (PhD, DSc, AO) and Geoff Durance (PhD)

In his previous email, Craig wrote:

> "I hope this information helps, and if you'd like any further detail on any of the above please don't hesitate to contact me."

This reformatted document above, including some changes from earlier drafts, represents my take-up of that offer. In return I make the same offer to Craig Kelly to present any additional, more persuasive data for study.