SOARING CLIMATOLOGY OF GAWLER AND SURROUNDINGS. SOUTH AUSTRALIA - a descriptive format.

By M. J. Hancy, B.A.

Presented at the XXVI OSTIV Congress, Bayreuth 1999

ABSTRACT:

Basic climatological statistics of temperature rainfall and wind are presented for the Gawler task area. Synoptic features such as cold fronts, Rossby Waves, hemispherical analysis and North-West cloud bands are described. In relation to these elements the more pertinent topics relevant to gliding are presented. These include convection, sea breezes, ridge lift topographic relevance, the River Murray, downdrafts, microbursts and dust devils. Finally SW to SE wind situations are described which are commonly associated with inversion waves (cycling), katabatic winds and wave-thermal interactions.

Gawler is the home of Adelaide Soaring Club and lies about 40 km north of that city.

Topography To the West is Gulf St.Vincent, while to the East rise the Mt.Lofty Ranges, part of the Flinders Ranges, which extend over 400 km northward. Between the ranges and the gulf are the Adelaide Plains.

Temperatures (January) - RAAF.Edinburgh is the nearest meteorological station. Mean January maxima are close to 30° C. The 14th and 86th percentiles are 23° C and 37° C, respectively, while the extreme is 46°C. Mean Minima are about 16 ° C with 14th and 86th percentiles of 12 °C and 21°C, respectively. The extreme is 7°C. Dew Points between 9 am and 3 pm are usually around 9°C to 10°C.

Rainfall (January) - The mean January Rainfall is 22.7 mm and the median January rainfall is 14.6 mm. There are 5 rain days on average (when 0.2 mm or more are recorded).

Wind - Winds are influenced by the ranges and the sea. N.E. Katabatic winds are experienced during the evening and early morning while seabreezes are common in the afternoons.

Pressure Patterns - Synoptic Features such as anticyclones, moving approximately from west to east, with their associated subsidence inversions and anticlockwise wind circulations, greatly influence the soaring conditions, especially the local effects experienced in the Gawler task area. The movement and dynamics of the highs, lows and cold fronts and their intensities are largely determined by Rossby Waves and their associated jet streams. The latter features are also instrumental in drawing streams of cloud from tropical systems over the Indian Ocean. Such tropical intrusions are usually associated with North-West Cloud Bands. These comprise dense cirrus, altocumulus and occasionally cumulonimbus clouds. Northeasterly tropical intrusions are less common. Low pressure systems form on the Polar Front but rarely develop as far north as the Australian Continent in summer, except on the east coast of New South Wales. Cold fronts are rarely intense except if they interact with tropical intrusions. Cold fronts may be steered, from the Great Australian Bight, northeastwards (after intensifying) or southeastwards (usually weakening and displaying a fanning or " spreading fingers" characteristic). Southeastward. Moving systems are often accompanied by strong/gale force northwest winds, low humidity, dust devils and unexpectedly high temperatures (due to Non-adiabatic effects).

With a stable Rossby Wave pattern, it is possible for anticyclones to "block" near New Zealand, steering cold fronts southeastwards, resulting in prolonged heat-wave conditions with day temperatures in excess of 35°C for 10 or more successive days. Upper level disturbances (cold pools, troughs etc.) occur occasionally.

Convection Under "blocking high" conditions convection heights of 3000 - 4000 meters or more may be achieved with thermal strengths in excess of 5 m/sec. These days may be accompanied by very strong winds making gliders difficult to handle on the ground. Under average anticyclonic conditions, subsidence inversions restrict convection to 1300 to 2300 metres and cumulus bases may limit actual achievable heights. (Flying inside clouds is illegal.) On days following the passage of a cold front, convection is usually weak to moderate, but tends to improve as the anticyclone in its wake translates eastwards and winds shift through south to southeast and eventually more northerly ahead of the next approaching front.

Seabreezes - Although there is little in the literature specifically pertaining to Gawler, forecasters and meteorologists have written extensively concerning southwesterly sea breezes near Adelaide. Holton(1978, personal communication) produced an aid for forecasting surface winds and sea breezes at Adelaide Airport. Brooks and Crookes (1990) published a meteorological code on winds along the Adelaide beaches. Hancy has contributed to numerous gliding and hang-gliding magazines and club newsletters concerning sea breezes throughout South Australia, particularly in the Gawler Task area. Clarke et al (1967) published a C.S.I.R.O. study showing isochrones of the sea breeze penetration on the eastern side of the Mt. Lofty Ranges and this study is being extended by Hancy to include the gliding areas around the Gawler region. Hacker and Reinhardt also conducted sea breeze experiments using a GROB motorglider. Inferences can be made from these studies:

- 1. The strongest genuine seabreezes occur with temperatures lower than 35 Degrees Celsius, with SE winds and a subsidence inversion of about 1000-1300 metres (ie.shallow convection).
- 2. Sea breezes are most unlikely when temperatures exceed 35°C with northerly winds and no subsidence inversion (ie.deep convection).
- 3.) Enhanced seabreezes are rare, but do occur, associated with a weak cold front or trough. They are particularly pronounced if the trough is related to a depression over Victoria.
- 4.) In SW gradients the wind is on-shore and will tend to increase in the afternoon. This is not a sea breeze as there is no circulation and no change in dew point.

With genuine sea breezes and those associated with weak cold fronts and troughs, the wind increases in speed and backs, humidity increases, cloud forms or increases and their bases lower, the air temperature drops and convection is suppressed. However, the seabreeze front itself may provide useful soarable lift.

SEABREEZES AND TOPOGRAPHY

The rising land to the East provides a natural obstacle to the seabreeze. However, the landscape is irregular and convergence along the valleys of the foothills can lead to the development of strong local seabreezes such as occur in the vicinity of Tarlee in the Gilbert Valley, about 50 km north of Gawler. Seabreezes in this area may be up to 70 percent stronger than at Gawler, on occasions. North of Tarlee the seabreeze rarely penetrates further inland than Riverton, or the escarpment between Blyth and Clare.

Ridge Lift and Topography Ridge Lift - Ridge lifts most likely when winds are perpendicular to the ridge in westerly and easterly wind regimes. The Adelaide University Gliding Club use the ridge just west of Lochiel, while the Kapunda Ridge is a useful source of lift for pilots returning to Gawler at the end of the soaring day. The Kapunda Ridge is often capped by small cumulus humilis cloud, while the surrounding air may be cloudfree. To the north, in the Burra-Black Springs area there are well-known ridges suitable for soaring.

The River Murray - To the east of Gawler, beyond the Barossa Valley, is the River Murray. In southerly wind situations, a pilot flying along the river will usually experience cool, sinking air. However, on hot days, near the end of the soaring day, the River Murray may provide very slight lift (<l metre per sec) or "no sink" conditions, enabling a pilot to fly a considerable distance with no loss of height. This is most likely under "blocking high" conditions, following several days of hot, but light NE winds, which allow the slow-flowing river to store heat. It should be noted that this area is known as the "Sunset Country," because the sun sets prematurely and abruptly, due to the proximity of the ranges to the west. Glider pilots should be aware of the danger of being able to fly in acceptable light in the air, while on the ground it may be absolutely dark, making landing extremely dangerous. Times of last remaining light should be greatly respected when flying near the River Murray as there is no twilight in South Australia, unlike in the Northern Hemisphere.

Virga Downdrafts and Microbursts - Hancy investigated many occurrences of downdrafts and Grace and Hancy reported on a microburst at Murray Bridge. Downdrafts of 8 metres per sec. have been measured, associated with altocumulus clouds, from which virga was observed. With cumulonimbus clouds with high bases of 3000 to 4000 metres, overlying a dry adiabatic layer downbursts or microbursts are possible, although they are much rarer events. (Grace & Hancy 1988).

Waves under Subsidence Inversions - "Cycling" - "Cycling" conditions are common under subsidence inversions in SW to SE airstreams. They are usually associated with "streeting." When cumulus clouds are present, their bases may tend to display marked tilting, rather than the more usual level horizontal orientation. With careful observations over time, using a stop-watch, it is possible to determine the periodicity of the wave motions. For inversion heights of 1200 to 1500 metres and wind speeds of 8 metres per sec, the wave-period is about 12 to 15 minutes. There are subtle differences in the characteristics of the thermals and cycling conditions of SW winds compared to SE winds:

1. With SW winds the "cycling" periodicity is often fairly regular, (assuming no troughs or fronts are evident).
2. With SE winds at Gawler, especially during the first hour or two of convection, the expected thermal strengths are seldom achieved at the launch site. This is because with SE winds, Gawler is in the lee of the Mt. Lofty Ranges, and the lee trough acts in opposition to the thermal activity. This conclusion may delay launching operations. Once the gliders have been launched and have started on task, the dampening effect may still exist, but is less pronounced and becomes a less serious threat than the approaching seabreeze. In southeasterly wind situations the seabreeze is likely to arrive earlier than normal.

The NE Katabatic Wind. - De-coupling and Re-coupling - During the morning, when a NE katabatic wind is present, the surface flow is de-coupled or separated from the upper flow. There is a danger of designating the take-off runway according to the katabatic wind. If the gradient wind is in opposition to the katabatic, there is the danger of having to change runways in the middle of a launch. To avoid this situation it is absolutely necessary to perform a local temperature sounding, with sufficient accuracy to determine the precise time of re-coupling of the surface layer to the gradient layer. This can be achieved with ease using a motorized glider, taking the temperature every 150 metres, and forecasting the time that re-coupling will occur. Time should be allowed to overcome cold air advectional replacement effects.

References.

Brooks B and Crookes 1990 Sea Front Winds near Adelaide. Bur. Of Met Adelaide S Australia.

Clarke R et al 1967 Climate of Australia and New Zealand. Gentilli Eilsevier press.

Grace W and Hancy MJ. 1988 Microburst at Murray Bridge Tech Soaring April XX OSTIV Congress

Hancy MJ. 1976 Assessment of Thermal Character istics in South Australia. XV OSTIV Congress Rayskala Finland.

Hacker, Joerg M. 1982 First results of boundary research flights with three powered gliders during the field experiment PUKK. Beitr.Phys. d.Atmos., 55, pp. 383402

Acknowledgements.

Thanks are given to "Wally" Wallington (now deceased), J.Kuettner and M.Reinhardt, without whose encouragement this small contribution would not have been possible.

Acknowledgement is also due to the Australian Bureau of Meteorology, Adelaide, for statistics provided and the institution with which for 34 years I have been employed; and to members of soaring clubs throughout South Australia, and especially those at Gawler.

SOUTH EAST SOUTH AUSTRALIA

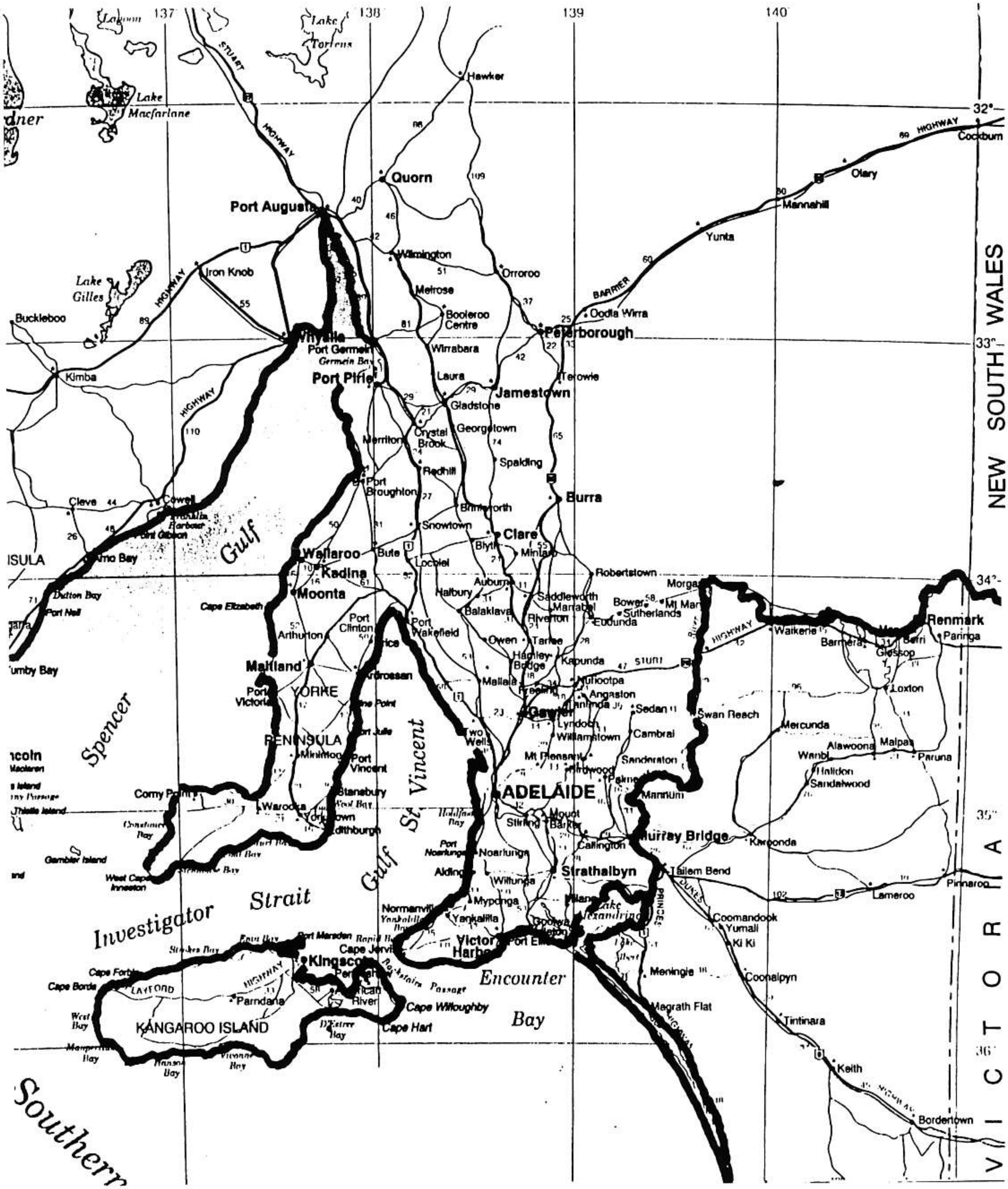

Figure 1.

Wind Roses using available data between 1972 and 1999 for

EDINBURGH RAAF

Site Number 023083 • Locality: EDINBURGH • Opened Jan. 1972 • Still Open
Latitude 34°42'15"S • Longitude 138°37'10"E • Elevation 18m

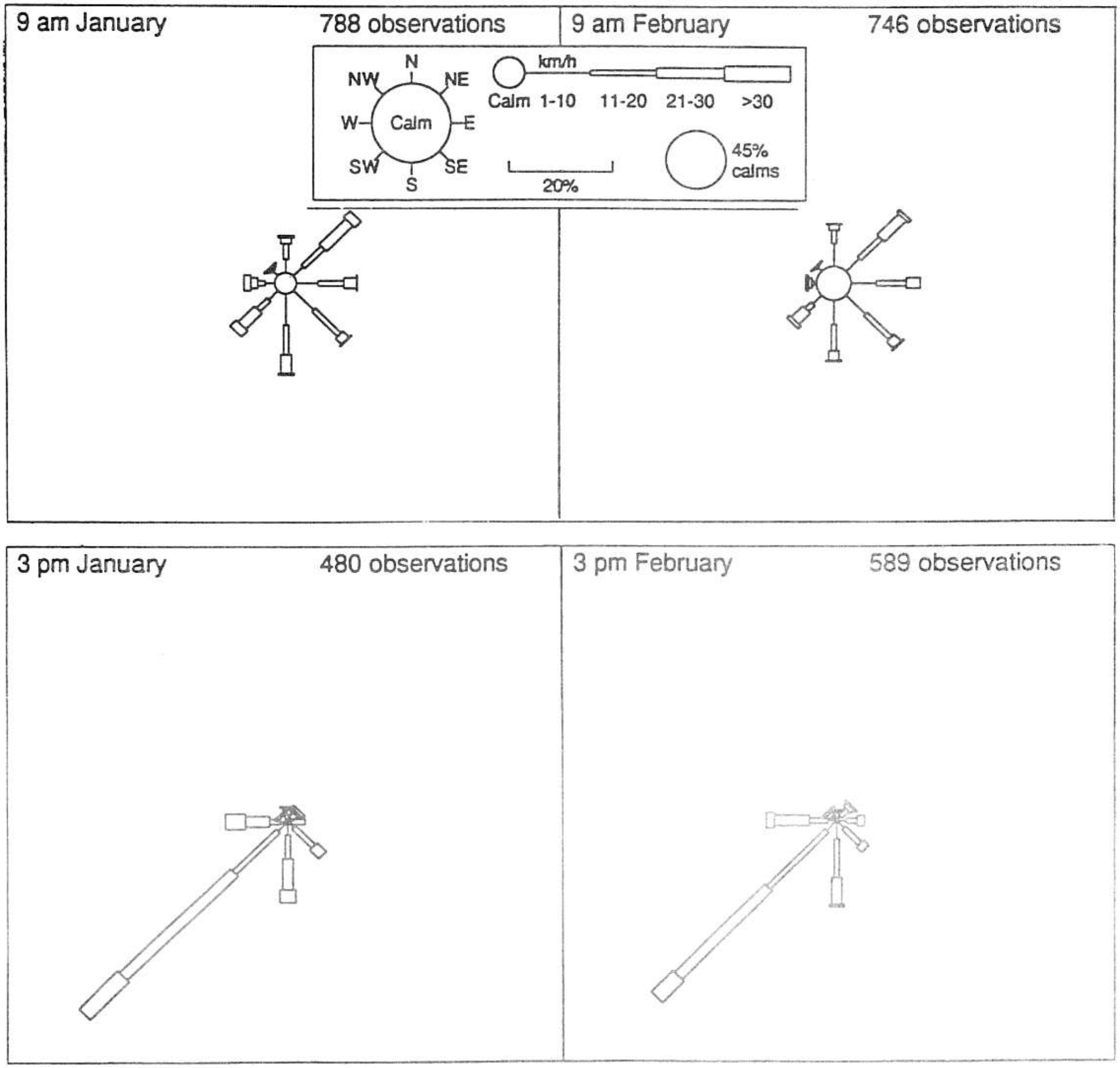

Figure 2.

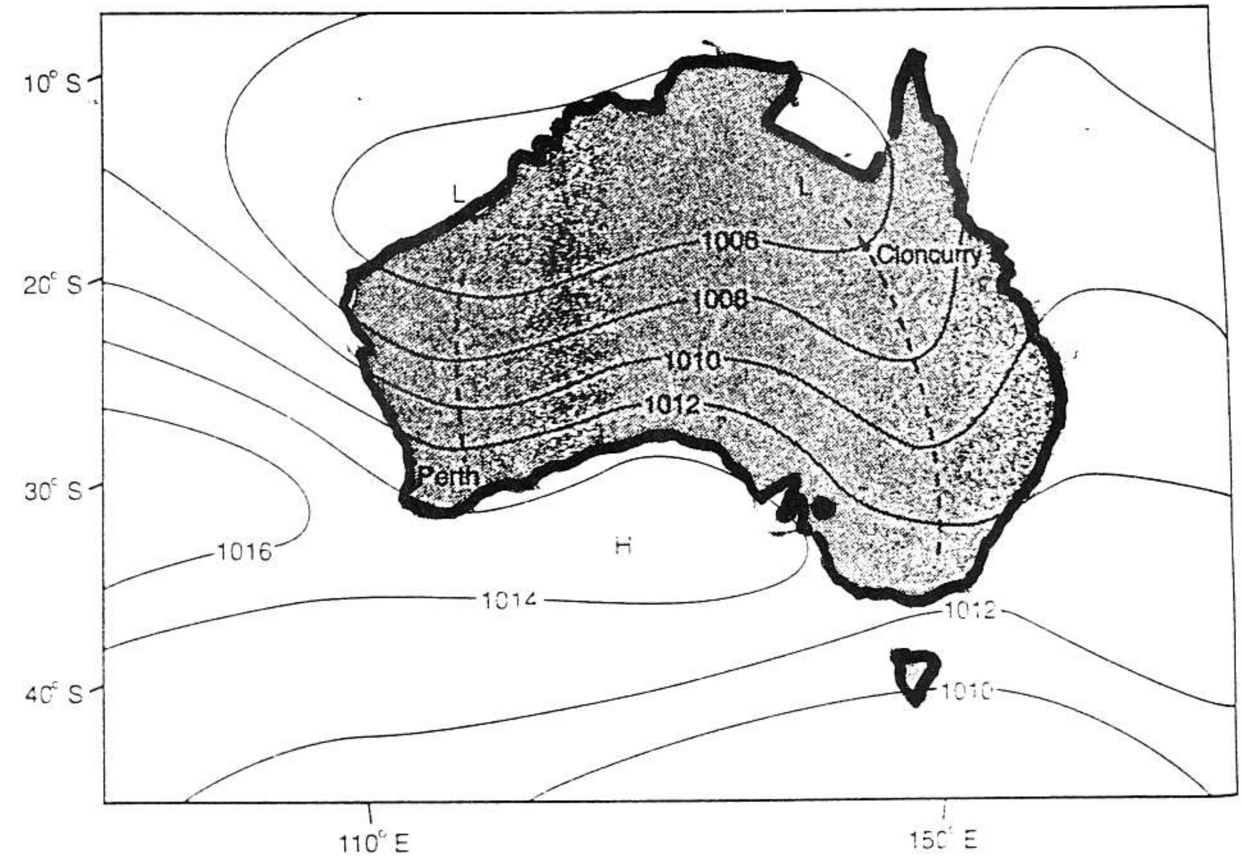

Figure 3. Ten-year average of the January 0000 UTC mean sea-level pressure field across Australia. The positions of the east and west coast troughs are indicated.

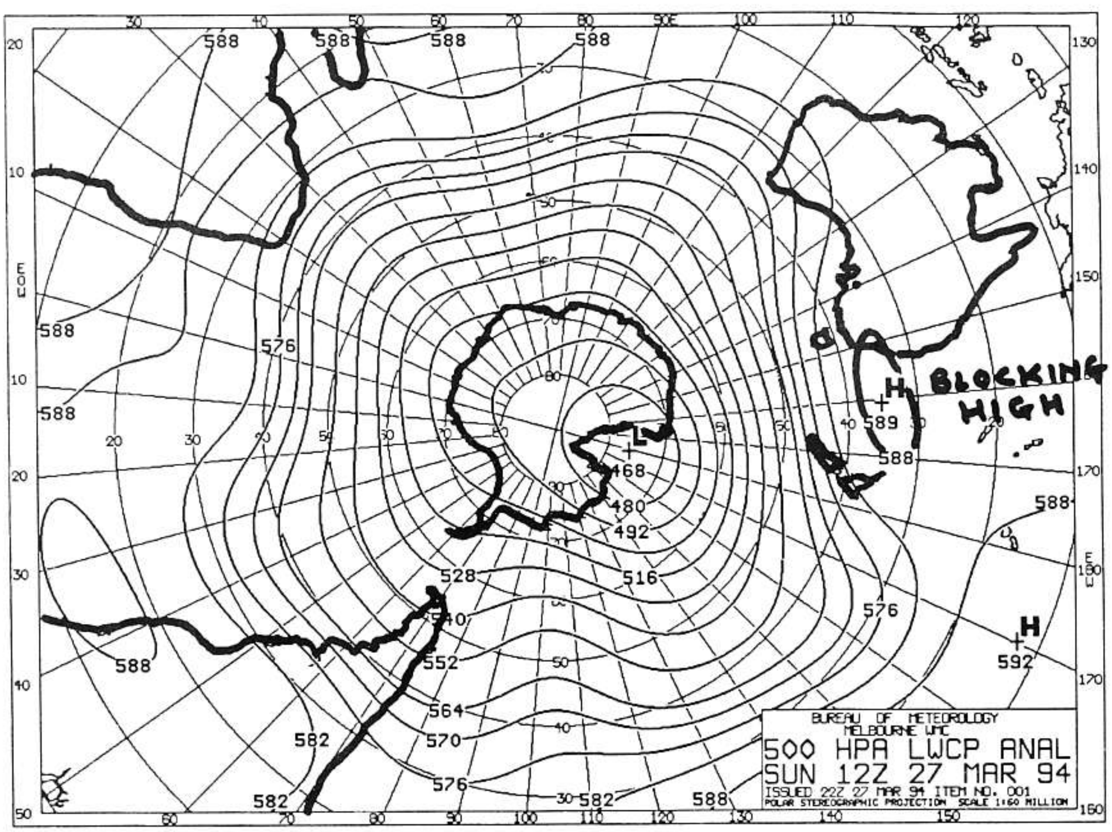

Figure 4

Some fundamental statistics - RAAF Edinburgh. (1972-1999)

Maximum temperature (C)	Jan.	Feb.
Mean	29.7	30.0
14th Percentile	23.2	23.8
86th Percentile	37.0	36.5
Extreme highest	46.2	44.6
Mean No. of days over 40 C	1.6	1.1
Mean No. of days over 35 C	5.9	5.4

Miminum temperature:	Jan.	Feb.
Mean	16.2	16.4
14th Percentile	12.0	12.5
86th Percentile	20.9	20.7
Extreme highest	7.2	7.1

Mean 9 am	21.8	21.5
Mean 3 pm	27.4	28.5
Mean 9 am Dew Point	10	11
Mean 3 pm Dew Point	9	10

Mean Rainfall	22.7	14.5
Median Rainfall	14.6	9.6
Rain Days	5	3

Table 1