26 September 2017 – 9pm

Honourable Josh Frydenberg MP
Minister for Environment and Energy

Dear Minister

Verifying September Record for Mildura

Just last Saturday, the Bureau of Meteorology announced a new September record for Mildura, in north western Victoria, of 37.7 degrees Celsius. According to Guinness World Records, a record must be measurable, standardisable and verifiable. While the temperature was measured from an electronic probe in an automatic weather station (AWS), the reading was not according to world standards of calibration such as are used in the UK. Indeed, this new record cannot be judged against any documented standard, and therefore cannot be verified.

The issue of whether temperature measurements from Mildura are legitimate – or not, is relevant to every maximum and minimum value recorded at Mildura for the last 21 years. Since 1 November 1996, measurements from the electronic probe at the Mildura AWS have been incorporated into international temperature datasets used to calculate the global average temperature – so the last 21 years of measurement from Mildura also becomes an issue for the Intergovernmental Panel on Climate Change (IPCC).

The World Meteorological Organisation (WMO) provides guidelines for measuring temperatures and the Australian Bureau of Meteorology claims to abide-by them. Except the recently published 'Review of the Bureau of Meteorology's Automatic Weather Stations' confirms that the Bureau is only taking a single one-second reading every sixty second (and also the highest-second and lowest-second), rather than averaging readings over at least one minute in accordance with WMO guidelines.

The 'Fast Facts' (published a few days after the Review) confirms that the Bureau has chosen to attempt to make readings from electronic probes comparable with readings from old-style mercury thermometers through the use of a time constant, rather than by averaging. In particular the Fast Facts stated that:

> "The [WMO] guide recommends that temperatures be integrated over time to smooth out rapid

> fluctuations. There is more than one method of achieving this. The WMO guidelines do not prescribe which method to take. In its automatic weather stations the Bureau achieves this by using platinum resistance thermometers. These are comparable to mercury in glass thermometers."

In fact, the WMO guidelines clearly state that platinum resistance thermometers are *not* comparable because their time constant is smaller. The 'Fast Facts' does not specify the time constant for the Bureau's electronic probes (platinum resistance thermometers), but in a report authored by Jane Warne of the Bureau in 1999 this is confirmed as 18 seconds. The WMO guidelines state that samplings to compute an average should occur such that it does not exceed the time constant. It follows that sampling of temperature readings by the Bureau should be more frequent than every 18 seconds. Yet the review indicates that a one-second sample is taken only every 60 seconds, and also the lowest and highest one second readings for that one minute interval.

In short, whichever way the available information is analysed, it is apparent that the Bureau is not following WMO guidelines – or any logical variation of the same.

Rather, the Australian Bureau of Meteorology appears to have put in place a measurement system guaranteed to provide new record high and low temperatures – but with record low temperatures limited through the application of filters. Indeed, while the Bureau's temperature data underpins the theory of human-caused global warming with far reaching economic policy consequences, there is no evidence to suggest that the Bureau has been providing anything but a biased picture of climate change since the 1990s, which is when automatic weather stations were first installed across Australia.

To be clear, electronic probes can be very sensitive to rapid variations in temperature. This is not in itself a problem, but it means measurements from electronic probes with a short time constant need to be averaged, otherwise they are not comparable with measurements from, for example, the mercury thermometer used at Mildura (post office and then airport) from 1889 until 2000. Therefore, it is disingenuous for the Bureau to claim that the temperature recorded at Mildura on Saturday was a new record for September and higher than any temperature previously recorded since 1889.

Weather enthusiasts across Australia will likely be as outraged about this faux September record for Mildura, as they were about the Bureau rounding up the minus 10.4 to minus 10.0 at Goulburn on 2 July. The average Australian may simply ask how could such suspicious data not be properly audited as a matter of urgency – given it ultimately has an impact on their electricity bill.

I have invested a significant amount of my own time on this issue over recent months because the integrity of historical temperature data is integral to my work with John Abbot (James Cook University) and Jaco Vlok (University of Tasmania) – specifically our research using artificial intelligence for rainfall forecasting and more recently temperature reconstructions.

In order to determine whether or not it is worth continuing with this research effort, I request the following data as a matter of urgency. This request is made following discussions with an international expert in metrology (measurement) who has indicated that the only real way to assess the effect of the Bureau converting to electronic probes (without following WMO guidelines), is to assess changes (particularly in variance) from parallel measurements i.e. measurements from electronic probes and mercury thermometers taken at the same site for a period of time.

a. According to the Bureau's own equipment catalogue, for the period 1 October 1989 until 13 October 2000 both an electronic probe and a mercury thermometer was recording temperatures at Mildura airport. Could this entire record of daily temperature measurements please be made available to enable a fair comparison of parallel data from an electronic probe (platinum resistance thermometer) and mercury thermometer – using the Bureau's own methods.

b. Issues can arise when electronic equipment is not adequately maintained, in particularly corrosion can introduce 'noise', offset errors and intermittent readings. In order to assess the variance in one-second recordings from the Mildura automatic weather station and whether it is consistent or not with the readings when the probe was first installed in October 1989, could

the last one year of readings from Mildura please be made available (highest-second, lowest-second and last-second for each one minute interval) through until at least 25th September 2017.

c. Airport radar, two-way radios and electric cables can create interference with the signal as measured from the electronic probes. Further, the Bureau's method of recording only the highest-second, lowest-second and last-second from each one minute interval makes it difficult to assess the true performance of the electronic probes given natural variations in wind speed and solar radiation. Could the data logger at the Mildura AWS please be reset to record data every second of every minute for at least the next three months. Interpretation of this data would be aided through the collection of parallel data from an old-style mercury thermometer in the same Stevenson screen – such an installation could easily be made.

d. The Bureau has been unnecessarily ambiguous about the time constant actually applied to its electronic probes (Platinum resistance thermometers). I understand from the recent review that measurement is in accordance with the British standard BS 1904:1984, and I have purchased a copy of the same. However, what I really need to know is the manufacturer's specifications, in the case of Mildura I would like to be told the specific time constant/response time for the temperature probe installed on 27th June 2012, Rosemount ST2401 S/N – 654. The time constant must be declared by the manufacturer and was no doubt provided to the Bureau at the time of purchase.

I do not believe that ordinary Australians, who through their taxes fund the Bureau, would consider that this is an excessive request – or in any way vexatious or conspiratorial. I am simply requesting a limited number of datasets from just one locations, and manufacturer specifications to enable clarification of the appropriate sampling period. I request this data to ascertain the extent to which the transition to automatic weather

stations using electronic probes may have created discontinuities in the historical temperature record for Mildura, which could affect my research work. This data and information would also enable me to judge the extent to which the new September record of 37.7 degrees Celsius for Mildura is in anyway justified – even if unable to be verified.

Yours faithfully

Dr Jennifer Marohasy
Noosa, Qld

About me: I am a Senior Fellow at the Melbourne-based Institute of Public Affairs, though I reside in Noosa where I also work at the Climate Lab. The Climate Lab is a space dedicated to applying the latest big data techniques to better rainfall forecasts. I have a Bachelor of Science and Doctor of Philosophy from the University of Queensland. I have several-dozen publications in peer-reviewed international science journals including *Atmospheric Research* and *Advances in Atmospheric Research*. The research associated with my climate science publications is wholly funded by the B. Macfie Family Foundation.

This letter was compiled with the assistance of Lance Pidgeon, Bob Fernley-Jones, Anthony Cox, and Ken Stewart.