

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:11
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW1: Canberra Airport [SEC=IN-CONFIDENCE]
Attachments: Development around Canberra Airport_v7.doc

From: Cooper, Maxine [Maxine.Cooper@act.gov.au]
Sent: Friday, 22 August 2008 10:58 AM
To: Stephen Lellyett; Kenn Batt
Cc: Burrows, Sarah; janette.lindesay@anu.edu.au; clem davis
Subject: NSW1: Canberra Airport

<<Development around Canberra Airport_v7.doc>>

Stephen and Kenn

Many thanks for your discussions yesterday (21/8/08). The State of the Environment Report (SoER) is available at our website www.envcomm.act.gov.au. I draw your attention to the *Climate and Greenhouse Issues paper* with its supporting indicator paper - *Weather* - that is of relevance to our discussion and this email. I have also attached a paper that Clem Davis has requested that we link to the weather paper, see above.

Below is the paragraph (1) in the *Climate and Greenhouse Issues Paper* that has been the focus of discussions with the Canberra Airport Corporation (CAC). Also below is a paragraph (2) that adds clarity and context to paragraph 1. **Associate Professor Janette Lindsay has had the final say on the words in this paragraph.** I am thinking about having the clarifying paragraph (paragraph 2) linked to SoER material as the SoER has been published we would that this material has been added following publication of the document.

I send this material to you to ask if you wish to give me any other information or wish to comment on any of the material. Please do consider Clem Davis' paper that he has requested be published on our web site. It seems appropriate for me to agree to his request as it elaborates on Weather indicator paper. We would need to say it has been added since the document was published.

1. SoER *Climate and Greenhouse Issues Paper* paragraph four:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

2. Clarifying and providing a context for material in paragraph four in the State of the Environment report 2007/08, Climate and Greenhouse Issues Paper, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station."

Measuring weather and climate conditions in the ACT has been undertaken at the weather station at the Canberra International Airport, one of the key climate reference station in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected the accuracy of measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have now been built adjacent to the weather station significantly changing the micro-climate of the measurement area for temperatures at the extremes. A multi-story building constructed east of the weather station now shades the sunshine recorder following sunrise. This means that data collected since these developments potentially cannot be effectively compared to the previous long-term record at this site. This would affect the long-term record and ongoing measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station is established at an appropriate location in the ACT as soon as possible, with data adequately correlated with previous data from the existing airport weather station.

If you have any questions or wish to discuss this further, please contact me. I will be contacting the CAC and sending the amended material following your response.

Max

Dr Maxine Cooper

Commissioner

Office of the Commissioner for Sustainability
and the Environment

Ph: 6207 2629

Fax: 6207 2630

E-mail: maxine.cooper@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Has Development around Canberra Airport affected its use as a Climate Reference Station?

Clem Davis
Visiting Fellow
Fenner School of Environment and Society, ANU

Introduction

Canberra Airport is one of the Observation sites used by the Bureau of Meteorology as a Climate Reference Station to measure climate change across Australia. The site commenced in March 1939 and has remained relatively unchanged through to 2005.

Development at Canberra airport has resulted in a hanger being constructed to the northwest of the Observation site in 2005 and new buildings and a car park to the north and east of the site during 2006-2007. The edge of the car park is now only meters from the eastern boundary of the Observation Site. The question arises, how much does this development impact on the ability to continue to use this site as a long term reference station?

Figure 1 a-d indicates the observation site as it was in 2005 while Figures 2 a-b and 3 a-b indicate the changes that have occurred to the north and east between 2005 and 2007. There has been no change to the site from the northwest through to the southeast. Figure 4 a-b shows the proximity of the development to the Observation site.

In 1996 an Automatic Weather Station (AWS) was installed in the Tuggeranong Valley in a joint project between the Bureau of Meteorology and the ACT Government. It is located around 15 km to the southwest of the airport. The relative positions of the two sites are shown in Figure 5.

There are now 11 full years of daily maximum and minimum temperatures from this AWS site that can be used to cross reference with Canberra Airport to identify whether any changes are occurring in maximum and minimum temperatures at the Airport Site. There are nine years of data during which time there was no physical change to the sites while there are two years of data during which time the development took place at Canberra Airport. A comparison of the daily maximum and minimum temperatures between the sites for these two periods can now be used to provide an indication on any trends in the temperature record at Canberra Airport that may be due to this development.

Figures 1 to 4 go here

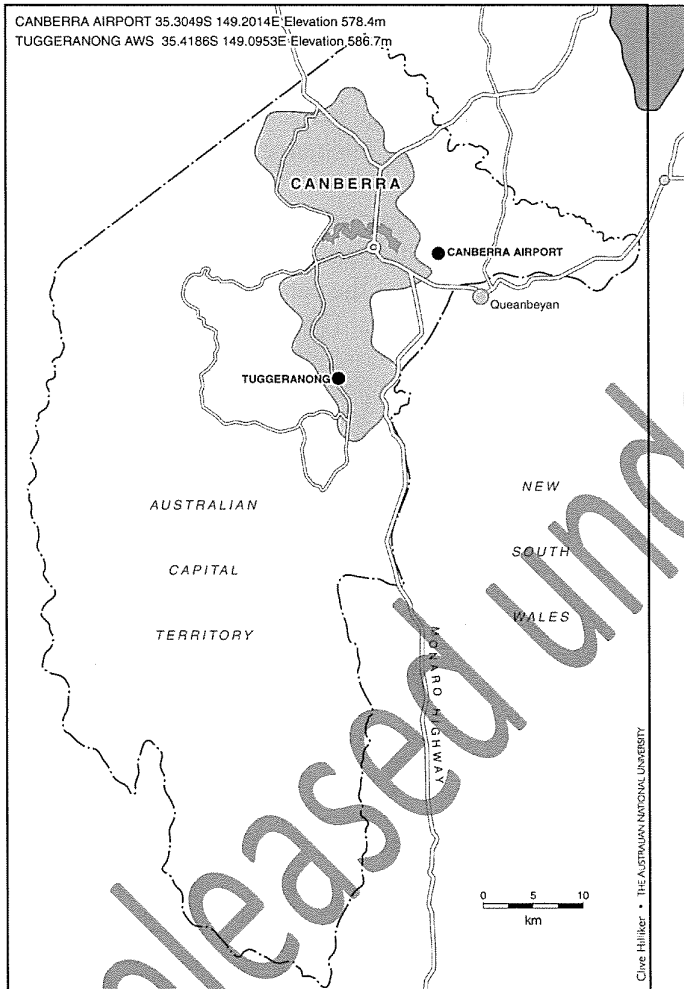


Figure 5: Locations of Tuggeranong AWS and Canberra Airport within ACT.

Method.

The available daily Tmax and Tmin data for Tuggeranong AWS and Canberra Airport obtained from the Bureau of Meteorology database were used in this analysis.

The analysis consisted of 4 steps:

1. Determining the relationship, if any, in the daily temperatures between Tuggeranong and Canberra Airport for the whole period 1997-2005.

2. Determining the annual and seasonal spreads between 1997-2005 to provide an indication of the variability of any correlation
3. Using the linear regression coefficients over these years to calculate the derived temperature at Canberra Airport using Tuggeranong values
4. Comparing these results with the data from 2006 and 2007 to identify changes in the values that may be occurring.

Figure 6 a-b indicates the correlation graphs between Canberra Airport and Tuggeranong for both Tmax and Tmin for the period 1997-2005.

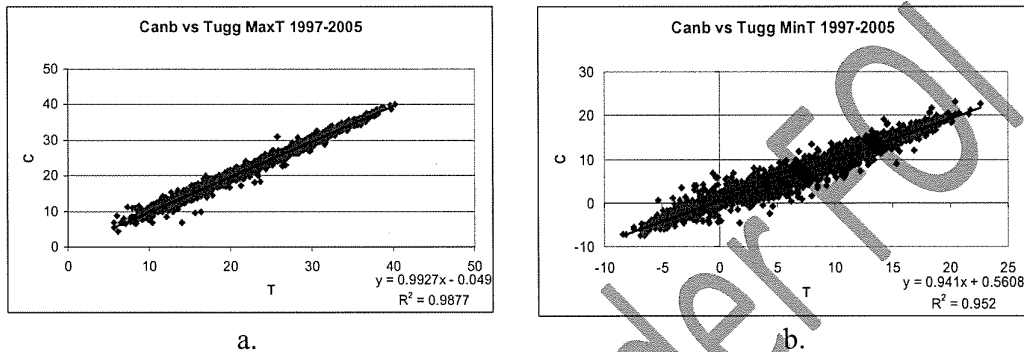


Figure 6 a-b Correlation graphs between Tuggeranong and Canberra Airport Daily Maximum and Minimum Temperatures 1997-2005

As can be seen the correlations between the two sites are extremely high with the average 97-05 annual R² values being 0.988 for the Maximum Temperatures and 0.952 for the Minimum Temperatures.

Results:

The annual results obtained from these correlations are listed in Table 1 together with the temperatures for Canberra Airport calculated from the Tuggeranong data using the regression relationships while the seasonal results are listed in Table 2.

These results indicate that:

1. the range in derived temperatures for Canberra Airport on an annual basis between 1997-2005 is small indicating the relationship between the 2 sites is quite stable.
2. the correlations for 2006 and 2007 are of similar magnitudes to the 97-05 period.
3. in 2006 the derived minimum temperatures remained within the 1997-2005 ranges.
4. in 2006 the derived maximum temperatures lie on or marginally above the upper limit of the 1997-2005 ranges.
5. in 2007 derived maximum temperatures for Canberra Airport above 25°C are higher than those in the control period. These differences appear to be more significant during Summer and Autumn, particularly as temperatures increase, with no trends evident in Spring and Winter.
6. in 2007 derived minimum temperatures for Canberra Airport below 5°C are higher than those in the control period. These differences appear to be more significant during Autumn with less significant warming trends evident during Winter and Spring and no trends evident in Summer.

Table 1: Results of the calculations from the linear regressions of Canberra Airport Annual Tmax and Tmin using Tuggeranong temperatures.

MaxT Annual	R ²		Selected Max Temperature for Tuggeranong						
			10.0	15.0	20.0	25.0	30.0	35.0	40.0
97-05 Average	0.9880	Derived	9.9	14.8	19.8	24.8	29.7	34.7	39.6
Lowest		MaxT	9.7	14.7	19.6	24.5	29.5	34.4	39.3
Highest		Canberra	10.1	15.0	20.0	25.0	30.0	34.9	39.9
2006	0.9928	Airport	10.1	15.1	20.1	25.0	30.0	35.0	40.0
2007	0.9907		9.9	15.0	20.1	25.2	30.3	35.4	40.5
MinT Annual	R ²		Selected Min Temperature for Tuggeranong						
			-5.0	0.0	5.0	10.0	15.0		
97-05 Average	0.9524	Derived	-4.1	0.6	5.3	10.0	14.7		
Highest		MinT	-3.8	0.8	5.5	10.1	14.9		
Lowest		Canberra	-4.5	0.2	5.0	9.7	14.4		
2006	0.9614	Airport	-4.2	0.5	5.3	10.0	14.7		
2007	0.9526		-3.4	1.2	5.7	10.2	14.7		

Table 2: Results of the calculations from the linear regressions of Canberra Airport Seasonal Tmax and Tmin using Tuggeranong temperatures.

MaxT				Selected Max Temperature for Tuggeranong						
				10.0	15.0	20.0	25.0	30.0	35.0	40.0
R ²										
Summer	97-05 Average	0.9728	Derived	14.8	19.8	24.8	29.8	34.8	39.8	
	Lowest		MaxT	14.5	19.5	24.5	29.5	34.4	39.4	
	Highest		Canberra	15.6	20.4	25.2	30.1	34.9	39.9	
	2006	0.9755	Airport	14.7	19.8	24.9	29.9	35.0	40.1	
	2007	0.9738		15.0	20.2	25.3	30.5	35.7	40.8	
Autumn	97-05 Average	0.9797	Derived	15.0	19.9	24.8	29.7	34.6		
	Lowest		MaxT	14.6	19.6	24.6	29.4	34.1		
	Highest		Canberra	15.4	20.1	25.0	29.9	34.9		
	2006	0.991	Airport	15.1	20.1	25.2	30.2	35.2		
	2007	0.9859		14.9	20.0	25.1	30.3	35.4		
Spring	97-05 Average	0.9778	Derived	14.7	19.6	24.6	29.5	34.4		
	Lowest		MaxT	14.5	19.4	24.1	28.8	33.6		
	Highest		Canberra	15.0	20.0	25.0	30.0	35.0		
	2006	0.9895	Airport	15.0	20.0	25.0	30.0	35.0		
	2007	0.9857		15.1	20.0	25.0	30.0	34.9		
Winter	97-05 Average	0.8676	Derived	10.1	14.7	19.3				
	Lowest		MaxT	9.9	14.5	18.8				
	Highest		Canberra	10.4	15.0	19.8				
	2006	0.9378	Airport	10.2	15.0	19.8				
	2007	0.9473		10.2	14.8	19.4				
MinT				Selected Min Temperature for Tuggeranong						
R ²				-5.0	0.0	5.0	10.0	15.0		
Summer	97-05 Average	0.8974	Derived			5.5	10.2	14.9		
	Highest		MinT			6.3	10.6	15.1		
	Lowest		Canberra			4.5	9.5	14.5		
	2006	0.9614	Airport			5.3	10.0	14.7		
	2007	0.9526				5.7	10.2	14.7		
Autumn	97-05 Average	0.9169	Derived		0.7	5.3	9.8	14.4		
	Highest		MinT		1.1	5.6	10.3	15.0		
	Lowest		Canberra		-0.2	4.6	9.3	13.6		
	2006	0.9566	Airport		0.5	5.3	10.1	14.8		
	2007	0.9311			2.1	6.2	10.3	14.4		
Winter	97-05 Average	0.8721	Derived	-3.9	0.4	4.6	8.9	13.2		
	Highest		MinT	-3.1	0.8	5.0	9.4	13.8		
	Lowest		Canberra	-4.3	-0.1	4.1	8.3	12.4		
	2006	0.8167	Airport	-3.8	0.4	4.7	8.9	13.1		
	2007	0.8943		-3.0	0.9	4.8	8.7	12.7		
Spring	97-05 Average	0.9098	Derived		0.8	5.4	10.0	14.6		
	Highest		MinT		1.0	5.6	10.4	15.3		
	Lowest		Canberra		0.6	5.2	9.8	14.3		
	2006	0.9199	Airport		0.4	5.2	10.0	14.8		
	2007	0.9187			1.3	5.9	10.5	15.1		

Discussion and Conclusion

Industrial or residential development around Climate Reference Observation Sites is cause for concern as any changes resulting from these developments can impact on the measurement of long term climate change. Changes of the order of around 0.4 °C or more can be considered as indications that changes to the site may be occurring due to this development.

The results of the cross comparison of daily maximum and minimum temperatures between Canberra Airport and Tuggeranong Automatic Weather Station is suggestive that there could be an effect commencing to occur at Canberra Airport on maximum and minimum temperatures as a result of development adjacent to the site and thus impact on its continued use as a Climate Reference Station. Development commenced in Spring 2006 and were completed in early 2007.

While the derived maximum temperatures in 2006 were all at or marginally above the upper ranges, there was no apparent impact on the minimum temperatures. As any changes during 2006 were very marginal, the significance of these changes is doubtful. The effects appear to be more prominent in 2007 after the development was completed and have a seasonal bias with maximum temperatures being affected in Summer and Autumn and minimum temperatures affected in Autumn, Winter and Spring.

However, it should be noted that this study is only based on one full year after development was completed and more data is needed to confirm these trends, also as this year (2007) was the warmest year on record over the whole region, these anomalies just being a result of this exceptional year cannot be discounted.

The tendency to higher temperatures for minimum temperatures is not entirely unexpected given the buildings and car park that have been constructed adjacent to the site with the edge of the car park being only metres from the eastern edge of the enclosure. The retention of heat by the asphalt of the car park during the day is the most likely reason for this trend.

The tendency to gradually higher maximum temperatures above 25°C is more difficult to explain. Whether this tendency is a result of radiant heat from the car park or from some micro scale circulation that develops above a threshold temperature needs further investigation.

While there are moves to relocate the Observation Site to where any effect from the car park is reduced, it is considered essential that there should be at least a 12 month overlap of observations once the site has been moved to enable a comparison to be made between all the sites.

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:09
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW2 : FW: Canberra Airport [SEC=IN-CONFIDENCE]
Attachments: Development around Canberra Airport_v7.doc

From: Cooper, Maxine [Maxine.Cooper@act.gov.au]
Sent: Monday, 25 August 2008 6:12 PM
To: Stephen Lellyett; Kenn Batt
Cc: Burrows, Sarah
Subject: NSW2 : FW: Canberra Airport

Just checking you have them email?

Max

<<Development around Canberra Airport_v7.doc>>

Stephen and Kenn

Many thanks for your discussions yesterday (21/8/08). The State of the Environment Report (SoER) is available at our website www.envcomm.act.gov.au I draw your attention to the *Climate and Greenhouse Issues paper* with its supporting indicator paper - *Weather* - that is of relevance to our discussion and this email. I have also attached a paper that Clem Davis has requested that we link to the weather paper, see above.

Below is the paragraph (1) in the *Climate and Greenhouse Issues Paper* that has been the focus of discussions with the Canberra Airport Corporation (CAC). Also below is a paragraph (2) that adds clarity and context to paragraph 1. **Associate Professor Janette Lindsay has had the final say on the words in this paragraph.** I am thinking about having the clarifying paragraph (paragraph 2) linked to SoER material as the SoER has been published we would that this material has been added following publication of the document.

I send this material to you to ask if you wish to give me any other information or wish to comment on any of the material. Please do consider Clem Davis' paper that he has requested be published on our web site. It seems appropriate for me to agree to his request as it elaborates on Weather indicator paper. We would need to say it has been added since the document was published.

1. SoER *Climate and Greenhouse Issues Paper* paragraph four:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate

and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

2. Clarifying and providing a context for material in paragraph four in the State of the Environment report 2007/08, Climate and Greenhouse Issues Paper, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station."

Measuring weather and climate conditions in the ACT has been undertaken at the weather station at the Canberra International Airport, one of the key climate reference station in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected the accuracy of measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have now been built adjacent to the weather station significantly changing the micro-climate of the measurement area for temperatures at the extremes. A multi-story building constructed east of the weather station now shades the sunshine recorder following sunrise. This means that data collected since these developments potentially cannot be effectively compared to the previous long-term record at this site. This would affect the long-term record and ongoing measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station is established at an appropriate location in the ACT as soon as possible, with data adequately correlated with previous data from the existing airport weather station.

If you have any questions or wish to discuss this further, please contact me. I will be contacting the CAC and sending the amended material following your response.

Max

Dr Maxine Cooper

Commissioner

Office of the Commissioner for Sustainability
and the Environment

Ph: 6207 2629

Fax: 6207 2630

E-mail: maxine.cooper@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Has Development around Canberra Airport affected its use as a Climate Reference Station?

Clem Davis
Visiting Fellow
Fenner School of Environment and Society, ANU

Introduction

Canberra Airport is one of the Observation sites used by the Bureau of Meteorology as a Climate Reference Station to measure climate change across Australia. The site commenced in March 1939 and has remained relatively unchanged through to 2005.

Development at Canberra airport has resulted in a hanger being constructed to the northwest of the Observation site in 2005 and new buildings and a car park to the north and east of the site during 2006-2007. The edge of the car park is now only meters from the eastern boundary of the Observation Site. The question arises, how much does this development impact on the ability to continue to use this site as a long term reference station?

Figure 1 a-d indicates the observation site as it was in 2005 while Figures 2 a-b and 3 a-b indicate the changes that have occurred to the north and east between 2005 and 2007. There has been no change to the site from the northwest through to the southeast. Figure 4 a-b shows the proximity of the development to the Observation site.

In 1996 an Automatic Weather Station (AWS) was installed in the Tuggeranong Valley in a joint project between the Bureau of Meteorology and the ACT Government. It is located around 15 km to the southwest of the airport. The relative positions of the two sites are shown in Figure 5.

There are now 11 full years of daily maximum and minimum temperatures from this AWS site that can be used to cross reference with Canberra Airport to identify whether any changes are occurring in maximum and minimum temperatures at the Airport Site. There are nine years of data during which time there was no physical change to the sites while there are two years of data during which time the development took place at Canberra Airport. A comparison of the daily maximum and minimum temperatures between the sites for these two periods can now be used to provide an indication on any trends in the temperature record at Canberra Airport that may be due to this development.

Figures 1 to 4 go here

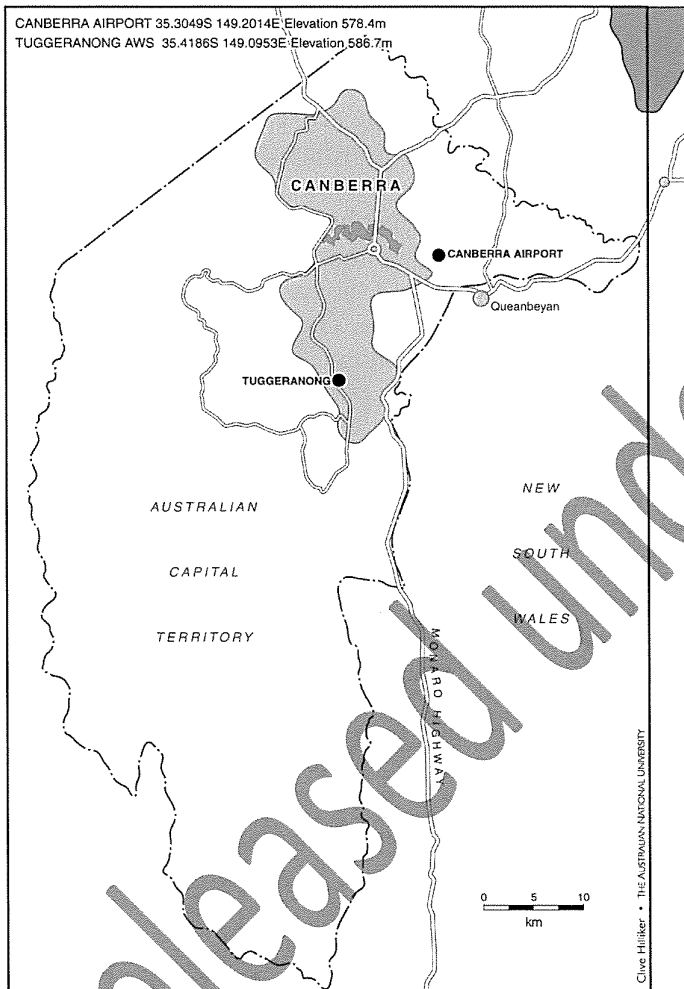


Figure 5: Locations of Tuggeranong AWS and Canberra Airport within ACT.

Method.

The available daily Tmax and Tmin data for Tuggeranong AWS and Canberra Airport obtained from the Bureau of Meteorology database were used in this analysis.

The analysis consisted of 4 steps:

1. Determining the relationship, if any, in the daily temperatures between Tuggeranong and Canberra Airport for the whole period 1997-2005.

2. Determining the annual and seasonal spreads between 1997-2005 to provide an indication of the variability of any correlation
3. Using the linear regression coefficients over these years to calculate the derived temperature at Canberra Airport using Tuggeranong values
4. Comparing these results with the data from 2006 and 2007 to identify changes in the values that may be occurring.

Figure 6 a-b indicates the correlation graphs between Canberra Airport and Tuggeranong for both Tmax and Tmin for the period 1997-2005.

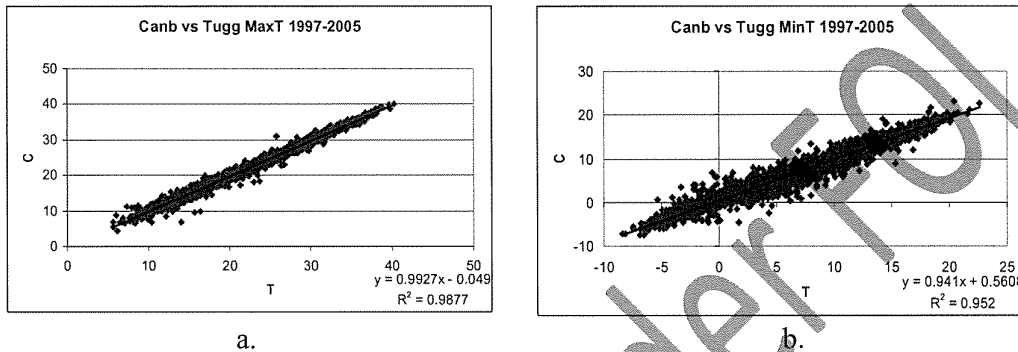


Figure 6 a-b Correlation graphs between Tuggeranong and Canberra Airport Daily Maximum and Minimum Temperatures 1997-2005

As can be seen the correlations between the two sites are extremely high with the average 97-05 annual R² values being 0.988 for the Maximum Temperatures and 0.952 for the Minimum Temperatures.

Results:

The annual results obtained from these correlations are listed in Table 1 together with the temperatures for Canberra Airport calculated from the Tuggeranong data using the regression relationships while the seasonal results are listed in Table 2.

These results indicate that:

1. the range in derived temperatures for Canberra Airport on an annual basis between 1997-2005 is small indicating the relationship between the 2 sites is quite stable.
2. the correlations for 2006 and 2007 are of similar magnitudes to the 97-05 period.
3. in 2006 the derived minimum temperatures remained within the 1997-2005 ranges.
4. in 2006 the derived maximum temperatures lie on or marginally above the upper limit of the 1997-2005 ranges.
5. in 2007 derived maximum temperatures for Canberra Airport above 25°C are higher than those in the control period. These differences appear to be more significant during Summer and Autumn, particularly as temperatures increase, with no trends evident in Spring and Winter.
6. in 2007 derived minimum temperatures for Canberra Airport below 5°C are higher than those in the control period. These differences appear to be more significant during Autumn with less significant warming trends evident during Winter and Spring and no trends evident in Summer.

Table 1: Results of the calculations from the linear regressions of Canberra Airport Annual Tmax and Tmin using Tuggeranong temperatures.

MaxT Annual	R ²		Selected Max Temperature for Tuggeranong						
			10.0	15.0	20.0	25.0	30.0	35.0	40.0
97-05 Average	0.9880	Derived	9.9	14.8	19.8	24.8	29.7	34.7	39.6
Lowest		MaxT	9.7	14.7	19.6	24.5	29.5	34.4	39.3
Highest		Canberra	10.1	15.0	20.0	25.0	30.0	34.9	39.9
2006	0.9928	Airport	10.1	15.1	20.1	25.0	30.0	35.0	40.0
2007	0.9907		9.9	15.0	20.1	25.2	30.3	35.4	40.5
MinT Annual	R ²		Selected Min Temperature for Tuggeranong						
			-5.0	0.0	5.0	10.0	15.0		
97-05 Average	0.9524	Derived	-4.1	0.6	5.3	10.0	14.7		
Highest		MinT	-3.8	0.8	5.5	10.1	14.9		
Lowest		Canberra	-4.5	0.2	5.0	9.7	14.4		
2006	0.9614	Airport	-4.2	0.5	5.3	10.0	14.7		
2007	0.9526		-3.4	1.2	5.7	10.2	14.7		

Table 2: Results of the calculations from the linear regressions of Canberra Airport Seasonal Tmax and Tmin using Tuggeranong temperatures.

MaxT				Selected Max Temperature for Tuggeranong						
				10.0	15.0	20.0	25.0	30.0	35.0	40.0
R ²										
Summer	97-05 Average	0.9728	Derived	14.8	19.8	24.8	29.8	34.8	39.8	
	Lowest		MaxT	14.5	19.5	24.5	29.5	34.4	39.4	
	Highest		Canberra	15.6	20.4	25.2	30.1	34.9	39.9	
	2006	0.9755	Airport	14.7	19.8	24.9	29.9	35.0	40.1	
	2007	0.9738		15.0	20.2	25.3	30.5	35.7	40.8	
Autumn	97-05 Average	0.9797	Derived	15.0	19.9	24.8	29.7	34.6		
	Lowest		MaxT	14.6	19.6	24.6	29.4	34.1		
	Highest		Canberra	15.4	20.1	25.0	29.9	34.9		
	2006	0.991	Airport	15.1	20.1	25.2	30.2	35.2		
	2007	0.9859		14.9	20.0	25.1	30.3	35.4		
Spring	97-05 Average	0.9778	Derived	14.7	19.6	24.6	29.5	34.4		
	Lowest		MaxT	14.5	19.4	24.1	28.8	33.6		
	Highest		Canberra	15.0	20.0	25.0	30.0	35.0		
	2006	0.9895	Airport	15.0	20.0	25.0	30.0	35.0		
	2007	0.9857		15.1	20.0	25.0	30.0	34.9		
Winter	97-05 Average	0.8676	Derived	10.1	14.7	19.3				
	Lowest		MaxT	9.9	14.5	18.8				
	Highest		Canberra	10.4	15.0	19.8				
	2006	0.9378	Airport	10.2	15.0	19.8				
	2007	0.9473		10.2	14.8	19.4				
MinT				Selected Min Temperature for Tuggeranong						
				-5.0	0.0	5.0	10.0	15.0		
R ²										
Summer	97-05 Average	0.8974	Derived			5.5	10.2	14.9		
	Highest		MinT			6.3	10.6	15.1		
	Lowest		Canberra			4.5	9.5	14.5		
	2006	0.9614	Airport			5.3	10.0	14.7		
	2007	0.9526				5.7	10.2	14.7		
Autumn	97-05 Average	0.9169	Derived		0.7	5.3	9.8	14.4		
	Highest		MinT		1.1	5.6	10.3	15.0		
	Lowest		Canberra		-0.2	4.6	9.3	13.6		
	2006	0.9566	Airport		0.5	5.3	10.1	14.8		
	2007	0.9311			2.1	6.2	10.3	14.4		
Winter	97-05 Average	0.8721	Derived	-3.9	0.4	4.6	8.9	13.2		
	Highest		MinT	-3.1	0.8	5.0	9.4	13.8		
	Lowest		Canberra	-4.3	-0.1	4.1	8.3	12.4		
	2006	0.8167	Airport	-3.8	0.4	4.7	8.9	13.1		
	2007	0.8943		-3.0	0.9	4.8	8.7	12.7		
Spring	97-05 Average	0.9098	Derived		0.8	5.4	10.0	14.6		
	Highest		MinT		1.0	5.6	10.4	15.3		
	Lowest		Canberra		0.6	5.2	9.8	14.3		
	2006	0.9199	Airport		0.4	5.2	10.0	14.8		
	2007	0.9187			1.3	5.9	10.5	15.1		

Discussion and Conclusion

Industrial or residential development around Climate Reference Observation Sites is cause for concern as any changes resulting from these developments can impact on the measurement of long term climate change. Changes of the order of around 0.4 °C or more can be considered as indications that changes to the site may be occurring due to this development.

The results of the cross comparison of daily maximum and minimum temperatures between Canberra Airport and Tuggeranong Automatic Weather Station is suggestive that there could be an effect commencing to occur at Canberra Airport on maximum and minimum temperatures as a result of development adjacent to the site and thus impact on its continued use as a Climate Reference Station. Development commenced in Spring 2006 and were completed in early 2007.

While the derived maximum temperatures in 2006 were all at or marginally above the upper ranges, there was no apparent impact on the minimum temperatures. As any changes during 2006 were very marginal, the significance of these changes is doubtful. The effects appear to be more prominent in 2007 after the development was completed and have a seasonal bias with maximum temperatures being affected in Summer and Autumn and minimum temperatures affected in Autumn, Winter and Spring.

However, it should be noted that this study is only based on one full year after development was completed and more data is needed to confirm these trends, also as this year (2007) was the warmest year on record over the whole region, these anomalies just being a result of this exceptional year cannot be discounted.

The tendency to higher temperatures for minimum temperatures is not entirely unexpected given the buildings and car park that have been constructed adjacent to the site with the edge of the car park being only metres from the eastern edge of the enclosure. The retention of heat by the asphalt of the car park during the day is the most likely reason for this trend.

The tendency to gradually higher maximum temperatures above 25°C is more difficult to explain. Whether this tendency is a result of radiant heat from the car park or from some micro scale circulation that develops above a threshold temperature needs further investigation.

While there are moves to relocate the Observation Site to where any effect from the car park is reduced, it is considered essential that there should be at least a 12 month overlap of observations once the site has been moved to enable a comparison to be made between all the sites.

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:08
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW3 : RE: Canberra Airport [SEC=IN-CONFIDENCE]

From: Kenn Batt
Sent: Monday, 25 August 2008 7:16 PM
To: Cooper, Maxine; Stephen Lellyett
Cc: Burrows, Sarah
Subject: NSW3 : RE: Canberra Airport [SEC=UNCLASSIFIED]

Thanks Maxine
Looks fine to me.
I'll let the boss (Stephen) et al have the final say as I;m really just a pretty face when it comes to this!!??
Cheers
Kenn

Kenn Batt
Manager
Canberra Meteorological Office
Australian Bureau of Meteorology
GPO Box 787
Canberra ACT
Australia 2601
Office: 02 62496269
Mobile: 0408 649402

From: Cooper, Maxine [mailto:Maxine.Cooper@act.gov.au]
Sent: Mon 25/08/2008 6:12 PM
To: Stephen Lellyett; Kenn Batt
Cc: Burrows, Sarah
Subject: FW: Canberra Airport

Just checking you have them email?
Max

<<Development around Canberra Airport_v7.doc>>

Stephen and Kenn
Many thanks for your discussions yesterday (21/8/08). The State of the Environment Report (SoER) is available at our website www.envcomm.act.gov.au I draw your attention to the *Climate and Greenhouse Issues paper* with its supporting indicator paper - *Weather* - that is of relevance to our

27/07/2011

discussion and this email. I have also attached a paper that Clem Davis has requested that we link to the weather paper, see above.

Below is the paragraph (1) in the *Climate and Greenhouse Issues Paper* that has been the focus of discussions with the Canberra Airport Corporation (CAC). Also below is a paragraph (2) that adds clarity and context to paragraph 1. **Associate Professor Janette Lindsay has had the final say on the words in this paragraph.** I am thinking about having the clarifying paragraph (paragraph 2) linked to SoER material as the SoER has been published we would that this material has been added following publication of the document.

I send this material to you to ask if you wish to give me any other information or wish to comment on any of the material. Please do consider Clem Davis' paper that he has requested be published on our web site. It seems appropriate for me to agree to his request as it elaborates on Weather indicator paper. We would need to say it has been added since the document was published.

1. SoER *Climate and Greenhouse Issues Paper* paragraph four:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

2. Clarifying and providing a context for material in paragraph four in the State of the Environment report 2007/08, *Climate and Greenhouse Issues Paper*, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station."

Measuring weather and climate conditions in the ACT has been undertaken at the weather station at the Canberra International Airport, one of the key climate reference station in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected the accuracy of measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have now been built adjacent to the weather station significantly changing the micro-climate of the measurement area for temperatures at the extremes. A multi-story building constructed east of the weather station now shades the sunshine recorder following sunrise. This means that data collected since these developments potentially cannot be effectively compared to the previous long-term record at this site. This would affect the long-term record and ongoing measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station is established at an appropriate location in the ACT as soon as possible, with data adequately correlated with previous data from the existing airport weather station.

If you have any questions or wish to discuss this further, please contact me. I will be contacting the CAC and sending the amended material following your response.

Max
 Dr Maxine Cooper
 Commissioner
 Office of the Commissioner for Sustainability
 and the Environment
 Ph: 6207 2629
 Fax: 6207 2630
 E-mail: maxine.cooper@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Released under FOI

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:08
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW4: RE: Canberra Airport [SEC=IN-CONFIDENCE]

From: Cooper, Maxine [Maxine.Cooper@act.gov.au]
Sent: Tuesday, 26 August 2008 9:07 AM
To: Kenn Batt; Stephen Lellyett
Cc: Burrows, Sarah
Subject: NSW4: RE: Canberra Airport [SEC=UNCLASSIFIED]

Appreciated Max

-----Original Message-----

From: Kenn Batt [mailto:K.Batt@bom.gov.au]
Sent: Monday, 25 August 2008 7:16
To: Cooper, Maxine; Stephen Lellyett
Cc: Burrows, Sarah
Subject: RE: Canberra Airport [SEC=UNCLASSIFIED]

Thanks Maxine
Looks fine to me.
I'll let the boss (Stephen) et al have the final say as I;m really just a pretty face when it comes to this!!??
Cheers
Kenn

Kenn Batt
Manager
Canberra Meteorological Office
Australian Bureau of Meteorology
GPO Box 787
Canberra ACT
Australia 2601
Office: 02 62496269
Mobile: 0408 649402

From: Cooper, Maxine [mailto:Maxine.Cooper@act.gov.au]
Sent: Mon 25/08/2008 6:12 PM
To: Stephen Lellyett; Kenn Batt
Cc: Burrows, Sarah
Subject: FW: Canberra Airport

Just checking you have them email?
Max

<<Development around Canberra Airport_v7.doc>>

Stephen and Kenn

Many thanks for your discussions yesterday (21/8/08). The State of the Environment Report (SoER) is available at our website www.envcomm.act.gov.au I draw your attention to the *Climate and Greenhouse Issues paper* with its supporting indicator paper - *Weather* - that is of relevance to our discussion and this email. I have also attached a paper that Clem Davis has requested that we link to the weather paper, see above.

Below is the paragraph (1) in the *Climate and Greenhouse Issues Paper* that has been the focus of discussions with the Canberra Airport Corporation (CAC). Also below is a paragraph (2) that adds clarity and context to paragraph 1. **Associate Professor Janette Lindsay has had the final say on the words in this paragraph.** I am thinking about having the clarifying paragraph (paragraph 2) linked to SoER material as the SoER has been published we would that this material has been added following publication of the document.

I send this material to you to ask if you wish to give me any other information or wish to comment on any of the material. Please do consider Clem Davis' paper that he has requested be published on our web site. It seems appropriate for me to agree to his request as it elaborates on Weather indicator paper. We would need to say it has been added since the document was published.

1. SoER *Climate and Greenhouse Issues Paper* paragraph four:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

2. Clarifying and providing a context for material in paragraph four in the State of the Environment report 2007/08, *Climate and Greenhouse Issues Paper*, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station."

Measuring weather and climate conditions in the ACT has been undertaken at the weather station at the Canberra International Airport, one of the key climate reference station in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected the accuracy of measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have now been built adjacent to the weather station significantly changing the micro-climate of the measurement area for temperatures at the extremes. A multi-story building constructed east of the weather station now shades the sunshine recorder following sunrise. This means that data collected since these developments potentially cannot be effectively compared to the previous long-term record at this site. This would affect the long-term record and ongoing measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station is established at an appropriate location in the ACT as soon as possible, with data adequately correlated with previous data from the existing airport weather station.

If you have any questions or wish to discuss this further, please contact me. I will be contacting the CAC and sending the amended material following your response.

Max
Dr Maxine Cooper
Commissioner
Office of the Commissioner for Sustainability
and the Environment
Ph: 6207 2629
Fax: 6207 2630
E-mail: maxine.cooper@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Released under FOI

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:07
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW5: RE: Canberra Airport [SEC=IN-CONFIDENCE]

From: Stephen Lellyett
Sent: Tuesday, 26 August 2008 10:16 AM
To: 'Cooper, Maxine'; Kenn Batt
Cc: 'Burrows, Sarah'; Stephen Lellyett
Subject: NSW5: RE: Canberra Airport [SEC=UNCLASSIFIED]

Hi Maxine,

Thanks for checking. I will have a response back to you later today with some suggested amendments to the words.

Kind regards,
Steve

Stephen Lellyett
Deputy Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.ellyett@bom.gov.au

From: Cooper, Maxine [mailto:Maxine.Cooper@act.gov.au]
Sent: Monday, 25 August 2008 6:13 PM
To: Stephen Lellyett; Kenn Batt
Cc: Burrows, Sarah
Subject: FW: Canberra Airport

Just checking you have them email?
Max

<<Development around Canberra Airport_v7.doc>>

Stephen and Kenn
Many thanks for your discussions yesterday (21/8/08). The State of the Environment Report (SoER)

27/07/2011

is available at our website www.envcomm.act.gov.au I draw your attention to the *Climate and Greenhouse Issues paper* with its supporting indicator paper - *Weather* - that is of relevance to our discussion and this email. I have also attached a paper that Clem Davis has requested that we link to the weather paper, see above.

Below is the paragraph (1) in the *Climate and Greenhouse Issues Paper* that has been the focus of discussions with the Canberra Airport Corporation (CAC). Also below is a paragraph (2) that adds clarity and context to paragraph 1. **Associate Professor Janette Lindsay has had the final say on the words in this paragraph.** I am thinking about having the clarifying paragraph (paragraph 2) linked to SoER material as the SoER has been published we would that this material has been added following publication of the document.

I send this material to you to ask if you wish to give me any other information or wish to comment on any of the material. Please do consider Clem Davis' paper that he has requested be published on our web site. It seems appropriate for me to agree to his request as it elaborates on Weather indicator paper. We would need to say it has been added since the document was published.

1. SoER *Climate and Greenhouse Issues Paper* paragraph four:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

2. Clarifying and providing a context for material in paragraph four in the State of the Environment report 2007/08, *Climate and Greenhouse Issues Paper*, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station."

Measuring weather and climate conditions in the ACT has been undertaken at the weather station at the Canberra International Airport, one of the key climate reference station in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected the accuracy of measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have now been built adjacent to the weather station significantly changing the micro-climate of the measurement area for temperatures at the extremes. A multi-story building constructed east of the weather station now shades the sunshine recorder following sunrise. This means that data collected since these developments potentially cannot be effectively compared to the previous long-term record at this site. This would affect the long-term record and ongoing measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station is established at an appropriate location in the ACT as soon as possible, with data adequately correlated with previous data from the existing airport weather station.

If you have any questions or wish to discuss this further, please contact me. I will be contacting the CAC and sending the amended material following your response.

Max

Dr Maxine Cooper

Commissioner

Office of the Commissioner for Sustainability
and the Environment

Ph: 6207 2629

Fax: 6207 2630

E-mail: maxine.cooper@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Released under FOI

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:06
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW6: RE: Canberra Airport [SEC=IN-CONFIDENCE]
Importance: High
Attachments: ACT SoE_Statements on Canberra Obs Site_BOMsuggestions26Aug08.doc

From: Stephen Lellyett
Sent: Tuesday, 26 August 2008 1:11 PM
To: 'Cooper, Maxine'
Cc: 'Burrows, Sarah'; Stephen Lellyett; Kenn Batt
Subject: NSW6: RE: Canberra Airport [SEC=UNCLASSIFIED]

Dear Maxine,

Thankyou very much for the opportunity to comment on the revised wording of the paragraphs in the ACT State of Environment Report which pertain to meteorological observations at Canberra Airport, as suggested below.

Please find attached some suggested amendments, marked up in Track Changes within WORD, from the Bureau of Meteorology which I feel would enhance the accuracy of the report.

If you require clarification on any point, please do not hesitate to contact me.

Kind regards,

Stephen Lellyett
Deputy Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.ellyett@bom.gov.au

From: Stephen Lellyett
Sent: Tuesday, 26 August 2008 10:16 AM
To: 'Cooper, Maxine'; Kenn Batt
Cc: 'Burrows, Sarah'; Stephen Lellyett
Subject: RE: Canberra Airport [SEC=UNCLASSIFIED]

Hi Maxine,

27/07/2011

Thanks for checking. I will have a response back to you later today with some suggested amendments to the words.

Kind regards,
Steve

Stephen Lellyett
Deputy Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.lelyett@bom.gov.au

From: Cooper, Maxine [<mailto:Maxine.Cooper@act.gov.au>]
Sent: Monday, 25 August 2008 6:13 PM
To: Stephen Lellyett; Kenn Batt
Cc: Burrows, Sarah
Subject: FW: Canberra Airport

Just checking you have them email?
Max

<<Development around Canberra Airport_v7.doc>>

Stephen and Kenn

Many thanks for your discussions yesterday (21/8/08). The State of the Environment Report (SoER) is available at our website www.envcomm.act.gov.au I draw your attention to the *Climate and Greenhouse Issues paper* with its supporting indicator paper - *Weather* - that is of relevance to our discussion and this email. I have also attached a paper that Clem Davis has requested that we link to the weather paper, see above.

Below is the paragraph (1) in the *Climate and Greenhouse Issues Paper* that has been the focus of discussions with the Canberra Airport Corporation (CAC). Also below is a paragraph (2) that adds clarity and context to paragraph 1. **Associate Professor Janette Lindsay has had the final say on the words in this paragraph.** I am thinking about having the clarifying paragraph (paragraph 2) linked to SoER material as the SoER has been published we would that this material has been added following publication of the document.

I send this material to you to ask if you wish to give me any other information or wish to comment on any of the material. Please do consider Clem Davis' paper that he has requested be published on our web site. It seems appropriate for me to agree to his request as it elaborates on Weather indicator paper. We would need to say it has been added since the document was published.

1. SoER *Climate and Greenhouse Issues Paper* paragraph four:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and

management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

2. Clarifying and providing a context for material in paragraph four in the State of the Environment report 2007/08, Climate and Greenhouse Issues Paper, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station."

Measuring weather and climate conditions in the ACT has been undertaken at the weather station at the Canberra International Airport, one of the key climate reference station in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected the accuracy of measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have now been built adjacent to the weather station significantly changing the micro-climate of the measurement area for temperatures at the extremes. A multi-story building constructed east of the weather station now shades the sunshine recorder following sunrise. This means that data collected since these developments potentially cannot be effectively compared to the previous long-term record at this site. This would affect the long-term record and ongoing measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station is established at an appropriate location in the ACT as soon as possible, with data adequately correlated with previous data from the existing airport weather station.

If you have any questions or wish to discuss this further, please contact me. I will be contacting the CAC and sending the amended material following your response.

Max

Dr Maxine Cooper

Commissioner

Office of the Commissioner for Sustainability
and the Environment

Ph: 6207 2629

Fax: 6207 2630

E-mail: maxine.cooper@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

1. SoER *Climate and Greenhouse Issues Paper* paragraph four:

Measuring weather patterns in the ACT has been undertaken at a number of sites over the years, including the weather station at the Canberra International Airport which has been used as a representation of the climate in the Canberra area since 1939. Recent expansion of the airport appears to have affected measurements at the weather station according to a study by Davis [insert reference]. Carparks have now been built around the weather station producing a measurable change in the micro-climate of the site. This means that some of the data collected now cannot be reliably compared to previous data. This will affect the identification of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. Therefore, it is important that a new weather station in the ACT is established, with data adequately correlated with data from the existing airport weather station.

- Deleted: traditionally
- Deleted: The
- Deleted: has
- Deleted: the accuracy of
- Deleted: significantly
- Deleted: changing
- Deleted: measurement area
- Deleted: effectively
- Deleted: measurement
- Deleted: I
- Deleted: previous

2. Clarifying and providing a context for material in paragraph four in the State of the Environment report 2007/08, *Climate and Greenhouse Issues Paper*, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station."

Measuring weather and climate conditions in vicinity of Canberra in the ACT has been undertaken at the weather station at the Canberra International Airport, one of a limited set of designated Climate Reference Stations in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have recently been built adjacent to the weather station significantly changing the micro-climate of the measurement area for maximum and minimum temperatures in some months. A multi-story building constructed east of the weather station now shades the sunshine recorder shortly after sunrise. This means that data collected since these developments potentially cannot be reliably compared to the previous long-term record at this site. This would affect the long-term record and ongoing monitoring of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management.

- Deleted: the key
- Deleted: c
- Deleted: r
- Deleted: s
- Deleted: the accuracy of
- Deleted: now
- Deleted: at the extremes
- Deleted: following
- Deleted: effectively
- Deleted: measurement

Hence, it is important that a new weather station with long term tenure be established at an appropriate location in the ACT as soon as possible, with a sufficiently long overlap period of concurrent measurements to establish a robust statistical relationship between the two sites through adequate correlation of new and previous data from the existing airport weather station. To that end, the Bureau of Meteorology and Canberra International Airport have been actively working together to identify a site which would satisfy the requirements of a Climate Reference Station, aerodrome meteorological requirements, long term airport development plan, environmental protection, and property lease requirements. The new comparison site is expected to be operational by September 2008.

- Deleted: I
- Deleted: is
- Deleted: data
- Deleted: ly
- Deleted: ed
- Deleted: with

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:05
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW7: RE: Canberra Airport [SEC=IN-CONFIDENCE]

From: Cooper, Maxine [Maxine.Cooper@act.gov.au]
Sent: Tuesday, 26 August 2008 2:23 PM
To: Stephen Lellyett
Cc: Burrows, Sarah; Kenn Batt
Subject: NSW7: RE: Canberra Airport [SEC=UNCLASSIFIED]

Stephen many thanks, "by September 2008" does that mean it is sorted in the next few days, if no do you wish to change the date?

Max

-----Original Message-----

From: Stephen Lellyett [mailto:S.Lellyett@bom.gov.au]
Sent: Tuesday, 26 August 2008 1:11
To: Cooper, Maxine
Cc: Burrows, Sarah; Stephen Lellyett; Kenn Batt
Subject: RE: Canberra Airport [SEC=UNCLASSIFIED]
Importance: High

Dear Maxine,

Thankyou very much for the opportunity to comment on the revised wording of the paragraphs in the ACT State of Environment Report which pertain to meteorological observations at Canberra Airport, as suggested below.

Please find attached some suggested amendments, marked up in Track Changes within WORD, from the Bureau of Meteorology which I feel would enhance the accuracy of the report.

If you require clarification on any point, please do not hesitate to contact me.

Kind regards,

Stephen Lellyett
Deputy Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.ellyett@bom.gov.au

From: Stephen Lellyett
Sent: Tuesday, 26 August 2008 10:16 AM
To: 'Cooper, Maxine'; Kenn Batt

Cc: 'Burrows, Sarah'; Stephen Lellyett
Subject: RE: Canberra Airport [SEC=UNCLASSIFIED]

Hi Maxine,

Thanks for checking. I will have a response back to you later today with some suggested amendments to the words.

Kind regards,
Steve

Stephen Lellyett
Deputy Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.ellyett@bom.gov.au

From: Cooper, Maxine [<mailto:Maxine.Cooper@act.gov.au>]
Sent: Monday, 25 August 2008 6:13 PM
To: Stephen Lellyett; Kenn Batt
Cc: Burrows, Sarah
Subject: FW: Canberra Airport

Just checking you have them email?
Max

<<Development around Canberra Airport_v7.doc>>

Stephen and Kenn

Many thanks for your discussions yesterday (21/8/08). The State of the Environment Report (SoER) is available at our website www.envcomm.act.gov.au I draw your attention to the *Climate and Greenhouse Issues paper* with its supporting indicator paper - *Weather* - that is of relevance to our discussion and this email. I have also attached a paper that Clem Davis has requested that we link to the weather paper, see above.

Below is the paragraph (1) in the *Climate and Greenhouse Issues Paper* that has been the focus of discussions with the Canberra Airport Corporation (CAC). Also below is a paragraph (2) that adds clarity and context to paragraph 1. **Associate Professor Janette Lindsay has had the final say on the words in this paragraph.** I am thinking about having the clarifying paragraph (paragraph 2) linked to SoER material as the SoER has been published we would that this material has been added following publication of the document.

I send this material to you to ask if you wish to give me any other information or wish to comment on any of the material. Please do consider Clem Davis' paper that he has requested be published on our web site. It seems appropriate for me to agree to his request as it elaborates on Weather indicator paper. We would need to say it has been added since the document was published.

1. SoER *Climate and Greenhouse Issues Paper* paragraph four:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

2. Clarifying and providing a context for material in paragraph four in the State of the Environment report 2007/08, *Climate and Greenhouse Issues Paper*, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station."

Measuring weather and climate conditions in the ACT has been undertaken at the weather station at the Canberra International Airport, one of the key climate reference station in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected the accuracy of measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have now been built adjacent to the weather station significantly changing the micro-climate of the measurement area for temperatures at the extremes. A multi-story building constructed east of the weather station now shades the sunshine recorder following sunrise. This means that data collected since these developments potentially cannot be effectively compared to the previous long-term record at this site. This would affect the long-term record and ongoing measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station is established at an appropriate location in the ACT as soon as possible, with data adequately correlated with previous data from the existing airport weather station.

If you have any questions or wish to discuss this further, please contact me. I will be contacting the CAC and sending the amended material following your response.

Max
 Dr Maxine Cooper
 Commissioner
 Office of the Commissioner for Sustainability
 and the Environment
 Ph: 6207 2629
 Fax: 6207 2630
 E-mail: maxine.cooper@act.gov.au

 This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

 This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or

use it for any purpose, nor disclose its contents to any other person.

Released under FOI

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:05
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW8: RE: Canberra Airport [SEC=IN-CONFIDENCE]

From: Stephen Lellyett
Sent: Tuesday, 26 August 2008 3:14 PM
To: Cooper, Maxine
Cc: Burrows, Sarah; Kenn Batt; Stephen Lellyett
Subject: NSW8: RE: Canberra Airport [SEC=UNCLASSIFIED]

Hi Maxine,

Thanks for requesting clarification on that point assuming there are no unexpected hold-ups to the site works, the new comparison AWS should be operational by the end of September. Therefore, if you could amend it to: "by the end of September 2008", that would be appreciated.

Many thanks,
Steve

Stephen Lellyett
Deputy Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.ellyett@bom.gov.au

From: Cooper, Maxine [<mailto:Maxine.Cooper@act.gov.au>]
Sent: Tuesday, 26 August 2008 2:24 PM
To: Stephen Lellyett
Cc: Burrows, Sarah; Kenn Batt
Subject: RE: Canberra Airport [SEC=UNCLASSIFIED]

Stephen many thanks, "by September 2008" does that mean it is sorted in the next few days, if no do you wish to change the date?

Max

-----Original Message-----

From: Stephen Lellyett [<mailto:S.Lellyett@bom.gov.au>]
Sent: Tuesday, 26 August 2008 1:11
To: Cooper, Maxine
Cc: Burrows, Sarah; Stephen Lellyett; Kenn Batt
Subject: RE: Canberra Airport [SEC=UNCLASSIFIED]
Importance: High

Dear Maxine,

Thankyou very much for the opportunity to comment on the revised wording of the paragraphs in the ACT State of Environment Report which pertain to meteorological observations at Canberra Airport, as suggested below.

Please find attached some suggested amendments, marked up in Track Changes within WORD, from the Bureau of Meteorology which I feel would enhance the accuracy of the report.

If you require clarification on any point, please do not hesitate to contact me.

Kind regards,

Stephen Lellyett
Deputy Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.lellyett@bom.gov.au

From: Stephen Lellyett
Sent: Tuesday, 26 August 2008 10:16 AM
To: 'Cooper, Maxine'; Kenn Batt
Cc: 'Burrows, Sarah'; Stephen Lellyett
Subject: RE: Canberra Airport [SEC=UNCLASSIFIED]

Hi Maxine,

Thanks for checking. I will have a response back to you later today with some suggested amendments to the words.

Kind regards,
Steve

Stephen Lellyett
Deputy Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.lellyett@bom.gov.au

From: Cooper, Maxine [<mailto:Maxine.Cooper@act.gov.au>]
Sent: Monday, 25 August 2008 6:13 PM
To: Stephen Lellyett; Kenn Batt
Cc: Burrows, Sarah
Subject: FW: Canberra Airport

Just checking you have them email?

Max

<<Development around Canberra Airport_v7.doc>>

Stephen and Kenn

Many thanks for your discussions yesterday (21/8/08). The State of the Environment Report (SoER) is available at our website www.envcomm.act.gov.au I draw your attention to the *Climate and Greenhouse Issues paper* with its supporting indicator paper - *Weather* - that is of relevance to our discussion and this email. I have also attached a paper that Clem Davis has requested that we link to the weather paper, see above.

Below is the paragraph (1) in the *Climate and Greenhouse Issues Paper* that has been the focus of discussions with the Canberra Airport Corporation (CAC). Also below is a paragraph (2) that adds clarity and context to paragraph 1. **Associate Professor Janette Lindsay has had the final say on the words in this paragraph.** I am thinking about having the clarifying paragraph (paragraph 2) linked to SoER material as the SoER has been published we would that this material has been added following publication of the document.

I send this material to you to ask if you wish to give me any other information or wish to comment on any of the material. Please do consider Clem Davis' paper that he has requested be published on our web site. It seems appropriate for me to agree to his request as it elaborates on Weather indicator paper. We would need to say it has been added since the document was published.

1. SoER *Climate and Greenhouse Issues Paper* paragraph four:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

2. Clarifying and providing a context for material in paragraph four in the State of the Environment report 2007/08, *Climate and Greenhouse Issues Paper*, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station."

Measuring weather and climate conditions in the ACT has been undertaken at the weather station at the Canberra International Airport, one of the key climate reference station in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected the accuracy of measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have now been built adjacent to the weather station significantly changing the micro-climate of the measurement area for temperatures at the extremes. A multi-story building constructed east of the weather station now shades the sunshine recorder following sunrise. This means that data collected since these developments potentially cannot be effectively compared to the previous long-term record at this site. This would affect the long-term record and ongoing measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station is established at an appropriate location in the ACT as soon as possible, with data adequately correlated with previous data from the existing airport weather station.

If you have any questions or wish to discuss this further, please contact me. I will be contacting the CAC and sending the amended material following your response.

Max
Dr Maxine Cooper
Commissioner
Office of the Commissioner for Sustainability
and the Environment
Ph: 6207 2629
Fax: 6207 2630
E-mail: maxine.cooper@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:04
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW9: Clarification of SOER Material - Airport Weather Station [SEC=IN-CONFIDENCE]
Importance: High

From: Cooper, Maxine [Maxine.Cooper@act.gov.au]
Sent: Tuesday, 26 August 2008 4:25 PM
To: n.mccann@canberraairport.com.au; s.bryon@canberraairport.com.au
Cc: Cooper, Maxine; Burrows, Sarah; janette.lindesay@anu.edu.au; Clem Davis (E-mail 2); Stephen Lellyett
Subject: NSW9: Clarification of SOER Material - Airport Weather Station

Stephen and Noel

I have consulted with the experts including those from the Bureau of Meteorology and am prepared to add a link to the SoER Climate Change and Greenhouse Issues paper paragraph 4 - see below. I will also need to ensure that the community is informed of the information. I have also been asked to link Clem Davis' paper - you have a copy - to add further clarity. I would like to provide the additional information later this week given the issue has been raised with this Office.

Existing SoER *Climate and Greenhouse Issues Paper* paragraph 4:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

Link - Clarifying and providing a context for material in paragraph 4 in the State of the Environment report 2007/08, Climate and Greenhouse Issues Paper, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station." Information provided by Associate Professor Janette Lindsay, Mr Clem Davis and Mr Stephen Lellyett (Bureau of Meteorology) 26 August 2008.

Measuring weather and climate conditions in vicinity of Canberra in the ACT has been undertaken at the weather station at the Canberra International Airport, one of a limited set of designated Climate Reference Stations in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have recently been built adjacent to the weather station significantly changing the micro-climate of the measurement area for maximum and minimum temperatures in some months. A multi-story building constructed east of the weather station now shades the sunshine recorder shortly after sunrise. This means that data collected since these developments potentially cannot be reliably compared to the previous long-term record at this site. This would affect the long-term record and ongoing monitoring of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management.

Hence, it is important that a new weather station with long term tenure be established at an appropriate location in the ACT as soon as possible, with a sufficiently long overlap period of concurrent measurements to establish a robust statistical relationship between the two sites through adequate correlation of new and previous data from the existing airport weather station. To that end, the Bureau of Meteorology and Canberra International Airport have been actively working together to identify a site which would satisfy the requirements of a Climate Reference Station, aerodrome meteorological requirements, long term airport development plan, environmental protection, and property lease requirements. The new comparison site is expected to be operational by the end of September 2008.

Max
Dr Maxine Cooper
Commissioner
Office of the Commissioner for Sustainability
and the Environment
Ph: 6207 2629
Fax: 6207 2630
E-mail: maxine.cooper@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Released under FOI

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:04
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW10: RE: Clarification of SOER Material - Airport Weather Station [SEC=IN-CONFIDENCE]

From: Stephen Lellyett
Sent: Thursday, 28 August 2008 12:07 AM
To: Cooper, Maxine
Cc: Stephen Lellyett
Subject: NSW10: RE: Clarification of SOER Material - Airport Weather Station [SEC=UNCLASSIFIED]

Dear Maxine, thanks.

May I suggest one further modification to the second sentence of the first paragraph, viz deleting the words "the accuracy of":

The expansion of the airport has affected [delete - the accuracy of] measurements at the weather station.

The reason for this is that the instruments themselves will still measure to the same level of accuracy, just as they would if the AWS were relocated to a completely different part of the country.

Kind regards,
Steve

Stephen Lellyett
Deputy Regional Director NSW
Australian Bureau of Meteorology

ps: I am in Melbourne until the end of the week, so if you need to contact me, please call on my mobile: 0408 023 687.

From: Cooper, Maxine [mailto:Maxine.Cooper@act.gov.au]
Sent: Tue 26/08/2008 4:25 PM
To: n.mccann@canberraairport.com.au; s.bryon@canberraairport.com.au
Cc: Cooper, Maxine; Burrows, Sarah; janette.lindesay@anu.edu.au; Clem Davis (E-mail 2); Stephen Lellyett
Subject: Clarification of SOER Material - Airport Weather Station

Stephen and Noel

I have consulted with the experts including those from the Bureau of Meteorology and am prepared to add a link to the SoER Climate Change and Greenhouse Issues paper paragraph 4 - see below. I will also need to ensure that the community is informed of the information. I have also been asked to link Clem Davis' paper - you have a copy - to add further clarity. I would like to provide the additional information later this week given the issue has been raised with this Office.

Existing SoER *Climate and Greenhouse Issues Paper* paragraph 4:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

Link - Clarifying and providing a context for material in paragraph 4 in the State of the Environment report 2007/08, Climate and Greenhouse Issues Paper, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station." Information provided by Associate Professor Janette Lindsay, Mr Clem Davis and Mr Stephen Lellyett (Bureau of Meteorology) 26 August 2008.

Measuring weather and climate conditions in vicinity of Canberra in the ACT has been undertaken at the weather station at the Canberra International Airport, one of a limited set of designated Climate Reference Stations in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have recently been built adjacent to the weather station significantly changing the micro-climate of the measurement area for maximum and minimum temperatures in some months. A multi-story building constructed east of the weather station now shades the sunshine recorder shortly after sunrise. This means that data collected since these developments potentially cannot be reliably compared to the previous long-term record at this site. This would affect the long-term record and ongoing monitoring of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. Hence, it is important that a new weather station with long term tenure be established at an appropriate location in the ACT as soon as possible, with a sufficiently long overlap period of concurrent measurements to establish a robust statistical relationship between the two sites through adequate correlation of new and previous data from the existing airport weather station. To that end, the Bureau of Meteorology and Canberra International Airport have been actively working together to identify a site which would satisfy the requirements of a Climate Reference Station, aerodrome meteorological requirements, long term airport development plan, environmental protection, and property lease requirements. The new comparison site is expected to be operational by the end of September 2008.

Max
 Dr Maxine Cooper
 Commissioner
 Office of the Commissioner for Sustainability
 and the Environment
 Ph: 6207 2629
 Fax: 6207 2630
 E-mail: maxine.cooper@act.gov.au

 This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:03
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW11: RE: Clarification of SOER Material - Airport Weather Station [SEC=IN-CONFIDENCE]

From: Cooper, Maxine [Maxine.Cooper@act.gov.au]
Sent: Thursday, 28 August 2008 12:43 PM
To: Stephen Lellyett
Subject: NSW11: RE: Clarification of SOER Material - Airport Weather Station [SEC=UNCLASSIFIED]

Stephen the first paragraph is what is in the text at present and the second is the one we wish people to read in place of it. I should have made this clearer so Ta Max

-----Original Message-----

From: Stephen Lellyett [mailto:S.Lellyett@bom.gov.au]
Sent: Thursday, 28 August 2008 12:07
To: Cooper, Maxine
Cc: Stephen Lellyett
Subject: RE: Clarification of SOER Material - Airport Weather Station [SEC=UNCLASSIFIED]

Dear Maxine, thanks.

May I suggest one further modification to the second sentence of the first paragraph, viz deleting the words "the accuracy of":

The expansion of the airport has affected [delete - the accuracy of] measurements at the weather station.

The reason for this is that the instruments themselves will still measure to the same level of accuracy, just as they would if the AWS were relocated to a completely different part of the country.

Kind regards,
Steve

Stephen Lellyett
Deputy Regional Director NSW
Australian Bureau of Meteorology

ps: I am in Melbourne until the end of the week, so if you need to contact me, please call on my mobile: 0408 023 687.

From: Cooper, Maxine [mailto:Maxine.Cooper@act.gov.au]
Sent: Tue 26/08/2008 4:25 PM
To: n.mccann@canberraairport.com.au; s.bryon@canberraairport.com.au
Cc: Cooper, Maxine; Burrows, Sarah; janette.lindesay@anu.edu.au; Clem Davis (E-mail 2); Stephen Lellyett
Subject: Clarification of SOER Material - Airport Weather Station

Stephen and Noel

I have consulted with the experts including those from the Bureau of Meteorology and am prepared to add a link to the SoER Climate Change and Greenhouse Issues paper paragraph 4 - see below. I will also need to ensure that the community is informed of the information. I have also been asked to link Clem Davis' paper - you have a copy - to add further clarity. I would like to provide the additional information later this week given the issue has been raised with this Office.

Existing SoER Climate and Greenhouse Issues Paper paragraph 4:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

Link - Clarifying and providing a context for material in paragraph 4 in the State of the Environment report 2007/08, Climate and Greenhouse Issues Paper, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station."

Information provided by Associate Professor Janette Lindsay, Mr Clem Davis and Mr Stephen Lellyett (Bureau of Meteorology) 26 August 2008.

Measuring weather and climate conditions in vicinity of Canberra in the ACT has been undertaken at the weather station at the Canberra International Airport, one of a limited set of designated Climate Reference Stations in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have recently been built adjacent to the weather station significantly changing the micro-climate of the measurement area for maximum and minimum temperatures in some months. A multi-story building constructed east of the weather station now shades the sunshine recorder shortly after sunrise. This means that data collected since these developments potentially cannot be reliably compared to the previous long-term record at this site. This would affect the long-term record and ongoing monitoring of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. Hence, it is important that a new weather station with long term tenure be established at an appropriate location in the ACT as soon as possible, with a sufficiently long overlap period of concurrent measurements to establish a robust statistical relationship between the two sites through adequate correlation of new and previous data from the existing airport weather station. To that end, the Bureau of Meteorology and Canberra International Airport have been actively working together to identify a site which would satisfy the requirements of a Climate Reference Station, aerodrome meteorological requirements, long term airport development plan, environmental protection, and property lease requirements. The new comparison site is expected to be operational by the end of September 2008.

Max

Dr Maxine Cooper
 Commissioner
 Office of the Commissioner for Sustainability
 and the Environment
 Ph: 6207 2629
 Fax: 6207 2630
 E-mail: maxine.cooper@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Released under FOI

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:03
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW12: Canberra Airport / State of the Environment Report (SoER) 2007-08 [SEC=IN-CONFIDENCE]
Attachments: Letter to Dr Foskey re Airport 100908.doc; Clarification of weather station at canberra airport.doc

From: Walters, Michele [Michele.Walters@act.gov.au]
Sent: Wednesday, 10 September 2008 2:39 PM
Cc: Zissler, Mike; janette.lindesay@anu.edu.au; Cappie-Wood, Andrew; Stephen Lellyett; Clem Davis (E-mail 2); n.mccann@canberraairport.com.au
Subject: NSW12: Canberra Airport / State of the Environment Report (SoER) 2007-08

Dear Dr Foskey

Please find enclosed an electronic copy of a letter from Dr Maxine Cooper, Commissioner for Sustainability and the Environment. The letter has two attachments but only one is attached to this email. The other one is so large that it would likely block access to your system for other users. However, a hard copy of the letter and both attachments is being sent via internal mail.

Yours sincerely

Michele Walters

A/g Office Manager

Office of the Commissioner for

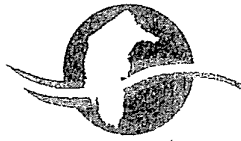
Sustainability and the Environment

Ph: 62072626

Fx: 62072630

<<Letter to Dr Foskey re Airport 100908.doc>> <<Clarification of weather station at canberra airport.doc>>

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.



**OFFICE OF THE COMMISSIONER
FOR SUSTAINABILITY AND THE ENVIRONMENT ACT**

ABN: 14 526 086 507

Dr Deb Foskey, MLA
ACT Legislative Assembly
GPO Box 1020
Canberra ACT 2601

10 September 2008

Dear Dr Foskey

Further to the release of the ACT State of the Environment Report (SoER) 2007/08, this is to inform you that a link will be added on our website to paragraph four (on the first page) of the SoER Climate Change and Greenhouse Issues Paper.

Canberra Airport Pty Ltd contacted this Office regarding information in the SoER related to the weather station at the Canberra Airport. Mr Clem Davies and Associate Professor Janette Lindesay from the ANU, who were contracted to write the weather indicator for the SoER, as well as Mr Stephen Lellyett, Deputy Regional Director (NSW), Australian Bureau of Meteorology, have clarified the information provided in the SoER. This clarification is attached to this letter and will be placed on our website, along with a paper on the issue from Mr Davies.

Canberra Airport Pty Ltd, was offered the opportunity to provide information on this issue for our website but declined. The Chief Minister and other Members of the Legislative Assembly whose responsibilities include sustainability and the environment have been informed of the link.

Sincerely

Dr Maxine Cooper
Commissioner

- cc: Mr Andrew Cappie-Wood, Chief Executive, Chief Minister's Department
- cc: Mr Mike Zissler, Chief Executive, Territory and Municipal Services
- cc: Associate Professor Janette Lindesay, Australian National University
- cc: Mr Clem Davis, Australian National University
- cc: Mr Stephen Lellyett, Deputy Regional Director (NSW), Australian Bureau of Meteorology
- cc: Mr Noel McCann, Director of Planning, Canberra Airport Pty Ltd

Level 1, Building 3, 9 Sandford Street, Mitchell ACT 2911
Commissioner: Dr Maxine Cooper
Phone: (02) 6207 2626 Fax: (02) 6207 2630 PO Box 356, Dickson ACT 2602
Email: EnvComm@act.gov.au
Website: www.EnvComm.act.gov.au

Existing SoER Climate and Greenhouse Issues Paper paragraph 4:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

Update: Clarification and context for the statement about the weather station at Canberra Airport

Update: Clarification and context for statement about the weather station at Canberra Airport

This update provides clarification and context for material in paragraph 4 of this page, that starts "Measuring weather" and concludes "...correlated with previous data from the airport weather station." The information is provided by Associate Professor Janette Lindsay, Mr Clem Davis and Mr Stephen Lellyett (Bureau of Meteorology) 26 August 2008

Measuring weather and climate conditions in vicinity of Canberra in the ACT has been undertaken at the weather station at the Canberra International Airport, one of a limited set of designated Climate Reference Stations in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have recently been built adjacent to the weather station significantly changing the micro-climate of the measurement area for maximum and minimum temperatures in some months. A multi-story building constructed east of the weather station now shades the sunshine recorder shortly after sunrise. This means that data collected since these developments potentially cannot be reliably compared to the previous long-term record at this site. This would affect the long-term record and ongoing monitoring of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management.

Hence, it is important that a new weather station with long term tenure be established at an appropriate location in the ACT as soon as possible, with a sufficiently long overlap period of concurrent measurements to establish a robust statistical relationship between the two sites through adequate correlation of new and previous data from the existing airport weather station. To that end, the Bureau of Meteorology and Canberra International Airport have been actively working together to identify a site which would satisfy the requirements of a Climate Reference Station, aerodrome meteorological requirements, long term airport development plan, environmental protection, and property lease requirements. The new comparison site is expected to be operational by the end of September 2008.

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:02
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW13: RE: Canberra Airport / State of the Environment Report (SoER) 2007-08 [SEC=IN-CONFIDENCE]

From: Stephen Lellyett
Sent: Thursday, 11 September 2008 11:10 AM
To: Walters, Michele; Cooper, Maxine
Cc: janette.lindesay@anu.edu.au; Clem Davis (E-mail 2); n.mccann@canberraairport.com.au; Stephen Lellyett
Subject: NSW13: RE: Canberra Airport / State of the Environment Report (SoER) 2007-08 [SEC=UNCLASSIFIED]

Dear Michele and Maxine,

Thanks for on-forwarding a copy of the letter to Dr Foskey.

The letter notes that I contributed to a clarification of the SoE statement as follows – this was the initial statement given to me for comment, not the one which I endorsed:

Existing SoER Climate and Greenhouse Issues Paper paragraph 4:
 Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

Update: Clarification and context for the statement about the weather station at Canberra Airport

The version I recommended to Maxine, which I believe to be a more accurate statement, to replace the above, is as follows:

1. SoER Climate and Greenhouse Issues Paper paragraph four:

Measuring weather patterns in the ACT has been undertaken at a number of sites over the years, including the weather station at the Canberra International Airport which has been used as a representation of the climate in the Canberra area since 1939. Recent expansion of the airport appears to have affected measurements at the weather station according to a study by Davis [insert reference]. Carparks have now been built around the weather station producing a measurable change in the micro-climate of the site. This means that some of the data collected now cannot be reliably compared to previous data. This will affect the identification of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. Therefore, it is important that a new weather station in the ACT is established, with data adequately correlated with data from the existing airport weather station.

I think it would also be prudent to pass on to Dr Foskey and publish online the passage below, as it serves to further clarify the situation, and, to highlight that definite action is underway to redress the problem jointly between BoM and Canberra International Airport:

Measuring weather and climate conditions in vicinity of Canberra in the ACT has been undertaken at the weather station at the Canberra International Airport, one of a limited set of designated Climate Reference Stations in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have recently been built adjacent to the weather station significantly changing the micro-climate of the measurement area for maximum and minimum temperatures in some months. A multi-story building constructed east of the weather station now shades the sunshine recorder shortly after sunrise. This means that data collected since these developments potentially cannot be reliably compared to the previous long-term record at this site. This would affect the long-term record and ongoing monitoring of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management.

Hence, it is important that a new weather station with long term tenure be established at an appropriate location in the ACT as soon as possible, with a sufficiently long overlap period of concurrent measurements to establish a robust statistical relationship between the two sites through adequate correlation of new and previous data from the existing airport weather station. To that end, the Bureau of Meteorology and Canberra International Airport have been actively working together to identify a site which would satisfy the requirements of a Climate Reference Station, aerodrome meteorological requirements, long term airport development plan, environmental protection, and property lease requirements. The new comparison site is expected to be operational by the end of September 2008.

Thanks and kind regards,

Stephen Lellyett
acting Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.lellyett@bom.gov.au

From: Walters, Michele [mailto:Michele.Walters@act.gov.au]
Sent: Wednesday, 10 September 2008 2:40 PM
Cc: Zissler, Mike; janette.lindesay@anu.edu.au; Cappie-Wood, Andrew; Stephen Lellyett; Clem Davis (E-mail 2); n.mccann@canberraairport.com.au
Subject: Canberra Airport / State of the Environment Report (SoER) 2007-08

Dear Dr Foskey

Please find enclosed an electronic copy of a letter from Dr Maxine Cooper, Commissioner for Sustainability and the Environment. The letter has two attachments but only one is attached to this email. The other one is so large that it would likely block access to your system for other users. However, a hard copy of the letter and both attachments is being sent via internal mail.

Yours sincerely

Michele Walters

A/g Office Manager

Office of the Commissioner for
Sustainability and the Environment

Ph: 62072626

Fx: 62072630

<<Letter to Dr Foskey re Airport 100908.doc>> <<Clarification of weather station at canberra airport.doc>>

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:10
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW14: FW: Canberra Airport / State of the Environment Report (SoER) 2007-08 [SEC=IN-CONFIDENCE]

From: Cooper, Maxine [Maxine.Cooper@act.gov.au]
Sent: Thursday, 11 September 2008 1:13 PM
To: Stephen Lellyett
Cc: janette.lindesay@anu.edu.au; clem.davis@bowtie.com.au; n.mccann@canberraairport.com.au; Walters, Michele; Burrows, Sarah
Subject: NSW14: FW: Canberra Airport / State of the Environment Report (SoER) 2007-08 [SEC=UNCLASSIFIED]

Stephen - we did exactly what you asked. You made edits to the existing text so we couldn't change that as it is existing but in the link material we have used all your comments and it is this that has been published. I will call to discuss.

Max

-----Original Message-----

From: Stephen Lellyett [mailto:S.Lellyett@bom.gov.au]
Sent: Thursday, 11 September 2008 11:10
To: Walters, Michele; Cooper, Maxine
Cc: janette.lindesay@anu.edu.au; Clem Davis (E-mail 2); n.mccann@canberraairport.com.au; Stephen Lellyett
Subject: RE: Canberra Airport / State of the Environment Report (SoER) 2007-08 [SEC=UNCLASSIFIED]

Dear Michele and Maxine,

Thanks for on-forwarding a copy of the letter to Dr Foskey.

The letter notes that I contributed to a clarification of the SoE statement as follows - this was the initial statement given to me for comment, not the one which I endorsed:

Existing SoER *Climate and Greenhouse Issues Paper* paragraph 4:

Measuring weather patterns in the ACT has traditionally been undertaken at the weather station at the Canberra International Airport. The expansion of the airport has affected the accuracy of measurements at the weather station. Carparks have now been built around the weather station significantly changing the micro-climate of the measurement area. This means that the data collected now cannot be effectively compared to previous data. This will affect the measurement of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. It is important that a new weather station in the ACT is established, with data adequately correlated with previous data from the airport weather station.

Update: Clarification and context for the statement about the weather station at Canberra Airport

The version I recommended to Maxine, which I believe to be a more accurate statement, to replace the above, is as follows:

1. SoER *Climate and Greenhouse Issues Paper* paragraph four:

Measuring weather patterns in the ACT has been undertaken at a number of sites over the years, including the weather station at the Canberra International Airport which has been used as a representation of the climate in the Canberra area since 1939. Recent expansion of the airport appears to have affected measurements at the weather station according to a study by Davis [insert reference].

27/07/2011

Carparks have now been built around the weather station producing a measurable change in the micro-climate of the site. This means that some of the data collected now cannot be reliably compared to previous data. This will affect the identification of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management. Therefore, it is important that a new weather station in the ACT is established, with data adequately correlated with data from the existing airport weather station.

I think it would also be prudent to pass on to Dr Foskey and publish online the passage below, as it serves to further clarify the situation, and, to highlight that definite action is underway to redress the problem jointly between BoM and Canberra International Airport:

Measuring weather and climate conditions in vicinity of Canberra in the ACT has been undertaken at the weather station at the Canberra International Airport, one of a limited set of designated Climate Reference Stations in Australia, since 1939. Based on limited data it appears that the expansion of built infrastructure at the airport has affected measurements at the weather station for temperatures and sunshine hours, and possibly for evaporation and humidity. Carparks have recently been built adjacent to the weather station significantly changing the micro-climate of the measurement area for maximum and minimum temperatures in some months. A multi-story building constructed east of the weather station now shades the sunshine recorder shortly after sunrise. This means that data collected since these developments potentially cannot be reliably compared to the previous long-term record at this site. This would affect the long-term record and ongoing monitoring of climate and weather trends in the ACT. With climate change and future weather changes becoming a significant issue, high quality long-term records are crucial for effective future planning and management.

Hence, it is important that a new weather station with long term tenure be established at an appropriate location in the ACT as soon as possible, with a sufficiently long overlap period of concurrent measurements to establish a robust statistical relationship between the two sites through adequate correlation of new and previous data from the existing airport weather station. To that end, the Bureau of Meteorology and Canberra International Airport have been actively working together to identify a site which would satisfy the requirements of a Climate Reference Station, aerodrome meteorological requirements, long term airport development plan, environmental protection, and property lease requirements. The new comparison site is expected to be operational by the end of September 2008.

Thanks and kind regards,

Stephen Lellyett
acting Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.lellyett@bom.gov.au

From: Walters, Michele [<mailto:Michele.Walters@act.gov.au>]

Sent: Wednesday, 10 September 2008 2:40 PM

Cc: Zissler, Mike; janette.lindesay@anu.edu.au; Cappie-Wood, Andrew; Stephen Lellyett; Clem Davis (E-mail 2); n.mccann@canberraairport.com.au

Subject: Canberra Airport / State of the Environment Report (SoER) 2007-08

Dear Dr Foskey

Please find enclosed an electronic copy of a letter from Dr Maxine Cooper, Commissioner for Sustainability and the Environment. The letter has two attachments but only one is attached to this email. The other one is so large that it would likely block access to your system for other users. However, a hard copy of the letter and both attachments is being sent via internal mail.

Yours sincerely

Michele Walters
A/g Office Manager
Office of the Commissioner for
Sustainability and the Environment
Ph: 62072626
Fx: 62072630

<<Letter to Dr Foskey re Airport 100908.doc>> <<Clarification of weather station at canberra airport.doc>>

27/07/2011

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Released under FOI

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 16:00
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW15 & 16: RE: further information on the weather station at canberra airport [SEC=IN-CONFIDENCE]
Attachments: CanberraAirport_ObservationSites_Sep08.jpg

From: Stephen Lellyett
Sent: Monday, 15 September 2008 10:33 AM
To: Burrows, Sarah; Cooper, Maxine
Cc: Stephen Lellyett
Subject: NSW15 & 16: RE: further information on the weather station at canberra airport [SEC=UNCLASSIFIED]

Dear Sarah and Maxine,

To answer your questions below:

- Location of instrument enclosures: see the attached map. Note that the anemometer (wind vein) is located elsewhere on the airport, and will not shift.
- When will the new comparison site be operational? : By the end of September 2008
- How much overlap is required?: The requirements are for a minimum of two years and 95% completeness of data, assuming non-exceptional years. It may be necessary to extend the overlap if data completeness is not adequate, or, if the years are considered to be (climatically) exceptional.

Kind regards,

Stephen Lellyett
acting Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.ellyett@bom.gov.au

From: Burrows, Sarah [mailto:Sarah.Burrows@act.gov.au]
Sent: Wednesday, 10 September 2008 4:10 PM
To: Stephen Lellyett
Subject: further information on the weather station at canberra airport
Importance: High

Hi Stephen,

27/07/2011

Max asked me to get in touch with you regarding some more information about the proposed new weather station at the airport. I am after information about where the new site will be, when it will be operational and how long the overlap between the data at the two sites will be.

If you can get back to me asap on this, that would be great.

Thanks

Sarah

Sarah Burrows

Office of the Commissioner for Sustainability and the Environment

ph: 620 73094

fax: 620 72630

email: sarah.burrows@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Released under FOI

Released under FOI

Canberra Airport

X Existing Instrument Enclosure

X Comparison



Image © 2008 DigitalGlobe

Pointer 35°18'20.85" S 149°11'50.53" E elev 1886 ft

Streaming 100%

Google

Eye alt 7011 ft

Brenda Coutinho

From: Stephen Lellyett
Sent: Monday, 20 June 2011 15:58
To: Brenda Coutinho
Cc: Stephen Lellyett
Subject: FW: NSW17: RE: further information on the weather station at canberra airport [SEC=IN-CONFIDENCE]

From: Cooper, Maxine [Maxine.Cooper@act.gov.au]
Sent: Monday, 15 September 2008 12:44 PM
To: Stephen Lellyett; Burrows, Sarah
Subject: NSW17: RE: further information on the weather station at canberra airport [SEC=UNCLASSIFIED]

appreciated

-----Original Message-----

From: Stephen Lellyett [mailto:S.Lellyett@bom.gov.au]
Sent: Monday, 15 September 2008 10:34
To: Burrows, Sarah; Cooper, Maxine
Cc: Stephen Lellyett
Subject: RE: further information on the weather station at canberra airport [SEC=UNCLASSIFIED]

Dear Sarah and Maxine,

To answer your questions below:

- Location of instrument enclosures: see the attached map. Note that the anemometer (wind vein) is located elsewhere on the airport, and will not shift.
- When will the new comparison site be operational? : By the end of September 2008
- How much overlap is required?: The requirements are for a minimum of two years and 95% completeness of data, assuming non-exceptional years. It may be necessary to extend the overlap if data completeness is not adequate, or, if the years are considered to be (climatically) exceptional.

Kind regards,

Stephen Lellyett
acting Regional Director (NSW)
Australian Bureau of Meteorology

phone: +612 9296 1501 post: PO Box 413
fax: +612 9296 1506 Darlinghurst
mobile: +614 0802 3687 NSW 1300, Australia
www: www.bom.gov.au email: s.ellyett@bom.gov.au

From: Burrows, Sarah [mailto:Sarah.Burrows@act.gov.au]
Sent: Wednesday, 10 September 2008 4:10 PM
To: Stephen Lellyett
Subject: further information on the weather station at canberra airport
Importance: High

Hi Stephen,

Max asked me to get in touch with you regarding some more information about the proposed new weather station at the airport. I am after information about where the new site will be, when it will be operational and how long the overlap between the data at the two sites will be.

If you can get back to me asap on this, that would be great.

Thanks

Sarah

Sarah Burrows

Office of the Commissioner for Sustainability and the Environment

ph: 620 73091

fax: 620 72630

email: sarah.burrows@act.gov.au

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

This email, and any attachments, may be confidential and also privileged. If you are not the intended recipient, please notify the sender and delete all copies of this transmission along with any attachments immediately. You should not copy or use it for any purpose, nor disclose its contents to any other person.

Brenda Coutinho

From: Blair Trewin
Sent: Thursday, 7 July 2011 18:27
To: Brenda Coutinho
Subject: FW: Canberra Airport Analysis [SEC=UNCLASSIFIED]

Brenda,

First of three (assuming I can find all three).

Blair

From: Clem Davis [clem.davis@anu.edu.au]
Sent: Thursday, 6 March 2008 3:07 PM
To: Blair Trewin
Subject: Canberra Airport Analysis

Blair,

Have just completed a more rigorous analysis.
Interesting results.

1. Correlation coefficients between daily MaxT between Tugg and Canb A/p is around 0.99 and for minT is around 0.95
2. 2006 lies within the boundaries of 1997-2005 data
3. 2007 is showing a tendency for the maxT at Canberra airport to be up to 0.5C higher at higher temperatures (40C) and up to 0.4C higher below 0C for minT. ie: there does appear to be an impact on the Obs site from the car park that increases for lower minT as well as for high maxT.

As the car park is only several metres from the eastern edge of the Obs site, this is probably not surprising.

I'll show you the analysis next week if you have time.

Clem

Brenda Coutinho

From: Blair Trewin
Sent: Thursday, 7 July 2011 18:32
To: Brenda Coutinho
Subject: FW: Study at Canberra Airport [SEC=UNCLASSIFIED]

Attachments: Development around Canberra Airport_v3.doc



Development
around Canberra Ai..

From: Clem Davis [clem.davis@anu.edu.au]
Sent: Friday, 7 March 2008 2:57 PM
To: Blair Trewin
Subject: Study at Canberra Airport

Blair,

Here with the draft results of the study of MaxT and MinT at Canberra Airport in comparison with Tuggeranong.

- a. I am getting a map made up to show their locations.
- b. I will get some photos showing how close the car park is to the Obs site.

Your comments on the method used for comparison would be appreciated.
Do you know if there are any WMO standards regarding placement of the Observation site in relation to car parks etc and whether the present set up at Canberra Airport breaches these standards?

Also, is it worthwhile submitting as an article for the AMOS Bulletin?

Hopefully we can discuss next week

Clem

Released under FOI

Has Development around Canberra Airport affected its use as a Climate Reference Station?

Clem Davis
Visiting Fellow
Fenner School of Environment and Society, ANU

Introduction

Canberra Airport is one of the Observation sites used by the Bureau of Meteorology as a Climate Reference Station to measure climate change across Australia. The site commenced in March 1939 and has remained relatively unchanged through to 2005.

Development at Canberra airport has resulted in a hanger being constructed to the northwest of the Observation site in 2005 and new buildings and a car park to the north and east of the site during 2006-2007. The edge of the car park is now only meters from the eastern boundary of the Observation Site. The question arises, how much does this development impact on the ability to continue to use this site as a long term reference station?

Figure 1 a-d indicates the observation site as it was in 2005 while Figures 2 a-b and 3 a-b indicate the changes that have occurred to the north and east between 2005 and 2007. There has been no change to the site from the northwest through to the southeast.

Released under FOI

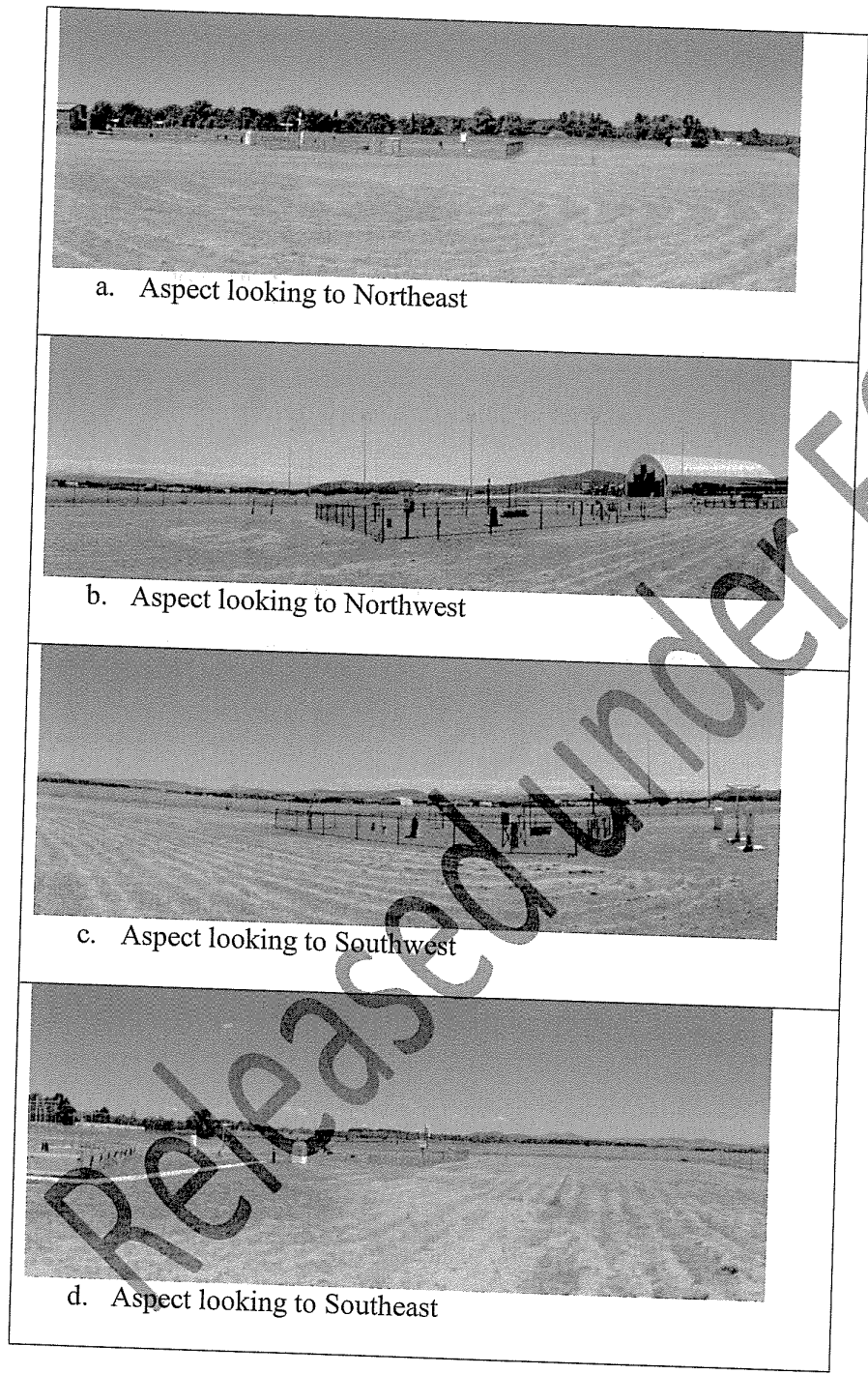


Figure 1a-d Aspects of Canberra Airport Observation Site November 2005

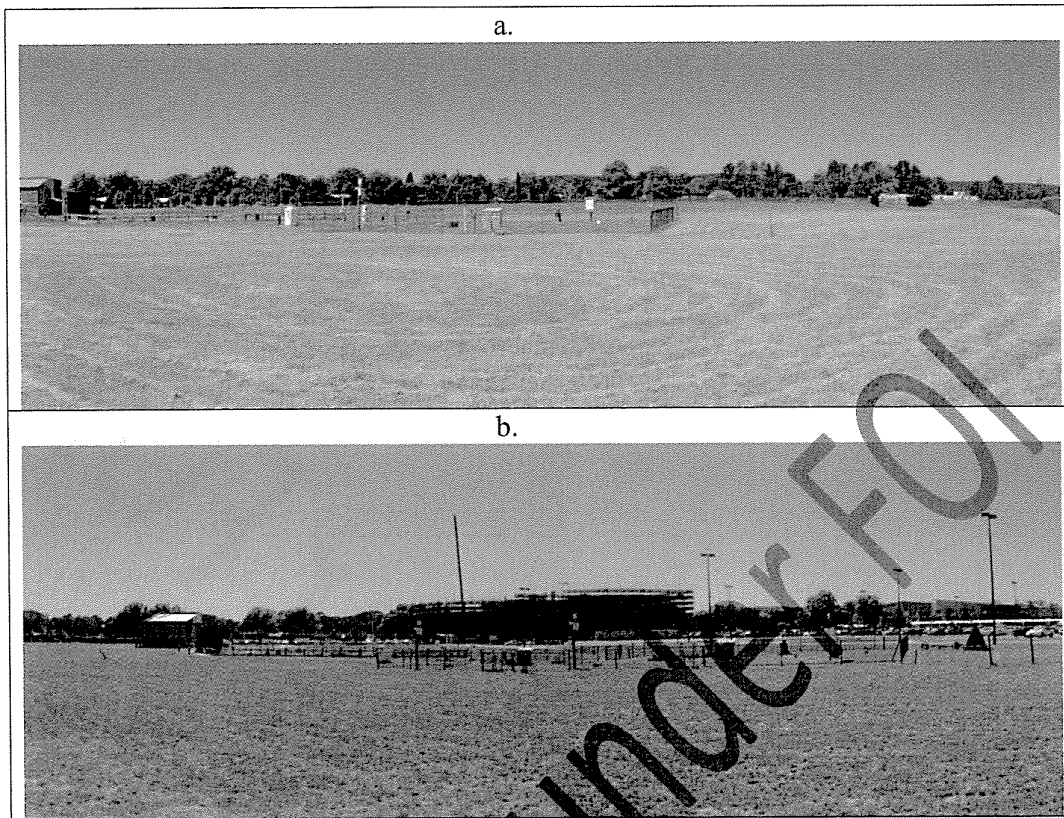


Figure 2 Difference in Aspect looking N/NE a: November 2005 b: March 2008

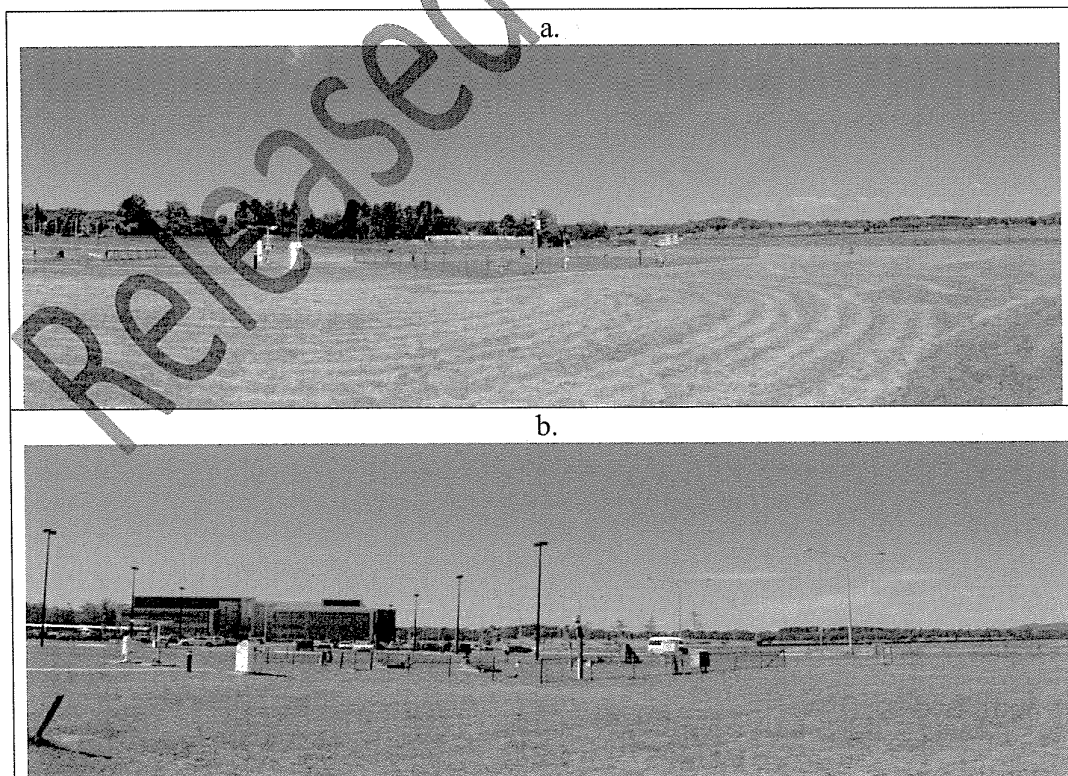


Figure 3 Difference in Aspect looking E/SE a: November 2005 b: March 2008

Released under FOI

In 1996 an Automatic Weather Station was installed in the Tuggeranong Valley, paid for by the ACT Government. It is located around xx km from the airport. The relative sites of the two sites are shown in Figure 4.

Figure 4: Locations of Tuggeranong AWS and Canberra Airport with ACT.

There are now 11 full years of daily maximum and minimum temperatures from this site that can be used to identify whether any changes are occurring in maximum and minimum temperatures at the Airport Site. There are nine years of data during which time there was no physical change to the sites while there are 2 years of data during which time the development took place at Canberra Airport. A cross comparison of the daily temperatures between the sites may thus provide an indication of possible changes in the temperature record at Canberra Airport due to this development.

Method.

The available daily Tmax and Tmin data for Tuggeranong AWS and Canberra Airport from the Bureau of Meteorology database were used in this analysis.

The analysis consisted of 4 steps:

1. Determining the relationship, if any, in the daily temperatures between Tuggeranong and Canberra Airport for the whole period 1997-2005.
2. Determining the yearly spread between 1997-2005 to provide an indication of the stability of any correlation
3. Using the linear regression coefficients over these years to calculate the derived temperature at Canberra Airport using Tuggeranong values

4. Comparing these results with the data from 2006 and 2007 to identify changes in the values that may be occurring.

Figure 5a-b indicates the correlation graphs between Canberra Airport and Tuggeranong for both Tmax and Tmin for the period 1997-2005.

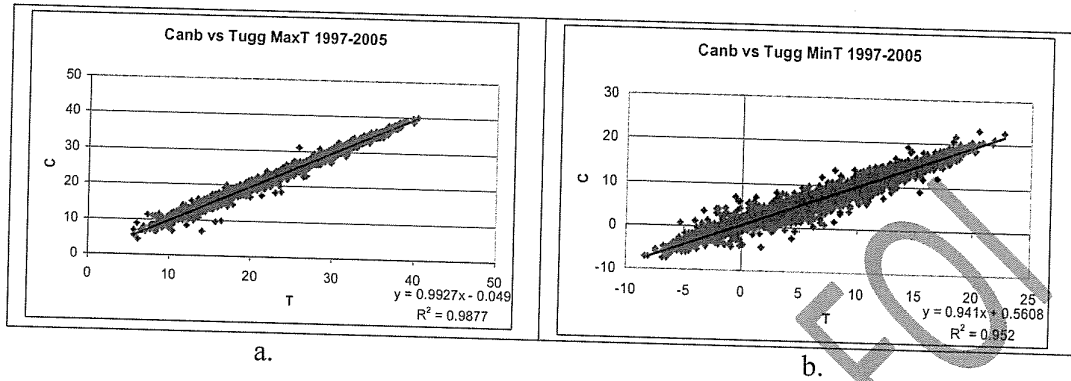


Figure 5a-b Correlation graphs between Tuggeranong and Canberra Airport Daily Maximum and Minimum Temperatures 1997-2005

As can be seen the correlations between the 2 sites are extremely high with the R^2 values being 0.988 for the Maximum Temperatures and 0.952 for the Minimum Temperatures.

Results:

The results obtained from these correlations are listed in Table 1 together with the temperatures for Canberra Airport calculated from the Tuggeranong data using the regression relationships.

Released under FOI

Table 1: Results of the calculations from the linear regressions of Canberra Airport TmaxT and Tmin using Tuggeranong temperatures.

MaxT	Year	R ²		Selected Max Temperature for Tuggeranong					
				10.0	15.0	20.0	25.0	30.0	35.0
	1997	0.9891	Derived	9.8	14.7	19.7	24.7	29.7	34.7
	1998	0.9903	MaxT	9.7	14.7	19.6	24.6	29.6	34.6
	1999	0.9907	Canberra	9.8	14.7	19.6	24.5	29.5	34.4
	2000	0.9891	Airport	9.8	14.8	19.7	24.6	29.6	34.5
	2001	0.9822		10.0	15.0	20.0	24.9	29.9	34.8
	2002	0.9876		9.9	14.9	19.8	24.8	29.8	34.7
	2003	0.9875		9.7	14.7	19.7	24.8	29.8	34.8
	2004	0.9891		10.1	15.0	20.0	24.9	29.8	34.8
	2005	0.9869		10.0	15.0	20.0	25.0	30.0	34.9
	Average	0.9880		9.9	14.8	19.8	24.8	29.7	34.7
			Lowest	9.7	14.7	19.6	24.5	29.5	34.4
			Highest	10.1	15.0	20.0	25.0	30.0	35.0
	2006	0.9928		10.1	15.1	20.1	25.0	30.0	35.0
	2007	0.9907		9.9	15.0	20.1	25.2	30.3	35.4

MinT	Year	R ²		Selected Min Temperature for Tuggeranong				
				-5.0	0.0	5.0	10.0	15.0
	1997	0.9486	Derived	-4.5	0.2	5.0	9.7	14.4
	1998	0.9524	MinT	-4.0	0.6	5.3	10.0	14.7
	1999	0.9627	Canberra	-4.3	0.4	5.2	9.9	14.6
	2000	0.9527	Airport	-4.1	0.6	5.3	10.0	14.7
	2001	0.9556		-4.3	0.4	5.2	10.0	14.7
	2002	0.9491		-4.3	0.5	5.3	10.1	14.9
	2003	0.9388		-3.8	0.7	5.3	9.9	14.5
	2004	0.9546		-4.0	0.7	5.4	10.1	14.8
	2005	0.9571		-3.8	0.8	5.5	10.1	14.8
	Average	0.9524		-4.1	0.6	5.3	10.0	14.7
			Highest	-3.8	0.8	5.5	10.1	14.8
			Lowest	-4.3	0.2	5.0	9.7	14.4
	2006	0.9614		-4.2	0.5	5.3	10.0	14.7
	2007	0.9526		-3.4	1.2	5.7	10.2	14.7

These results indicate that:

1. the range in derived temperatures for Canberra Airport between 1997-2005 is small indicating that over this period, the relationship between the 2 sites is stable.
2. the correlations for 2006 and 2007 are of similar magnitudes.
3. both maximum and minimum temperatures during 2006 remain mostly within the 1997-2005 ranges.
4. in 2007 derived maximum temperatures for Canberra Airport above 25°C are higher than those in the control period (increasing to 0.5°C at 40°C).
5. in 2007 derived minimum temperatures for Canberra Airport below 5°C are higher than those in the control period (by 0.4°C at 0°C and -5°C).

Discussion and Conclusion

Industrial or residential development around Climate Reference Observation Sites is cause for concern as any changes resulting from these developments can impact on the measurement of long term climate change where changes of the order of less than 0.5°C are important.

Cross comparison with Tuggeranong Automatic Weather Station is suggestive that there could be an effect commencing to occur at Canberra Airport on maximum and minimum temperatures as a result of development adjacent to the site and thus impact on its continued use as a Climate Reference Station. These effects appear to be increasing the maximum temperatures above 25°C, (increasing by 0.5°C at 40°C) and increasing the minimum temperatures below 5°C (increasing by 0.4°C below 0°C). It should be noted that this study is only based on one full year after development was completed and more data is needed to confirm these trends.

This tendency to higher temperatures for minimum temperatures is not entirely unexpected given the buildings and car park that have been constructed adjacent to the site with the edge of the car park being only metres from the eastern edge of the enclosure. The retention of heat by the asphalt of the car park during the day is the most likely reason for this trend.

The tendency to gradually higher maximum temperatures above 25°C is more difficult to explain but may be related to a threshold temperature being reached that may create a micro scale circulation that results in the hotter air developing over the car park being advected across the Observation site.

While there are moves to relocate the Observation Site to where any effect from the car park is reduced, it is considered essential that there should be at least a 12 month overlap of observations once the site has been moved to enable a comparison to be made between all the sites.

Brenda Coutinho

From: Blair Trewin
Sent: Thursday, 7 July 2011 18:30
To: Brenda Coutinho
Subject: FW: Canberra Airport Analysis [SEC=UNCLASSIFIED]

From: Blair Trewin
Sent: Friday, 7 March 2008 5:16 PM
To: Clem Davis; clem davis
Subject: RE: Canberra Airport Analysis [SEC=UNCLASSIFIED]

Clem,

Would be interested to see it - can talk about it next Thursday.

On another subject, do you know if ANU has wireless access for visitors? I'll probably be spending a bit of time in the ANU libraries during the next couple of weeks so I'm interested to know how accessible I'll be to the outside world during that time.

Blair

-----Original Message-----
From: Clem Davis [mailto:clem.davis@anu.edu.au]
Sent: Thursday, 6 March 2008 3:07 PM
To: Blair Trewin
Subject: Canberra Airport Analysis

Blair,

Have just completed a more rigorous analysis.
Interesting results.

1. Correlation coefficients between daily MaxT between Tugg and Canb A/p is around 0.99 and for minT is around 0.95
2. 2006 lies within the boundaries of 1997-2005 data
3. 2007 is showing a tendency for the maxT at Canberra airport to be up to 0.5C higher at higher temperatures (40C) and up to 0.4C higher below 0C for minT. ie: there does appear to be an impact on the Obs site from the car park that increases for lower minT as well as for high maxT.

As the car park is only several metres from the eastern edge of the Obs site, this is probably not surprising.

I'll show you the analysis next week if you have time.

Clem