

Editorial

Over the Northern Hemisphere summer, online weather services are offering users more than just a look at the weather itself. Several websites have added information in the form of quirky indices to summer weather forecasts.

Yahoo Japan's online weather service is providing four extra indices during the summer months this year: a beer index, a heat-exhaustion index, a sweat index and a UV ray index have been added to the already interesting laundry, umbrella and starry sky indices. The beer index covers 138 points across Japan, rating the best days to drink beer. Among the ratings are, "90: It's sweltering! Don't forget to cool the beer," and "70: It's hot! Beer will probably go down well today."

Weathernews also provides an ice cream index, and humans aren't the only ones to benefit from the forecasts. Dog food manufacturer Masterfoods has provided summer weariness forecasts for dogs, offering owners advice on taking their dogs for walks and replenishing their water.

I wonder when the Bureau of Meteorology will bring out the Aussie beer index?

Lee Tryhorn

Further Information:

<http://mdn.mainichi-msn.co.jp/national/news/20060812p2a00m0na015000c.html>

News

The Bruce Morton 80th Birthday Symposium

To celebrate Bruce Morton's 80th birthday, the Melbourne Branch of the Australian Meteorological and Oceanographic Society held a symposium at Monash University. The symposium comprised a series of invited lectures on topics with relevance to Bruce's research interests. They were: **The generation of vorticity**, Joe Monaghan (School of Mathematical Sciences, Monash University);

Vortices: how they are affected by barriers and walls, Ted Johnson (Department of Mathematics, University College London); **Clouds and convection**, Todd Lane (School of Earth Sciences, University of Melbourne); **The lifecycle of stratospheric polar vortices**, Greg Roff (Bureau of Meteorology Research Centre). Bruce Morton also gave a talk on **Vorticity**. Happy birthday Bruce!

New Chief of BMRC

Dr. Neville Smith FTSE has formally been appointed as Chief Scientist (Research) of the Bureau of Meteorology Research Centre.

Dr. Smith's first appointment in BMRC was as a meteorologist in 1986. He gained a PhD in geophysical fluid dynamics from Monash University in 1979 and further periods at Melbourne University and the University of Southampton developed his knowledge and skills in both meteorology and oceanography. Dr. Smith was active in WOCE, TOGA, CLIVAR, and GOOS and in 1995 was the convener of a large international conference (TOGA95) which celebrated the end of TOGA. These international programs allowed Dr. Smith to develop invaluable overseas networks and contacts and from this he was

invited to join numerous high level international committees. It was not long before a new international experiment - GODAE (Global Ocean Data Assimilation Experiment) was in place and the role of Director of the Office of GODAE fell to Dr. Smith. From 1997 - 2005 Dr. Smith has seen GODAE grow from an idea to an international reality with operational ocean forecasting now being implemented. Along the way, Dr. Smith has also written many papers and co-authored textbooks.

He was given the job of leading a new group in BMRC in 1998 - the Ocean & Marine Forecasting Group. In 2002, the title of Bureau of Meteorology, Oceans Policy Advisor was conferred on Dr. Smith. Dr.

Smith is not only the Bureau's marine science advisor, but also represents Australia at the IOC (Intergovernmental Oceanographic Commission) annual assembly. He is currently the Vice-President of IOC.

Dr. Smith has received many awards over his career, including a UNESCO Medal in 2002.

Born into a family of dairy farmers in the beautiful Gippsland town of Mirboo North, climate and weather has always been a big part of Dr. Smith's early life and coupled with his studies and work in the marine sciences it is obvious he is the right person for the job. Congratulations Neville.

ACCESS

ACCESS is the "Australian Community Climate Earth System Simulator". ACCESS will include an Earth System Model (atmosphere, ocean, land and sea ice) with the capacity for regional downscaling, numerical weather prediction, and comprehensive data assimilation, and including significant model evaluation and software engineering components. ACCESS represents a major initiative led by the Bureau of Meteorology and CSIRO with strong involvement from the University sector, Tasmanian Partnership for Advanced Computing (TPAC) and others.

The key objectives of ACCESS are to assist the Bureau of Meteorology in meeting its statutory requirements in providing the best possible meteorological services and assist CSIRO by providing the best possible science for use in analysing climate impacts and adaptation. In this context it is intended to provide a framework for substantial linkages

with relevant university research and for interaction between the Australian scientific community and leading international groups. A key target for ACCESS will be to contribute appropriate climate projections and scenarios to the Fifth Assessment by the Intergovernmental Panel on Climate Change.

ACCESS will ultimately include a fully coupled carbon-cycle model covering terrestrial, ocean and atmosphere systems (incorporating a dynamic vegetation model) and will provide eventually the opportunity for incorporation of socio-economic processes. In this way, it is intended to meet the information needs of those interested in scenarios that speak to the impacts of and adaptation to climate change in Australia. Finally, the ACCESS program aims to support fulfilling careers for Australian research scientists in related fields.

Awards

Congratulations to Dr. John Church

Dr. John Church of CSIRO Div. of Marine and Atmospheric Research was awarded the prestigious Intergovernmental Oceanographic Commission (IOC) Roger Revelle Medal during the IOC 39th Assembly in Paris in June 2006. Dr. Church presented the Roger Revelle Memorial Lecture on "Global sea levels: Past present and future". His talk addressed factors

governing sea level rise, its possible anticipation and actions to reduce uncertainty, as well as the identification of needs for additional research, technical developments and collection of sustained systematic observations.

Congratulations John.

Dr. George Cresswell awarded Silver Jubilee Award

Dr. George Cresswell, a CSIRO Marine and Atmospheric Research Fellow based in Hobart, recently received the Australasian Marine Sciences Association Silver Jubilee Award at the Association's annual conference in Cairns.

A scientist with CSIRO for several decades Dr. Cresswell engaged in a research career studying the East Australian and Leeuwin Currents, two of the country's most influential natural features. Without the Leeuwin, much of the West Australian coast would be desert. So young is the research field in Australia that

it was Dr. Cresswell and a colleague Terry Golding, who described and named the Leeuwin Current in 1980.

In total, Dr. Cresswell has spent several years working at sea on research vessels, deploying moored and drifting instruments to obtain valuable ocean measurements. His fieldwork

included nearly all of Australia's surrounding seas, as well as studies of Southeast Asian and Papua New Guinean seas.

Further Information:

<http://www.csiro.au/csiro/content/standard/ps1zv,,.html>

AMOS Uwe Radok Award

AMOS has introduced a new award to be known as the "*AMOS Uwe Radok Award*" that will honour the lifetime contribution of Dr Uwe Radok to research and teaching in meteorology, climatology and glaciology. On page 81 of this issue of the Bulletin Peter Schwerdtfeger gives some insight into Uwe's achievements. The AMOS Council has decided that the award will be made each year. The *AMOS Uwe Radok Award* will be awarded to the PhD student in the atmospheric sciences or oceanography, who is judged by an independent panel to have submitted the best

thesis in that year to an Australian University. For more information on how to apply for the award please see the flyer included in this issue. The award was originally promoted by a group of past students and colleagues of Dr Radok who have generously donated to a fund to launch it. In order to enhance the value of the award and ensure its long-term future, other AMOS members may also desire to contribute. If you wish to do so, please contact the Society's Treasurer, Blair Trewin, (b.trewin@bom.gov.au or by mail or telephone – see the back page of the Bulletin for details).

Call for nominations for the AMOS Medal 2006

In 2000 the Australian Meteorological and Oceanographic Society extended its professional activities to better serve its members by establishing a major new prize, the **AMOS Medal**. This medal is offered every second (even) year, and thus will again be awarded in 2006.

The AMOS Award recognises *leadership* in meteorology, oceanography, climate and related fields in Australia, particularly through education and the development of young scientists, and through the building of research environments. In particular the Award is directed to senior scientists who have made a substantial contribution over many years, advancing the science of meteorology, oceanography and climatology through leadership, mentoring and research management rather than personal research. It should be noted that these criteria are complementary to those for the Priestley Medal and Christopher Taylor Award.

Since its inception awards have been made to:

Ian Simmonds	Univ. of Melb.	2000
Lance Leslie	Univ. of NSW	2002
Matthias Tomczak	Flinders Univ.	2004

Any scientist may make a nomination, whether they are junior or hold a senior position in the organisation in which they work. Younger scientists in particular are encouraged to nominate their mentors for this Award. The Committee has limited ability to seek additional information to that in the nomination papers and therefore depends on the nomination papers to provide a full and fair account of the candidate taking particular account of the criteria for this award. The Committee's preferred form of nomination/application comprises: a summary of the reasons for the candidature, a listing of the major achievements in leadership in meteorology and a curriculum vitae.

Council believes that the AMOS Awards provide an important means of recognising talent both among its members and in the fields that it represents, and it does not restrict nominations or applications to those who are already members of the Society. It is expected that Award winners will give serious consideration to joining the Society and taking an active part in its affairs. Where award winners are not already members of AMOS, Council will provide a complimentary membership for the remainder of the year of award.

Nominations with supporting papers should be sent by email to mark.williams@bom.gov.au by 30th September. Further information can

be obtained from Mark Williams of the Bureau's Victoria Regional Office.

Call for nominations for the year 2006 Christopher Taylor Award

Christopher Taylor was a Bureau of Meteorology analyst and forecaster from the mid-70s until his untimely death at age 35 in July 1988. He had a natural curiosity in, and an enthusiasm and energy for investigating observed weather phenomena and operational forecasting problems, which was largely carried out in his own time.

The Award carries a prize of \$500 very generously provided by his former wife Jacqueline Healy, and is open to professional meteorologists for contributions of all kinds to operational forecasting and supporting activities. In the spirit of Christopher Taylor's efforts, the Awards Committee will give extra weight to nominations for operational meteorologists who have either commenced or performed a substantial part of their investigative work, or other contribution to operational forecasting, outside of normal duties. Meteorologists whose normal role is to support operations either through investigations or the development of operational tools may also be nominated:- however a case should be made that the contribution has exceeded the normal expectations of a person working in that position. It should be noted that achievements of a more academic nature are recognised through other AMOS awards.

Nominations may be made by AMOS members or others, especially senior staff of

the Bureau of Meteorology who will be familiar with the work of their regional operational staff. The Awards Committee now seeks nominations with supporting papers if possible by 30th September 2006. Please return completed nominations to Mark Williams, Victoria Regional Office, preferably in electronic format to mark.williams@bom.gov.au.

The Awards Committee has limited ability to seek additional information to that given in the nomination papers and therefore depends on these papers to provide a full and fair account of each candidate. The Committee's preferred form of nomination comprises: a summary of the reasons for the nomination, a listing of the achievements of the candidate and a curriculum vitae.

The high quality of nominations in recent years has two implications: first that those unsuccessful in one year could succeed in a subsequent year, and second that competition is such that nominating papers should be prepared with care to ensure that members of the Awards Committee will be fully aware of the achievements of each candidate.

There is also a perpetual plaque held for the year by the appropriate regional or other office.

Since its inception awards have been made to:

Geoff Feren	Victoria	1994
Russell Stringer	Northern Territory	1995
Milton Speer	New South Wales	1996
David Thomas	Northern Territory	1997
John Bally	Tasmania	1998
Robert Leighton	NMOC	1999
Greg Connor	Queensland	2000
Phil Davill	South Australia	2001
Stephen Pendlebury	Tasmania/Antartica	2002
Roger Deslandes	BMTC	2003
Neil Adams	Tasmania/Antartica	2004
Graeme King	Northern Territory	2005

Articles

Heatwave Trends in Adelaide

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Abstract:

In Adelaide the locally accepted definition of a heatwave has evolved over time to cover two situations; either the maximum temperature equals or exceeds 35°C on five consecutive days or reaches at least 40°C on three consecutive days. These conditions are a relatively uncommon occurrence in Adelaide during the summer months and are characterised by a slow moving or almost stationary synoptic mean sea level pressure pattern. Records in Adelaide between 1890 and 1960 show a general decrease in average summer maximum temperatures and a similar decrease in the number of heatwaves. Since 1960 the average maximum summer temperatures appear to have shown an increase towards values earlier in the 20th century, yet paradoxically, the number of heatwaves has stayed very low. In this article an analysis of heatwaves in Adelaide is presented together with trends and conclusions.

Reliable temperature records for Adelaide are available from 1887 when air temperature was first measured using thermometers housed in a Stevenson screen. Until 1977 the instrument enclosure was located at West Terrace and since then it has been at Kent Town. For the purposes of this article a merged data set of West Terrace and Kent Town has been used, that is, a continuous temperature record of 118 years. The site at West Terrace was located on the western edge of the city perimeter some 8.3 kilometres from the coast at an elevation of 40 metres above sea level, while the site at Kent Town is on the eastern edge of the city, 11.5 kilometres from the coast and at an elevation of 48 metres above sea level. While it is acknowledged that there are small differences between the two sites, these differences are not considered to be significant in the context of this discussion. An example of the difference between the sites is the average summer maximum temperature, which for the period 1887 to 1977 at West Terrace was 28.0°C, and for the period 1978 to 2006 at

Kent Town was 28.3°C. Without taking into consideration any outside influences, this is a not unexpected difference given the slightly greater distance from the sea at Kent Town, and a little less influence of the sea breeze. A similar difference was also observed using overlapping data from the two sites for the summers of 1978 and 1979.

In broad terms a heatwave is a prolonged period of excessive heat (Heat Stress in Australia Project). A more precise definition is site dependent and quite subjective, however, for Adelaide a local definition of heatwaves has been determined to be five consecutive days at or above 35°C or three consecutive days at or above 40°C. Plummer et al. (1999) found that there has been an increase in the frequency of warm events (greater than three consecutive warm days) in Australia over the period 1961 to 1995 and one of the aims of this paper is to see if this trend is displayed in the Adelaide record.

Using the local definition for heatwaves, Adelaide has experienced 55 such individual events over the last 118 years. Also, over the period of record there were 76 years (occasions) when a heatwave did not occur, or to put it another way, heatwaves in Adelaide occur in about 1 in 3 years. On 10 occasions, multiple heatwaves were experienced in the same summer, mostly two, but in the summer of 1907/08, three heatwaves were experienced, one of which included six consecutive days above 40°C. The maximum duration of a heatwave in Adelaide has been 8 days, with heatwaves of this length occurring seven times; in 1899, 1910 (twice), 1931, 1939, 1997 and 2004. It is interesting to note that after a long break, two such lengthy events have occurred in the last ten years. Also of note is the heatwave of January 2006, where there were 4 days above 40°C, an event which last occurred in Adelaide 66 years ago in March 1940, and interestingly, had occurred on six occasions prior to the 1940 event, in a 14 year period from 1899 to 1912.

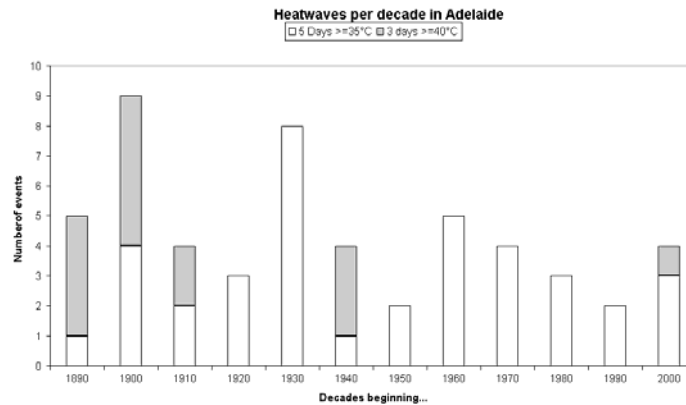


Figure 1 Heatwaves per decade in Adelaide

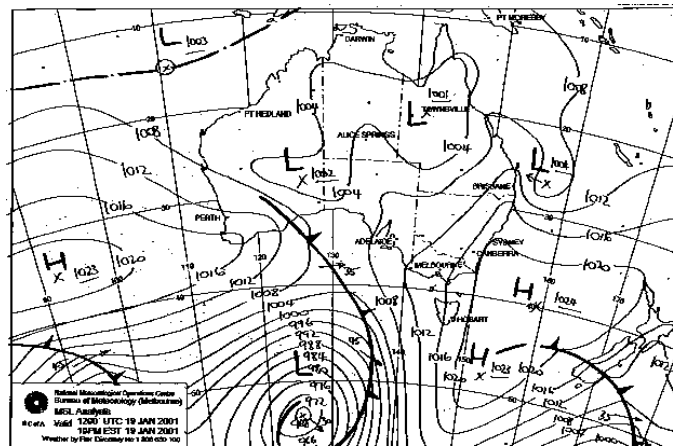


Figure 2 - Typical summer synoptic pattern during heatwaves.

We can also look at the record another way, by dividing it into two halves. In the 59 years to 1946 there were 34 heatwave events, whereas in the 60 years since 1947 there have been just 21 heatwave events, a considerable difference. This difference is evident in the decadal frequency analysis, shown in Figure 1, which also depicts a downward trend during the last decades of the 20th century. This trend is different to the results of Collins et al. (2000) who found that for all of the sites investigated over South Australia - notably not including the Adelaide site - there was a tendency for hot day events of three to five days to have increased slightly.

The decades of the 1900's and 1930's certainly do stand out as having a higher number of heat waves. It is interesting to note that the summer of 1905/06 had the warmest summer ever recorded in Adelaide, with an average maximum temperature of 31.4°, while the highest daily maximum temperature of 46.1°C was recorded on 12 January 1939. A chronological list of each heatwave event with dates and details of the daily temperatures is given in Appendix 1.

To provide a possible explanation for the decadal variability and longer-term trend in heatwave frequencies, it is necessary to consider the synoptic features conducive to prolonged heatwave conditions in Adelaide. Synoptically, to achieve temperatures over 35°C for a sequence of days during the summer months requires a high pressure cell to be located near or south of the western Tasman Sea (see figure 2), with a resulting north to northeasterly airstream over South Australia and Adelaide. From time to time these high pressure cells become near stationary. In this situation cool frontal systems weaken as they move eastwards toward Adelaide, resulting in very little variation to the overall synoptic pattern over South Australia, although very shallow cool air may advect over the southeast of the State in a southeasterly airstream behind the weakened front. This shallow stream may penetrate inland to the east of the Mount Lofty Ranges, but fails to cross the ranges and relieve the hot conditions on the Adelaide Plains. A possible explanation for the high frequency of heatwaves during the 1900's and 1930's is that blocking mechanisms, with a

near-stationary high pressure system located in the Tasman Sea, were more frequent in these decades, whereas in more recent decades the synoptic pattern has been more mobile at mid-latitudes in the eastern Australian region.

Analyses of cyclonicity or anticyclonicity (Leighton and Deslandes, pers. comm.) over the Australian area give a possible explanation of heat waves but unfortunately data for this has only become available for the last half of the period of interest.

Finally, we also examined the correlation of Adelaide heatwaves with El Nino and/or La Nina events in the preceding year. Of the 12 “classic” or strongest La Nina events, three (1939, 1951, and 1989) coincided with heatwaves in Adelaide; and of the 12 “classic” El Nino events four (1906, 1942, 1947 and 1973) coincided with heatwaves in Adelaide. Clearly then, heatwaves in Adelaide do not align markedly with either La Nina or El Nino events.

Heatwaves are examples of very unusual weather events and are caused by many concurrent effects. Protracted drought over northern South Australia might be considered to cause a source of hot dry air and be contributory to the length of heatwaves. Figure 3 below shows the warm decade starting in 1900 and the average summer maximum temperature decreasing in Adelaide through to the 1960s. To investigate dry conditions in northern South Australia a dry year was considered to be in the lowest quintile of annual rainfall for the north eastern part of South Australia (district 17). A 30 year count was considered to reflect a period long enough for meaningful comparisons. Figure 3 suggests the highest summer maximum temperatures for Adelaide are not coincident with very dry conditions in northern South Australia and may not cause the high average summer maximum temperatures.

La Nina years		El Nino years	
Year	Heatwave in following Summer	Year	Heatwave in following Summer
1910	No	1905	Yes
1916	No	1914	No
1917	No	1940	No
1938	Yes	1941	Yes
1950	Yes	1946	Yes
1955	No	1965	No
1956	No	1972	Yes
1971	No	1977	No
1973	No	1982	No
1975	No	1991	No
1988	Yes	1994	No
1998	No	1997	No
Total ‘Yes’	3	Total ‘Yes’	4

Table 1 – Heatwave frequency following El Nino/La Nina events.

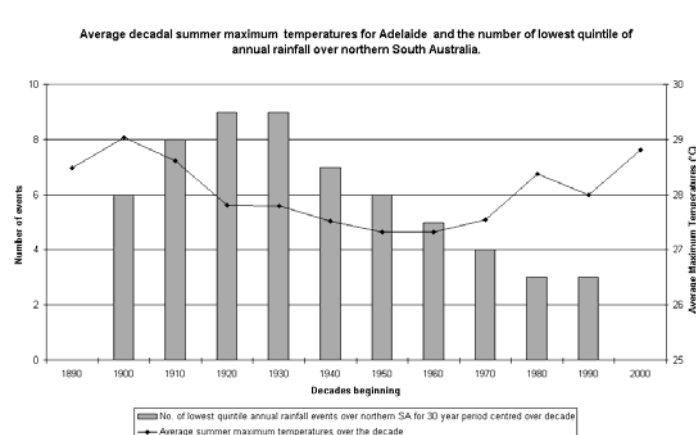


Figure 3 Average decadal summer maximum temperatures for Adelaide and the number of lowest quintile of annual rainfall over northern South Australia.

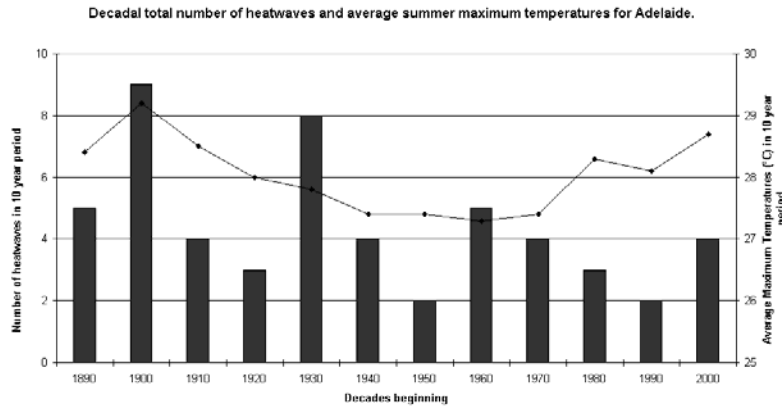


Figure 4 Decadal total number of heatwaves and average summer maximum temperatures for Adelaide

Potential Impact on long term heatwave trends:

Regional projections by CSIRO (McInnes et al, 2003) based on Climate Change Model scenarios project mean maximum temperatures to increase in Adelaide by 0.3°C – 1.4°C, and for hot spells >35°C to increase to a mean of 2 spells per year by 2030 and 2-6 spells per year by 2070. The results above suggest that if the downturn in frequency of hot spells in the latter part of the 20th century is due to natural variability and if the blocking systems return to the frequency of the early part of the 20th century, mean maximum temperatures and extended hot spells could occur at the higher end of the projected range.

Conclusion:

While the overall frequency of heatwave events at a selection of sites in South Australia has shown an upward trend (Collins et al, 2000), in the Adelaide region specifically the tendency has been downward, despite average summer maximum temperatures increasing since the 1960's (see Figure 4). This finding also highlights the need to better understand the natural variability of our climate system to enable us to reduce the uncertainty in climate change projections. It should be noted that during the 20th century, the environment in the west parklands surrounding the observing site at West Terrace underwent change, eg open paddocks became playing fields and other grassed areas, traffic increased and building density to the east of the site increased. The impact of these changes, if any, requires further research.

Thanks:

The authors wish to thank the anonymous reviewer and Beth Curran, Manager of the Climate Services, Bureau of Meteorology, South Australia for her comments.

References:

The 'Heat Stress in Australia' Project Site – http://web.bom.gov.au/spb/spawspo/public/heat_stress/heat_stress.htm#stages

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Plummer, N., Salinger, M.J., Nicholls, N., Suppiah, R., Hennessy, K.J., Leighton, R.M., Trewin, B.C., Page, C.M. and Lough, J.M. 1999. Changes in climate extremes over the Australian region and New Zealand during the twentieth century. *Climatic Change*, 42, 183-202.

Collins, D.A., Della-Marta, P.M., Plummer, N. and Trewin, B.C. 2000. Trends in annual frequencies of extreme temperature events in Australia. *Aust. Met. Mag.* 49, 277-292

McInnes, K.L., Suppiah, R., Whetton, P.H., Hennessy K.J. and Jones, R.N, 2003. Climate Change in South Australia. Undertaken for the South Australian Government by the Climate Impact Group, CSIRO Atmospheric Research.

Appendix 1

2006	19/1	20/1	21/1	22/1	22/1	
MAXIMUM	40.2	41.8	43.1	40.8		
MINIMUM	21.5	27.9	27.7	33.1		
2004	13/2	14/2	15/2	16/2	17/2	18/2 19/2 20/2
MAXIMUM	38.4	44.3	42.3	36.0	36.2	35.0 37.4 35.3
MINIMUM	17.6	22.9	30.0	22.2	20.1	19.8 19.5 21.9
2001	19/1	20/1	21/1	22/1	23/1	24/1 25/1
MAXIMUM	36.5	37.0	36.9	39.3	41.0	38.9 38.0
MINIMUM	18.4	25.3	21.6	23.1	26.2	27.1 26.5

2001 9/1 10/1 11/1 12/1 13/1 14/1
 MAXIMUM 35.9 38.3 37.1 35.0 43.3 41.0
 MINIMUM 21.3 24.0 20.8 19.3 25.2 26.5

1997 15/2 16/2 17/2 18/2 19/2 20/2 21/2 22/2
 MAXIMUM 35.3 35.5 38.6 40.4 40.3 38.9 39.7
 38.3
 MINIMUM 20.8 19.1 20.9 26.9 27.8 24.4 24.5 25.7

1993 30/1 31/1 1/2 2/2 3/2
 MAXIMUM 35.6 39.1 40.1 39.8 41.5
 MINIMUM 18.3 23.4 28.7 26.9 27.6

1989 27/2 28/2 1/3 2/3 3/3
 MAXIMUM 37.3 39.2 39.4 38.0 38.7
 MINIMUM 18.9 25.8 25.8 24.0 28.8

1989 24/1 25/1 26/1 27/1 28/1
 MAXIMUM 35.4 36.2 37.5 38.5 38.6
 MINIMUM 17.5 25.7 26.8 27.3 22.9

1982 18/1 19/1 20/1 21/1 22/1 23/1 24/1
 MAXIMUM 38.9 39.9 40.5 40.8 39.6 44.2 42.0
 MINIMUM 22.1 28.2 26.9 24.2 24.9 29.8 33.5

1979 8/2 9/2 10/2 11/2 12/2
 MAXIMUM 35.5 36.9 37.7 36.7 38.1
 MINIMUM 21.8 22.0 22.2 21.8 18.8

1973 18/1 19/1 20/1 21/1 22/1 23/1
 MAXIMUM 38.3 39.0 40.5 38.0 35.1 39.8
 MINIMUM 22.9 29.8 32.3 28.6 22.0 25.3

1971 15/2 16/2 17/2 18/2 19/2
 MAXIMUM 37.8 39.6 38.2 36.6 36.8
 MINIMUM 22.2 29.7 27.2 27.4 27.9

1970 5/2 6/2 7/2 8/2 9/2
 MAXIMUM 36.8 37.8 39.3 40.5 37.1
 MINIMUM 18.8 24.2 25.6 31.7 27.9

1968 27/1 28/1 29/1 30/1 31/1
 MAXIMUM 37.1 36.3 37.5 43.1 42.1
 MINIMUM 20.0 22.8 23.7 24.2 30.0

1968 14/2 15/2 16/2 17/2 18/2
 MAXIMUM 35.3 35.4 35.6 37.3 36.2
 MINIMUM 23.3 26.1 25.4 26.9 25.4

1967 3/2 4/2 5/2 6/2 7/2
 MAXIMUM 36.7 37.2 37.4 39.0 36.1
 MINIMUM 21.6 26.1 27.5 26.5 27.7

1961 24/1 25/1 26/1 27/1 28/1
 MAXIMUM 35.7 39.4 39.6 40.4 38.9
 MINIMUM 20.8 28.2 25.4 29.3 20.7

1960 26/12 27/12 28/12 29/12 30/12
 MAXIMUM 37.2 37.0 37.2 38.5 39.3
 MINIMUM 21.3 22.7 24.0 27.6 21.1

1951 26/1 27/1 28/1 29/1 30/1 31/1
 MAXIMUM 36.8 36.6 36.4 37.7 37.7 39.7
 MINIMUM 26.6 25.6 27.1 26.8 25.9 25.6

1950 3/12 4/12 5/12 6/12 7/12
 MAXIMUM 37.2 37.2 37.9 38.1 40.0
 MINIMUM 19.1 22.5 26.0 24.6 18.8

1947 2/2 3/2 4/2 5/2 6/2 7/2
 MAXIMUM 36.4 35.4 37.3 36.0 36.8 39.7
 MINIMUM 21.9 25.3 22.8 23.4 25.2 25.2

1943 26/1 27/1 28/1 29/1 30/1 31/1 1/2
 MAXIMUM 39.6 42.0 41.1 40.9 35.6 43.4 42.2
 MINIMUM 16.4 26.9 25.9 27.5 23.6 20.6 28.7

1942 2/3 3/3 4/3
 MAXIMUM 41.2 41.8 40.5
 MINIMUM 25.1 27.3 29.1

1940 7/3 8/3 9/3 10/3 11/3 12/3 13/3
 MAXIMUM 38.9 40.4 41.6 41.1 40.9 39.0 38.1
 MINIMUM 20.9 24.9 27.7 27.5 27.7 26.5 27.6

1939 6/1 7/1 8/1 9/1 10/1
 MAXIMUM 39.3 40.1 38.5 44.0 45.9
 MINIMUM 20.7 23.2 24.2 20.2 33.2

1939 7/2 8/2 9/2 10/2 11/2 12/2 13/2 14/2
 MAXIMUM 39.4 36.9 40.7 37.7 38.7 39.2 42.0
 35.5
 MINIMUM 20.0 20.3 20.6 22.0 20.9 23.6 23.9 23.5

1935 23/2 24/2 25/2 26/2 27/2
 MAXIMUM 37.5 39.2 38.3 36.4 37.6
 MINIMUM 15.8 27.5 26.1 23.6 22.4

1934 13/1 14/1 15/1 16/1 17/1 18/1 19/1
 MAXIMUM 35.1 37.1 37.7 37.6 39.8 40.7 38.1
 MINIMUM 22.3 22.9 22.4 25.8 27.7 25.2 22.4

1934 7/3 8/3 9/3 10/3 11/3 12/3 13/3 14/3
 MAXIMUM 39.8 39.8 41.5 41.0 38.7 39.2 41.0
 35.9
 MINIMUM 19.7 25.2 23.3 27.8 28.6 23.9 25.7 23.6

1932 15/1 16/1 17/1 18/1 19/1
 MAXIMUM 35.1 36.3 35.1 39.8 40.1
 MINIMUM 18.1 22.4 16.0 20.4 25.7

1931/32 25/12 26/12 27/12 28/12 29/12 30/12
 31/12 1/1
 MAXIMUM 36.7 36.7 37.3 41.2 43.9 38.1 38.1
 37.1
 MINIMUM 15.6 18.8 17.4 21.3 22.4 23.9 19.6
 26.4

1930 7/2 8/2 9/2 10/2 11/2
 MAXIMUM 35.8 38.0 42.0 39.1 36.9
 MINIMUM 19.9 19.4 24.6 28.9 22.6

1927 9/1 10/1 11/1 12/1 13/1 14/1
 MAXIMUM 40.9 41.0 39.0 39.7 41.4 38.4
 MINIMUM 25.0 29.4 27.6 24.8 28.6 24.4

1921 8/2 9/2 10/2 11/2 12/2 13/2
 MAXIMUM 35.6 36.7 38.0 38.0 41.6 38.3
 MINIMUM 18.6 24.4 22.2 22.1 28.2 19.2

1920 20/12 21/12 22/12 23/12 24/12
 MAXIMUM 35.6 38.2 39.4 42.1 42.1

MINIMUM 16.3 19.7 20.0 25.6 28.6

1914 17/2 18/2 19/2
MAXIMUM 40.4 42.7 40.6
MINIMUM 20.9 29.4 26.7

1912 30/1 31/1 1/2 2/2 3/2
MAXIMUM 36.4 41.8 43.4 43.3 42.2
MINIMUM 16.1 22.7 24.8 26.4 26.3

1910 1/1 2/1 3/1 4/1 5/1 6/1 7/1 8/1
MAXIMUM 37.2 37.4 36.7 37.5 39.9 38.5 36.7
35.9
MINIMUM 20.6 27.5 23.9 21.0 27.7 26.1 23.4 22.9

1910 14/2 15/2 16/2 17/2 18/2 19/2 20/2 21/2
MAXIMUM 35.9 38.7 40.4 38.3 37.2 40.7 39.5
37.6
MINIMUM 17.0 21.9 22.1 19.3 18.8 25.0 28.3 24.1

1908 1/1 2/1 3/1 4/1 5/1 6/1 7/1
MAXIMUM 35.7 39.8 38.4 40.8 41.0 41.6 41.1
MINIMUM 15.6 19.4 21.9 24.7 25.5 25.6 26.6

1908 13/1 14/1 15/1 16/1 17/1 18/1 19/1
MAXIMUM 38.4 40.7 43.1 41.8 43.4 42.8 43.4
MINIMUM 19.7 26.6 25.3 25.4 26.2 28.0 25.9

1908 24/2 25/2 26/2 27/2 28/2
MAXIMUM 35.1 37.9 36.8 37.6 37.7
MINIMUM 18.9 23.2 22.8 25.5 25.6

1908 3/12 4/12 5/12 6/12 7/12
MAXIMUM 36.1 36.8 38.6 40.0 40.7
MINIMUM 15.3 19.2 21.8 22.9 30.1

1906 3/2 4/2 5/2 6/2 7/2 8/2
MAXIMUM 38.3 40.1 36.4 41.1 42.2 36.3
MINIMUM 22.4 27.2 20.7 21.7 28.6 22.2

1906 2/1 3/1 4/1 5/1 6/1 7/1
MAXIMUM 36.3 40.7 43.9 43.4 42.6 36.2

MINIMUM 20.1 22.4 26.9 23.3 25.9 26.7

1905 8/1 9/1 10/1 11/1 12/1 13/1
MAXIMUM 37.4 35.2 41.3 42.2 42.0 41.0
MINIMUM 19.6 19.7 20.3 25.9 24.3 29.9

1904/05 28/12 29/12 30/12 31/12 1/1
MAXIMUM 38.4 35.8 41.9 44.2 37.5
MINIMUM 14.4 15.7 18.9 23.2 21.8

1899/00 30/12 31/12 1/1 2/1 3/1
MAXIMUM 37.2 41.8 43.1 42.1 37.2
MINIMUM 16.2 23.2 30.3 30.1 27.9

1899 6/2 7/2 8/2 9/2 10/2 11/2 12/2 13/2
MAXIMUM 35.4 36.4 37.9 38.9 40.3 43.1 43.1
41.9
MINIMUM 17.3 21.2 22.4 22.4 25.2 29.6 32.9 23.4

1898 31/1 1/2 2/2 3/2 4/2
MAXIMUM 40.3 41.6 39.7 37.8 40.4
MINIMUM 20.9 32.0 29.1 27.1 29.6

1898 26/12 27/12 28/12 29/12 30/12 31/12
MAXIMUM 35.6 36.7 40.6 41.9 41.9 39.5
MINIMUM 17.5 18.4 20.9 26.2 26.8 26.3

1897 26/12 27/12 28/12 29/12 30/12
MAXIMUM 39.7 39.3 42.3 42.6 41.0
MINIMUM 24.2 28.5 24.4 31.8 29.3

1895 11/2 12/2 13/2 14/2 15/2 16/2
MAXIMUM 36.2 40.3 39.1 39.0 38.0 37.2
MINIMUM 20.2 27.1 27.7 27.0 26.7 24.4

1889 20/1 21/1 22/1
MAXIMUM 40.8 40.6 40.9
MINIMUM 24.8 26.8 30.6

1887 8/2 9/2 10/2 11/2 12/2
MAXIMUM 36.8 37.7 36.3 37.4 36.3
MINIMUM 20.6 23.1 25.8 23.5 23.7

A protracted dry and exceptionally hot period affecting NSW and most of eastern Australia, 2001-2006.

Clinton Rakich and Perry Wiles

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Summary

The period 2001 to 2005 has been the driest five-year period since 1968 and the warmest five-year period ever recorded for NSW (records commence in 1910). The absence of extensive heavy rain events during this period is reflected by the notable absence of flooding across inland NSW. The last widespread flooding event across inland NSW occurred in November 2000. The chances of a La Niña event faded during the past several weeks, and

the Bureau of Meteorology's seasonal outlooks are now suggesting that there is no strong signal that might presage an end to the dry period during the next three months. This statement places the current dry period into a historical context with evidence that the state has endured multidecadal dry/wet periods in the past.

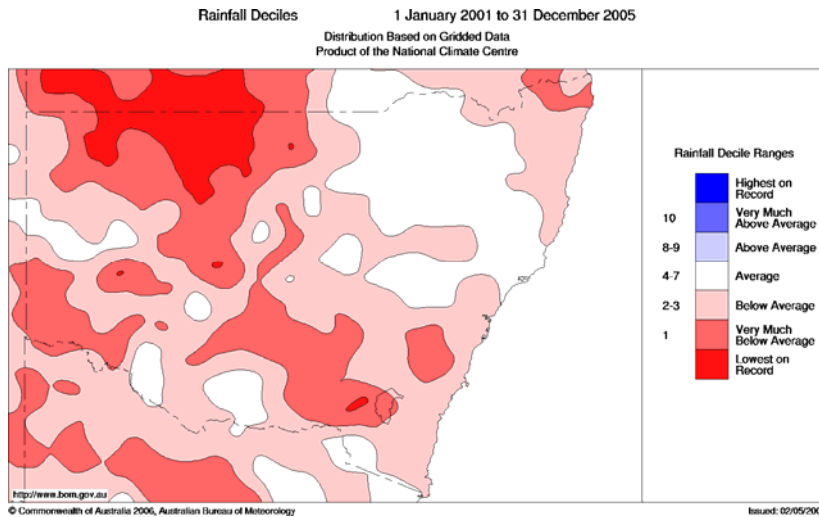


Figure 1. NSW rainfall deciles for the period 1 January 2001 to 31 December 2005.

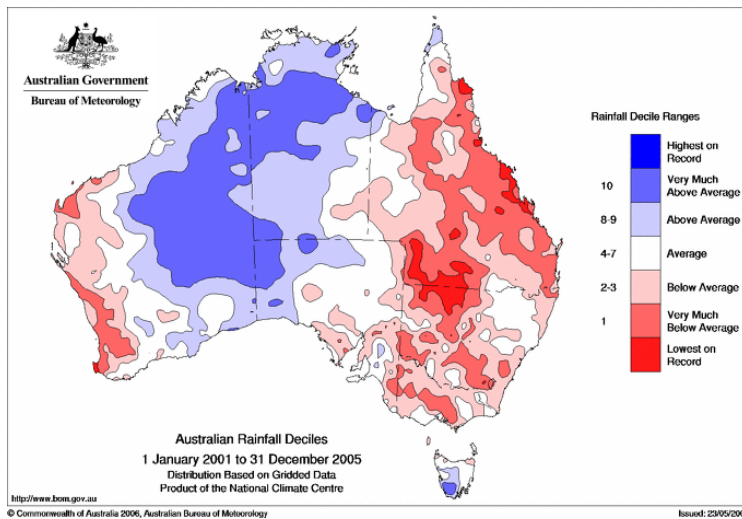


Figure 2. Australian rainfall deciles for the period 1 January 2001 to 31 December 2005

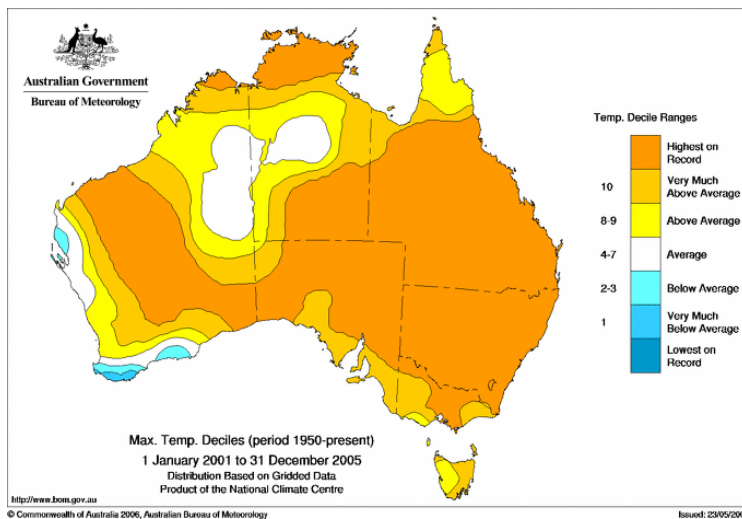


Figure 3. Australian maximum temperature deciles for the period 1 January 2001 to 31 December 2005.

The long hot dry for NSW

The statewide average rainfall for the past five years has been only 457.6 mm compared to the standard reference period (1961-90) average of 566.0 mm. The only five-year period in the rainfall record (beginning 1900) significantly drier than the last five years was in the mid 1940s (439.1 mm in 1942-46). There has been no major flooding west of the divide since November 2000, while the last major coastal flooding occurred in March 2001. The dry conditions have been widespread across the state, with the only district to receive close to average falls for the past five years being the Northwest Slopes and Plains (see Figure 1).

The effects of the dry conditions have been exacerbated by much higher than average temperatures across the entire state during the last five years. The period from January 2001 to December 2005 is the warmest five-year period in the statewide high-quality temperature record, which began in 1950. The average maximum temperature for NSW was 1.2°C above the average of 23.9°C. Significantly, all areas of the state endured these high average temperatures. The 2002 El Niño year was especially warm, with much of the state west of the divide experiencing the highest annual maximum temperatures in the high-quality temperature record.

Extremely hot conditions continued to affect most of NSW during the summer of 2005/06, with below average rainfall widespread. Only the northeast corner of the state was spared, receiving above average rainfall. Throughout the remainder of the state high temperatures and below to very much below average rainfall persisted. Autumn 2006 too has been very dry across most of NSW, and exceptionally so in

the Central Tablelands and along central parts of the coast including Sydney.

Coastal areas around Sydney experienced record low humidity in April 2006 and it was also the area's sunniest and fifth driest April on record. Autumn 2006 was Sydney's warmest (for maximum temperatures), sunniest and fifth driest autumn on record (temperature and rainfall records from 1859, sunshine records from 1931).

Sydney's current dry period commenced in 2000, a year earlier than inland areas of the state. In that year coastal areas of NSW received below average rainfall, while inland areas were experiencing flooding rains. The 2000 to 2005 period is significant in that no similar dry period has occurred in nearly 60 years (see Table 1). The last dry spell in Sydney, which ran from 1935 to 1948, was the longest and most severe, with an average annual rainfall of only 990 mm over the 14-year period, compared to 1009 mm over the current 6-year period. Sydney's long-term average annual rainfall is 1217 mm (records commenced 1859).

Only 261 mm was recorded in Sydney from January to May, the driest start to the year since 1965 when 196 mm was recorded over a similar period. The long-term average for the five months January to May is 601 mm. This extended period of abnormally dry and hot conditions has not only affected NSW but also much of the eastern half of the country. Most of Queensland and Victoria have experienced very dry conditions from 2001 to 2005 (see Figure 2).

Dry period	Length of period (years)	Annual totals (mm)	Average over the period (mm)
1880 - 1886	7	749, 1045, 1072, 1194, 1120, 1014, 999	1028
1893 - 1898	6	1197, 971, 812, 1077, 1063, 1098	1036
1901 - 1912	12	1019, 1096, 980, 1164, 888, 809, 794, 1159, 823, 1194, 1273, 1207	1034
1920 - 1928	9	1105, 1102, 1000, 941, 941, 1280, 943, 1234, 1019	1063
1935 - 1941	7	788, 769, 1323, 996, 857, 1001, 680	916
1935 - 1948	14	788, 769, 1323, 996, 857, 1001, 680, 1245, 1290, 787, 1177, 916, 1040, 987	990
Current dry spell 2000 - 2005	6	822, 1359, 860, 1200, 995, 816	1009

Table 1. Dry periods affecting Sydney during the period 1859 to 2006. Dry periods are designated as periods of 6 or more years that include at least 4 consecutive years of below average rainfall and no single year with rainfall above 1367 mm (150 mm above Sydney's annual average. Note that while the 1935-41 period is a subset of the 1935-48 period, it is also treated separately to acknowledge its particular severity.

The five-year period 2001-2005 was the also warmest in the high-quality temperature record for much of Queensland and large parts of Victoria (see Figure 3 – high-quality records available from 1950 for this decile analysis).

The recent return of the Pacific Ocean to neutral conditions after a near La Niña event means that the likelihood of drought breaking rainfall has diminished somewhat.

The historical context for the long dry

Recent research into historical rainfall across NSW has uncovered a pattern of recurring extended dry and wet periods. The state endured a lower rainfall regime from 1900 to 1946, with a statewide average annual rainfall of 478 mm across these 47 years. A marked shift occurred around 1947 to a higher rainfall regime, which persisted through to around 2000. This latter period had a much higher average annual rainfall of 574 mm, representing an increase of about 20%. The non-linear relationship between rainfall and runoff means that the rainfall increases would have been disproportionately reflected in increased river flows. Whilst high interannual variability was a significant feature during

both periods, the shift to wetter conditions in the second half of the century is quite pronounced (see Figure 4).

Looking further back into individual town rainfall records it becomes apparent that the state endured a shift to drier conditions in the late 1800s. These multidecadal shifts from wet to dry and vice versa are poorly understood, with a longer perspective on rainfall variability limited by the relatively small window of time in which we have been collecting conventional rainfall records across the state. It is probable that the shifts are a natural feature of the NSW climate, and may have been occurring for millennia. What also remains uncertain is how these cycles in rainfall might interact with anthropogenic climate change, particularly change forced by the enhanced greenhouse effect. What is clear, however, is that the general rises in temperatures being experienced across Australia, which are being attributed to anthropogenic climate change, can be expected to exacerbate the effect of future ‘naturally occurring’ dry phases, thus leading to even greater water stress during these periods.

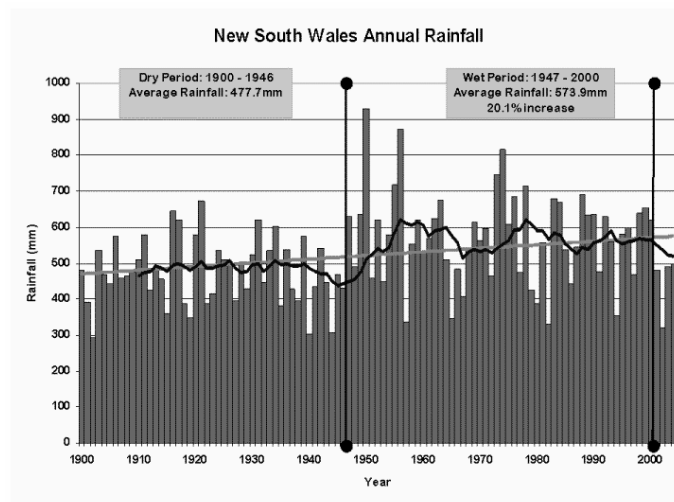


Figure 4. New South Wales Annual Rainfall

The life and times of Uwe Radok.

Peter Schwerdtfeger

As a young university student, Uwe Radok fled Germany as Nazism’s grip intensified. He found himself working as an engineering draftsman in England before becoming interned, along with future Nobel Prize winners. As one of the “Dunera Boys”, so well described by the author Cyril Pearl, he

involuntarily reached Australia for a further period of internment and subsequent release on voluntarily joining the Australian Army in 1942. This decision entitled him to further studies in Meteorology at the University of Melbourne after the close of hostilities. Through his monumental PhD thesis under Dr.

Fritz Loewe, another German refugee, he was that notable polar explorer's only higher degree candidate.

Radok's interests covered an enormous range of experimental and theoretical studies. Feeling isolated in the diminutive Meteorology Department of the University, he sought cooperation with research partners from many organisations, including the Bureau of Meteorology, CSIRO, the Snowy Mountains Hydro-electric Authority, the (then) Weapons Research Establishment and Antarctic Division. It was with the latter that he built up a remarkably successful programme in Glaciology, years before anyone else in the Australian meteorological community realised the significance of Antarctic land- and sea-ice as long and short-term climate indicators. In a country devoid of glaciers, many, including Prof. Bill Budd, were able to build their careers on Radok's pioneering ideas.

Following the University's access to digital computing facilities on CSIRAC, Radok continued to demonstrate his versatility as he and his student Dr. Dick Jessen managed to wring out Australia's first numerical weather forecasts from a primitive system which ran with a 100 memory elements! Later he supervised the BoM's pioneers, including Ross Maine, in this important field.

Responding to problems experienced by higher flying civilian aircraft as passenger jets commenced service in Australia, he cooperated

with Prof. Elmar Reiter of Colorado State University and Kevin Spillane of the BoM, in clarifying concepts of clear air turbulence.

His support for and encouragement of students was enormous. When the University Radio Club sought help in building an antenna to receive the then revolutionary satellite images of the Earth's clouds, his decision to offer space and funds was rewarded by successful reception of images which greatly helped the BoM until it built its own receiving station.

In spite of his prodigious personal output of publications and a continuous stream of successful graduate students, circumstances were such that in 1977 he felt that he had no choice but to leave the University of Melbourne, which he had intellectually enriched for a quarter of a century. The U.S. benefited from his last decade of research.

Nevertheless, Australia remained home to Uwe Radok and he returned to retire quietly with his wife Anita. Even now, having celebrated his 90th birthday earlier this year, email enables him to remain in contact with his many friends, including former students and colleagues. Many of these students have made distinguished careers in Meteorology and they will applaud the decision by AMOS, facilitated by the generosity of some of them, to found the annual "Uwe Radok Award" for the best PhD thesis submitted at an Australian University.

Review of "An Inconvenient Truth"

*Barrie Pittock, Climate change scientist and author of
"Climate Change: Turning Up the Heat"*

This highly topical documentary about global warming is pitched at a public that cares about what humans are doing to our planet and especially about the legacy we are leaving for our children and grandchildren. It is Al Gore's story, and he likens the issue to his family growing up on a tobacco farm and much later seeing his sister die of lung cancer from many years of smoking. That was when his father stopped growing tobacco.

Al introduces himself to his audience as the "former next President of the United States". Amidst the laughter he adds that he does not think that is funny. Al comes across as sincere, dedicated and knowledgeable about the complexities of the science. I for one, as a climate scientist for the last 30 years and more can hardly fault his science, apart from the odd complicating word I might have added. But

then my efforts at popularising the science have been too technical to appeal to a mass audience, and Al does it brilliantly.

Based on a slide show Al Gore has given to more than a thousand audiences around the globe, the film is finely honed to discuss the evidence, illustrated with coverage from the field of melting glaciers and ice sheets, rising sea levels and severe storms, floods and droughts. He discusses the arguments of the so-called sceptics or contrarians, and notes that it is difficult to get a man to understand a problem if their salary depends on their not understanding it (not that that accounts for all the contrarians).

While Al paints a grim picture of a future based on business-as-usual, he strongly exudes hope. He points out that old habits with old

technology lead to predictable consequences, that old habits with new technology can lead to worse consequences (because of the greater power of the technology), but that new habits plus new technology can greatly improve the result. He states that we have the new technology needed but lack the political will to tackle the problem. However, he points out that political will is a renewable resource. Humans have abolished slavery, encouraged women to vote, and abolished diseases such as polio. Now we can move on to a prosperous future without destroying the world as we know it.

He suggests ways that individuals can reduce greenhouse gas emissions, but he recognises that for this to happen fast enough globally we

need governments that will set the framework for a low-carbon emissions technology to prosper. He urges his audience to become activists in order to save those things we presently take for granted but which are threatened by climate change.

I give the film 5 out of 5. It is technically brilliant, remarkably accurate and up to date, and should be palatable to a wide audience. If you care for your children's future you should see it. It should bring you up to speed on climate change and give you hope we can solve the problem. (And if you want the documentation try my somewhat more academic book and endnotes at www.publish.csiro.au/pid/4992.htm).

Mates Rates... 20% off Double Helix Science Club membership

CSIRO's Double Helix Science Club is celebrating its double decade and you can save 20% off new or renewing memberships for your family or a gift for someone special. Membership is perfect for young, inquisitive Aussie minds that like to laugh while they learn. **OFFER CLOSSES 30 SEPTEMBER 2006.**

Membership offers:

- A choice of two magazines, *Scientriffic* or *The Helix*, delivered every two months. Both magazines are fun-packed scientific education resources featuring hands-on activities, research, experiments, comics, brain-stretching puzzles, competitions and freebies.
- Member events, adventures and holiday

programs run from nine CSIRO Science Education Centres in every capital city and Townsville.

- Science by Email weekly e-mail newsletter, packed with experiments and news.
- Discounts at CSIRO Shop www.csiroshop.com and Double Helix Holiday Programs.
- Exclusive deals and discounts at participating science centres across Australia.

For club info visit www.csiro.au/helix or call 02 6276 6643.

To join, visit

www.csiro.au/helix/promo/OrgClubDeal.pdf or call

02 6276 6643 and mention this offer.

An opportunity to be part of Weather and Society * Integrated Studies!

The National Center for Atmospheric Research (NCAR) Societal Impacts Program, in association with the Monash Sustainability Institute, announces an exciting opportunity: Weather and Society * Integrated Studies (WAS*IS). WAS*IS is a workshop that is going to change from what WAS to what IS the future of integrated weather and climate studies.

We are looking for bright, enthusiastic, innovative people who feel strongly about the need to bring together researchers, practitioners, and stakeholders in order to make our science relevant, but who might not know how to do that, where to begin, or other people with similar interests.

Following on the successful U.S. WAS*IS workshops, we are pleased to have funding to offer an Aus WAS*IS in Melbourne, Australia, from 28 January to 2nd February, 2007.

See our webpage

(<http://www.sip.ucar.edu/wasis>) to read more about WAS*IS and to apply for the Aus WAS*IS workshop. Applications are due Wednesday, 29 September 2006. Please contact Amanda Lynch (Amanda.Lynch@arts.monash.edu.au, 03 9905 8291); or Lee Tryhorn (Lee.Tryhorn@arts.monash.edu.au, 03 9905 8419) if you have questions. We'd love to talk with you about WAS*IS!

Significant weather

May 2006

Summary

Thunderstorms were reported in Queensland, New South Wales, Western Australia and a tornado was reported in South Australia. Flooding continued to ease in Queensland from the rains during April. State record low minimum temperatures for May were set in Tasmania and Queensland.

Thunderstorms/Tornado

South Australia

A tornado was reported at Kingston on the 6th causing some damage.

Flooding

Queensland

Moderate to minor flooding continued to ease in the Georgina River, Eyre Creek, Lower Thomson River and Cooper Creek catchments early in May from rains during April.

June 2006

Summary

Significant wind gusts were reported in New South Wales, Victoria, Tasmania and Western Australia. Dry westerly winds produced high fire danger in the southeast corner of Queensland. Western Australia experienced a very dry and cold June with several stations recording their lowest recorded rainfall, in some cases in over 100 years of observations.

Thunderstorms

New South Wales

On the 5th at Anna Bay (Hunter) a thunderstorm produced heavy rain (50mm in 30 minutes) and small hail.

Bushfires

Queensland

On the 3rd dry, gusty westerly winds produced very high fire danger about the southeast corner. Some small fires were reported, but only one significant blaze at Cooyar, in the southern Burnett. A number of homes were threatened.

Temperature/Rainfall

Western Australia

Western Australia experienced the driest June since at least 1900 and also the coldest June minimum and mean temperatures since at least 1950. Many temperature and rainfall records were broken with several stations recording their lowest ever rainfall totals in June for over 100 years. The previous state June minimum temperature record of -5.7°C recorded at Wandering in 1964 was broken twice with -5.9°C at Eyre on 14th and again on the 17th at Collie East, which recorded -6.0°C .

Records

Record low monthly rainfall occurred in June at 166 stations with 50 years or more of data, and record low minimum temperature at 54 stations with 30 years or more of data. Only selected stations are shown.

Records set – May 2006 (# - state record for May; * - record for any month)							
Station	State	Element	Value	Date	Previous record	Year	Years of record
Streaky Bay	SA	Low daily max	13.1	26	13.4	1968	49
Moruya Heads	NSW	Low daily max	12.0	23	12.2	1962	50
Mount Lofty	SA	Low daily max	5.1#	24	6.0	1992	16
Wyndham	WA	Low daily min	10.5	31	12.8	2001	39
Pemberton	WA	Low daily min	2.0	26	2.5	1975	50
Victoria R. Downs	NT	Low daily min	4.5	30	5.0	2002	40
Keith	SA	Low daily min	-2.3	24	-1.3	1994	45
Burketown	QLD	Low daily min	4.9	29	5.7	1925	108
Amberley	QLD	Low daily min	-3.1	31	-1.3	2004	65
		Low monthly min	6.1		6.5	1994	65
Stanthorpe	QLD	Low daily min	-6.8#	31	-6.1	1965	44
Wilcannia	NSW	Low daily min	-2.5	26	-0.4	2004	50
Tenterfield	NSW	Low daily min	-8.8	31	-7.1	1995	41
		Low monthly min	-0.4		1.5	2004	91
Parkes	NSW	Low daily min	-1.5	30	-1.1	1999	50
Hay	NSW	Low daily min	-2.2	30	-1.6	1999	50
Mildura	VIC	Low daily min	-2.1	24	-1.6	1999	60
Horsham	VIC	Low daily min	-3.5	30	-3.0	1994	50
Liawenee AWS	TAS	Low daily min	-10.5#	30	-9.7	2001	6
Croydon	QLD	Low monthly max	29.1		29.3	1983	82
Cobar	NSW	Low monthly min	5.9		7.2	2001	44
Collarenebri	NSW	Low monthly min	4.3		5.1	1994	86
Murrurundi	NSW	Low monthly min	0.7		1.5	2004	87
		Low monthly rain	0.8		0.9	1994	135
Bathurst ARS	NSW	Low monthly min	-0.8		-0.2	1976	87
Ballarat	VIC	Low monthly min	3.6		3.8	1984	98
South Johnstone	QLD	High monthly min	20.6		20.5	1990	52
Geraldton Port	WA	Low monthly rain	4.0		4.3	1948	111
Bridgetown	WA	Low monthly rain	31.2		31.9	1948	120
Cape Leeuwin	WA	Low monthly rain	35.0		43.2	1949	110
Cape Naturaliste	WA	Low monthly rain	33.8		35.4	1959	103
Mount Barker	WA	Low monthly rain	6.9		16.3	1896	120
Cape Moreton	QLD	Low monthly rain	9.0		15.2	1909	137
Quirindi	NSW	Low monthly rain	0.0		0.3	1934	123
Kurrajong Heights	NSW	Low monthly rain	2.2		2.3	1957	136
Records set – June 2006 (** - state record for any month)							
Station	State	Element	Value	Date	Previous record	Year	Years of record
Wittenoom	WA	Low daily min	4.0	30	4.2	1982	48
		Low monthly min	10.1		10.5	1971	53
Perth Airport	WA	Low daily min	-1.3*	17	-1.1	1946	63
		Low monthly rain	27.8		56.2	2001	63
Balladonia	WA	Low monthly min	3.2		3.7	1984	78
Bridgetown	WA	Low daily min	-5.1*	17	-4.0	1981	99
		Low monthly rain	32.0		41.9	1893	120
		Low monthly min	1.8		2.0	1931	106
Collie East	WA	Low daily min	-6.0#	17	-3.0	2003	4
Donnybrook	WA	Low daily min	-2.5	17	-2.2	1938	100
		Low monthly rain	33.8		40.6	2001	107
Kellerberrin	WA	Low daily min	-5.2*	16	-2.5	2003	97
		Low monthly min	0.7		3.4	1971	94
Katanning	WA	Low daily min	-3.0*	17	-2.1	1931	99
		Low monthly rain	18.2		21.3	1958	115
		Low monthly min	3.0		3.6	1931	112
Salmon Gums	WA	Low daily min	-5.7	15	-5.4	1956	70

Parafield	SA	Low monthly min	2.2		3.7	1946	59
		Low daily min	-2.3*	15	-2.2	1982	50
		Low monthly min	3.3		4.6	1982	50
Parkes	NSW	Low daily min	-4.0	15	-2.6	1998	50
Mildura	VIC	Low daily min	-3.7	15	-3.3	1982	60
Benalla	VIC	Low daily min	-4.5*	14	-4.4	1965	50
		Low monthly min	0.5		0.7	1982	103
Rutherglen	VIC	Low daily min	-7.5*	14	-6.5	1984	42
		Low monthly min	-2.4		-0.4	1927	92
Palmerville	QLD	High daily rain	67.4	11	64.5	1927	117
Rockhampton AP	QLD	High daily rain	80.0	11	74.6	1988	68
Rosedale	QLD	High daily rain	149.4	11	132.1	1912	108
Northampton	WA	Low monthly rain	8.2		27.4	2001	124
Denham	WA	Low monthly rain	0.8		3.9	1922	106
Carnamah	WA	Low monthly rain	10.0		13.0	1984	120
Dongara	WA	Low monthly rain	11.4		22.6	1902	121
Geraldton Port	WA	Low monthly rain	3.8		19.0	1976	112
Gerladton AP	WA	High monthly max	23.3		23.2	1949	63
Mullewa	WA	Low monthly rain	3.0		13.0	1896	109
		High monthly max	23.1		22.4	1949	60
Gingin	WA	Low monthly rain	27.0		28.0	2001	118
Cape Naturaliste	WA	Low monthly rain	53.2		68.8	1990	103
Pinjarra	WA	Low monthly rain	36.2		50.5	1893	127
Collie	WA	Low monthly rain	36.6		36.8	2001	108
Williams	WA	Low monthly rain	17.4		18.4	2001	122
Lucindale	SA	Low monthly rain	9.6		16.5	1930	127
Culgoa	VIC	Low monthly rain	2.0		2.5	1914	107
Edenhope	VIC	Low monthly rain	5.2		9.6	1930	117
Korumburra	VIC	Low monthly rain	28.0		33.2	1907	105
Caulfield	VIC	Low monthly rain	11.4		13.4	1969	114
Warburton	VIC	Low monthly rain	18.6		25.9	1972	128
Mount Buninyong	VIC	Low monthly rain	17.8		18.8	1967	150
Woodend	VIC	Low monthly rain	20.7		22.9	1969	105
Ballarat	VIC	Low monthly rain	12.2		14.0	1969	99
Colac	VIC	Low monthly rain	16.8		17.3	1937	104
Lilydale	TAS	Low monthly rain	16.8		17.3	1930	104
Avoca	TAS	Low monthly rain	7.0		10.2	1944	110
Sorell	TAS	Low monthly rain	5.8		6.3	1966	119
Dwellingup	WA	High monthly max	16.9		16.3	2000	69
		Low monthly min	3.5		3.9	1960	70
Albany AP	WA	Low monthly min	6.0		6.8	1973	42
Leonora	WA	Low monthly min	4.2		5.1	1981	57
Norseman	WA	Low monthly min	3.1		3.7	1960	56
Marree	SA	Low monthly min	3.2		3.3	1982	67
Oodnadatta	SA	Low monthly min	3.3		3.5	1940	58
Ceduna	SA	Low monthly min	2.8		2.9	1975	65
Kyancutta	SA	Low monthly min	1.0		1.7	1975	77
Yongala	SA	Low monthly min	-1.9**		-0.9	1972	81
Hillston	NSW	Low monthly min	1.9		2.3	1965	74
Echuca	VIC	Low monthly min	0.9		1.3	1982	124
Launceston AP	TAS	Low monthly min	0.2		0.8	1973	68
Flinders Island	TAS	Low monthly min	4.6		5.4	1995	44

Charts From The Past by Blair Trewin

28 May, 1987

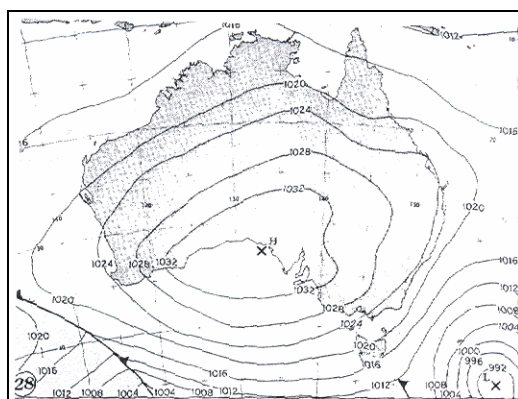
The situation in the closing days of May 1987 had all the ingredients for very low minimum temperatures in eastern Australia: a cold outbreak, followed by rapid ridging from the west and dry southwesterlies extending over the continent. When it comes to the setting of records in autumn, the timing of the event, in the last few days of a month, was also highly favourable.

The precursor to the severe late-month frosts was a cold outbreak over southeastern Australia on the 26th and 27th. This brought very low daytime temperatures on the 27th in many areas. Melbourne (10.9°C) had its coldest May day for a decade, while further north, on the NSW Central Tablelands, Oberon only reached 3.0 and Orange 4.1, and many low-elevation locations in Victoria, southern NSW and southeastern South Australia struggled to reach double figures. There were damaging winds in the Adelaide and Melbourne area, and some raised dust ahead of the front in southern inland NSW (although autumn rainfall had been near normal). Snow fell above about 500 metres in Victoria, and by the evening of the 27th had extended to central New South Wales, including Goulburn, Murrurundi and Coonabarabran, although amounts were light.

The cold outbreak had only limited moisture associated with it. None penetrated beyond central New South Wales, but the cold air behind the front reached well into Queensland and the Northern Territory. Reinforcing an already frosty situation, this saw many records set in inland southern Queensland. Mitchell's -6.4 on the 29th was a Queensland record for May (until it was broken in 2006), whilst May records were also set at locations such as Charleville (-3.3 on the 29th and -3.6 on the 30th). On this occasion well-known Queensland cold spots such as Stanthorpe (-3) missed out, possibly because of local winds. Alice Springs managed -2.7 on the 30th, a May record for the airport site and only 0.1 degrees short of the NT May record.

Further south, minimum temperatures were well below normal, but mostly not of record-breaking proportions. Sydney had its coldest May night since 1931 (5.6) on the 28th, whilst it was -5.6 in Canberra and -9 in Thredbo.

In marked contrast to the wintry look of the charts from the 28th, the days leading up had seen a late-season tropical cyclone off Queensland, although it posed no threat to the Australian mainland at any stage. Blanch formed off the Solomon Islands on the 21st and drifted south through the Coral Sea before dissipating on the 27th.



Synoptic chart for 0000 UTC (1000 AEST), 28 May 1987

Calendar

August

28-1 September 12th Conference on Mountain Meteorology, Santa Fe, NM, U.S.A.

September

4-6 17th Australia New Zealand Water and Climate Forum, Australia National University, Canberra, ACT.

October

31-4 November, Symposium on Impact Evaluation of Global Warming and Approach to Risk, Taipei, Taiwan.

November

6-17, Responding to Climate Change 2007, Nairobi, Kenya.

9-12 Earth System Science Partnership, Global Environmental Change: Regional Challenges, Beijing, China
<http://www.essp.org/essp/ESSP2006/>

December

4-8 2nd THORPEX International Science Symposium, Landshut, Bavaria, Germany

11-15, American Geophysical Union Fall Meeting, San Francisco, CA, USA.

2007

January

14-18 87th Annual Meeting of the American Meteorological Society, San Antonio, Texas, USA.

28-2 February, Aus WAS*IS, Mt. Macedon, Victoria. <http://www.sip.ucar.edu/wasis>

February

5-8, AMOS National Conference, Adelaide, South Australia

May

22-25, American Geophysical Union, Joint Assembly, Acapulco, Mexico.

June

25-29 22nd Conference on Weather Analysis and Forecasting/18th Conference on Numerical Weather Prediction, Park City, Utah, USA.

September

3-7, Royal Meteorological Society Conference, Edinburgh, Scotland.

Australian Meteorological Magazine. Vol 55 No.3, September 2006.

Articles:

Finkele, Mills, Beard and Jones: National gridded drought factors and comparison of two soil moisture deficit formulations used in prediction of Forest Fire Danger Index in Australia.

Le Marshall, Jung, Zapotocny, Derber, Treadon, Lord, Goldberg and Wolf: The application of AIRS radiances in numerical weather prediction.

Nicholls. Detecting and attributing Australian

climate change: a review.

Tryhorn and Risbey: Observed and projected changes in heat waves over the Australian region.

Book reviews:

Lynch. Encyclopedia of World Climatology, ed. Oliver.

Further Information:

<http://www.bom.gov.au/amm>