# 3

# CLIMATE

## CLIMATE IN VICTORIA

### General conditions

Victoria experiences a wide range of climatic conditions ranging from the hot summer of the Mallee to the winter blizzards of the snow covered Alps, and from the relatively dry wheat belt to the wet eastern elevated areas where many of Victoria's permanent streams spring.

*Circulation patterns affecting Victoria*

The predominating pattern which affects Victoria is an irregular succession of depressions and anticyclones. Although these systems generally move from west to east, this is not always the case. Systems can develop or degenerate *in situ*. Their speed of movement can vary considerably. They can remain quasi-stationary for even a week or more at a time.

The mean tracks of the depressions and anticyclones show a marked annual variation across the Australian region. In winter, due to the cold continent, anticyclones are centred over inland Australia, and a series of depressions over southern waters provide a persistent zonal flow across southern parts of the continent. However, on occasions when an anticyclone develops a ridge to southern waters and a depression intensifies east of Tasmania, a "cold outbreak" occurs. This brings cold and relatively dry air from southern waters rapidly across Victoria, giving windy, showery weather with some hail and snow. On other occasions, when an anticyclone moves slowly over Victoria, a prolonged spell of fine weather with frost and fog results.

During the spring the average track of depressions and anticyclones shifts further south until in summer the average position for anticyclones is south of the continent. At this time of the year the troposphere is warmer, and therefore can hold more moisture. For this reason, rainfall during the summer months tends to be heavier. However, lifting agents in the form of cold fronts are weaker and are not as frequent as the succession of fronts that pass in winter and spring, and so rain days are less frequent in summer.

Heat-wave conditions, which usually last between two and three days, and occasionally longer, are not infrequent in summer when a large anticyclone remains quasi-stationary over the Tasman Sea. Dry air from the hot interior of the continent is brought over south-eastern Australia, and

hot gusty northerly winds strengthen with the approach of a southerly change. These changes vary in intensity and while some are dry, others may produce rain and thunderstorms.

During the autumn, the mean track of the anticyclones moves northwards and extremes of temperature become less frequent as the season progresses.

The circulation pattern at the surface does not always bear the same relation to the weather pattern. Rainfall may be produced by a depression in the upper atmosphere without any indication at the surface. One of the greatest State-wide rain producing systems is a weak surface depression, centred over the State and extending upwards in the atmosphere to 6,000 metres and more. On occasions, the surface depression is not a closed system, but a trough extending south from northern Australia. This situation is more common in the summer months and when preceded by an extensive flow of moist humid air over Victoria from the Tasman Sea, very heavy rainfall can result.

The heaviest rainfall in east Gippsland is produced by intense depressions to the east of Bass Strait. These may have come from the west and intensified in this area, or alternatively may have developed to the east of New South Wales or further north, and moved southwards along the coast.

The distribution of the average annual rainfall in Victoria is shown on the map on page 71.

### *Rainfall*

Rainfall exhibits a wide variation across the State and although not markedly seasonal, most parts receive a slight maximum in the winter or spring months. The relatively dry summer season is a period of evaporation, which greatly reduces the effectiveness of the rainfall. Average annual totals range between 250 mm for the driest parts of the Mallee to over 1,500 mm for parts of the North-Eastern Highlands. An annual total exceeding 3,500 mm has been reported from Falls Creek in the north-east; however, with the sparse population and inaccessibility of the highland localities, it is not practicable to obtain a representative set of observations from this area. Most areas south of the Divide receive an annual rainfall above 600 mm, with over 1,000 mm on the Central Highlands, Otway Ranges, and southern Gippsland. The wheat belt receives chiefly between 300 and 500 mm. With the exception of Gippsland, 60 to 65 per cent of the rain falls during the period May to October. This proportion decreases towards the east, until over Gippsland the distribution is fairly uniform with a warm season maximum in the far east. All parts of the State have on rare occasions been subjected to intense falls, and monthly totals exceeding three times the average have been recorded. Monthly totals exceeding 250 mm have been recorded rarely at most places on and south of the Divide, the chief exception being over the lowlands extending from Melbourne to the central Western District. Occurrences are more frequent, but still unusual, over the north-east and east Gippsland and isolated parts such as the Otways. This event has rarely been recorded over the north-west of the State. The highest monthly total ever recorded in the State was a fall of 891 mm at Tanybryn in the Otway district in June 1952.

The average annual number of wet days (0.2 mm or more in 24 hours) is over 150 on the west coast and west Gippsland, and exceeds

200 over the Otway Ranges. The average number of wet days a year is reduced to 100 at a distance of approximately one hundred miles inland from the coast.

An estimate of the area, distribution of average annual rainfall, and the actual distribution of rainfall in Victoria as shown by area for the years 1969 to 1973 is given in the following table :

VICTORIA—DISTRIBUTION OF AVERAGE AND ANNUAL RAINFALL

| Rainfall (mm) | Area ('000 sq km) (*a*) | | | | | |
|---|---|---|---|---|---|---|
| | Average | 1969 | 1970 | 1971 | 1972 | 1973 |
| Under 300 | 18.4 | .. | 8.8 | 9.6 | 55.2 | .. |
| 300–400 | 36.5 | 45.2 | 36.7 | 23.6 | 38.5 | .. |
| 400–500 | 27.5 | 42.4 | 29.6 | 30.0 | 35.0 | .. |
| 500–600 | 34.9 | 34.8 | 18.2 | 24.6 | 40.7 | 22.6 |
| 600–800 | 52.3 | 37.8 | 35.8 | 50.0 | 40.9 | 76.2 |
| 800–1,000 | 29.0 | 37.2 | 38.2 | 47.1 | 12.9 | 65.2 |
| Over 1,000 | 29.0 | 30.2 | 60.3 | 42.7 | 4.4 | 63.6 |

(*a*) Total area of the State is 227,620 sq km.

*District rainfall*

*Mallee and Northern Country*

These districts receive very little rain from western cold fronts, and rain is usually brought by depressions moving inland, " upper lows ", and thunderstorms. The amount received is highly variable from year to year. The average rainfall is fairly even through the year, except near the northern edge of the ranges where more rain falls in winter than in summer.

*Wimmera*

Rainfall in this district is more reliable than further to the north, as cold fronts bring showers, particularly in winter. The average rainfall shows a slight maximum in the winter months. This district includes part of the Grampians, which receive much higher rainfall than the plains.

*Western and Central Districts*

Rain may fall in these districts in a variety of situations and they have the most reliable rainfall in the State. Most rain comes with the westerly winds and cold fronts that predominate in winter and the average rainfall shows a winter maximum which is most marked along the west coast. The heaviest rain falls on the Otways, the Dandenongs, and the Upper Yarra valley, while the plain to the west and south-west of Melbourne has relatively low rainfall due to the " rain shadow " of the Otway Ranges.

*North Central*

Most of this district consists of elevated country surrounding the Dividing Range and rainfall is heaviest on the higher parts, particularly towards the east. There is a well marked winter maximum in the yearly rainfall distribution.

*North-Eastern*

The greater part of this district consists of ranges, some mountains being 1,800 metres in elevation, and rainfall on this higher country is generally

heavy. The higher peaks lie under snow cover for most of the winter. A marked " rain shadow " area is evident near Omeo, which receives only half as much rain as the highlands to the north-west or north-east.

*West Gippsland*

The western part of this district has a very similar rainfall régime to the Western and Central Districts. The heaviest rain falls on the ranges of the Divide and the south Gippsland hills. Towards the east, however, a " rain shadow " is evident in the Sale–Maffra area. This eastern section receives some of its rain from east coast depressions.

*East Gippsland*

Depressions off the east coast bring most rain to this district, and such rainfall can be very heavy. The average rainfall shows a summer maximum. Fronts moving in a westerly stream bring very little rain, and with north-westerly winds in winter, the coastal section has the mildest weather in the State. " Rain shadows " are evident along the valleys of the Mitchell, Tambo, and Snowy Rivers, while the heaviest rain falls on the surrounding highlands.

VICTORIA—RAINFALL IN DISTRICTS
(mm)

| Year | District | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Mallee | Wimmera | Northern | North Central | North-Eastern | Western | Central | Gippsland |
| 1964 | 410 | 636 | 532 | 874 | 1,023 | 983 | 899 | 965 |
| 1965 | 299 | 387 | 390 | 656 | 655 | 627 | 637 | 668 |
| 1966 | 317 | 418 | 515 | 812 | 1,048 | 746 | 815 | 990 |
| 1967 | 130 | 221 | 240 | 408 | 448 | 417 | 434 | 593 |
| 1968 | 348 | 500 | 532 | 880 | 1,004 | 852 | 733 | 865 |
| 1969 | 408 | 443 | 481 | 690 | 878 | 679 | 664 | 915 |
| 1970 | 367 | 474 | 515 | 843 | 993 | 857 | 937 | 1,122 |
| 1971 | 384 | 568 | 529 | 891 | 888 | 905 | 849 | 872 |
| 1972 | 261 | 365 | 331 | 576 | 522 | 600 | 564 | 601 |
| 1973 | 634 | 764 | 905 | 1,144 | 1,307 | 856 | 933 | 908 |
| Average (*a*) | 327 | 458 | 468 | 709 | 862 | 724 | 741 | 856 |

(*a*) Average for 60 years 1913 to 1972.

### *Rainfall reliability*

It is not possible to give a complete description of rainfall at a place or in a district by using a single measurement. The common practice of quoting the annual average rainfall alone is quite inadequate in that it does not convey any idea of the extent of the variability likely to be encountered. Examination of rainfall figures over a period of years for any particular place indicates a wide variation from the average ; in fact, it is rare for any station to record the average rainfall in any particular year. Thus for a more complete picture of annual rainfall the variability or deviation from the average should be considered in conjunction with the average.

Rainfall variability assumes major importance in some agricultural areas. Even though the average rainfall may suggest a reasonable margin of safety for the growing of certain crops, this figure may be based on a

few years of heavy rainfall combined with a larger number of years having rainfall below minimum requirements. Variability of rainfall is also important for water storage design, as a large number of relatively dry years would not be completely compensated by a few exceptionally wet years when surplus water could not be stored.

Although variability would give some indication of expected departures from normal over a number of years, variability cannot be presented as simply as average rainfall.

Several expressions may be used to measure variability, each of which may have a different magnitude. The simplest measure of variability is the range, i.e., the difference between the highest and lowest annual amounts recorded in a series of years. Annual rainfall in Victoria is assumed to have a " normal " statistical distribution. These distributions can be described fully by the average and the standard deviation. To compare one distribution with the other, the coefficient of variation $\left(\frac{\text{standard deviation}}{\text{the average}} \times 100\right)$ has been used. The coefficient of variation has been calculated for the fifteen climatic districts of Victoria (see fig. 5) for the 60 years 1913 to 1972 and the results are tabulated below in order of rainfall reliability :

VICTORIA—ANNUAL RAINFALL VARIATION

| District | Average annual rainfall (*a*) | Standard deviation | Coefficient of variation |
|---|---|---|---|
| | mm | mm | per cent |
| 1 West Gippsland | 915 | 144 | 15.7 |
| 2 West Coast | 773 | 127 | 16.4 |
| 3 East Central | 885 | 150 | 16.9 |
| 4 Western Plains | 630 | 113 | 17.9 |
| 5 East Gippsland | 767 | 144 | 18.8 |
| 6 West Central | 607 | 119 | 19.6 |
| 7 Wimmera South | 493 | 99 | 20.1 |
| 8 Wimmera North | 407 | 88 | 21.6 |
| 9 North Central | 709 | 157 | 22.1 |
| 10 Upper North | 508 | 119 | 23.4 |
| 11 Upper North-east | 1,106 | 268 | 24.2 |
| 12 Lower North-east | 766 | 187 | 24.4 |
| 13 Mallee South | 348 | 89 | 25.6 |
| 14 Lower North | 423 | 116 | 27.4 |
| 15 Mallee North | 299 | 85 | 28.4 |

(*a*) Average for 60 years 1913 to 1972.

The higher the value of the coefficient of variation of the rainfall of a district, the greater the departure from the average and hence the more unreliable the rainfall.

### *Droughts*

The variability of annual rainfall is closely associated with the incidence of drought. Droughts are rare over areas of low rainfall variability and more common in areas where this index is high.

Since records have been taken, there have been numerous dry spells in various parts of Victoria, most of them of little consequence but some widespread and long enough to be classified as droughts. The severity of

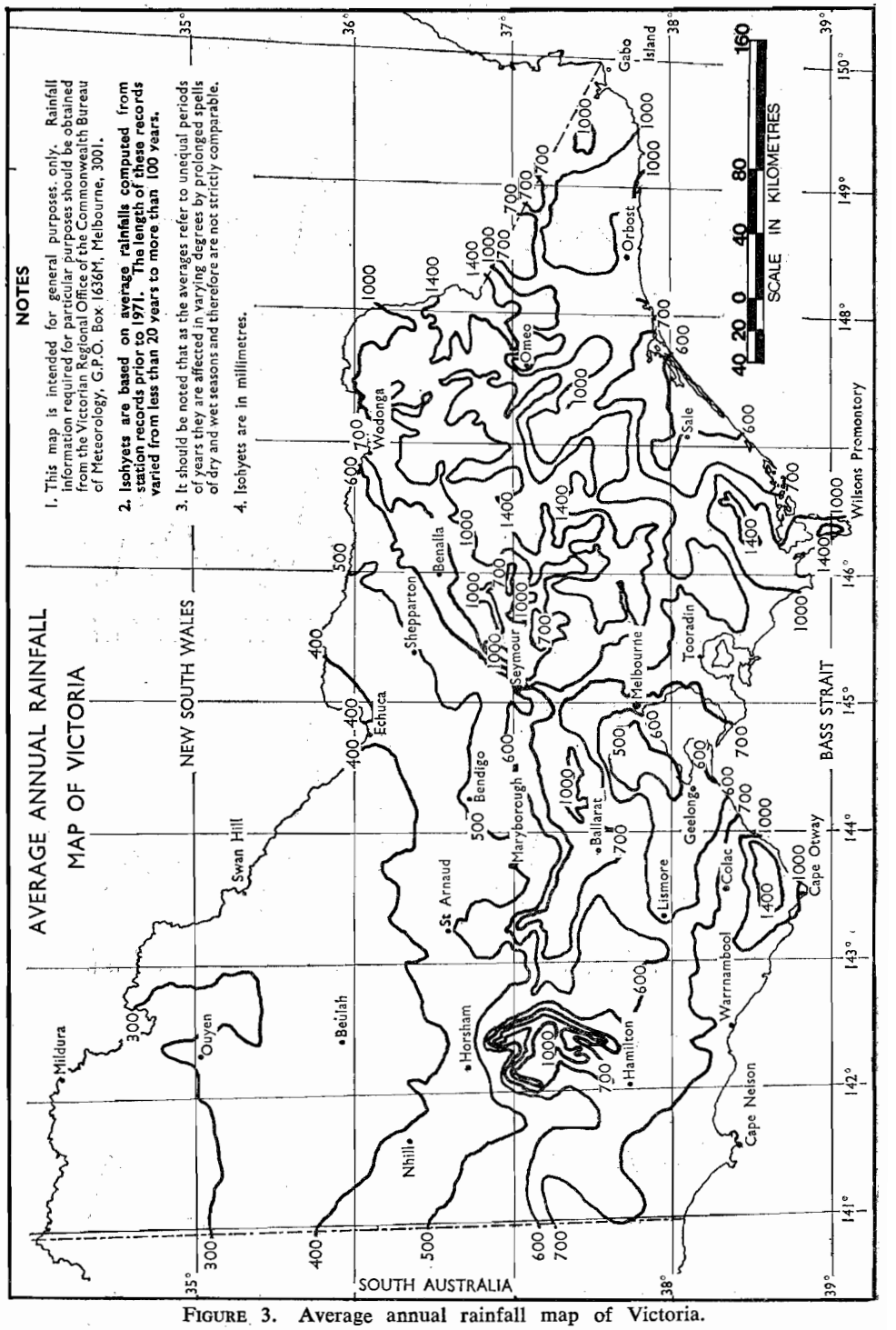


FIGURE 3. Average annual rainfall map of Victoria.

## VICTORIA—DISTRICT MONTHLY RAINFALL: AVERAGE AND 1973

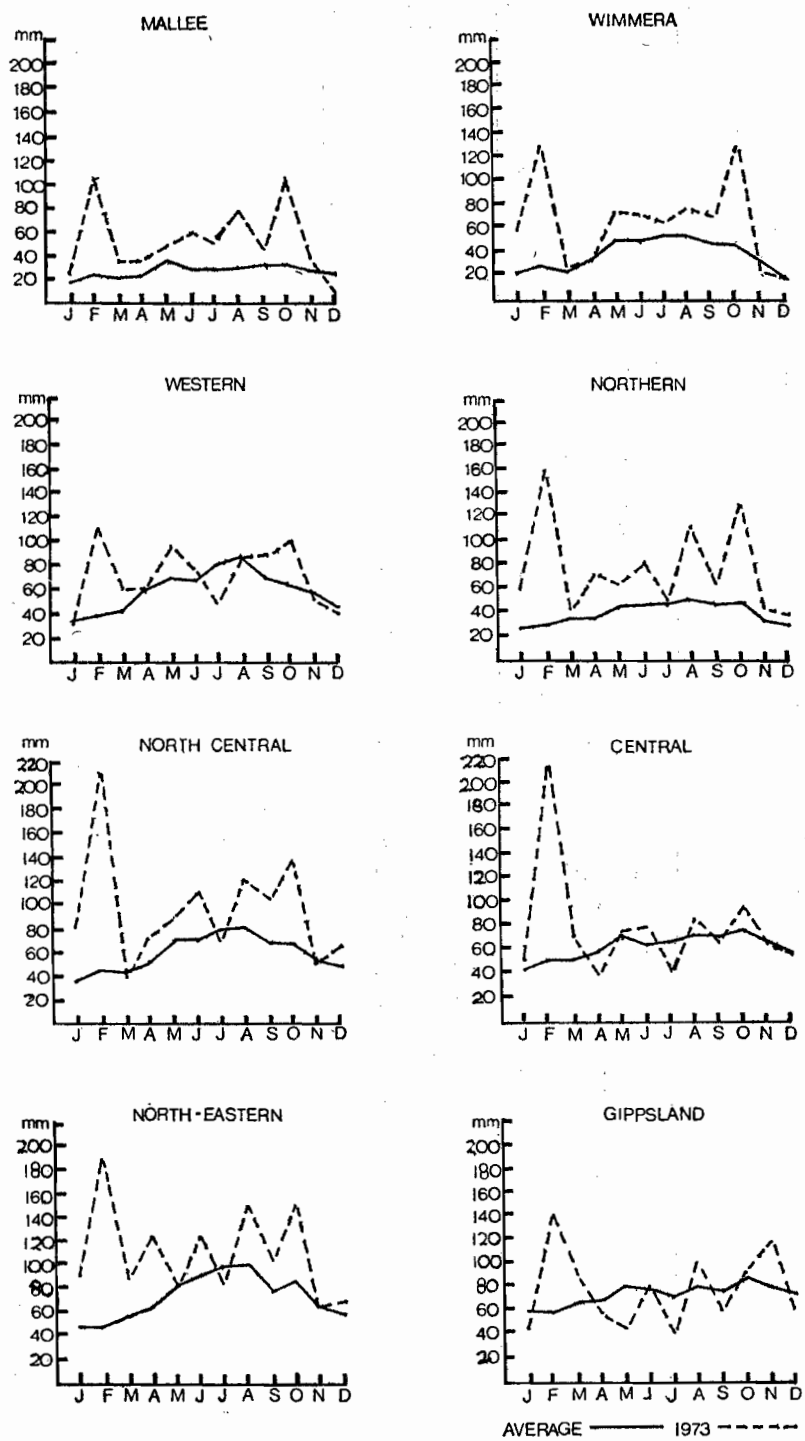


FIGURE 4.

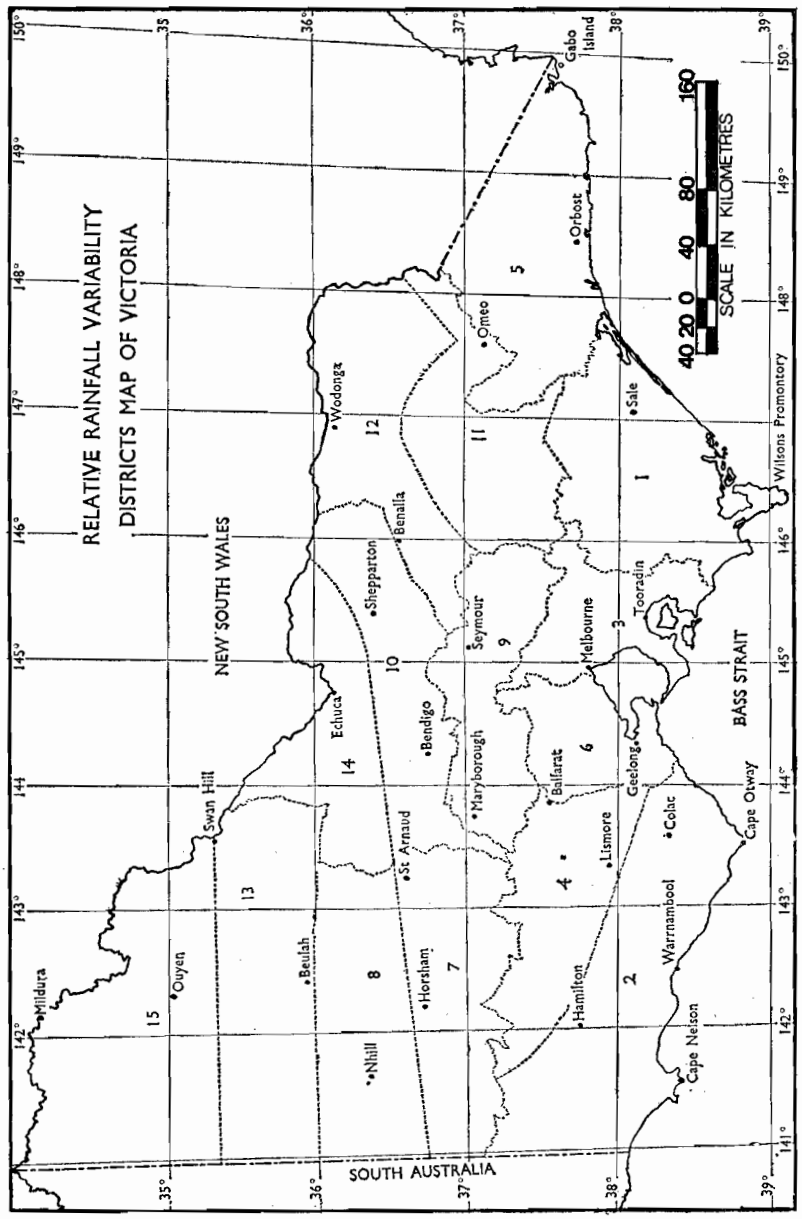


FIGURE 5. Relative rainfall variability districts. Names of climatic districts are shown in the table on page 70.

major droughts or dry spells is much lower in Gippsland and the Western District than in northern Victoria.

The earliest references to drought in Victoria appear to date from 1865 when a major drought occurred in northern Victoria, and predominantly dry conditions prevailed in the Central District. Another dry spell of lesser intensity occurred in 1868.

The most severe and widespread drought recorded since European settlement in Australia occurred in the period 1897 to 1902. Victoria was most affected in the south in 1897–98 and in the north in 1902.

The next major drought commenced about June 1913 and continued until April 1915 in the north and west and until August 1916 in Gippsland. The worst period was from May to October 1914.

Droughts of shorter duration and lower intensity occurred in 1877, 1888, in 1907–08 in Gippsland, and in the 1920s, particularly in 1925, 1927, and 1929.

The period from 1937 to 1945 was marked by three major droughts. The first commenced in February 1937 and continued with a break in the succeeding spring and summer until January 1939, the effects being felt much more severely in northern districts than elsewhere. Good rains in 1939 were followed by another dry period from December 1939 to December 1940. The third drought of the period extended from 1943 to 1945 in which the worst period was from June to October 1944. The drought from 1967 to 1968 is described on pages 53 and 67 of the *Victorian Year Book* 1969 and other effects noted on pages 309–12 of the *Victorian Year Book* 1970.

Drought prevailed in east Gippsland in 1971. In 1972 this drought extended westwards to affect most parts of the State by the end of the year, before breaking with heavy rain in February 1973. The following article contains detailed information on this drought.

*Drought of 1971 to 1973*

The worst effects of the drought of 1971 to 1973 were felt in the area of Gippsland from Yarram to Bruthen and north along the Tambo valley to Swifts Creek. In the Bairnsdale area stock numbers were greatly reduced as a consequence, with the number of beef cattle falling by 70 per cent and of sheep by 40 per cent, while dairy production almost ceased on non-irrigated land. Elsewhere in the State, this drought was not to be compared in length or severity with that of 1967.

Following very heavy rain in January and February 1971, when the Macalister, Avon, and Snowy Rivers reached near-record levels, dry weather prevailed in East Gippsland for the following eight months. The rainfall total for the three winter months of June, July, and August was the lowest on record at Sale, Maffra, and Bairnsdale, and less than half the normal level at most other places in eastern Gippsland. However, this area shared in the very heavy rain which fell over most of Victoria early in November 1971.

The summer of 1971–72 in Victoria was wet with frequent widespread rain and thunderstorms, although falls were not so heavy in west and south Gippsland where summer rainfall was about average. After the first two days of March, the weather became very dry. June rainfall in 1972

was the lowest on record in the La Trobe valley, Yarra valley, Mornington Peninsula, and the Upper Murray. In South Gippsland, a number of places experienced their driest January to June period on record, and other parts further east in Gippsland received less than half their normal rainfall for the first half of the year.

Substantial rain fell in July in South Gippsland and in the south-west of the State, but it was dry in East Gippsland and the north-west. At Bairnsdale and Orbost it was the driest July on record. In the eleven weeks from 22 May to 5 August only 13 mm fell at Bairnsdale, and less than 20 mm over the area from Sale to Lakes Entrance and north to Ensay. In this area, rainfall for the five months March to July inclusive was less than one third of normal.

Rain fell on several occasions during August, and totals for the month were above average in the north and east. However, cumulative totals since March were now well below average at many places. The rainfall in Melbourne for the six months March to August was the lowest on record and the dry weather continued in September and October 1972. September rainfall was the lowest on record in the Ballarat–Willaura area. Unusually warm weather occurred during September and a large number of bushfires broke out in East Gippsland. The first restrictions on the use of water in the Melbourne metropolitan area were imposed on 19 October 1972.

Substantial rain fell east of Bairnsdale at the end of November and total rainfall for that month was fairly close to average over much of the State. However, very dry weather prevailed in December. Over a large area of southern and north-eastern Victoria it was the driest December on record, many places receiving no rain at all, and there was some unusually hot weather in the middle of the month. By the end of December, some paddocks in East Gippsland and northern districts were completely bare.

Dry weather continued until the night of 12 January 1973 when rain fell throughout the State, with very heavy falls in the Castlemaine area. Following hot weather in the second half of January, heavy rain fell at the end of the month, particularly in the Wimmera. On 5 February exceptionally heavy rain began in almost all of Victoria and by the middle of the month Victorians were treated to the rare sight, for late summer, of green fields and meadows. All this was due to a rare meteorological event—a tropical cyclone which remained alive over the continent of Australia. The south-west and East Gippsland missed the exceptionally heavy rain of February, but rain in this and subsequent months was sufficient for a renewal of growth in pastures.

Readers should refer to the publication *Droughts in Australia,* Bulletin No. 43 of the Bureau of Meteorology, published in 1957, for a definitive treatment of the subject of droughts in Victoria.

### *Floods*

Floods have occurred in all districts, but they are more frequent in the wetter parts of the State such as the north-east and Gippsland. However, although a rarer event over the north-west lowlands, they may result from less intense rainfall and continue longer because of the poor drainage in this section of the State. In many instances the frequency of flooding is increased by valley contours and damage is often greater because of the higher density of adjacent property and crops.

## VICTORIA—MEANS OF CLIMATIC ELEMENTS: SELECTED VICTORIAN TOWNS

| | Locality | Legend (a) | Years of record | January | February | March | April | May | June | July | August | Sept. | October | Nov. | Dec. | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MALLEE | Mildura | 1 | 27 | 19 | 25 | 25 | 18 | 28 | 23 | 26 | 29 | 26 | 30 | 25 | 20 | 294 |
| | | 2 | 27 | 32.1 | 30.8 | 28.1 | 23.4 | 18.7 | 16.0 | 15.2 | 17.0 | 20.2 | 23.6 | 26.9 | 29.7 | 23.5 |
| | | 3 | 27 | 16.7 | 16.3 | 13.8 | 10.3 | 7.4 | 5.3 | 4.4 | 5.3 | 7.3 | 9.8 | 12.1 | 14.6 | 10.3 |
| | Swan Hill | 1 | 89 | 21 | 24 | 24 | 25 | 34 | 36 | 31 | 35 | 31 | 34 | 26 | 24 | 345 |
| | | 2 | 73 | 31.5 | 31.1 | 27.8 | 22.8 | 18.2 | 14.8 | 14.3 | 16.2 | 19.4 | 22.9 | 26.8 | 29.9 | 22.9 |
| | | 3 | 67 | 15.3 | 15.3 | 12.8 | 9.6 | 6.7 | 4.7 | 4.0 | 4.8 | 6.5 | 8.8 | 11.5 | 13.8 | 9.6 |
| WIMMERA | Horsham | 1 | 100 | 22 | 27 | 25 | 34 | 47 | 51 | 45 | 48 | 45 | 43 | 34 | 28 | 449 |
| | | 2 | 65 | 30.0 | 29.8 | 26.5 | 21.5 | 17.1 | 13.9 | 13.3 | 15.0 | 17.8 | 21.0 | 24.9 | 27.8 | 21.5 |
| | | 3 | 66 | 13.4 | 13.6 | 11.4 | 8.6 | 6.3 | 4.6 | 3.8 | 4.6 | 5.7 | 7.5 | 9.8 | 11.9 | 8.4 |
| | Nhill | 1 | 87 | 22 | 25 | 23 | 31 | 41 | 48 | 45 | 47 | 43 | 40 | 30 | 28 | 423 |
| | | 2 | 69 | 29.6 | 29.3 | 26.2 | 21.5 | 17.2 | 14.3 | 13.6 | 15.1 | 17.9 | 21.1 | 24.8 | 27.8 | 21.5 |
| | | 3 | 70 | 12.9 | 13.2 | 10.9 | 8.3 | 6.0 | 4.2 | 3.4 | 4.1 | 5.4 | 7.2 | 9.3 | 11.6 | 8.0 |
| WESTERN | Ballarat | 1 | 63 | 38 | 50 | 47 | 56 | 69 | 64 | 69 | 77 | 73 | 68 | 56 | 52 | 719 |
| | | 2 | 64 | 25.0 | 24.7 | 21.9 | 17.3 | 13.3 | 10.6 | 9.9 | 11.3 | 13.9 | 16.6 | 19.4 | 22.3 | 17.2 |
| | | 3 | 63 | 10.7 | 11.7 | 10.0 | 7.6 | 5.8 | 4.1 | 3.4 | 3.9 | 5.0 | 6.4 | 7.7 | 9.5 | 7.2 |
| | Hamilton | 1 | 103 | 33 | 33 | 43 | 55 | 69 | 73 | 74 | 77 | 72 | 66 | 51 | 46 | 692 |
| | | 2 | 86 | 25.6 | 25.5 | 22.9 | 18.8 | 15.2 | 12.7 | 12.0 | 13.1 | 15.3 | 17.7 | 20.5 | 23.3 | 18.5 |
| | | 3 | 87 | 11.3 | 11.9 | 10.5 | 8.5 | 6.8 | 5.2 | 4.5 | 5.0 | 6.0 | 7.1 | 8.4 | 10.0 | 7.9 |
| | Warrnambool | 1 | 76 | 32 | 36 | 47 | 60 | 77 | 75 | 84 | 83 | 71 | 64 | 53 | 44 | 726 |
| | | 2 | 69 | 22.0 | 22.0 | 20.9 | 18.5 | 15.9 | 13.8 | 13.2 | 13.9 | 15.6 | 17.2 | 18.8 | 20.5 | 17.7 |
| | | 3 | 69 | 12.7 | 13.2 | 12.1 | 10.3 | 8.5 | 6.8 | 6.1 | 6.6 | 7.6 | 8.9 | 10.0 | 11.5 | 9.5 |
| NORTHERN | Bendigo | 1 | 112 | 33 | 35 | 36 | 41 | 54 | 61 | 55 | 56 | 53 | 52 | 37 | 33 | 546 |
| | | 2 | 108 | 29.4 | 29.0 | 25.9 | 20.9 | 16.1 | 12.9 | 12.2 | 13.8 | 16.7 | 20.3 | 24.2 | 27.3 | 20.7 |
| | | 3 | 106 | 14.1 | 14.3 | 12.3 | 9.1 | 6.4 | 4.8 | 3.7 | 4.4 | 6.0 | 8.1 | 10.3 | 12.5 | 8.8 |
| | Echuca | 1 | 95 | 27 | 29 | 34 | 34 | 41 | 45 | 40 | 43 | 39 | 43 | 32 | 29 | 436 |
| | | 2 | 91 | 30.8 | 30.4 | 27.1 | 22.1 | 17.4 | 14.1 | 13.3 | 15.1 | 18.3 | 22.0 | 26.0 | 29.0 | 22.1 |
| | | 3 | 90 | 15.3 | 15.3 | 13.0 | 9.6 | 6.7 | 4.9 | 4.0 | 5.0 | 6.5 | 8.9 | 11.3 | 13.7 | 9.5 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NORTH CENTRAL | Alexandra | 1 | 95 | 41 | 39 | 52 | 53 | 65 | 72 | 71 | 74 | 66 | 70 | 56 | 48 | 707 |
| | | 2 | 48 | 29.3 | 29.3 | 26.0 | 20.5 | 15.8 | 12.0 | 11.7 | 13.8 | 17.0 | 20.3 | 23.8 | 27.3 | 20.6 |
| | | 3 | 48 | 11.2 | 11.7 | 9.4 | 6.3 | 4.3 | 2.9 | 2.5 | 2.9 | 4.4 | 6.0 | 8.0 | 9.9 | 6.6 |
| | Kyneton | 1 | 98 | 37 | 39 | 46 | 54 | 75 | 89 | 82 | 84 | 74 | 69 | 52 | 50 | 751 |
| | | 2 | 75 | 27.1 | 26.7 | 23.5 | 18.3 | 13.8 | 10.7 | 9.9 | 11.5 | 14.8 | 18.0 | 21.7 | 24.9 | 18.4 |
| | | 3 | 69 | 9.9 | 10.3 | 8.4 | 5.7 | 3.6 | 2.3 | 1.6 | 1.9 | 3.3 | 4.8 | 6.6 | 8.6 | 5.6 |
| CENTRAL | Geelong | 1 | 103 | 31 | 37 | 41 | 45 | 50 | 49 | 46 | 48 | 51 | 52 | 48 | 40 | 538 |
| | | 2 | 64 | 25.0 | 24.9 | 23.2 | 19.9 | 16.6 | 14.1 | 13.6 | 14.8 | 16.9 | 19.2 | 21.2 | 23.3 | 19.4 |
| | | 3 | 64 | 13.3 | 13.8 | 12.5 | 10.3 | 8.0 | 6.0 | 5.2 | 5.7 | 6.9 | 8.4 | 10.1 | 11.9 | 9.4 |
| | Mornington | 1 | 84 | 45 | 45 | 52 | 64 | 70 | 71 | 69 | 70 | 70 | 69 | 58 | 53 | 736 |
| | | 2 | 40 | 24.9 | 24.9 | 23.1 | 19.4 | 16.0 | 13.4 | 12.7 | 13.7 | 15.9 | 18.1 | 20.3 | 23.0 | 18.8 |
| | | 3 | 38 | 13.3 | 13.8 | 12.8 | 10.9 | 9.0 | 7.1 | 6.4 | 6.8 | 8.0 | 9.5 | 10.7 | 12.1 | 10.0 |
| NORTH-EASTERN | Omeo | 1 | 94 | 51 | 54 | 54 | 46 | 53 | 57 | 52 | 55 | 62 | 72 | 63 | 62 | 681 |
| | | 2 | 88 | 26.2 | 25.8 | 23.1 | 18.7 | 14.1 | 10.8 | 10.1 | 12.1 | 15.3 | 18.5 | 21.8 | 24.5 | 18.4 |
| | | 3 | 89 | 9.4 | 9.5 | 7.8 | 4.8 | 2.1 | 0.8 | -0.2 | 0.7 | 2.6 | 4.7 | 6.4 | 8.3 | 4.7 |
| | Wangaratta | 1 | 94 | 38 | 40 | 48 | 48 | 56 | 72 | 64 | 64 | 59 | 63 | 46 | 42 | 640 |
| | | 2 | 71 | 31.0 | 30.6 | 27.3 | 22.0 | 17.3 | 13.6 | 12.7 | 14.5 | 17.6 | 21.1 | 25.3 | 28.9 | 21.8 |
| | | 3 | 70 | 15.0 | 14.9 | 12.2 | 8.4 | 5.5 | 3.8 | 3.3 | 4.1 | 5.8 | 8.2 | 10.7 | 13.3 | 8.7 |
| WEST GIPPSLAND | Yallourn | 1 | 24 | 50 | 61 | 56 | 66 | 97 | 78 | 79 | 95 | 87 | 88 | 86 | 67 | 910 |
| | | 2 | 24 | 24.8 | 24.2 | 22.4 | 18.8 | 14.6 | 12.6 | 11.8 | 13.0 | 15.3 | 17.6 | 19.5 | 22.1 | 18.0 |
| | | 3 | 24 | 12.7 | 13.3 | 12.0 | 9.7 | 7.5 | 5.9 | 4.7 | 5.3 | 6.5 | 8.3 | 9.5 | 11.1 | 8.9 |
| | Sale | 1 | 30 | 47 | 46 | 55 | 46 | 58 | 46 | 38 | 53 | 50 | 66 | 65 | 59 | 629 |
| | | 2 | 28 | 25.1 | 24.8 | 23.1 | 20.1 | 16.3 | 14.0 | 13.5 | 14.7 | 16.7 | 18.9 | 20.7 | 23.1 | 19.2 |
| | | 3 | 28 | 12.5 | 13.2 | 11.3 | 8.5 | 6.1 | 4.2 | 3.3 | 4.1 | 5.4 | 7.6 | 9.2 | 11.1 | 8.0 |
| EAST GIPPSLAND | Bairnsdale | 1 | 69 | 60 | 50 | 66 | 50 | 54 | 58 | 50 | 49 | 57 | 70 | 64 | 68 | 765 |
| | | 2 | 67 | 24.6 | 24.7 | 23.0 | 20.4 | 17.1 | 14.4 | 13.9 | 15.3 | 17.5 | 19.6 | 21.6 | 23.5 | 19.6 |
| | | 3 | 66 | 12.3 | 12.7 | 11.2 | 8.5 | 6.0 | 4.2 | 3.4 | 4.1 | 5.9 | 7.8 | 9.4 | 11.2 | 8.1 |
| | Orbost | 1 | 90 | 70 | 61 | 68 | 71 | 72 | 81 | 65 | 60 | 68 | 78 | 69 | 76 | 839 |
| | | 2 | 32 | 25.1 | 25.0 | 23.6 | 20.7 | 17.3 | 14.9 | 14.5 | 15.6 | 17.6 | 19.5 | 21.1 | 23.5 | 19.9 |
| | | 3 | 30 | 12.7 | 13.3 | 11.8 | 9.1 | 6.7 | 4.9 | 3.9 | 4.6 | 5.9 | 8.1 | 9.9 | 11.6 | 8.6 |

(*a*) Legend : 1. Average monthly rainfall in mm (for all years of record to 1973).
2. Average daily maximum temperature (°C) (for all years of record to 1973).
3. Average daily minimum temperature (°C) (for all years of record to 1973).

### *Snow*

Snow in Victoria is confined usually to the Great Dividing Range and the alpine massif, which at intervals during the winter and early spring months may be covered to a considerable extent, especially over the more elevated eastern section. Falls elsewhere are usually light and infrequent. Snow has been recorded in all districts except the Mallee, Wimmera, and northern country. The heaviest falls in Victoria are confined to sparsely populated areas and hence general community disorganisation is kept to a minimum. Snow has been recorded in all months on the higher Alps, but the main falls occur during the winter. The average duration of the snow season in the alpine area is from three to five months.

### *Temperatures*

February is the hottest month of the year while January is only slightly cooler. Average maximum temperatures are under 25°C along the coast and over elevated areas forming the Central Divide and North-Eastern Highlands. Apart from these latter areas, there is a steady increase towards the north, until, in the extreme north, an average of 32°C is reached. Values decrease steadily with height, being under 20°C in alpine areas above 1,000 metres and as low as 15°C in the very highest localities.

Temperatures fall rapidly during the autumn months and then more slowly with the onset of winter. Average maximum temperatures are lowest in July; the distribution during this month again shows lowest values over elevated areas, but otherwise there is practically no variation across the State. Day temperatures along the coast average about 13°C in July; much the same value is recorded over the wheat belt, and only a degree or two higher in the far north-west under conditions of few clouds and relatively high winter sunshine. The Alps experience blizzard conditions every year with minimum temperatures 5°C–10°C less than at lowland stations.

In summer high temperatures may be experienced throughout the State except over the alpine area. Most inland places have recorded maxima over 43°C with an all time extreme for the State of 50.8°C at Mildura on 6 January 1906. Usually such days are the culmination of a period during which temperatures gradually rise, and relief comes sharply in the form of a cool change when the temperature may fall as much as 17°C in an hour. However, such relief does not always arrive so soon and periods of two or three days or even longer have been experienced when the maximum temperature has exceeded 38°C. On rare occasions extreme heat may continue for as long as a week with little relief.

Night temperatures, as gauged by the average minimum temperature, are, like the maximum, highest in February. Values are below 10°C over the elevated areas, but otherwise the range is chiefly 13°C–15°C. The highest night temperatures are recorded in the far north and along the coast. In mid-winter average July minima exceed 5°C along the coast and at two or three places in the far north. The coldest point of the State is the north-east alpine section, where temperatures frequently fall below freezing point. Although three or four stations have been set up at different times in this area, none has a very long nor satisfactory record. The lowest temperature on record so far is —12.8°C at Hotham Heights

(station height 1,760 metres) at an exposed location near a mountain. However, a minimum of —22.2°C has been recorded at Charlotte Pass (station height 1,840 metres)—a high valley near Mt Kosciusko in New South Wales—and it is reasonable to expect that similar locations in Victoria would experience similar temperatures, although none has been recorded due to lack of observing stations.

### *Frosts*

Frosts may occur at any time of the year over the ranges of Victoria, whereas along the exposed coasts frosts are rare and severe frosts (air temperature 0°C or less) do not occur. Frost, however, can be a very localised phenomenon, dependent on local topography. Hollows may experience frost while the surrounding area is free of frost.

The average frost-free period is less than 50 days over the higher ranges of the north-east while it exceeds 200 days within 50 miles of the coast and north of the Divide. The average number of severe frosts (air temperature 0°C or less) exceeds 20 per year over the ranges. The average number of light frosts (air temperature between 0°C and 2°C) varies from less than 10 per year near the coast to 50 per year in the highlands of the north-east.

The first frosts of the season may be expected in April in most of the Mallee and northern country and in March in the Wimmera. Over the highlands of the north-east frosts may be severe from March to November. Severe frosts on the northern side of the Divide are twice as frequent as on the southern side at the same elevation.

### *Humidity*

Generally, humidity in the lower atmosphere is much less over Victoria than in other eastern States. This is because the extreme south-east of the continent is mostly beyond the reach of tropical and sub-tropical air masses. For several periods in the summer, however, air from the Tasman Sea has a trajectory over Bass Strait and parts of the State, and it is then that the moisture content rises to show wet bulb temperatures above 18°C. The incidence of high humidity is important to the vine and fruit industry, tobacco growers, and wheat farmers.

### *Evaporation*

Since 1967 the Class A Pan has been the standard evaporimeter used by the Bureau of Meteorology. This type is being progressively installed at evaporation recording stations in Victoria ; there were sixty-four in mid-1974, sixty-two of which were owned by the Bureau of Meteorology.

Measurements of evaporation have been made with the Australian tank at about thirty stations, about half of which are owned by the Bureau of Meteorology. Results from these stations show that evaporation exceeds the average annual rainfall in inland areas, especially in the north and north-west, by about 1,000 mm. In all the highland areas and the Western District the discrepancy is much less marked, and in the Central District and the lowlands of east Gippsland annual evaporation exceeds annual rainfall by 200 to 400 mm. Evaporation is greatest in the summer months in all districts. In the three winter months rainfall exceeds evaporation in many parts of Victoria, but not in the north and north-west.

### *Winds*

The predominant wind stream over Victoria is of a general westerly origin, although it may arrive over the State from the north-west or south-west. There are wide variations from this general description, however, and many northerlies and southerlies occur. The latter is the prevailing direction from November to February with a moderate percentage of northerlies often associated with high temperatures. Easterly winds are least frequent over Victoria, but under special conditions can be associated with some of the worst weather experienced over the State. Wind varies from day to night, from season to season, and from place to place. Examples of the diurnal variation are the sea breeze, which brings relief on many hot days along the coastline, and the valley or katabatic breeze, which brings cold air down valleys during the night. The latter is well developed in many hilly areas of Victoria, being the result of differential cooling after sunset. It springs up during the night, often suddenly, and continues after sunrise until the land surfaces are sufficiently heated again. The sensitive equipment required to measure extreme wind gusts has been installed at only about five or six places in the State and to date the highest value recorded is 164 kilometres per hour (km/h) at Point Henry near Geelong in 1962. There is no doubt, however, that similar gusts have been experienced in other parts of the State, although not in the vicinity of a recording anemometer. It is considered that any place in Victoria could feasibly experience at some time a local gust of 160 km/h or more.

### *Thunderstorms*

Thunderstorms occur far less frequently in Victoria and Tasmania than in the other two eastern States. They occur mainly in the summer months when there is adequate surface heating to provide energy for convection. Between ten and twenty storms occur each year in most of Victoria, but the annual average is about thirty in the north-eastern ranges. Isolated severe wind squalls and tornadoes sometimes occur in conjunction with thunderstorm conditions, but these destructive phenomena are comparatively rare. Hailstorms affect small areas in the summer months ; and showers of small hail are not uncommon during cold outbreaks in the winter and spring.

## Forecasting for the general public

Although about one third of the professional staff of the Bureau of Meteorology is engaged in overall forecasting duties, forecasting for the general public comprises only a small part of the work, while forecasting for shipping (which was begun in the nineteenth century in some countries) and for aviation occupies considerable time and manpower.

All forecasts in Victoria are prepared at the Regional Forecasting Centre in Melbourne, where staff are on duty round-the-clock. Comprehensive forecasts for the public are prepared at 5.15 a.m. for " today and tonight ", at 11.15 a.m. for " today and tomorrow ", at 5.15 p.m. for " tonight and tomorrow " and at 8.30 p.m. for " tomorrow ". These forecasts include a general statement of expected weather over Victoria ; and more detailed forecasts for each of nine districts in the State—Melbourne, Geelong, Ballarat, Bendigo, and for Port Phillip and Western Port Bays. Forecasts are also prepared once or twice a day for other provincial cities in the State.

A forecast may often contain, in a few words, a description of the weather over an area of several thousand square kilometres, over a period of up to 36 hours. At the present time it is not possible to be precise about the time and place of meteorological events. For example, it is possible to forecast scattered thunderstorms in a district tomorrow. It is not possible to state which towns will experience them or at what time during the day. Thus forecasts have to be rather generalised statements, often giving only a trend of events such as " becoming fine " or " rain developing ". As with professional opinions in other disciplines, a percentage of them are going to be incorrect because of the inherent difficulty of prediction.

The terms used in the forecast have definite meanings attached to them. " Fine " means the absence of rain but not necessarily a clear sky. " Showers " begin and end abruptly and are interspersed with breaks in the cloud. " Periods of rain " last for some hours and the sky remains overcast. " Some heavy falls " means that some places will have 25 mm or more of rain in 24 hours. Local showers or local thunderstorms affect only a small area of a few square kilometres, the remaining area not having any rain. " Mostly fine, a shower or two " means that although a few places may experience one or two showers during the forecast period it will be fine for most of the period. " Mild " means temperatures about the seasonal average. " Fresh winds " means a general wind speed of 34 to 42 kilometres per hour.

With one or two exceptions, the Bureau has to depend on the mass media for announcement and presentation of forecasts, warnings, and information to the general public. Forecasts are collected by hand from the Bureau, or are sent by telegram or telex to newspaper, radio, and television stations. The forecast for Melbourne is provided for the Post Office six times a day, updated more frequently if necessary, and is available to the public by telephoning 1196.

Warnings are issued of expected severe weather, such as gales and strong winds on the coast, floods, bushfire weather, severe local squalls and storms, severe frosts, cold wind and rain which may affect sheep, and hazardous road conditions. Warnings are sent immediately to radio and television stations and to newspapers, and are renewed every six hours until the dangerous weather has passed.

The period of validity of daily forecasts is 24 to 36 hours. An outlook for the State for a further period of a day may be added to the forecast. Forecasts for three days ahead are prepared regularly for each of the nine districts of Victoria, and are sent to country newspapers on request. At the present time it is not possible to issue forecasts for periods more than three or four days ahead. Monthly forecasts have been prepared experimentally in many countries, but these are general statements of the weather for the month, not a day by day description. As knowledge of the behaviour of the atmosphere increases, and as computers are developed which are large enough and fast enough to handle the data, extended period forecasts for the public may become a reality in the future.

## Melbourne

### *Temperature*

The proximity of Port Phillip Bay bears a direct influence on the local climate of the metropolis. The hottest months in Melbourne are normally January and February, when the average maximum temperature is 26°C. Inland, Watsonia has an average of 27°C, while along the Bay, Aspendale and Black Rock, subject to any sea breeze, have an average of 25°C. This difference does not persist throughout the year, however, and in July average maxima at most stations are within 1°C of one another at approximately 13°C. The hottest day on record in Melbourne was 13 January 1939, when the temperature reached 45.6°C. This is the second highest temperature ever recorded in an Australian capital city. In Melbourne, the average number of days per year with maxima over 38°C is about four, but there were fifteen in the summer of 1897–98 and there have been a few years with no occurrences. The average annual number of days over 32°C is approximately nineteen.

Nights are coldest at places a considerable distance from the sea, and away from the City where buildings may maintain the air at a slightly higher temperature. The lowest temperature ever recorded in the City was −2.8°C on 21 July 1869, and the highest minimum ever recorded was 30.6°C on 1 February 1902.

In Melbourne the overnight temperature remains above 20°C on only about two nights a year and this frequency is the same for nights on which the air temperature falls below 0°C. Minima below −1°C have been experienced during the months of May to August, while even as late as October extremes have been down to 0°C. During the summer minima have never been below 4°C.

Wide variations in the frequencies of occurrences of low air temperatures are noted across the metropolitan area. For example, there are approximately ten annual occurrences of 2°C or under around the bayside, but frequencies increase to over twenty in the outer suburbs and probably to over thirty a year in the more frost susceptible areas. The average frost free period is about 200 days in the outer northern and eastern suburbs, gradually increasing to over 250 days towards the City, and approaching 300 days along parts of the bayside.

The means of the climatic elements for the seasons in Melbourne computed from all available official records are given in the following table :

MELBOURNE—MEANS OF CLIMATIC ELEMENTS

| Meteorological elements | Spring | Summer | Autumn | Winter |
|---|---|---|---|---|
| Mean atmospheric pressure (millibar) | 1,014.9 | 1,013.2 | 1,018.3 | 1,018.4 |
| Mean temperature of air in shade (°C) | 14.4 | 19.3 | 15.3 | 10.1 |
| Mean daily range of temperature of air in shade (°C) | 10.3 | 11.6 | 9.6 | 7.8 |
| Mean relative humidity at 9 a.m. (saturation=100) | 64 | 61 | 72 | 80 |
| Mean rainfall (mm) | 185 | 156 | 169 | 148 |
| Mean number of days of rain | 40 | 25 | 34 | 44 |
| Mean amount of evaporation (mm) | 261 | 441 | 208 | 97 |
| Mean daily amount of cloudiness (scale 0 to 8) (*a*) | 4.8 | 4.2 | 4.7 | 5.1 |
| Mean daily hours of sunshine | 6.0 | 7.7 | 5.2 | 3.9 |
| Mean number of days of fog | 1.5 | 0.6 | 6.1 | 11.2 |

(*a* Scale: 0 = clear, 8 = overcast.

In the following table the yearly means of the climatic elements in Melbourne for each year 1969 to 1973 are shown. The extreme values of temperature in each year are also included.

MELBOURNE—YEARLY MEANS AND EXTREMES OF CLIMATIC ELEMENTS

| Meteorological elements | 1969 | 1970 | 1971 | 1972 | 1973 |
|---|---|---|---|---|---|
| Mean atmospheric pressure (millibar) | 1,017.5 | 1,015.8 | 1,014.2 | 1,018.2 | 1,017.0 |
| Temperature of air in shade (°C)— | | | | | |
| Mean | 15.2 | 15.1 | 15.5 | 15.5 | 15.5 |
| Mean daily maximum | 19.7 | 19.4 | 19.8 | 20.3 | 19.8 |
| Mean daily minimum | 10.8 | 10.7 | 11.0 | 10.8 | 11.2 |
| Absolute maximum | 38.7 | 37.3 | 38.7 | 39.9 | 40.5 |
| Absolute minimum | −0.8 | 0.6 | −0.1 | 0.0 | −0.5 |
| Mean terrestrial minimum temperature (°C) | 9.8 | 9.2 | 9.4 | 8.9 | 9.6 |
| Number of days maximum 38°C and over | 3 | .. | 1 | 2 | 4 |
| Number of days minimum 2°C and under | 3 | 3 | 4 | 7 | 10 |
| Rainfall (mm) | 625 | 803 | 779 | 566 | 817 |
| Number of wet days | 137 | 153 | 154 | 120 | 150 |
| Total amount of evaporation (mm) (*a*) | 1,438 | 1,465 | 1,503 | 1,587 | 1,496 |
| Mean relative humidity at 9 am (saturation= 100) | 70 | 71 | 70 | 69 | 69 |
| Mean daily amount of cloudiness (scale 0 to 8) (*b*) | 4.7 | 4.5 | 4.9 | 4.3 | 5.1 |
| Mean daily hours of sunshine (*c*) | 5.8 | 6.3 | 5.9 | 6.7 | 6.3 |
| Mean daily wind speed (km/h) | 11.6 | 11.4 | 12.2 | 12.7 | 9.7 |
| Number of days of wind gusts 63 km/h and over | 41 | 61 | 69 | 58 | 79 |
| Number of days of fog | 7 | 9 | 7 | 9 | 8 |
| Number of days of thunder | 8 | 12 | 13 | 11 | 7 |

(*a*) Evaporation measured by Class A Pan.
(*b*) Scale: 0 = clear, 8 = overcast.
(*c*) Sunshine measured at Laverton.

### *Rainfall*

The average annual rainfall in the City is 658 mm over 143 days. The average monthly rainfall varies from 48 mm in January to 67 mm in October. Rainfall is relatively steady during the winter months, when the extreme range is from 7 mm to 180 mm, but variability increases towards the warmer months. In the latter period totals range between practically zero and over 230 mm.

Over 75 mm of rain have been recorded in 24 hours on several occasions, but these have been restricted to the warmer months, September to April. Only twice has a fall above 50 mm during 24 hours been recorded in the cooler months.

The average rainfall varies considerably over the Melbourne metropolitan area. The western suburbs are relatively dry and Deer Park has an average annual rainfall of 499 mm. Rainfall increases towards the east, and at Mitcham averages 899 mm a year. The rainfall is greater still on the Dandenong Ranges and at Sassafras the annual average is 1,376 mm.

The number of wet days, defined as days on which 0.2 mm or more of rain falls, exhibits marked seasonal variation ranging between a minimum of seven in February and a maximum of fifteen each in July and August. This is in spite of approximately the same total rainfall during each month and indicates the higher intensity of the summer rains. The relatively high number of wet days in winter gives a superficial impression of a wet winter in Melbourne which is not borne out by an examination of total rainfall.

The highest number of wet days ever recorded in any one month in the City is twenty-seven, in August 1939. On the other hand, there has been only one rainless month in the history of the Melbourne records—April 1923. On occasions, each month from January to May has recorded three wet days or less. The longest wet spell ever recorded was eighteen days and the longest dry spell forty days.

*Fogs*

Fogs occur on an average of four or five mornings each month in May, June, and July, and average twenty days for the year. The highest number ever recorded in a month was twenty in June 1937.

*Cloud and sunshine*

Cloudiness varies between a minimum in the summer months and a maximum in the winter, but the range, like the rainfall, is not great compared with many other parts of Australia. The number of clear days or nearly clear days averages two to three each month from May to August, but increases to a maximum of six to seven in January and February. The total number for the year averages forty-eight. The high winter cloudiness and shorter days have a depressing effect on sunshine in winter and average daily totals of three to four hours during this period are the lowest of all capital cities. There is a steady rise towards the warmer months as the days become longer and cloudiness decreases. An average of over eight hours a day is received in January ; however, the decreasing length of the day is again apparent in February, since the sunshine is then less in spite of a fractional decrease in cloudiness. The total possible monthly sunshine hours at Melbourne range between 465 hours in December and 289 in June under cloudless conditions. The average monthly hours, expressed as a percentage of the possible, range between 55 per cent for January and February to 35 per cent in June.

*Wind*

Wind exhibits a wide degree of variation, both diurnally, such as results from a sea breeze, and as a result of the incidence of storms. The speed is usually lowest during the night and early hours of the morning just prior to sunrise, but increases during the day, especially when strong surface heating induces turbulence into the wind stream, and usually reaches a maximum during the afternoon. The greatest mean wind speed at Melbourne for a 24 hour period was 36.7 km/h, while means exceeding 30 km/h are on record for each winter month. These are mean values ; the wind is never steady. Continual oscillations take place ranging from lulls, during which the speed may drop to or near zero, to strong surges which may contain an extreme gust, lasting for a period of a few seconds only, up to or even over 95 km/h. At Melbourne, gusts exceeding 95 km/h have been registered during every month with a few near or over 110 km/h, and an extreme of 119 km/h on 18 February 1951. At Essendon a wind gust of 143 km/h has been measured.

*Thunder, hail, and snow*

Thunder is heard in Melbourne on an average of 14 days per year, the greatest frequency being in the summer months. On rare occasions thunderstorms are severe, with damaging wind squalls. Hail can fall at any

time of the year, but the most probable time of occurrence is from August to November. Most hail is small and accompanies cold squally weather in winter and spring, but large hailstones may fall during thunderstorms in summer.

Snow has occasionally fallen in the City and suburbs; the heaviest snow storm on record occurred on 31 August 1849. Streets and housetops were covered with several centimetres of snow, reported to be 30 cm deep at places. When thawing set in, floods in Elizabeth and Swanston Streets stopped traffic, causing accidents, some of which were fatal. One report of the event indicates that the terrified state of the Aboriginals suggested they had never seen snow before.

**Victorian weather summary 1973**

The year 1973 opened under drought conditions, having been preceded by ten months of low rainfall which had culminated in a record dry month in December 1972 for most of southern Victoria. After this poor start conditions altered rapidly.

The first substantial rain for the year fell throughout the State on the night of 12 January, Castlemaine recording 90 mm. Hot weather prevailed in the second half of January, with many grass and forest fires. A large grass fire destroyed 10,100 hectares at Lancefield. Heavy rain fell at the end of the month, particularly in the Wimmera ; then, at the beginning of February exceptionally heavy rain fell in all Victoria except the south-west and East Gippsland. In two days over 200 mm fell at Elaine, Red Hill, and Portarlington. Many other places in the West Central District had their highest rainfall on record for a one and a two day period.

Further heavy rain fell from 19 to 21 February. Over 150 mm fell near Charlton on 19 February causing some flooding in that area. In the early hours of 21 February falls of 150 mm over a small area near Seymour caused rapid and severe flooding of Whiteheads Creek, which flows through the town, with the loss of one life. The monthly rainfall totals were the highest on record for February at many places in Victoria, and the highest on record for any month at some.

Rainfall was frequent through the autumn, and seasonal totals were above average over most of Victoria, although East Gippsland was rather dry in April and May. Heavy rain fell in the north-east on 29 March and on 25–26 April. During a cold spell in the last four days of March, the maximum temperature in Melbourne dropped to 14.5°C on 29 March, and this was the lowest for March in the City since 1941. Warm conditions prevailed for the first two weeks of April with temperatures exceeding 30°C on some days. In the second and third weeks, fogs were widespread and Melbourne Airport was closed for a short period on 11 April. Another warm spell in the first two weeks of May produced daily temperatures up to 10°C above normal in north-west and western Victoria, but this was followed by a rather cold week with widespread fogs and frosts.

June rainfall was near or above average. Rain on the night of 20–21 June resulted in flooding on the Avoca, Loddon, Campaspe, and Goulburn rivers. July rainfall was below average except in the Mallee and Wimmera but August was wet. Rivers remained high through the winter and minor flooding occurred frequently on most northern and north-eastern streams.

Although rainfall was high during the winter, snow was infrequent and snow cover on the Alps was less than in preceding years.

Rain continued through the spring, October being particularly wet, and several places in northern Victoria had their wettest October on record. Heavy rain fell in the north on 8 October and 19–20 October. Serious flooding occurred in the Kerang–Swan Hill area in September and was prolonged by the continuing wet weather over northern catchments. Waterlogging of land resulted in major losses of cereal crops and many fruit trees died in the Goulburn valley.

Heavy rain fell in East Gippsland on the weekend 3–4 November and a flood occurred on the Snowy River for the first time since February 1971. The Princes Highway was cut at Cann River. Temperatures were below average in November. In Melbourne the temperature did not exceed 28.6°C during the month for the first time on record.

December opened with gales in South Gippsland causing structural damage at Yarram and Thorpdale. This was followed by ten days of dry weather before substantial State-wide rainfall fell in the middle of the month. On 21 December an intense depression developed over the south-east of South Australia and moved over western Bass Strait. The atmospheric pressure at Cape Nelson fell to 983.5 millibars. Gale force winds and thunderstorm squalls caused structural damage, particularly in the central districts and the northern suburbs of Melbourne. A gust of 112 kilometres per hour in Melbourne was the highest recorded for December. The year closed with yet more rain over the State and heavy falls in the north-east.

**Agricultural meteorology, 1964; Maritime meteorology, 1966; Aeronautical meteorology, 1967; Meteorology in fire prevention, 1968; Meteorological services for commerce and industry, 1969; Meteorological observations, 1970; Computers in meteorology, 1971; Hydrometeorology, 1972; Meteorology in Victoria, 1974**