



**Australian Government**  
**Bureau of Meteorology**

**Dr Geoff Love**  
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In reply please quote  
Exec 06-0182

Dr John Tamblyn  
Chairman  
Australian Energy Market Commission  
P O Box H166  
AUSTRALIAN SQUARE NSW 1215

Dear Dr Tamblyn

Your senior advisor, Mr Tendai Gregan has requested that my organisation provide you with information relating to the frequency, duration and magnitude of summer storm in the vicinity of the Geehi Dam, and relate these storms to preceding high temperature events in Melbourne, Sydney and Adelaide. Mr Tendai has asked that we complete this work in less than two days and has offered no recompense for the task.

In respect of data in the Geehi catchment we are particularly handicapped. In the vast majority of catchments across Australia, water authorities in all States and Territories, make their data available to the Bureau, sometimes on a commercial-in-confidence basis, sometimes quite freely. We then use these data for flood warnings and other basic, public good services. We only redistribute the data when the providing authority has given us permission to do so. In the case of the Snowy Mountains area I am advised that we are provided with very little data, as the relevant authority considers its operational stream flow data, in particular, to be too commercially valuable to share on a basis that would help us to respond to requests of this nature in a timely and efficient way.

I asked my Climate Centre and Hydrology Unit staff to assemble the best statistical data sets available to shed light on the questions put to us by Mr Gregan and attach to this letter these data and the conclusions we believe can reasonably be drawn from them. In responding to such questions in the normal course of events we would attempt to understand the quantitative response of the Geehi Dam to rainfall in its catchment. We would also analyse the weather events that led to rainfall and attempt to assess whether climate variability, or ongoing climate change was likely to affect the conclusions we would draw from the statistical analysis, but as you would recognise time does not allow us to do this in the present situation.

I trust that the attached report and data are of use to you and would be willing to discuss the results further if you thought there was some advantage in doing so.

Yours sincerely

(Dr Geoff Love)  
Director of Meteorology

7 September 2006

cc: Manager, Special Services Unit  
Superintendent, National Climate Centre

**Report on historical incidence of summer storms over the Snowy Mountains and the relationship between such storm activity and high temperatures in Victoria, South Australia and New South Wales**

For the purposes of this report, given the very limited time available, only a very few data records have been selected for analysis. Noting the purpose of the enquiry, the capital cities of Sydney/Parramatta, Melbourne and Adelaide/Kent Town were chosen as most representative of their respective states for the number of hot spells. Only a few rainfall stations were used to represent the summer rainfall regime in the general vicinity of the Geehi reservoir. It has not been possible in the time available to determine the extent to which the stations chosen are indeed representative of the range of variability of summer rainfall in the region.

**1. Frequency, duration and magnitude of summer rain storm weather in the areas feeding Geehi Reservoir over the last 10/20/30 years.**

For the purposes of this analysis a “summer rain storm” was defined as rainfall exceeding the 3-month ARI (Average Recurrence Interval) using summer rainfall data only. Durations of 24 hours and 6 hours were considered using the nearest rainfall intensity station in the Bureau’s archives with sufficient data (Corryong). The number of occurrences of “storms” of different magnitudes were extracted from the data record for each duration. The results are presented below for periods of the last 10, 20 and 30 years.

**For a 24-hour duration storm**, the 3-month ARI rainfall is 12.8mm. The number of occurrences of storms equal to and greater than this amount are presented in the following table.

Storm Magnitude (mm)	Last 30 years	Last 20 years	Last 10 years
12.8	89	62	39
15	73	49	32
20	59	42	28
30	26	20	13
40	11	9	5
50	3	2	0
60	1	0	0
70	0	0	0
80	0	0	0

**For a 6-hour duration storm**, the 3-month ARI rainfall is 8.8mm. The number of occurrences of storms equal to and greater than this amount are presented in the following table.

Storm Magnitude (mm)	Last 30 years	Last 20 years	Last 10 years
8.8	135	92	48
15	60	44	22
20	45	34	16
30	11	7	1
40	4	3	0
50	3	2	0
60	0	0	0
70	0	0	0
80	0	0	0

## **2. Comparisons of historical temperature data for Melbourne, Adelaide (Kent Town) and Sydney (Parramatta) sites, with Rainfall near Geehi Reservoir, Snowy Mountains.**

Comparisons were performed for representative sites in the three state capital cities (Sydney, Melbourne and Adelaide) for periods of hot weather, taken to be three or more consecutive days when the temperature equalled or exceeded 35°C, and subsequent significant rainfall in the vicinity of the Geehi Catchment/Dam. For the longer period analysis, significant rainfall was considered to be those days when rainfall exceeded the 3-month ARI (Average Recurrence Interval).

For the closest rainfall station with best data (Ingebyra), a comparison was made with the 24 hour 3-month ARI value (12.8 mm in 24 hours), and hot spells at the city sites over the 30-year period.

An analysis of rainfall events that followed periods of hot weather was performed for each capital city. A total of 80 individual hot spell events were analysed over the 30 year period. The analysis revealed a small likelihood of a rainfall event following periods of hot weather in Melbourne (15%), Adelaide (13%) and Sydney (6%).

### **Conclusion:**

The likelihood of a significant rainfall event following hot weather at any of the major cities within 3 days was 13%, while the likelihood of a rainfall event within 7 days increased to 31%.

An ~30-year analysis of summer rainfall totals in the catchment (using Khancoban), correlated with the total number of days in summer when the temperature exceeded 35°C in each of the cities, reveals weak negative correlations for Melbourne (-0.12) and Adelaide (-0.13), and a somewhat stronger negative correlation for Sydney (-0.36).

### **Conclusion:**

Hotter summers in Adelaide and Melbourne are associated weakly with lower summer rainfall totals in Khancoban, with the association being somewhat stronger for Sydney.

## **3. Summer rain storm frequency and its relationship to high temperatures in Melbourne, Adelaide and Sydney in the severe drought of 1982-83**

Six rain events occurred at Khancoban where near or over 10mm fell in one day, during the summer of 1982/83.

These were:

9/12/82	18mm
31/12/82	11.2mm
2/1/83	32mm
3/1/83	9.4mm
13/2/83	11.8mm
22/2/83	14mm
23/2/83	15 mm

At Sydney (Parramatta), preceding hot days (>35°C) only occurred to 2 of these events:

8-10/01/83	(36.4, 42, 42.3)
23/01/83	(39C)
(total days over 35 = 19)	

At Melbourne:

31/12/82	(35.8)
22/01/83	(37)
(total days over 35 = 14)	

At Adelaide:

21-22/01/83 (38.5, 41.2)

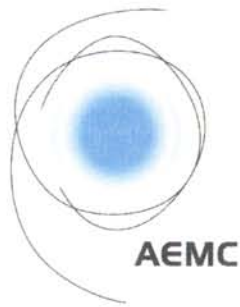
(total days over 35 = 19)

The suggestion from the above brief figures is that hot temperatures ( $>35^{\circ}\text{C}$ ) at these capital cities (taken as fairly representative of states) during the summer of 1982/83, preceding rain events of any magnitude, were not common. For Sydney (Parramatta), Melbourne, Adelaide only 20%, 14% and 10% of days were above  $35^{\circ}\text{C}$  prior to Khancoban rain events of any magnitude.

The two significant rain events at Khancoban (41.4 mm on 2-3/1/83, and 29mm on 22-23/1/83 ) was preceded by a hot day in Melbourne on the 31st, and hot conditions on concurrent days at all three cities (21-23/1/83). This second spell was the only occasion of extended hot conditions corresponding with rainfall at Khancoban.

**Conclusion:**

For the 1982/83 summer, the relationship between hot spells at any city and significant rain appears weak. In general, it would be fair to state that hot conditions were not significantly related to subsequent significant rainfall in the Geelhi catchment.



Our ref: 17682

**URGENT**

5 September 2006

Mr Tony Baldwin  
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Australian Bureau of Meteorology  
Melbourne VIC 3000

Sent via e-mail: [a.baldwin@bom.gov.au](mailto:a.baldwin@bom.gov.au), [g.love@bom.gov.au](mailto:g.love@bom.gov.au)

Dear Mr Baldwin

**Urgent weather data request — Snowy Mountains region**

The Australian Energy Market Commission (AEMC) is currently considering two alternative changes to the rules governing the National Electricity Market (NEM), one of which it is claimed will create a risk to the reliability of electricity supplies into Victoria and South Australia during summer 2006/07 due to the possibility of storm activity over the Snowy Mountains at these times.

The AEMC has been established by Australian governments under the National Electricity Law (NEL) to:

- consider Rule change proposals and the effect that such proposals may have on the national energy market;
- conduct energy market reviews and inquiries for the Ministerial Council on Energy (providing analysis and recommendations to inform policy making by the MCE); and
- provide policy advice to the MCE as requested or on AEMC initiative.

The Commission is urgently seeking to understand the historical incidence of summer storms over the Snowy Mountains and the relationship between such storm activity and high temperatures in Victoria/South Australia and NSW.

The Commission is particularly interested in understanding:

1. The frequency, duration and magnitude of summer rain storm weather in the Snowy Mountains region over the last 30 years/20 years/10 years, particularly in the areas feeding into the Geehi Reservoir;

Australian Energy Market Commission [www.aemc.gov.au](http://www.aemc.gov.au)

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2. The relationship between summer storm activity in 1. to past or co-incident high temperature days in Sydney, Melbourne and Adelaide, based on historical data over the last 30/20/10 years. In particular, after a period of high summer temperatures in one or more of these capital cities, what is the likelihood of storm activity in the Snowy Mountains (particularly around Geehi Reservoir)? Is the storm activity generally associated with a cold front moving across the south-east of the continent following hot weather in VIC and/or SA?
3. Summer rain storm weather frequency and its relationship to high temperatures in VIC, SA and NSW in the severe drought of 1982/83.

The Chairman of the Commission, Dr John Tamblyn, has requested that this data be provided to the Commission within the next two days, if at all possible. This tight turnaround is so that the Commission can assess whether its decision on these rule change proposals potentially has an adverse effect on electricity supply reliability in Victoria and South Australia over the coming summer.

If you have any questions relating to this, do not hesitate to call me on (02) 8296 7823 or Dr John Tamblyn on (02) 8296 7800.

Yours sincerely



Tendai Gregan  
Senior Advisor