SECTION B: THE LANDSCAPE

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3. Climate

The objective of this section is to provide a broad overview of the climate within the study area. It must be emphasised that the analysis is a 'broad bush' treatment and for some planning purposes, it may be necessary to analyse particular climatic elements in more detail.

The coverage of recording stations for rainfall is satisfactory, however climatological recording stations with sufficient records are sparse in the study area. It was therefore not practicable to produce maps for climatic elements other than rainfall. The selection of stations for figures and tables was based on data availability, length of record and ability to depict typical and extreme conditions. All climatic information provided is qualified by the number of years of record on which it is based.

General climatic influences and weather patterns

The dominant influences on the weather of the area are topography and the mean latitude of the anticyclone belt. Topographical features vary from lowlands less then 100 m in elevation in the north-west to highlands rising to over 1,500 m in the south-east. As temperature lapse rate is 0.5°C to 1.0°C per 100 m, there is a wide variation in temperature from lowlands to highlands. Rainfall is also greatly influenced by the topography with falls in the highlands more than double those of the lowlands.

The mean latitude of anticyclone tracks across Australia in summer corresponds roughly to the latitudes of the study area, implying that the large scale surface wind over the area in summer would be variable. In winter the larger scale mean wind direction is westerly due to the more northerly track of the anticyclones. On a local scale however, these wind directions are modified considerably by topographical influences.

Occasionally in winter or spring, an anticyclone develops a ridge of high pressure to southern waters and a depression simultaneously intensifies east of Tasmania. This causes cold air to be brought up rapidly over the study area, bringing windy, showery weather with occasional snow above 600 m and some hail.

On other occasions, when an anticyclone moves slowly over Victoria and Tasmania, a spell of fine weather with frost or fog may result. These spells may last as long as a week. When cyclones move into the Tasman Sea, where that sometimes stagnate for several days, winds tend north-east to northerly and sometimes increase in speed. This situation in summer results in heat wave conditions which persist until relieved by the west to south-west winds associated with the next oncoming depression.

The weather in the warmer months may occasionally be influenced by penetration of moist air of tropical origin. Although an infrequent event, this is responsible for some of the heaviest rainfalls.

Rainfall

Median annual rainfall depends mainly on elevation and ranges from less than 600 mm in the north-west to more than 1,700 mm in the far south-east. A map of median annual rainfall based on records from about 70 stations with at least 30 years of record is given in Figure 3.1. More rain falls in winter and spring than in the other seasons. This is illustrated in Figure 3.4 which is a bar chart of mean annual rainfall and raindays. The length of the bar for each element gives its value. Rainfall in summer is more variable than in winter and the higher potential evaporation of this season greatly reduces the effectiveness of the rainfall.

Rainfall intensity

The highest daily falls on record for stations with at least 30 years of record, are shown in Table A.1. Estimated short duration intensities for specified return periods are provided in Table A.2, for several pluvio-graph stations with at least 16 years of record.

Rainfall variability

It is not possible to give a complete description of rainfall without mentioning variability. Rainfall variability assumes major importance in some agricultural areas and is also important for water storage design. Annual rainfall variability may be obtained directly from Figures 3.1, 3.2 and 3.3 which are maps of the 50, 10 and 90 percentile of annual rainfall.

Raindays

The average annual number of raindays is generally correlated with the medium annual rainfall and varies from about 90 over the lower rainfall areas to a maximum of about 180 in the high rainfall areas of the study area. Figure 3.4 shows the monthly distribution of raindays for selected stations.

Temperatures

February and July respectively are generally the hottest and coldest months of the year. In February, the mean maximum temperature is approximately 29^{o}C over the lowland areas. Temperature at higher elevations can be estimated by applying a lapse rate of 0.5^{o}C to 1.0^{o}C per 100 m. Minimum temperatures over lowland areas in summer are of the order of 12^{o}C and the diurnal temperature range from about 17^{o}C.

In July, the mean maximum is approximately 13^{o}C for lowland stations and decreases as above for stations at higher elevations. The mean minimum is generally around 3^{o}C, but less at higher elevations. The winter diurnal range is about 10^{o}C. Lower valleys may experience relatively cold night time conditions due to cold air drainage from surrounding mountains.

The extreme maximum temperature in lowland areas in summer is about 48^{o}C, and in winter, temperatures as low as -10^{o}C are possible on the highlands. Figure 3.5 shows the distribution of mean monthly maximum and minimum temperature and diurnal temperature range for selected stations.

Wind

Wind direction is the most variable of the climatic elements in this area. In summer the surface prevailing wind direction due to the general atmospheric circulation is variable and in winter, it is westerly. However these directions may be greatly modified by local topography. This is demonstrated by Tables A.3(a) and A.3(b) which are wind speed versus direction frequency analyses for 9 a.m. and 3 p.m. for January and July.

Humidity

Mean monthly humidity is highest in June/July and lowest in January. In July, the mean 9 a.m. and 3 p.m. relative humidities are about 90 and 70 percent respectively, whilst in January they are about 60 and 40 percent respectively. Figure 3.6 gives the distribution of mean monthly 9 a.m. and 3 p.m. relative humidity for several stations in the study area.

Evaporation

Daily evaporation varies enormously from summer to winter. In January, the mean daily potential evaporation averages about 7.5 mm whilst in July 1 mm is a general figure. Measured evaporation is influenced to a large extent by wind sheltering and the proximity of water bodies or irrigation systems (Figure 3.7).

Cloud cover

In winter the prevailing westerly airstream with embedded low pressure systems and associated fronts, brings increased cloud cover to the area, averaging about six-eighths. This decreases in summer to about three to four-eighths. In summer the 3 p.m. cloud cover is generally greater than at 9 a.m. due to increased atmospheric instability and enhanced convection, but in winter there is no appreciable difference between the 9 a.m. and 3 p.m. cloud cover. The distribution of mean monthly 9 a.m. and 3 p.m. cloud cover for selected stations is given in Figure 3.8.

Sunshine duration

Mean daily sunshine duration varies from a maximum of about 8 hours in January to a minimum of approximately 2-3 hours in winter. Bar charts of the monthly distribution of mean daily sunshine hours are provided in Figure 3.9 for several stations.

Radiation

The Bureau network for this element is very sparse. However, because it is dependent to a large extent on latitude, reasonable interpolations may be made from stations in neighbouring areas. Table A.4 shows the monthly distribution of mean daily radiation totals for some stations in surrounding regions.

Phenomena

A summary of the main types of phenomena which occur in the study area, namely fog, frost and thunderstorms, is provided in Table A.5. Hail occurs mainly in the winter/spring period and is generally limited to the higher elevation areas. It is not a common occurrence in these areas, perhaps only 1 day per month for the winter/spring period. Snow is rare below 600 m and occurs on the average up to several days per month in the winter and spring seasons above this level.

Further Reading

The following list details some information pertinent to the climate of the study area which is presently held by the National Climate Centre Library in Melbourne.

Climatic Averages; Australia Metric Edition. Melbourne Bureau of Meteorology 1975

The Upper Goulburn Region Resources Survey (1951). Central Planning Authority and The Upper Goulburn Regional Committee. Victorian Government Printer, Melbourne.

Victoria Year Book (1982). No. 96 Melbourne. Australian Bureau of Statistics, Victorian Office.

WMO Guide to Climatological Practices (1983). World Meteorological Organisation. 2nd Ed. Geneva, Switzerland.

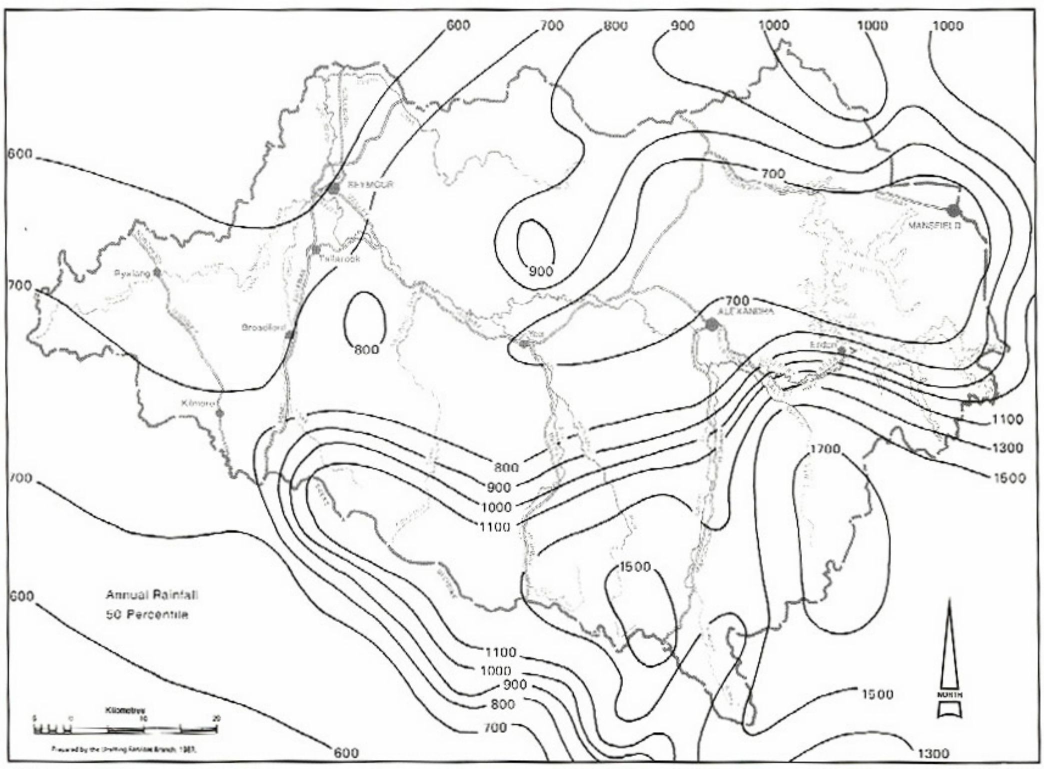

Figure 3.1 Rainfall isohyets for the median, 50 percentile of annual rainfall for the study area.

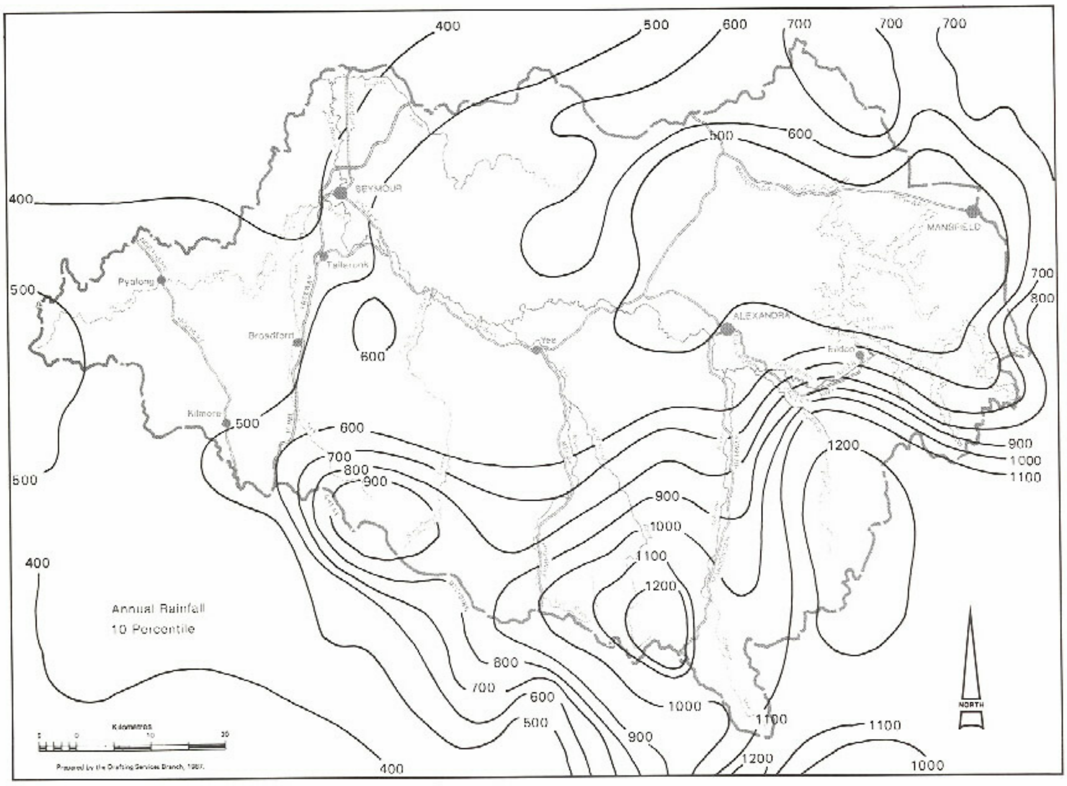

Figure 3.2 Rainfall isohyets for the 10 percentile annual rainfall for the study area.

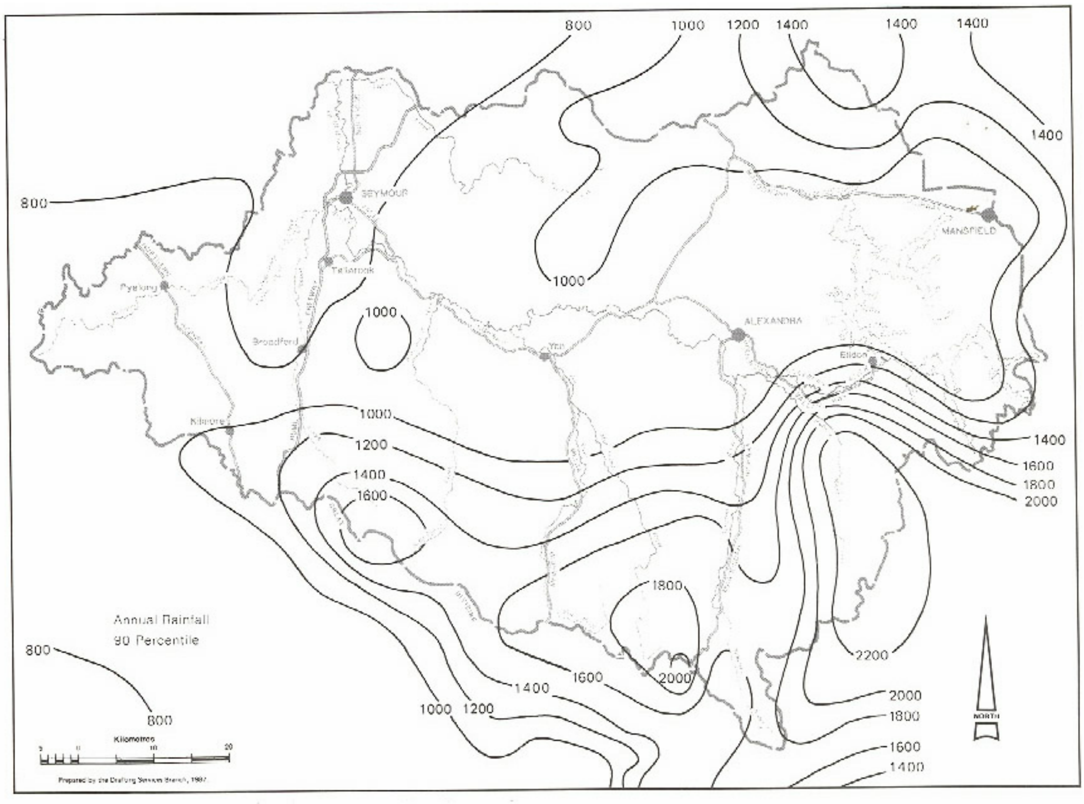

Figure 3.3 Rainfall isohyets for the 90 percentile of annual rainfall for the study area.

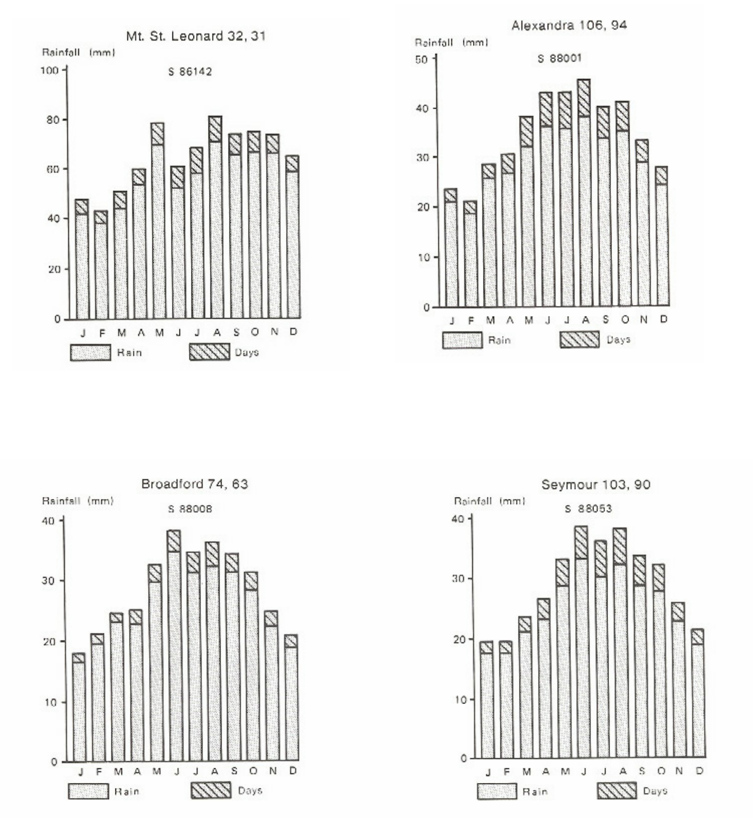

Figure 3.4 Monthly distribution of rain days for selected stations.

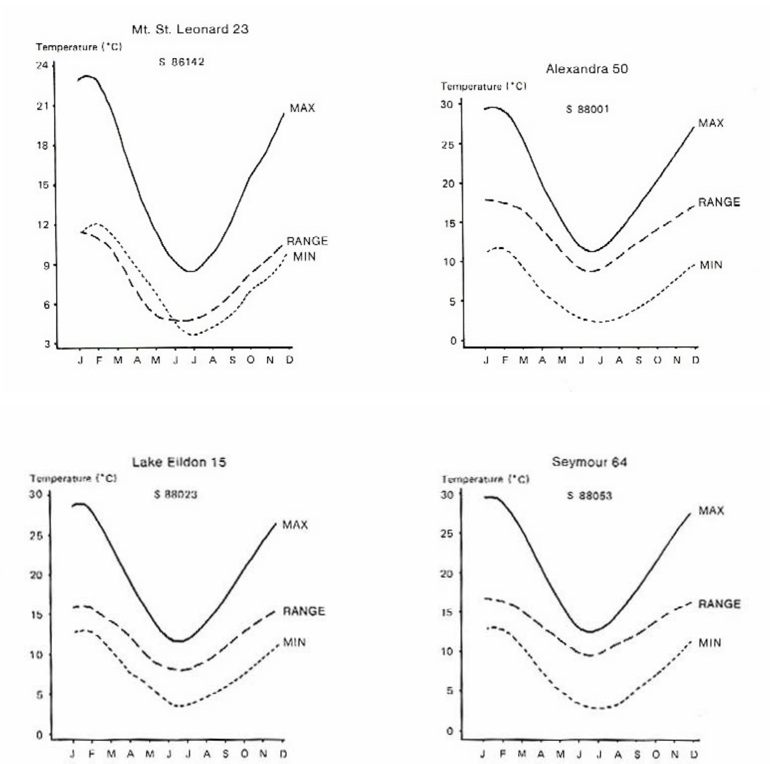

Figure 3.5 Distribution of mean monthly maximum and minimum temperature and diurnal temperature range for selected stations.

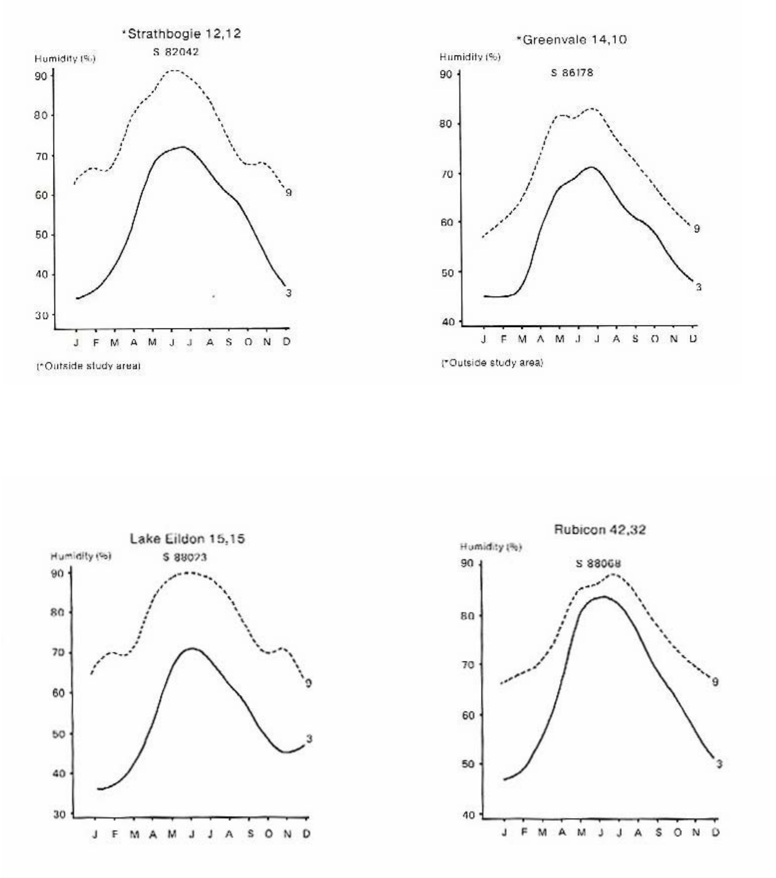

Figure 3.6 Distribution of mean monthly 9am and 3pm relative humidity for selected stations.

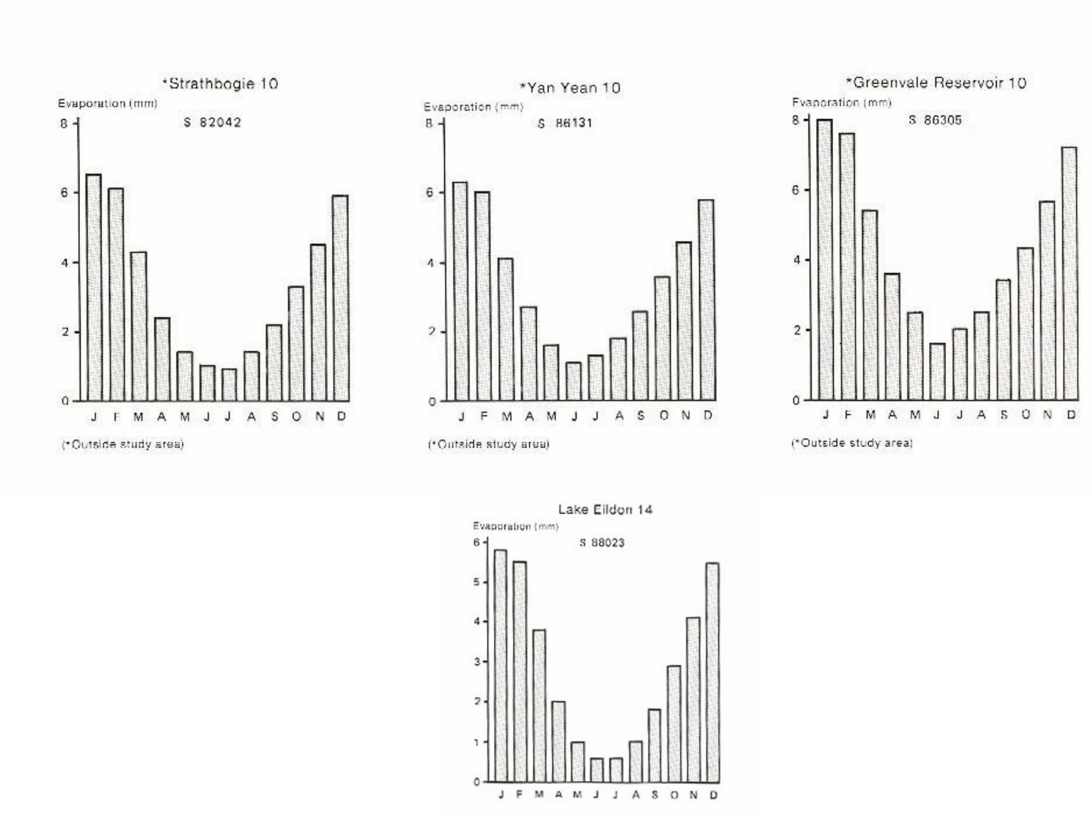

Figure 3.7 Monthly distribution of measured evaporation for selected stations.

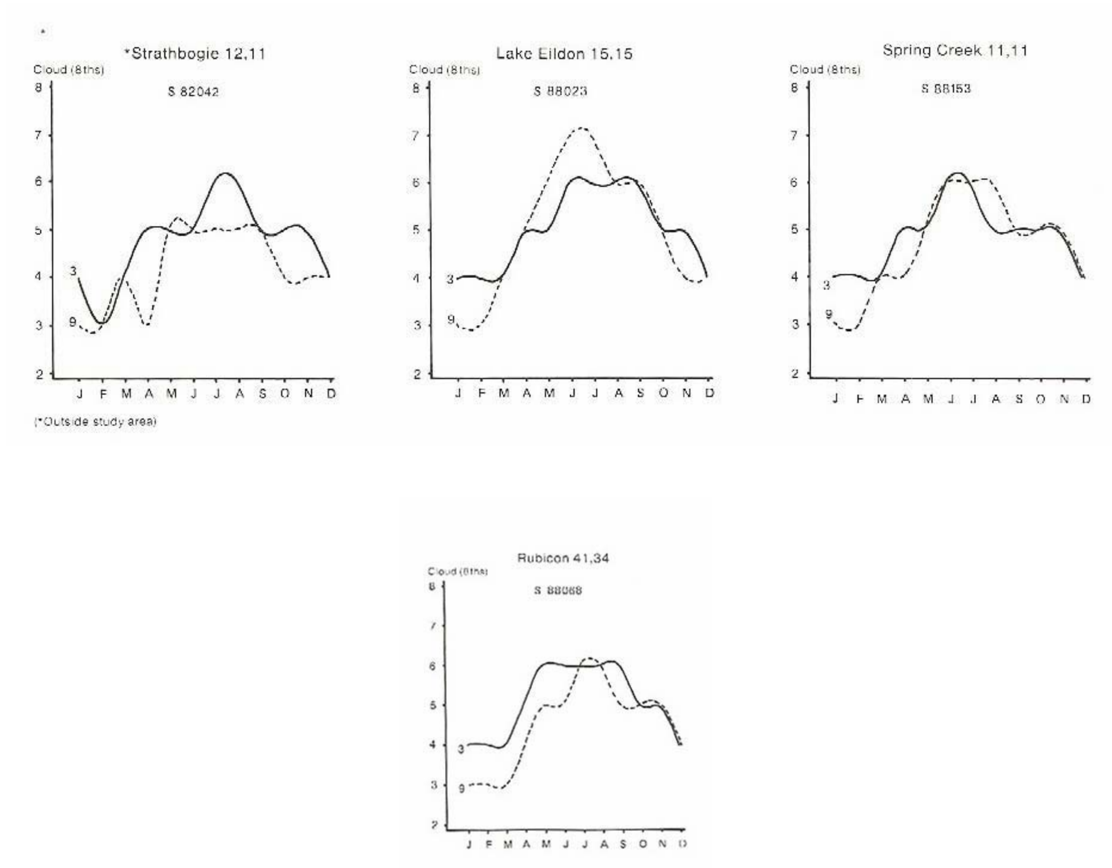

Figure 3.8 Distribution of mean monthly 9am and 3pm cloud cover for selected stations.

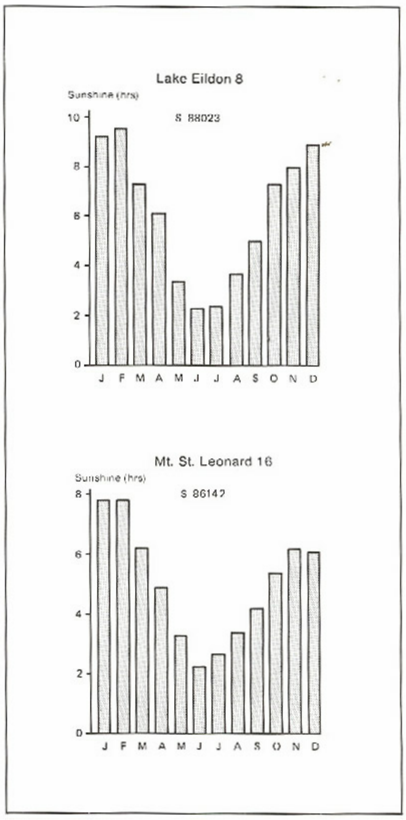

Figure 3.9 Bar charts of the monthly distribution of mean daily sunshine hours for selected stations.

Tables and data associated with this chapter may be found in Appendix A.