January 27, 2015

Marc Hendrickx
PO Box 61
Berowra Heights NSW 2082

The Hon. Bob Baldwin MP
Parliamentary Secretary for the Minister to Environment
PO Box 6022
House of Representatives
Parliament House
CANBERRA ACT 2600

RE: Review of Bureau of Meteorology's official national temperature records

Dear Mr Baldwin,
This is a submission for the review into the Bureau of Meteorology's official national temperature records. The submission concerns issues with the Urban Heat Island effect at one of the weather stations (Laverton 87031) included in the BOM's "high quality" stations used in calculating national averages (ACORN).

I am an engineering geologist running a small consultancy specialising in landslide risk assessment. Extreme rainfall events are an important trigger for landslides and hence my interest in climate and weather records in general. High quality weather data is key in providing evidence to link landslide frequency with climatic triggers-mainly rainfall, and to help make predictions of future landslide behaviour. I provide this background as explanation for my continued interest in the BOM's weather and climate data.

My interest in data at the Laverton station arose when I discovered problems in a published biological study[1] that used weather data from the Laverton station to claim anthropogenic global warming as the cause of early emergence of a species of butterfly in South East Australia. I noted numerous issues with the study that were published by the journal and replied to by the authors (see e-letters attached). One of these issues was the potential UHI effect on the Laverton temperature record. The authors claimed there was no UHI signal at Laverton and the station was "rural". However if UHI had affected the data it would affect the conclusions of the study. It was clear from my research that Laverton was indeed affected by UHI and this was subsequently confirmed in a re-analysis of the station data by the BOM in 2012 (see LAVERTON UHI).

As part of my research in 2010 I was contacted by the BOM's Dr David Jones, then Head of Climate Monitoring and Prediction. In our correspondence (see emails) Dr Jones concluded there was no UHI signal at Laverton, and this information was used by the study authors in responding to my comment on their paper. This was not on the basis of any new studies or an analysis of the weather station

[1] Early emergence in a butterfly causally linked to anthropogenic warming Michael R. Kearney, Natalie J. Briscoe, David J. Karoly, Warren P. Porter, Melanie Norgate, Paul Sunnucks

DOI: 10.1098/rsbl.2010.0053Published 13 September 2010

records, but based on previous work that included significant reservations about the potential UHI effect on the records at Laverton (see email correspondence with D Jones).

A re-analysis of the data at Laverton by the BOM published in 2012 has found a clear UHI effect is present (see email correspondence), disproving the claims of Dr Jones, and the study authors:

http://www.bom.gov.au/climate/change/acorn-sat/documents/ACORN-SAT-Station-Catalogue-2012-WEB.pdf

Page 57: Laverton RAAF (087031)

This site is on the grounds of the former RAAF base at Laverton, about 20km west-southwest of central Melbourne. The site is over short unwatered grass.

History

The site was originally a Meteorological Office; there is no clear evidence of moves before 1997.

An automatic weather station was installed on 22 February 1997, about 1.2km northeast of the previous site (which continued until July 1998 under the station number 087177).Whilst there has been no significant building on the base grounds, the surrounding region is a major urban growth corridor and a new housing development has been built in recent years a few hundred metres west of the site. There is evidence of recent anomalous urban warming in the minimum temperature data.

Extract from Email to Bob Fearnley-Jones from BOM Climate Analysis Section, March 31, 2014

The Bureau in maintaining homogenised datasets periodically assesses stations for emerging urban signals. The status of Laverton as a site where the temperatures were influenced by urbanisation was assessed on the basis of its temperature trend relative to clearly non-urban stations in Victoria over the whole period of record. The most recent assessment, carried out in 2012, found evidence that there was indeed an anomalous temperature trend at Laverton over the recent period up to 2011. As the previous assessment in 2004 did not find an anomalous trend at Laverton, it would be reasonable to conclude that the elevated urban influence on Laverton temperatures is quite recent. This is not surprising as it is near a major urban growth corridor which has seen rapid urban development in recent years.

I raise several issues that I would like the committee to examine as part of their investigation.

1. A senior BOM scientist made pronouncements about the UHI effect at a nationally important weather station without first conducting any statistical analysis of the data. This information, that turned out to be incorrect, was passed onto the authors of a scientific paper and used to defend a deeply flawed study from criticism.

What processes can BOM institute to prevent this ad hoc and haphazard approach to providing professional advice happening in the future?

2. BOM include stations affected by UHI in their ACORN temperature series.
How many stations affected by UHI are used in the ACORN series and what methods are used to remove the UHI signal from the data?

Regards
Marc Hendrickx

What is the Urban Heat Island Effect?

The Urban Heat Island Effect is localised warming due to the increase in the large amounts of paved and dark coloured surfaces like roads, roofs and car parks as a result of urban development. The suns heat is absorbed not reflected and causes the surface and ambient temperatures to rise. Anthropogenic heat production, such as the heat produced through car engines and air conditioners also contribute to the Urban Heat Island Effect. On hot summer days, cities can be several degrees hotter than their rural surrounds.

Refer also http://www.bom.gov.au/announcements/media_releases/ho/20101013.shtml

Biology Letters-e letters

http://rsbl.royalsocietypublishing.org/content/6/5/674.e-letters

Early emergence in a butterfly causally linked to anthropogenic warming

Michael R. Kearney, Natalie J. Briscoe, David J. Karoly, Warren P. Porter, Melanie Norgate, Paul Sunnucks

DOI: 10.1098/rsbl.2010.0053Published 13 September 2010

Published eLetters

Comment on Early emergence in a butterfly causally linked to anthropogenic warming

- Marc Hendrickx, PhD Candidate/Consultant

(10 June 2010)

Comment on Kearney et al., 2010.
I thank the authors for their acknowledgement that an earlier critique that I made improved their paper; however, I do not agree with the paper's conclusions and highlight the following issues that require clarification.

I have obtained the same data used in this study as Kearney et al. and am unable to confirm the results for the historical observation data. I count 239 observations made in Oct-Dec from 1942 to 2009. The annual data show a wide range of earliest observation dates (Figure 1), and at face value the use of 5 year or 10 year averages appears to be a convenient statistical method that hides the very wide spread of observation dates. Applying a linear regression to a graph of the earliest observation date for each year indicates a trend of -0.7 days per decade. However, with an R2 of 0.0091 the trend has no statistical significance. Based on a 10 year average of earliest observance dates, Kearney et al., 2010 claim -1.5 days per decade with R2 of 0.766. This is an artifact of averaging the dataset, and misrepresents the wide spread of observation dates and resulting uncertainty in trends.

Regardless of any trend noted, there remains a major problem using this "opportunistic" data as a proxy for emergence. This has been poorly discussed in the paper and requires further comment. Indeed the caption for Figure 1a is incorrect and misleading. The graph is in fact a measure of earliest "observance" times, not emergence. This should be amended here and elsewhere in the paper (eg Abstract). Using this "opportunistic" data to establish emergence is like dating a volcanic eruption based on collection dates of samples housed in a museum. The historical trends identified simply reflect variation in the time collectors have ventured out to observe and collect butterflies. The databases in question do not record a single observation of natural emergence of H.Merope. Indeed no work has been published that records natural emergence times for the butterfly concerned. In order to establish a change in emergence, the authors should actually be observing emergence. The proxy used is simply not close enough. I understand this is difficult because the

"bugs" are small and difficult to observe under natural conditions. There remains considerable temporal bias in the data, with over 50% of total observations post dating 1990. There is also a considerable bias in observation locations, with the vast majority collected in Melbourne's east and none in the vicinity of Laverton, the weather station that was used to characterise temperature change over the whole of the study area (Figure 2).

The other issue relates to the use of this Laverton weather station to characterise temperature over the very large and geographically diverse study area, amounting to approximately 12,000km2 (37.60-38.54 S, 144.17-145.48 E). The paper does not mention well documented Urban Heat Island effects over Melbourne that encompasses Laverton that have clearly affected temperature at this station over the period of study (see Morri and Simmonds, 2000 and Torok et al., 2001). Close examination of other stations in the study area shows a wide variety of temperature trends (Figure 2). It seems the authors have chosen one station that favours their theory without adequately explaining why others should be rejected. The choice of Laverton with its inherent problems of Urban Heat Island effects are not sufficiently explained. Trends for other stations (eg Durdidwarrah) fall well within the limits of natural temperature change indicted by Kearney's Figure 1d and provide an indication that observed temperature trends over parts of the study area can be adequately explained by natural factors without recourse to warming through increased green house gases.

Based on these points, I believe that the authors' conclusions remain unsupported by the data presented.

In addition, there is apparently an error in the discussion section where the trend from the previous version (-1.6) is used.

Figure 1 Earliest observations dates of H.Merope. Study Area (37.60-38.54 S, 144.17-145.48 E)1942-2009. Available on request.

Figure 2. Sample locations and temperature trends from weather stations super-imposed on the study area. Note the geographic variation, bias in observation location, and range of temperature trends over the study area.

Figures available on request from Marc Hendrickx, email marc.hendrickx@uon.edu.au.

Acknowledgement
The author thanks Kelvyn Dunn for access to the Dunn and Dunn butterfly database, that contains extensive butterfly observational data for many species, collected over 27 years by KL Dunn and LE Dunn. Dunn K.L., 2009. Overview of the butterfly database: Part 1 History and inception. Victorian Entomologist 39: 73-79

References
Morris C.J.G and Simmonds I., 2000. Associations between varying magnitudes of the urban heat island and the synoptic climatology in Melbourne, Australia. International Journal of Climatology 20: 1931-1954.

Torok S.J, Morris C.J.G., Skinner C. and Plummer N., 2001. Urban Heat Island features of southeast Australian towns.Australian Meteorological Journal 50:1-13.

Conflict of Interest:

None declared

Conflict of Interest: None declared.

Re:Comment on Early emergence in a butterfly causally linked to anthropogenic warming

- Michael R. Kearney
- Other Contributors:
  - David J. Karoly, Natalie J. Briscoe, Warren P. Porter, Melanie Norgate and Paul Sunnucks

(28 July 2010)

We are glad for the opportunity to respond to Marc Hendrickx's critique of our paper and explain the analyses and results in more detail.

First, we agree it would be ideal if we could base our estimate of the trend of emergence date on systematic surveys of observations of butterflies emerging from their chrysalides. However, owing to funding and logistical factors, systematic surveys are exceedingly rare, especially in the southern hemisphere (Rosenzweig et al. 2008). Instead, the alternative, standard practice is to use historical data from museums and other collections (Graham et al. 2004; Sparks 2007). For obvious reasons, there is considerable noise in such data sets. We agree that there is a risk of bias in such data sets, an obvious one being in the number of records available through time. To protect against this, our analysis accounted statistically for the number of records.

We emphasize the strong correspondence between the observed emergence pattern and that predicted from our physiological study (Fig. 1a of our paper). We measured the thermal dependence of development of over 350 individuals of this species, from egg, through the five larval instars and the pupal phase. When combined with the observed temperature trend in Laverton, this produced almost exactly the same rate of change in emergence pattern as observed. Moreover, the emergence date correlates well with Laverton air temperatures and even more strongly when we transform the Laverton air temperatures into physiological responses (note the varied, and often non-linear, responses of the development rate of the different stages to temperature in Fig. 1c of our paper). This is precisely what one would expect to see if the eggs, caterpillars and pupae were indeed warming as the temperature around Melbourne warmed, and developed at a correspondingly faster rate. In a sense it would be biologically more interesting if the caterpillars were somehow able to avoid this rising air temperature effect on their development rate (as endotherms do, for example, by

physiologically regulating core temperature). While the (flying) adults have great capacity to behaviourally thermoregulate, the immature stages are either totally immobile (eggs, pupae) or restricted to vertical movements within their grass tussock (caterpillars). We would thus suggest that it is not particularly controversial that there is congruence between the signal of emergence time in the observation data and the physiologically-based prediction of emergence in response to regional temperature change.

This still leaves the issue of whether the historical air temperature trend from Laverton weather station is representative of the general area around Melbourne and to what extent the observed warming is the result of the urban heat island effect. It is important to use only high-quality weather station data to describe long-term trends, as changes in station location or instrumentation may affect trends in the data. The Bureau of Meteorology in Australia has developed a network of high-quality climate stations (http://www.bom.gov.au/climate/change/hqsites/). As stated in our paper, Laverton is a Bureau of Meteorology high-quality climate station with a homogeneous temperature record and no urban influence is reported in its data record. The location of Laverton to the south-west of Melbourne means that the typical wind patterns limit the effect of Melbourne's urban heat island on Laverton (Morris and Simmonds, 2000).

Hendrickx refers to his Figure 2, showing a wide range of temperature trends for a sample of locations around Melbourne. Almost all of those stations are excluded from the Bureau of Meteorology's high-quality climate station network and many have heterogeneous records. The specific example of Durdidwarrah noted by Hendrickx has several known discontinuities in its data record. The trends in the data at those stations are likely affected by heterogeneities in the data and do not represent the underlying climate trends around Melbourne.

The long term temperature trend at Laverton is very similar to the temperature trends at the other high quality rural climate stations in southern Victoria that clearly have no urban influence. For example, if one analyzes the trends in mean annual temperature from 1940 to 2009 from the 12 closest high-quality sites to Melbourne (King Island, Cape Otway, Geelong, Laverton, Ballarat, Maryborough, Ararat, Melbourne, Wilsons Promontary, Sale, Bairnsdale, Benalla), all have very strong and consistent trends of 0.15 degrees C per decade and there is no difference between the trends at urban- and rural-classified sites (ANOVA, $F_{1,10} = 0.3$, $P = 0.60$, rural mean 0.16, urban mean 0.15). Thus despite the well- known pattern that urban sites are warmer than rural ones, there is no evidence of an influence of urbanization on the rate of change in annual mean air temperature in southern Victoria over the past 70 years. The long - term warming trends over our study period at high-quality rural climate stations around Melbourne are statistically significant, cannot be explained by natural climate variations alone, and agree with the predicted climate response to increasing greenhouse gases.

Hence, all the criticisms of our methods and conclusions by Hendrickx are not supported by further examination and the conclusions from our paper remain valid.

Literature Cited

Graham, C. H., S. Ferrier, F. Huettmann, C. Moritz, and A. T. Peterson. 2004. New developments in museum-based informatics and applications in biodiversity analysis. Trends in Ecology & Evolution 19:497-503.

Morris C. J. G and Simmonds I., 2000. Associations between varying magnitudes of the urban heat island and the synoptic climatology in Melbourne, Australia. International Journal of Climatology 20: 1931-1954.

Rosenzweig, C., D. Karoly, M. Vicarelli, P. Neofotis, Q. Wu, G. Casassa, A. Menzel, T. L. Root, N. Estrella, B. Seguin, P. Tryjanowski, C. Liu, S. Rawlins, and A. Imeson. 2008. Attributing physical and biological impacts to anthropogenic climate change. Nature 453:353-357.

Sparks, T. H. 2007. Lateral thinking on data to identify climate impacts. Trends in Ecology & Evolution 22:169-171.

Conflict of Interest:

We are the authors of the original paper.

Conflict of Interest: None declared.

Email correspondence David Jones BOM Head of Climate Monitoring and Prediction

From: David Jones [D.Jones@bom.gov.au]
Sent: Thursday, June 17, 2010 9:32 AM
To: Marc Hendrickx
Subject: copy of figures [SEC=UNCLASSIFIED]

Marc,

could you please send me a copy of your figures quoted at http://rsbl.royalsocietypublishing.org/content/early/2010/06/07/rsbl.2010.0053.short/reply .

I am interested in the evidence you have that Laverton is affected by an UHI - while it is a while since I read the work by Torok, Morris et al. I do not recall them showing evidence of an UHI effect at Laverton.

Regards,

Dr David Jones
d.jones@bom.gov.au

From: Marc Hendrickx
Sent: Thursday, June 17, 2010 12:15 PM
To: David Jones
Subject: RE: copy of figures [SEC=UNCLASSIFIED]

Dear David,
Thanks for your interest, the figures are attached. I quote the references to show a well established UHI affect is present over most of the Melbourne metro area, not just as evidence to show Laverton has a UHI. I think it's important to look at the big picture in this regard. Morris and Simmonds used Laverton as a "rural" station to judge UHI effect over the Melbourne CBD along with other "rural" stations at Melbourne Airport and Moorabbin airport. However if you compare Laverton trends with remote stations with little development (eg Durdidwarrah) there is a clear difference in trends and I account for this difference by UHI at Laverton. A plot of population change and temperature at Laverton also shows a close link. I note that NASA GISS also characterise Laverton as urban with a population of 2.7 million - seems I am not alone (see link below).

In their 2001 study Torok et al note that "It is possible that the measured Melbourne UHI is a slight underestimate, as measurements across the urdab-rural boundary were not continued far into the rural area." I have requested the location of the traverse from Simon Torok. I suspect it extends from near Laverton or Werribee in the west. So the potential UHI at Laverton remains un-measured and it seems worthwhile of further work.
You will note a high degree of variability in temperature trends over the rest of the large study area that also include some negative trends (eg Queenscliff-Figure 2), and these are obviously not all the stations. To me this indicates that the study area of Kearney et al is characterised by strong local

temperature variability. How you can choose the Laverton station as representative of temperature trends over such a large, geographically diverse area is a little beyond me. I don't think it is appropriate and it is a good indication of selective use of weather station data on the part of Kearney et al. A better method would have looked at averaging the trends in the area with the most butterfly observations and then in putting this into the models. I suspect this may have not fitted the story Kearney et al wanted to tell.

You will also notice from Figure 2 that there are NO butterfly observations within Coo-wee of Laverton-they are concentrated to the city's east.Why didn't the study by Kearney et al use the high quality data from Moorabbin Airport which is also a "rural" site (according to Morris and Simmonds)? This station is closer to the bulk of the butterfly observations. Of course the correlation they report between temperature and observations again would fall over.

To me the major problem with the study remains the use of observation dates as a proxy for emergence. There may be an effect as there is a well established link between temperature and emergence, and also seasonal change in daylight, (one wonders what affect light pollution is having) however it is not appropriate to use this data as a proxy in this case. Any trends are those in the behaviour of observers and not the butterflies. It requires much more work and some actual observations of emergence in natural settings. It would be like using the collection dates of basalt samples in a mineral collection to establish an eruption date.

See also the post at WUWT which includes additional comments that might interest:
http://wattsupwiththat.com/2010/04/23/butterfly-study-a-case-study-in-confirmation-bias/

NASA GIS reference ; GISTEMP 2010. NASA GISS Surface Temperature Analysis – Station Data 'Laverton' GISTEMP ID 501948650000 (http://data.giss.nasa.gov/cgi-bin/gistemp/gistemp_station.py?id=501948650000&data_set=0&num_neighbors=1) (accessed 18 March 2010).

Best wishes
Marc Hendrickx

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From: David Jones [D.Jones@bom.gov.au]
Sent: Friday, June 18, 2010 2:28 PM
To: Marc Hendrickx
Cc: dkaroly@unimelb.edu.au; David Jones
Subject: Your letter at
http://rsbl.royalsocietypublishing.org/content/early/2010/06/07/rsbl.2010.0053.short/reply
[SEC=UNCLASSIFIED]

Marc (David Karoly, for info),

I assume you are aware that the Wattsupwiththat "analyses" have been published by Menne et al (paper attached). Anthony Watts is still to publish an alternative analysis in a peer reviewed publication.

You comments about Durdidwarrah are problematic. There was a site shift in 1957 so there is not

one site - rather there are (at least) two that go under the same name. Here are a few observations from the site taken from the Station File.

Durdidwarrah,087021
08/1900: Thermometer screen sent by rail. Misplaced, but probably found and erected soon after this date.
12/1922: First correspondence.
12/1951: Screen painted green and roof warped.
05/1953: Screen fixed.
08/1957: Site move.
02/1975: Small screen replaces poor one.
07/2000: SITE CLOSED - no continuing record.

As you can imagine a site shift (in 1957/58) and a green screen could have dramatic impact on the homogeneity of the record.

In reference to the sentence "..... The paper does not mention well documented Urban Heat Island effects over Melbourne that encompasses Laverton that have clearly affected temperature at this station over the period of study (see Morri and Simmonds, 2000 and Torok et al., 2001)." in your letter.

As I have already advised your reference to Morris and Simmonds 2000 and Torok et al. 2001 are problematic. Torok et al. Figure 3b does not give evidence of a UHI near Laverton - indeed it suggest to me just the opposite (attachment 2) as the UHI transect commences near Laverton.

This is what Morris and Simmonds say about Laverton (the third attachment)

"The three non-urban sites include the weather monitoring stations located at Melbourne Airport (086282), Moorabbin Airport (086077) and Laverton Airport (087031). By using three sites as a proxy for
rural conditions, the approach minimizes local influences on the air temperature that may be particular
to one site. Analyses (not presented here) did not reveal any influences on any of the group mean UHIs
as a result of differences in arrival times of sea breeze or frontal activity between the airport sites. The airport sites are all located between 16.6 and 20.5 km away, and at different points of the compass from
the CBD (Figure 1)."

Again this does not support a conclusion that the Laverton data is affected by a UHI signal.

Kind Regards,

David
Dr David Jones
Head of Climate Monitoring and Prediction
National Climate Centre
Bureau of Meteorology

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_____

From: Marc Hendrickx [marc.hendrickx@uon.edu.au]
Sent: Friday, 18 June 2010 8:05 PM
To: David Jones
Cc: dkaroly@unimelb.edu.au
Subject: RE: Your letter at
http://rsbl.royalsocietypublishing.org/content/early/2010/06/07/rsbl.2010.0053.short/reply
[SEC=UNCLASSIFIED]

Thanks for your input David,
The station notes for Durdidwarrah clear up some of the issues apparent with the raw data, in particular the spurious warming trend in the 1940s-50s that appears to correspond with a time the the screen was painted green (see figure attached). However based on the notes and despite your comments it is quite clear that the station data is essentially usable. If there is a bias it appears on the warming side, especially with the green roof. I don't suppose you could pass on the station notes for Laverton, it would be interesting to see if any important events affect its history.

The overall trends for Durdidwarrah remain flat. Durdidwarrah is located in the Brisbane Ranges National Park in an area that has not experienced significant land use change since the 1870s when dams were constructed. The Laverton area however has experienced population growth from 7854 in 1933 to 132793 in 2008. Additionally significant development has been encroaching on the site for some time, not to mention other land use changes.
I am interested in how you account for the differences in trends between Durdidwarrah and Laverton? Or sites further a field? There is a clear difference in trends between Laverton and other sites remote from development-see Queenscliff and Cape Shank for instance.

What is influencing the Laverton data, David? Regional/global factors do not appear to explain the difference because the trends are different, in fact the trends show a high degree of variability all over Melbourne indicating local variation is swamping any regional or global trend. The post 1957 trend for Durdidwarrah is quite flat. Based on the population changes and increased development around Laverton UHI is a feasible factor to account for the higher rate of warming at Laverton.

As I previously pointed out in their 2001 study Torok et al note that "It is possible that the measured Melbourne UHI is a slight underestimate, as measurements across the urban-rural boundary were not continued far into the rural area." Based on this it is clear that they didn't get out of the UHI bubble over the Melbourne area. David, what do you think the effect would have been if they had actually started the survey at a remote site, at Durdidwarrah for instance?

In their paper Kearney et al use the Laverton station to characterise temperature over their very large study area. Do you consider this legitimate? As previously stated an average of all available station data would have provided a truer picture of temperature trends over the Melbourne area.

In the end it is clear from an outsider that a definitive study of UHI affect over major cities in Australia is missing from the literature. Perhaps you could use your influence to once and for tackle this problem. As a geologist you get used to looking at the big picture. In the case of Laverton your focus on the site appears to risk missing the bigger story.

David, again thanks for your input. While I have your attention would it be possible for you to comment on other questions I have posed?

Regards
Marc Hendrickx

From: David Jones [D.Jones@bom.gov.au]
Sent: Saturday, June 19, 2010 5:03 PM
To: Marc Hendrickx
Cc: dkaroly@unimelb.edu.au
Subject: RE: Your letter at
http://rsbl.royalsocietypublishing.org/content/early/2010/06/07/rsbl.2010.0053.short/reply
[SEC=UNCLASSIFIED]

Marc,

The whole of southeast Australia minimum temperature trend is 0.11C/decade (http://www.bom.gov.au/cgi-bin/climate/change/timeseries.cgi?graph=tmin&area=seaus&season=0112&ave_yr=T).

The Laverton minimum temperature trend is 0.08C/decade (http://www.bom.gov.au/cgi-bin/climate/hqsites/site_data.cgi?variable=minT&area=aus&station=087031&dtype=raw&period=annual&ave_yr=T).

There is no discrepency to explain - or if there is - it is why Laverton is not warming as fast as the other more rural high-quality sites in the southeast of Australia.

I see no problem with using Laverton to represent central Victoria - though in an ideal world with a large number of HQ data series one would form a local area average. I do see a problem with using the highly inhomogenous and multisite series at Durdidwarrah - the site change in 1957 alone caused a 0.5C drop in minimum temperature. Were you aware of the problems with Durdidwarrah when you went to press?

David
d.jones@bom.gov.au

From: Marc Hendrickx
Sent: Saturday, June 19, 2010 7:46 PM
To: David Jones
Cc: dkaroly@unimelb.edu.au; m.kearney@unimelb.edu.au

Subject: RE: Your letter at
http://rsbl.royalsocietypublishing.org/content/early/2010/06/07/rsbl.2010.0053.short/reply
[SEC=UNCLASSIFIED]

Dear David,
You seem to miss the point(s). The paper by Kearney et al claims a match between rising temps and changes in butterfly (H.Merope) emergence times over the Melbourne region. It links the warming with increased CO2. It fails on a number of levels, the UHI issue is just one.

Firstly the observation data do not make for an adequate proxy for emergence. The measured trends are changes in butterfly observation times, not butterfly emergence. There is clear temporal bias in the observation dataset with over half of the observations made post 1990. A random datset similarly skewed would probably provide the same result. There is also clear location bias in the data with the vast majority of observations made in the eastern Suburbs. The small black dots in Figure 2 are the observation locations, again you will note there are none near Laverton.

Secondly, not withstanding the problems with the butterfly dataset Kearney et al have inappropriately applied a 10 year average to the data to smooth over the very large annual variation in observation dates. They have not shown the error bars on their figure 1or even bothered discussing these, leaving a grossly false impression of the statistical strength of the trend. The data are inappropriate as a proxy for emergence, AND the trend in the data is statistically meaningless.

The third issue surrounds the use of Laverton to characterise temperature over the study area. You clearly believe there are no problems with this station, but it is certain that further work is required to establish this as a matter of fact. You have not provided any facts as to why Laverton is not affected by UHI. As indicated the study by Torok et al note that "It is possible that the measured Melbourne UHI is a slight underestimate, as measurements across the urban-rural boundary were not continued far into the rural area." As you indicate they started around Laverton. Again, based on this it is clear that they didn't get out of the UHI bubble over the Melbourne area. David I ask again, what do you think the effect would have been if they had actually started the survey at a remote site? Would they have observed lower temperatures west of Laverton, further way from human settlement? I think they would have. It would clearly be worthwhile if BOM could repeat this experiment starting further a field to provide some actual data, rather than speculation.

Fourth issue surrounds confounding by other factors that might affect emergence times. These are not discussed in the paper but include things like affect of light pollution, chemical pollution, changes in habitat, affect of CO2 on feed stock to name a few.

Fifth, the link to CO2 implied by the climate models falls flat when one considers that other stations in the study area, including those closer to butterfly observations, show trends that fall into the area of Kearney et al's figure 1d, where they can be accounted for by natural climate variations. There is no need to use Greenhouse gases. Occam's razor would suggest Kearney et al are over complicating the story.

In regard to Durdidwarrah, it is but one of a number of stations shown in my Figure 2. Are you now claiming that every site in Melbourne is poor quality except for Laverton, I find that remarkable? What about Cape Shank, Queenscliff, Moorabbin etc etc? As previously indicated the issues with Durdidwarrah are not fatal and can be worked around. Did you read my previous comments on this

David. The trends are consistently flat either side of a brief period in the 1950s where there appear to be some issues with the screen. The trends are what is at stake. Have you managed to look at the station notes for Laverton as I requested? I understand that it too has experienced changes since its installation. If you claim this is a problem for Durdidwarrah then this would also be problematic for Laverton. More so as BOM claim it to be a high quality station.

The trend over SE Australia as a whole is of little consequence in this case as the butterflies are responding to changes on a LOCAL level. In other words use of average SE Australian data is not appropriate. As previously stated there is a high degree of local variation in trends over the Melbourne area, most of the observations are in the eastern suburbs, the choice of Laverton is not reasonable not only for its UHI issues but also due to its distance to any observations. In short the study does not hold up to close examination. Perhaps David Karoly or Michael Kearney can provide you with a copy.

Regards and thanks for an enjoyable discussion.
Marc Hendrickx

LAVERTON UHI

Extract from ACORN Station data, BOM (2012)

http://www.bom.gov.au/climate/change/acorn-sat/documents/ACORN-SAT-Station-Catalogue-2012-WEB.pdf

Page 57: Laverton RAAF (087031)

This site is on the grounds of the former RAAF base at Laverton, about 20km west-southwest of central Melbourne. The site is over short unwatered grass.

History

The site was originally a Meteorological Office; there is no clear evidence of moves before 1997.

An automatic weather station was installed on 22 February 1997, about 1.2km northeast of the previous site (which continued until July 1998 under the station number 087177).Whilst there has been no significant building on the base grounds, the surrounding region is a major urban growth corridor and a new housing development has been built in recent years a few hundred metres west of the site. There is evidence of recent anomalous urban warming in the minimum temperature data.

Correspondence Bob Fearnley Jones and BOM climate Analysis Section

From: helpdesk.climate@bom.gov.au
Sent: Monday, March 31, 2014 3:13 PM
To: bobfjones@optusnet.com.au
Subject: Re: Other/Request for Data, Forecasts or other services/vic/Climate and Historical Weather Information-D – Reference ID: [E3IH2A1856] [SEC=UNCLASSIFIED]

In reply please quote: E3IH2A1856

Dear Bob,

1. The Bureau in maintaining homogenised datasets periodically assesses stations for emerging urban signals. The status of Laverton as a site where the temperatures were influenced by urbanisation was assessed on the basis of its temperature trend relative to clearly non-urban stations in Victoria over the whole period of record. The most recent assessment, carried out in 2012, found evidence that there was indeed an anomalous temperature trend at Laverton over the recent period up to 2011. As the previous assessment in 2004 did not find an anomalous trend at Laverton, it would be reasonable to conclude that the elevated urban influence on Laverton temperatures is quite recent. This is not surprising as it is near a major urban growth corridor which has seen rapid urban development in recent years.

2. Many thanks for the question - turns out there was a multiplication error in the code which has now been fixed.

Regards,
Climate Analysis Section
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