

## CHAPTER 2

# PHYSICAL GEOGRAPHY AND METEOROLOGY

### General description of Australia

#### Geographical position

The Australian Commonwealth, which includes the island continent of Australia and the island of Tasmania, is situated in the Southern Hemisphere, and comprises an area of 2,967,909 square miles, the mainland alone containing 2,941,526 square miles. Bounded on the west and east by the Indian and Pacific Oceans respectively, it lies between longitudes 113° 9' E. and 153° 39' E., while its northern and southern limits are the parallels of latitude 10° 41' S. and 43° 39' S., or, excluding Tasmania, 39° 8' S. On its north are the Timor and Arafura Seas and Torres Strait, on its south the Southern Ocean\*. The extreme points are Steep Point on the west, Cape Byron on the east, Cape York on the north, and South-East Cape or, if Tasmania be excluded, Wilson's Promontory, on the south. The difference in latitude between Cape York and Wilson's Promontory is 1,959 miles, and in longitude between Steep Point and Cape Byron 2,489 miles.

#### Tropical and temperate regions

Of the total area of Australia, nearly 39 per cent lies within the tropics. Taking the latitude of the Tropic of Capricorn as 23° 30' S., the areas within the tropical and temperate zones are approximately as follows.

#### AREAS OF TROPICAL AND TEMPERATE REGIONS: STATES AND TERRITORIES (Square miles)

Area	N.S.W. (a)	Vic.	Qld	S.A.	W.A.	Tas.	N.T.	Total
Within tropical zone . . .			360,642		364,000		422,980	1,147,622
„ temperate zone . . .	310,372	87,884	306,358	380,070	611,920	26,383	97,300	1,820,287
Total area . . .	310,372	87,884	667,000	380,070	975,920	26,383	520,280	2,967,909

(a) Includes Australian Capital Territory (939 square miles).

Fifty-four per cent of Queensland lies within the tropical zone and 46 per cent in the temperate zone; 37 per cent of Western Australia is tropical and 63 per cent temperate; while 81 per cent of the Northern Territory is tropical and 19 per cent temperate. All the remaining States lie within the temperate zone. The tropical part of Australia thus comprises about 39 per cent of the whole of the continent.

#### Area of Australia compared with areas of other countries

The area of Australia is almost as great as that of the United States of America excluding Alaska, four-fifths of that of Canada, more than half as large again as Europe excluding the U.S.S.R., and about twenty-five times that of Great Britain and Ireland. The areas of Australia and of certain other countries are shown in the table on the following page. The areas shown are in the main obtained from the *Demographic Yearbook*, 1964, published by the Statistical Office of the United Nations, and the countries have been arranged in accordance with the continental groups used therein.

\* The Southern Ocean is a local designation for that part of the Indian Ocean lying between the southern shores of Australia and Antarctica.

## AREA OF AUSTRALIA AND OF OTHER COUNTRIES, circa 1963

('000 square miles)

Country	Area	Country	Area
<b>Continental divisions—</b>		<b>Africa—continued</b>	
Europe(a) . . . . .	1,912	Niger . . . . .	489
Asia(a) . . . . .	10,655	Angola . . . . .	481
U.S.S.R. (Europe and Asia)	8,650	South Africa, Republic of .	471
Africa . . . . .	11,671	Mali . . . . .	464
North and Central America		Ethiopia . . . . .	457
and West Indies . . . . .	9,365	Mauritania . . . . .	419
South America . . . . .	6,870	United Arab Republic . . .	386
Oceania . . . . .	3,285	Tanzania, United Republic	
		of . . . . .	363
<b>Total, World, excluding</b>		Nigeria . . . . .	357
<b>Arctic and Antarctic</b>		South-West Africa . . . . .	318
<b>continents . . . . .</b>	<b>52,408</b>	Mozambique . . . . .	302
		Zambia . . . . .	288
<b>Europe(a)—</b>		Somalia . . . . .	246
France . . . . .	211	Central African Republic . .	238
Spain (incl. possessions)	195	Madagascar . . . . .	230
Sweden . . . . .	174	Kenya . . . . .	225
Finland . . . . .	130	Other . . . . .	1,968
Norway . . . . .	125		
Poland . . . . .	121	<b>Total, Africa . . . . .</b>	<b>11,671</b>
Italy . . . . .	116		
Yugoslavia . . . . .	99	<b>North and Central America—</b>	
Germany, Fed. Republic of	96	Canada . . . . .	3,852
United Kingdom . . . . .	94	United States of America(b)	3,615
Romania . . . . .	92	Greenland . . . . .	840
Other . . . . .	459	Mexico . . . . .	762
		Nicaragua . . . . .	54
<b>Total, Europe(a) . . . . .</b>	<b>1,912</b>	Cuba . . . . .	44
		Honduras . . . . .	43
<b>Asia(a)—</b>		Other . . . . .	155
China, Mainland . . . . .	3,692		
India . . . . .	1,176	<b>Total, North and Central</b>	
Saudi Arabia . . . . .	870	<b>America . . . . .</b>	<b>9,365</b>
Iran . . . . .	636		
Mongolia . . . . .	593	<b>South America—</b>	
Indonesia . . . . .	576	Brazil . . . . .	3,286
Pakistan . . . . .	366	Argentina . . . . .	1,072
Turkey . . . . .	292	Peru . . . . .	496
Burma . . . . .	262	Colombia (excl. Panama) . .	440
Afghanistan . . . . .	254	Bolivia . . . . .	424
Thailand . . . . .	198	Venezuela . . . . .	352
Iraq . . . . .	173	Chile . . . . .	286
Other . . . . .	1,567	Paraguay . . . . .	157
		Ecuador . . . . .	105
<b>Total, Asia(a) . . . . .</b>	<b>10,655</b>	Other . . . . .	252
<b>U.S.S.R.—</b>		<b>Total, South America . . . . .</b>	<b>6,870</b>
<b>Total, U.S.S.R. . . . .</b>	<b>8,650</b>		
		<b>Oceania—</b>	
<b>Africa—</b>		Australia . . . . .	2,968
Sudan . . . . .	968	New Zealand . . . . .	104
Algeria . . . . .	920	New Guinea(c) . . . . .	92
Congo, Democratic Republic		Papua . . . . .	86
of . . . . .	906	Other . . . . .	35
Libya . . . . .	679		
Chad . . . . .	496	<b>Total, Oceania . . . . .</b>	<b>3,285</b>

(a) Excludes U.S.S.R., shown below. (b) Includes Hawaii. (c) Australian Trust Territory. Western New Guinea (West Irian) is included in Other Asia.

## Areas of States and Territories

## AREAS OF STATES AND TERRITORIES, COASTLINE AND STANDARD TIMES

State or Territory	Area	Percentage of total area	Coastline	Area per mile of coastline	Standard times	
					Meridian selected	Ahead of G.M.T.
	sq. miles		miles	sq. miles		hours
New South Wales . . . . .	309,433	10.43	(a) 700	(a) 443	150° E.	10
Victoria . . . . .	87,884	2.96	680	129	150° E.	10
Queensland . . . . .	667,000	22.47	3,236	206	150° E.	10
South Australia . . . . .	380,070	12.81	1,540	247	142°30'E.	9½
Western Australia . . . . .	975,920	32.88	4,350	224	120° E.	8
Northern Territory . . . . .	520,280	17.53	1,040	500	142°30'E.	9½
Australian Capital Territory . . . . .	939	0.03	..	..	150° E.	10
<i>Mainland</i> . . . . .	<i>2,941,526</i>	<i>99.11</i>	<i>11,546</i>	<i>255</i>	..	..
Tasmania . . . . .	26,383	0.89	900	29	150° E.	10
<b>Australia</b> . . . . .	<b>2,967,909</b>	<b>100.00</b>	<b>12,446</b>	<b>238</b>	..	..

(a) Includes Australian Capital Territory.

## Geographical features of Australia

The following description is a broad summary of the main physical characteristics of the Australian continent.

A section through the Australian continent from east to west, at the point of its greatest breadth, shows first a narrow belt of coastal plain. This plain, extending north and south along the whole east coast, is well watered by rivers. It is of variable width, seldom more than sixty or seventy miles, and occasionally only a few miles, the average being roughly about forty to fifty miles. Bordering this plain is the Great Dividing Range, which extends from the north of Queensland to the south of New South Wales, and thence one branch sweeps westwards towards the boundary of Victoria and South Australia, and the other, the main branch, terminates in Tasmania. This range, which rises, often abruptly, from the plain, frequently presents bold escarpments on its eastern face, but the descent on its western slopes is gradual, until, in the country to the north of Spencer's Gulf, the plain is not above sea-level and occasionally even below it. Thence there is another almost imperceptible rise until the mountain ranges of Western Australia are reached, and beyond these lies another coastal plain. The mountains of Australia are relatively low, the highest peak, Mount Koscuisko, in New South Wales, being only about 7,300 feet. Three-quarters of the land-mass of Australia lies between the 600 and 1,500 feet contours in the form of a huge plateau, constituting the most distinctive feature of the Australian continent, to which the peculiarities of Australia's climate can probably be largely ascribed.

The rivers of Australia may be divided into two major classes, those of the coastal plains with moderate rates of fall and those of the central plains with very slight fall. Of the former not many are navigable for any distance from their mouths, and bars make many of them difficult of access or inaccessible from the sea.

The two longest rivers of the northern part of the east coast are the Burdekin and the Fitzroy in Queensland. The Hunter is the largest coastal river of New South Wales, and the Murray River, with its great tributary the Darling, drains part of Queensland, the major part of New South Wales, and a large part of Victoria, finally flowing into the arm of the sea known as Lake Alexandrina, on the eastern side of the South Australian coast. The total length of the Murray

is about 1,600 miles, 400 being in South Australia and 1,200 constituting the boundary between New South Wales and Victoria. The total length of the Murray-Darling from the source of the Darling to the mouth of the Murray is about 2,300 miles. The rivers of the north-west coast of Australia (Western Australia), e.g. the Murchison, Gascoyne, Ashburton, Fortesque, De Grey, Fitzroy, Drysdale and Ord are of considerable size. So also are those in the Northern Territory, e.g. the Victoria and Daly, and those on the Queensland side of the Gulf of Carpentaria, such as the Gregory, Leichhardt, Cloncurry, Gilbert and Mitchell. The rivers of Tasmania have short and rapid courses, as might be expected from the configuration of the country.

The 'lakes' of Australia may be divided into three classes: true permanent lakes; lakes which, being very shallow, become mere morasses in dry seasons or even dry up and finally present a cracked surface of salt and dry mud; and lakes which are really inlets of the ocean, opening out into a lake-like expanse. The second class is the only one which seems to demand special mention. These are a characteristic of the great central plain of Australia. Some of them, such as Lakes Torrens, Gairdner, Eyre and Frome, are of considerable extent.

For further information on the geographical features of Australia earlier issues of the Year Book should be consulted. The list of special articles, etc., at the end of this volume indicates the nature of the information available and its position in the various issues.

### Climate and meteorology of Australia

This section has been prepared by the Director of the Commonwealth Bureau of Meteorology, and the various States and Territories have been arranged in the standard order adopted by that Bureau. The section concludes with a brief summary of the weather of 1965.

#### Introduction

Australia extends from about latitude 10° S. to latitude 44° S., but owing largely to the moderating effects of the surrounding oceans and the absence of very pronounced and extensive mountain masses it is less subject to extremes of climate than are regions of similar size in other parts of the world. The average elevation of the land surface is low—probably close to 900 feet above the sea; while the maximum altitude is just above 7,300 feet. Latitude for latitude the Australian climate is generally more temperate than that of the other large land masses of the earth, although it varies considerably from the tropical to the alpine.

The Australian meteorological seasons are: Summer—December, January, February; Autumn—March, April, May; Winter—June, July, August; Spring—September, October, November.

The following general discussion of the climate of Australia is necessarily brief. However, extensive records of Australian climatic data are held and published in various forms by the Bureau of Meteorology. A programme of regional climatic survey has been in progress for some years, and a large number of studies have been published by the Bureau of Meteorology and by the Department of National Development and State Development Authorities. The Bureau of Meteorology welcomes inquiries for climatic information, which may be made at its Central Office in Melbourne or through the Regional Offices which are situated in each of the State capital cities and in Darwin. Reference may also be made to various bulletins and research papers mentioned in this text for more detailed information on particular topics.

#### Precipitation

Precipitation of moisture from the atmosphere may take various forms depending chiefly on the thermal conditions existing at the time. Within the Australian region, precipitation occurs chiefly as rain because of the generally mild temperatures, but may also occur as snow or hail. Broadly, the immediate physical cause of rainfall may be said to be the lifting of moist air with resultant cooling, condensation into cloud, and eventual precipitation of the heavy water droplets

as rain. This process may be achieved by three different means each of which may be combined with either or both of the others:

- (a) Orographic lifting caused by winds blowing onto rising terrain;
- (b) convective lifting resulting in the development of individual rain clouds of the cumulus or cumulonimbus type producing showers and thunderstorms;
- (c) lifting of a warm air mass as it rises over cooler air—known as a 'frontal' process.

*Average annual rainfall.* The distribution of the average annual rainfall over Australia is shown in plate 2 (between pages 32 and 33), while plate 3 shows the distribution in 1965.

While Australia is a continent of comparatively low relief, the orographic processes in rain production are very marked in the chain of the Great Dividing Range bordering the whole east coast of the continent, in the ranges of the south-western corner of Western Australia, and in Tasmania. Thus on the east coast the higher rainfall areas lie between the ranges and the Pacific Ocean in the region of prevailing south-east wind circulation. In Tasmania and the south-west of Western Australia the region of high rainfall lies between the ranges and the ocean to the west, these areas lying in a region of predominantly westerly wind flow.

The north-western part of the continent and to some extent the whole region of the Northern Territory and inland north Queensland comes under the influence of the Australian-Asian monsoon. This results in high rainfalls in a summer wet season with the inflow of moist air from the north-west, and a winter dry season with predominantly south-east winds blowing across the dry regions of the interior and producing little rainfall. Tropical cyclones affect the waters adjacent to the north-east and north-west of Australia between December and April. Their frequency varies greatly from season to season, but on the average about three of these disturbances occur in the Coral Sea each season and about two in the eastern Indian Ocean adjacent to the west coast of the continent. When tropical cyclones move close to the tropical coast of the continent they cause very heavy rainfalls over the coastal regions. On occasions these cyclones move over the land and lose intensity, but may still continue to be accompanied by heavy rainfall along their path.

Southern Australia lies in the region of the mid-latitude westerlies for the winter half of the year and is subject to the rain-producing influences of the great depressions of the Southern Ocean and their associated frontal systems. The combined effects of these systems and the topography lead to high winter rainfalls in south-western and south-eastern Australia and in Tasmania, with the highest falls occurring on the windward side of the mountains. The rainfall generally decreases inland with distance from the coast, although the 10-inch isohyet reaches the shore of the Great Australian Bight and the central western coast of Western Australia in regions which are of very flat relief and which because of their position and the orientation of the coastline are only rarely exposed to moist winds.

**AREA DISTRIBUTION OF AVERAGE ANNUAL RAINFALL:  
STATES AND TERRITORIES  
(Per cent)**

Average annual rainfall	W.A.	N.T.	S.A.	Qld	N.S.W. (a)	Vic.	Tas.	Total
Under 10 inches .	58.0	24.7	82.8	13.0	19.7	Nil	Nil	39.0
10 and under 15 inches .	22.4	32.4	9.4	14.4	23.5	22.4	Nil	20.6
15 and under 20 " .	6.8	9.7	4.5	19.7	17.5	15.2	0.7	11.2
20 and under 25 " .	3.7	6.6	2.2	18.8	14.2	17.9	11.0	9.0
25 and under 30 " .	3.7	9.3	0.8	11.6	9.1	18.0	11.4	7.2
30 and under 40 " .	3.3	4.7	0.3	11.1	9.9	16.1	20.4	6.1
40 inches and over .	2.1	12.6	Nil	11.4	6.1	10.4	56.5	6.9
<b>Total . . . . .</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

(a) Includes Australian Capital Territory.

The region with the highest average annual rainfall is the east coast of Queensland between Port Douglas and Cardwell, where Tully has an annual average of 177 inches. A further very high rainfall region is the mountainous west coast of Tasmania, where Lake Margaret has the highest average annual total of 145 inches. The area of lowest average annual rainfall is that

of some 180,000 square miles surrounding Lake Eyre in South Australia, where on the average only 4 to 6 inches are received annually. The lowest average over a long period of record is at Troudaninna—4.13 inches. Rain occurs very irregularly, averaging only about one or two days a month in this region.

Of all the continents (excluding Antarctica), Australia receives the least average depth of rainfall and has the least run-off from its rivers into the oceans. Only in relatively small areas of the continent could the rainfall be described as abundant.

*Seasonal distribution of rainfall.* The average monthly distribution of rainfall in the various Australian rainfall districts is shown by the histograms of plate 4.

The following are the most marked features.

- (a) The clearly defined wet summer and dry winter of the monsoon region of northern Australia.
- (b) The more regular distribution of rainfall throughout the year in south-eastern Australia. In the region to the south and west of the Great Dividing Range, a less pronounced maximum of rainfall is noticeable in the winter or early spring. On the Gippsland (eastern Victoria) coast the rainfall is fairly evenly distributed throughout the year but further along the east coast of the continent the rainfall minimum in late winter and early spring begins to appear and becomes more marked as the tropical regions are approached.
- (c) The marked maximum of rainfall in the south-western districts of Western Australia in winter—the period of the most active southern depressions and frontal systems in this region.

For further information on monthly rainfalls reference may be made to the various Australian rainfall bulletins, to the Climatological Surveys of particular districts and to the annual rain maps and books of normals (standard 30 year periods), all published by the Bureau of Meteorology.

*Variability of rainfall.* For most agricultural pursuits a more important criterion of the value of rainfall is its variability or reliability. The adequate description of rainfall variability over an extensive geographical area is a matter of some difficulty. Probably the best available measures are to be found in the tables which have been calculated for a number of individual stations in some of the Climatological Survey districts. These tables show the percentage chances of receiving specified amounts of rainfall in monthly seasonal or annual time spans. Statistical indexes of rainfall variation based on a number of different techniques have been used to produce maps which show the main features of the variability of annual rainfall over Australia. A discussion of these methods and the maps is given by F. Loewe in *Some Considerations Regarding the Variability of Annual Rainfall in Australia*, Bureau of Meteorology Bulletin No. 39 (1948).

In general it may be stated that the regions of most reliable rainfall are the south-west of Western Australia, western Tasmania, and western and southern Victoria south of the divide. These areas have one of the most reliable rainfalls in the world. Elsewhere in Australia the degree of variability, in general, increases inland but the region of the highest variability for low average annual rainfalls extends across the central part of the continent from south-western Queensland to the central coast of Western Australia. Some outstanding examples of the numerous instances of high rainfall variability throughout Australia are given below.

At Onslow (Western Australia) annual totals vary from 0.05 inches to 28 inches, and in the four consecutive years 1921 to 1924 the annual totals were 22.25, 2.71, 26.82, and 2.18 inches respectively. At Whim Creek, where 29.41 inches have been recorded in a single day, only 17 points (0.17 inches) were received in the whole of 1924. Great variability can also occur in the heavy rainfall areas, e.g. at Tully the annual rainfalls have varied from 310.92 inches in 1950 to 104.98 inches in 1943.

The following table of annual rainfall for the Australian Capital cities for the past thirty years indicates the variation in rainfall at these sites.

RAINFALL: AUSTRALIAN CAPITAL CITIES, 1935 TO 1964

Year	Perth		Adelaide		Brisbane		Sydney		Canberra(a)		Melbourne		Hobart(b)	
	Amount	No. of days	Amount	No. of days	Amount	No. of days	Amount	No. of days	Amount	No. of days	Amount	No. of days	Amount	No. of days
1935	32.28	129	23.45	140	34.64	111	30.97	131	23.78	95	29.98	183	32.22	196
1936	30.64	118	19.34	121	21.77	101	30.22	130	26.24	108	24.30	187	19.60	178
1937	35.28	120	23.01	128	34.79	113	52.00	157	20.46	82	21.45	144	20.65	160
1938	29.64	111	19.26	119	43.49	110	39.17	132	19.26	79	17.63	131	31.32	169
1939	45.70	123	23.29	139	41.43	122	33.67	127	27.63	116	33.11	166	27.23	188
1940	20.00	98	16.16	116	42.37	93	39.34	125	17.38	64	19.83	126	17.17	135
1941	34.74	122	22.56	126	31.50	105	26.74	129	19.55	91	31.78	157	23.49	145
1942	39.24	140	25.44	133	44.01	125	48.29	121	25.76	104	29.79	148	19.42	163
1943	31.46	117	17.84	135	50.68	126	50.74	136	24.59	123	18.80	150	20.84	149
1944	27.39	123	17.13	114	27.85	100	31.04	115	12.05	75	21.32	143	26.23	151
1945	52.67	137	17.85	105	48.16	130	46.47	136	22.35	100	19.22	152	16.92	157
1946	41.47	122	22.59	135	38.66	83	36.05	111	22.31	94	29.80	177	39.45	193
1947	43.42	137	21.89	146	60.30	146	41.45	137	27.95	135	30.47	163	38.61	181
1948	34.75	126	21.40	122	41.54	106	38.83	131	32.11	101	20.98	155	23.42	178
1949	27.15	126	18.23	119	47.18	121	66.26	149	27.71	100	31.41	163	22.85	157
1950	32.27	122	16.06	91	63.93	152	86.33	183	43.35	132	26.18	147	19.25	131
1951	34.14	127	25.44	135	33.89	87	53.15	143	22.00	103	29.85	155	24.57	163
1952	39.28	123	19.99	128	33.49	122	59.19	130	37.87	141	34.39	177	30.35	165
1953	37.14	119	20.00	121	43.60	101	40.86	110	19.40	102	28.38	148	28.06	162
1954	28.05	112	16.73	109	61.36	142	41.29	134	18.81	82	33.53	139	27.20	143
1955	46.52	138	24.58	134	50.41	136	72.46	160	30.85	124	30.70	160	22.32	168
1956	37.35	107	27.24	154	59.18	120	67.33	155	40.46	150	30.96	188	36.63	175
1957	33.40	117	16.71	110	20.58	80	27.13	110	14.41	81	20.68	146	28.66	129
1958	32.08	107	17.57	121	46.61	115	59.19	144	30.23	117	26.98	155	36.55	166
1959	24.23	114	11.32	88	45.84	146	59.67	164	34.41	112	25.84	131	19.28	136
1960	28.21	112	23.07	129	27.51	103	51.01	152	30.99	136	33.50	162	29.35	140
1961	32.27	113	14.91	122	42.36	134	57.08	161	32.34	116	22.05	129	18.03	156
1962	28.75	123	17.96	125	41.39	131	44.90	137	28.91	126	23.06	140	25.40	161
1963	39.14	140	24.43	118	49.09	134	80.11	169	25.37	141	29.04	149	15.51	129
1964	38.40	127	21.89	135	48.18	112	43.30	99	28.69	121	27.80	166	28.06	169
Average	34.80	121	20.93	121	44.71	124	47.80	150	25.59	107	25.97	143	24.88	165
No. of years	89	89	126	126	113	105	106	106	37	37	109	109	82	82
Standard 30 years' normal(c)	35.99	128	21.09	122	40.09	117	44.80	143	d24.53	d103	25.89	156	25.03	180

(a) Commonwealth Forestry Bureau; records in issues of the Year Book prior to No. 36 were for the station at Acton which closed down in 1939. (b) Records taken from present site commenced 1883. (c) 1911-1940. (d) Thirty years to 1957 inclusive.

Prolonged dry spells are fairly common in much of Australia particularly in inland areas. A detailed discussion of the history of droughts and the frequency in particular areas may be found in Foley, J. C., *Droughts in Australia*, Bureau of Meteorology Bulletin No. 43 (1957). A shorter account of droughts in Australia will be found in a special article in Year Book No. 45, pages 51-6.

*Rainfall and vegetation.* In general, the three main climatic zones of the continent exert a particular controlling influence on the general vegetation. These are the northern third of the continent where rainfall is almost always restricted to the warmer months of the year, the southern third where rainfall is predominantly a winter and spring event, and a transitional zone which experiences rainfall from both sources, although in greatly reduced quantity over the interior, which is subject to frequent drought.

The length of the growing season, or conversely the extent of dry periods during the year, decides the type of vegetation which establishes in a region. The climatic influence on vegetative response is primarily through soil moisture and temperature. Thus in colder south-eastern areas the growing season is mainly temperature dependent, but elsewhere the availability of soil

moisture is the prime factor. All rainfall is not equally effective in increasing the soil moisture, its availability from the soil storage to plants depending on the extent of surface run-off, seepage beyond the root zone, and loss by surface evaporation. Furthermore, the effectiveness of available soil moisture depends on the evaporative demand of the local climate; for example, an inch of stored moisture may maintain vigorous plant growth for twice as long in Tasmania as in the warmer, drier atmosphere of inland New South Wales. Thus it is not a sound practice to assess the agricultural potential of different areas simply by reference to average rainfall.

Generally speaking, the length of the growing season exceeds nine months over the far south-west of Western Australia and in all eastern coastal districts from Cape York Peninsula to Western Victoria, and within this region humid and semi-humid plant formations thrive. Soil types, of course, also play a part in the distribution of vegetation, but they too are, to a considerable extent, the result of climate and weather.

The climate of Arnhem Land (Northern Territory) is such that there is a considerable surplus of moisture for about five months of the warm season, followed regularly by a virtual drought which frequently reaches severe intensity, and this special combination of meteorological conditions results in annual and perennial vegetation adapted to this cycle.

Over the interior the position is more complex because of the lower levels of the rainfall, its greater variability, and the high evaporative power of the drier, warmer atmosphere. In this vast section of the continent the climatic demands are so severe that the vegetative formations of the moister zones (i.e. the mesophytes, requiring about five months or longer growing season) are unable to exist. Thus a plant species adapted to these very dry and variable conditions (xerophytes), e.g. spinifex, salt bush, blue bush and stunted eucalypts capable of maintaining a cattle population, predominates over the arid interior.

The arid and semi-arid lands of Western Australia and inland New South Wales which border the desert carry the majority of the sheep in these States. In New South Wales the most important vegetative formations in these areas are savannah (treeless plains), savannah woodland, mulga scrub and mallee scrub. In Western Australia sclerophyllous grass steppe and mulga scrub border the deserts and are succeeded to the south by zones of mallee scrub and mallee heath.

*Rainfall intensity.* The study of extremely high rainfall intensities is important in the investigation of the flow characteristics of river systems and flood prevention measures, the design of irrigation works and hydro-electric schemes. Some of the more notable falls in a period of 24 hours are listed for the various States in the following tables. Most of the very high intensities have occurred in the coastal strip of Queensland, where the combination of a tropical cyclone moving close to mountainous terrain provides ideal conditions for spectacular falls. The highest fall recorded in 24 hours, 35.71 inches, occurred at Crohamhurst, Queensland, on 3 February 1893.

Rainfall at most reporting stations in Australia is recorded only for the 24-hour period from 9 a.m. to 9 a.m. The data in this table are based on these records. Where automatic recording gauges are installed, more detailed intensity data are available for shorter and exactly measured time intervals. For other very heavy falls at various localities, reference may be made to Year Book No. 14, pages 60-4, No. 22, pages 46-8 and No. 29, pages 43, 44 and 51.

## HEAVY RAINFALLS TO 1964, INCLUSIVE

Name of town or locality	Date	Amount (inches)	Name of town or locality	Date	Amount (inches)
WESTERN AUSTRALIA					
Whim Creek . . .	3 Apr. 1898	29.41	Roebuck Plains . . .	5 Jan. 1917	14.01
Fortesque . . .	3 May 1890	23.36	Broome . . .	6 Jan. 1917	14.00
Roebuck Plains . . .	6 Jan. 1917	22.36	Onslow P.O. . . .	8 Feb. 1963	14.00
Widjip . . .	1 Apr. 1934	19.54	Carlton Hill . . .	7 Feb. 1942	12.75
Kimberley (Research) . . .	6 Apr. 1959	16.98	Wyndham . . .	4 Mar. 1919	12.50
Derby . . .	7 Jan. 1917	16.47	Onslow P.O. . . .	3 Mar. 1961	12.38
Boodarie . . .	21 Mar. 1899	14.53	Onslow Aerodrome .	3 Mar. 1961	12.29
Balla Balla . . .	21 Mar. 1899	14.40	Towrana . . .	1 Mar. 1943	12.16
Winderrie . . .	17 Jan. 1923	14.23	Marble Bar . . .	2 Mar. 1941	12.00
Pilbara . . .	2 Apr. 1898	14.04	Jimba Jimba . . .	1 Mar. 1943	11.54



HEAVY RAINFALLS TO 1964, INCLUSIVE—*continued*

Name of town or locality	Date	Amount (inches)	Name of town or locality	Date	Amount (inches)
--------------------------	------	-----------------	--------------------------	------	-----------------

## NORTHERN TERRITORY

Brocks Creek . . .	24 Dec. 1915	14.33	Borroloola . . .	7 Jan. 1940	12.68
Groote Eylandt . . .	9 Apr. 1931	14.29	Borroloola . . .	4 Feb. 1938	12.00
Borroloola . . .	14 Mar. 1899	14.00	Bathurst Island		
Timber Creek . . .	5 Feb. 1942	13.65	Mission . . .	7 Apr. 1925	11.85
Cape Don . . .	13 Jan. 1935	13.58	Darwin . . .	7 Jan. 1897	11.67

## SOUTH AUSTRALIA

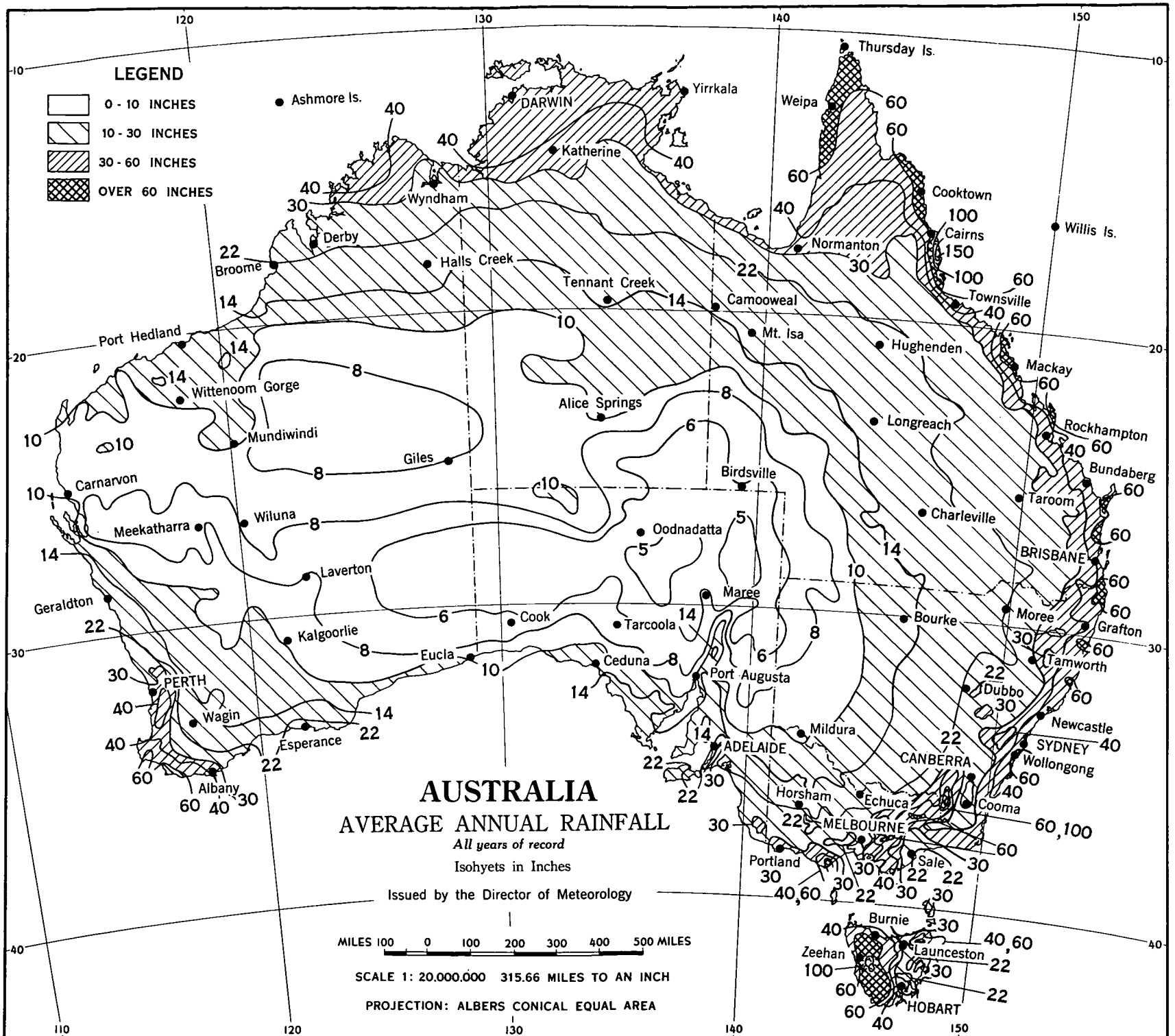
Ardressan . . .	18 Feb. 1946	8.10	Port Victoria . . .	18 Feb. 1946	7.08
Carpa . . .	18 Feb. 1946	7.83	Wynbring . . .	28 Feb. 1921	7.00
Edithburgh . . .	18 Feb. 1946	7.46	Mannum . . .	25 Jan. 1941	6.84
Hesso . . .	18 Feb. 1946	7.36	Wirrbarra Forest		
Maitland . . .	18 Feb. 1946	7.21	Reserve . . .	7 Mar. 1910	6.80
Wilmington . . .	1 Mar. 1921	7.12	Cape Willoughby . . .	18 Feb. 1946	6.80

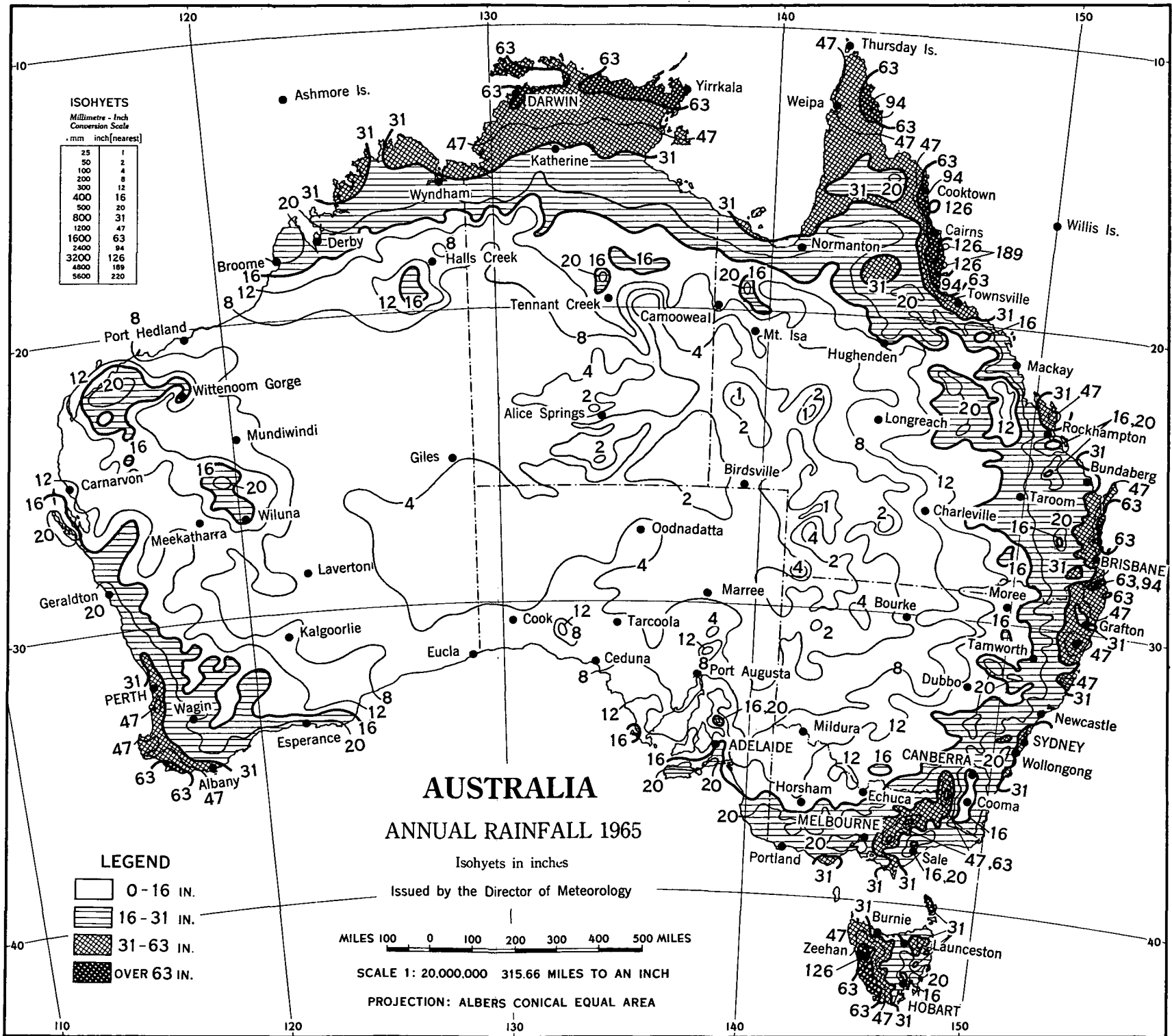
## QUEENSLAND

Crohamhurst . . .	3 Feb. 1893	35.71	Springbrook . . .	21 Feb. 1954	27.04
Finch-Hatton . . .	18 Feb. 1958	34.58	Mt. Jukes . . .	18 Feb. 1958	26.40
Port Douglas . . .	1 Apr. 1911	31.53	Buderim Mountain . . .	12 Jan. 1898	26.20
Yarrabah . . .	2 Apr. 1911	30.65	Byfield (Parnass		
Mt. Charlton . . .	18 Feb. 1958	29.95	Vale) . . .	3 Mar. 1949	25.43
Mooloolah . . .	3 Feb. 1893	29.11	Flat Top Island . . .	21 Jan. 1918	25.18
Kuranda . . .	2 Apr. 1911	28.80	Landsborough . . .	3 Feb. 1893	25.15
Calen . . .	18 Feb. 1958	27.84	Harvey Creek . . .	31 Jan. 1913	24.72
Harvey Creek . . .	3 Jan. 1911	27.75	Kuranda . . .	1 Apr. 1911	24.30
Sarina . . .	26 Feb. 1913	27.75	Babinda (Cairns) . . .	2 Mar. 1935	24.14
Plane Ck. (Mackay) . . .	26 Feb. 1913	27.73	Goondi . . .	30 Jan. 1913	24.10
Deeral . . .	2 Mar. 1935	27.60	Banyan (Cardwell) . . .	12 Feb. 1927	24.00
Yarrabah Mission . . .	24 Jan. 1916	27.20	Carruchan . . .	24 Jan. 1934	24.00
Springbrook . . .	24 Jan. 1947	27.07	Tully Mill . . .	12 Feb. 1927	23.86

## NEW SOUTH WALES

Dorrigo . . .	24 June 1950	25.04	Tallowood Point . . .	21 Feb. 1954	19.87
Cordeaux River . . .	14 Feb. 1898	22.58	Buladelah . . .	16 Apr. 1927	19.80
Morpeth . . .	9 Mar. 1893	21.52	Orara Upper . . .	24 June 1950	19.80
Broger's Creek . . .	13 Jan. 1911	20.83	Dorrigo (Townsend)	11 July 1962	19.18
South Head (Sydney			Tallowood Point . . .	24 June 1950	18.82
Harbour) . . .	16 Oct. 1844	20.41	Madden's Creek . . .	13 Jan. 1911	18.68
" " . . .	29 Apr. 1841	20.12	Condong . . .	27 Mar. 1887	18.66
Mount Pleasant . . .	5 May 1925	20.10	Candelo . . .	27 Feb. 1919	18.58
Broger's Creek . . .	14 Feb. 1898	20.05	Tallowood Point . . .	22 Jan. 1959	18.55
Towamba . . .	5 Mar. 1893	20.00	Mt. Kembla . . .	13 Jan. 1911	18.25
Viaduct Creek . . .	15 Mar. 1936	20.00	Bega . . .	27 Feb. 1919	17.88

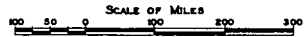




BUREAU OF METEOROLOGY.

# MONTHLY DISTRIBUTION OF RAINFALL OVER AUSTRALIA.

ALL YEARS OF RECORD TO 1957.



EXPLANATION— THE GRAPHS SHOW THE AVERAGE RAINFALL IN EACH MONTH OF THE YEAR IN THE VARIOUS RAINFALL DISTRICTS. THE BOUNDARIES OF WHICH ARE SHOWN BY THE BROKEN LINES ON THE MAP. THE NUMBERS ON THE MAP REFER TO THE DISTRICTS. THE CORRESPONDING DISTRICT NAMES ARE GIVEN IN THE INSERT ON PAGE 89. THE COLUMNS FOR THE SUCCESSIVE MONTHS, JANUARY TO DECEMBER, RUN FROM LEFT TO RIGHT.

THE LENGTH OF A VERTICAL COLUMN REPRESENTS THE AVERAGE MONTHLY RAINFALL ACCORDING TO THE SCALE GIVEN BELOW.

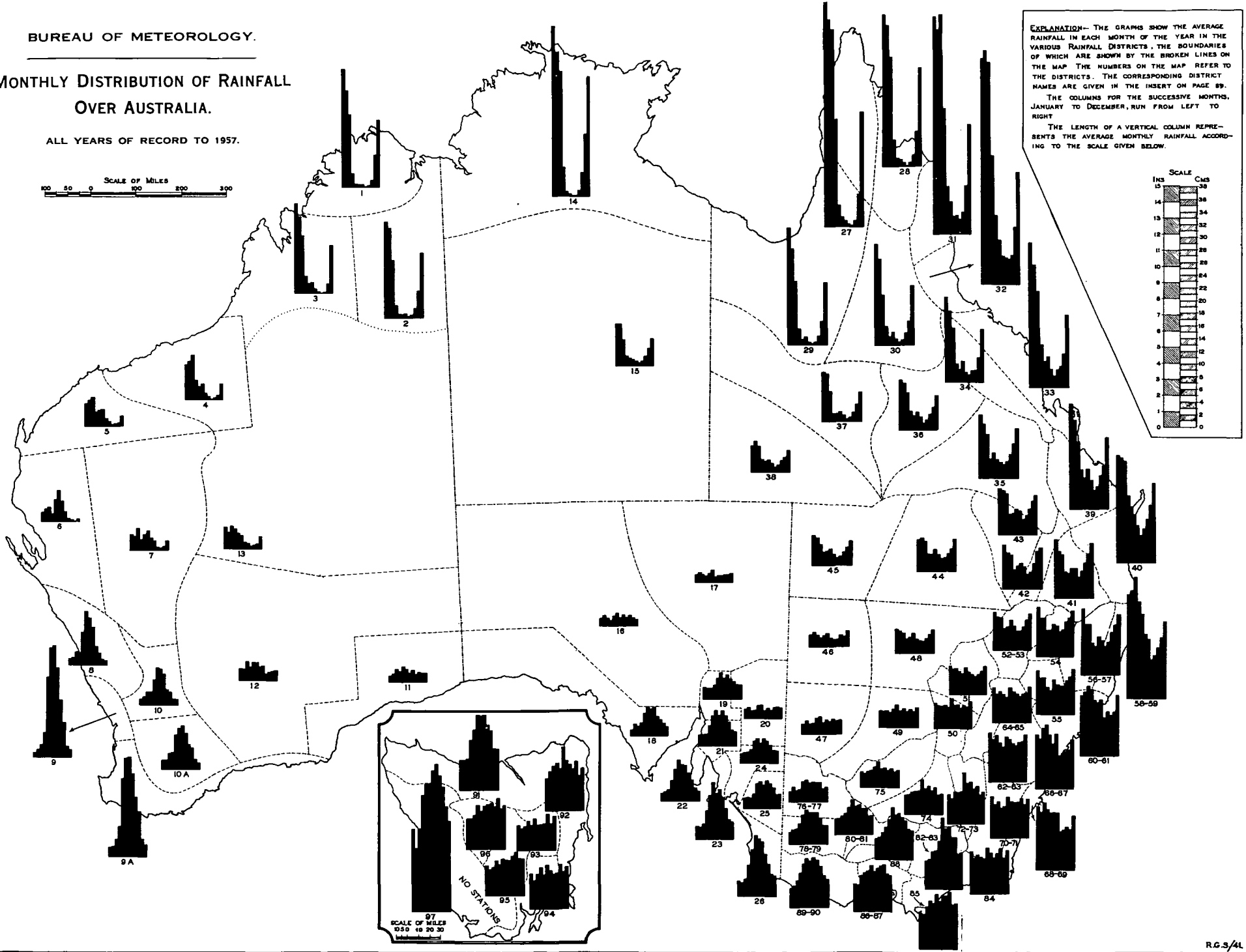
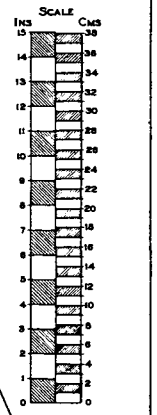


PLATE 4

R.G.S./41

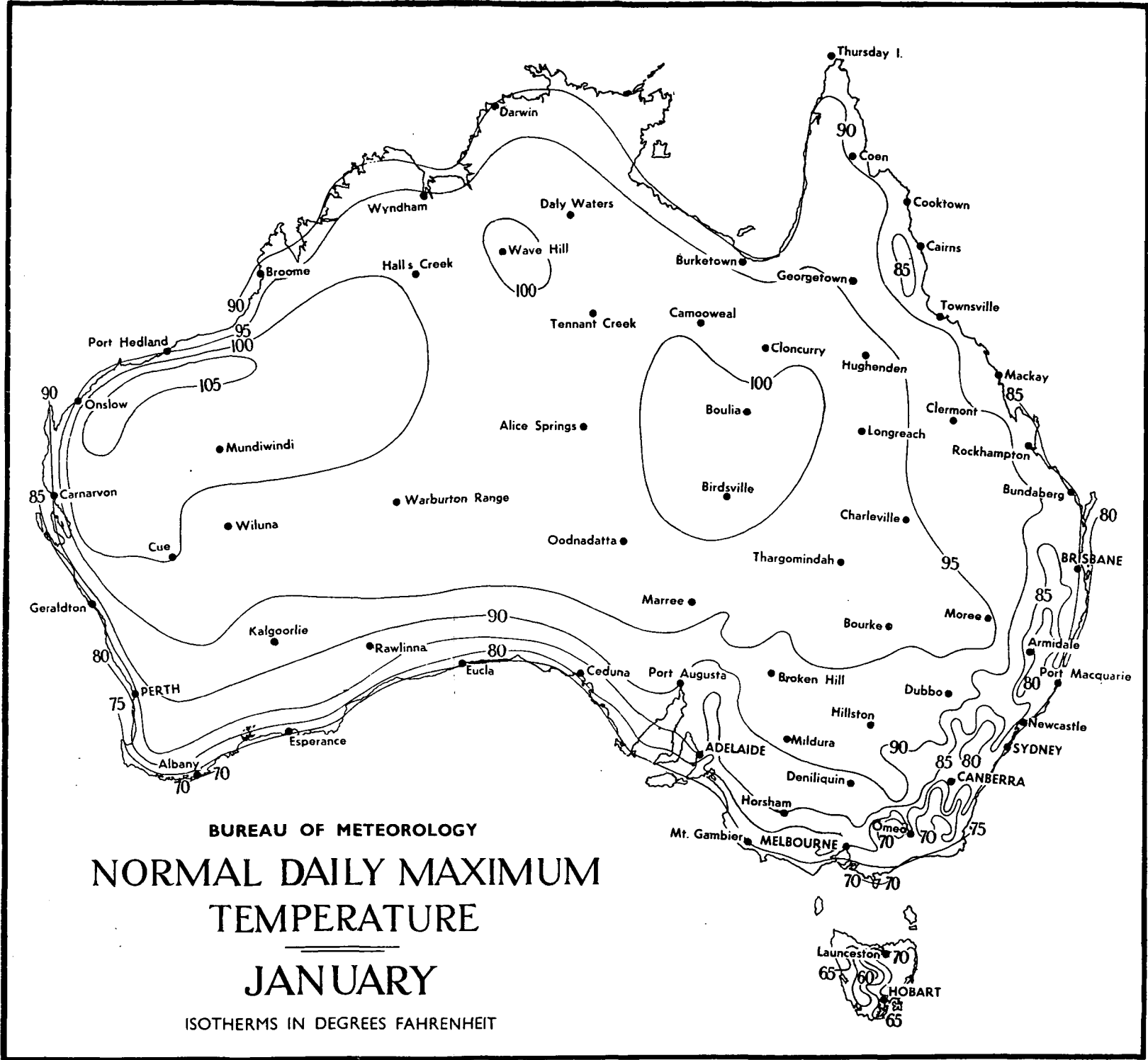
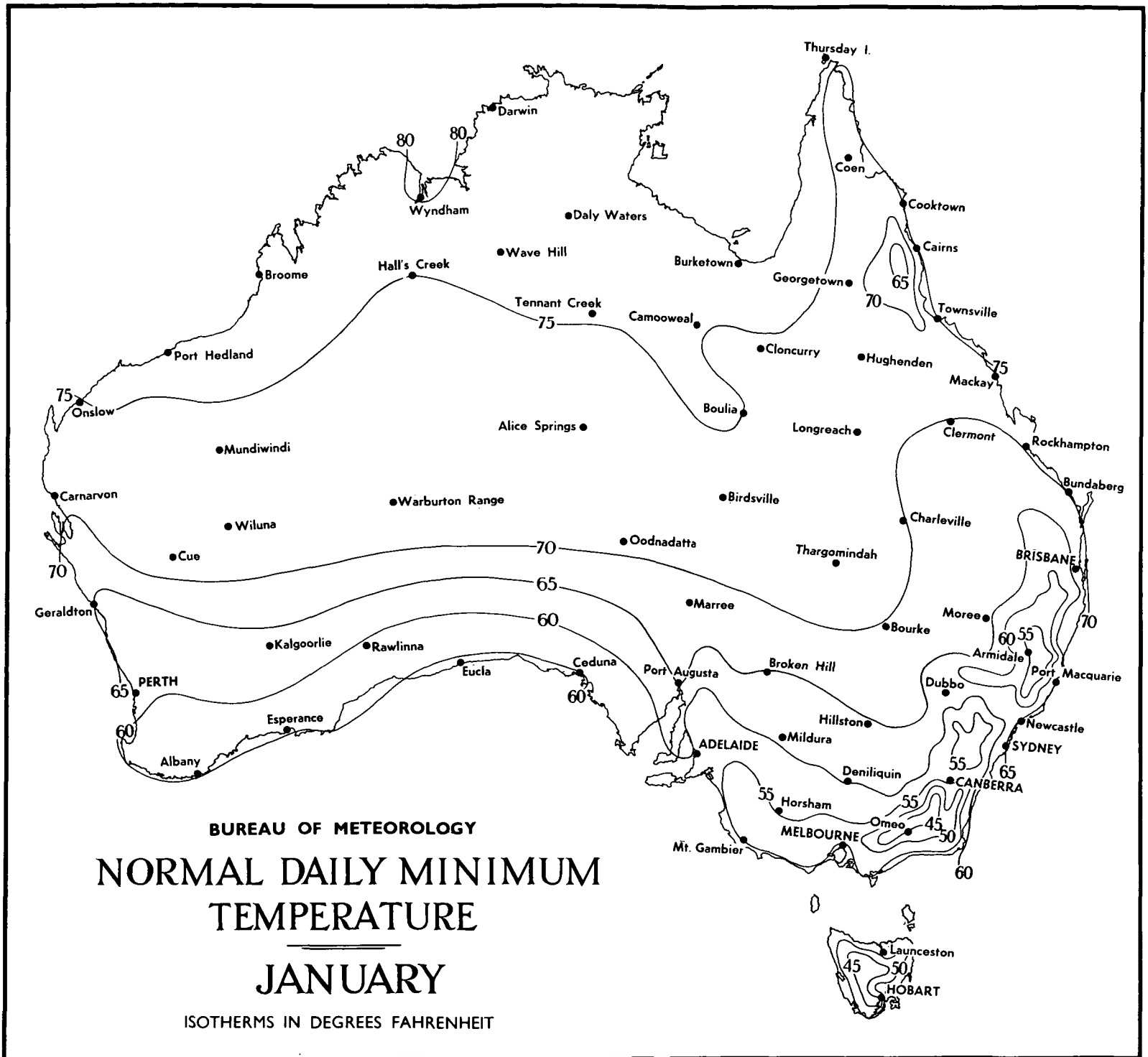
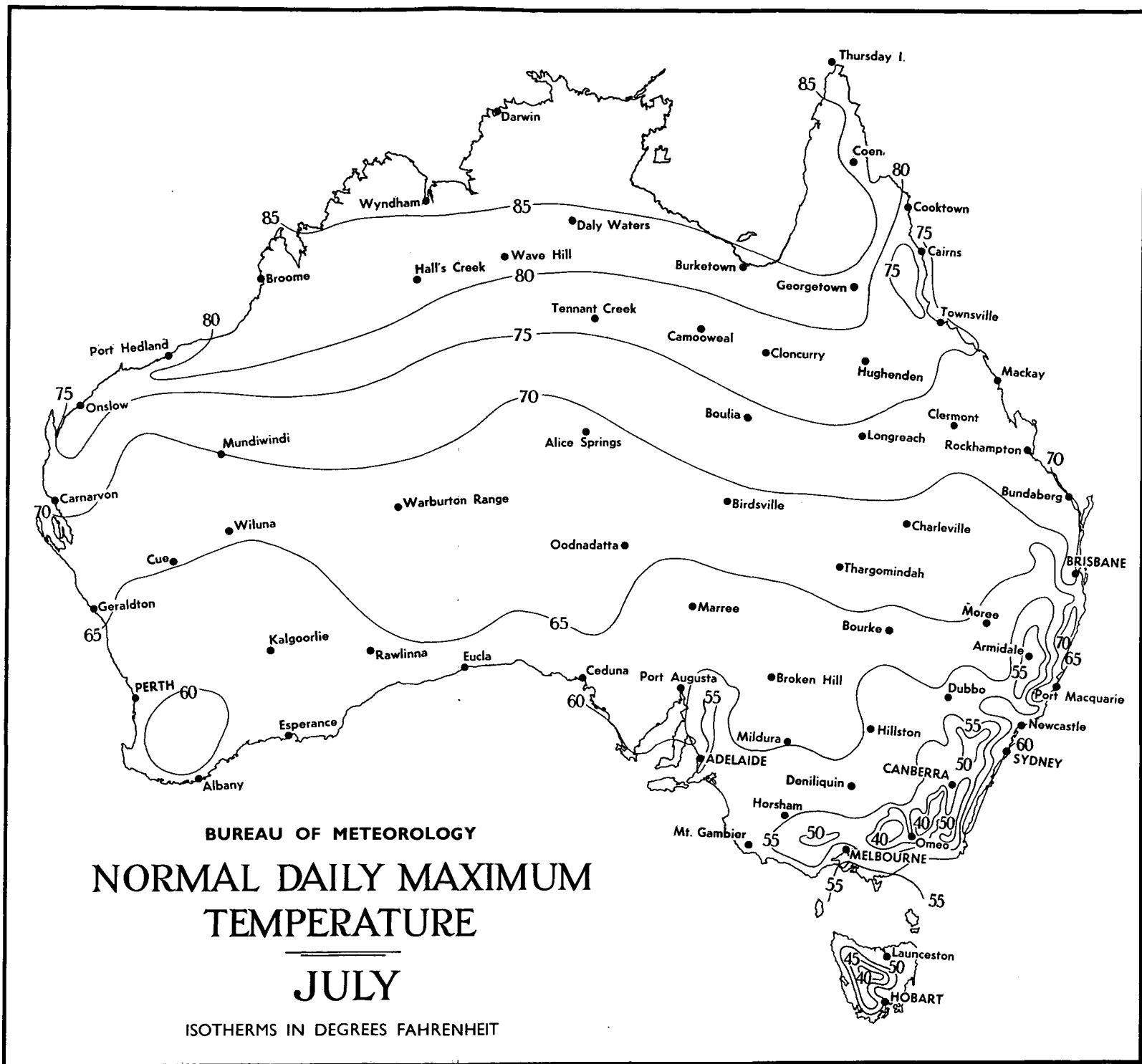


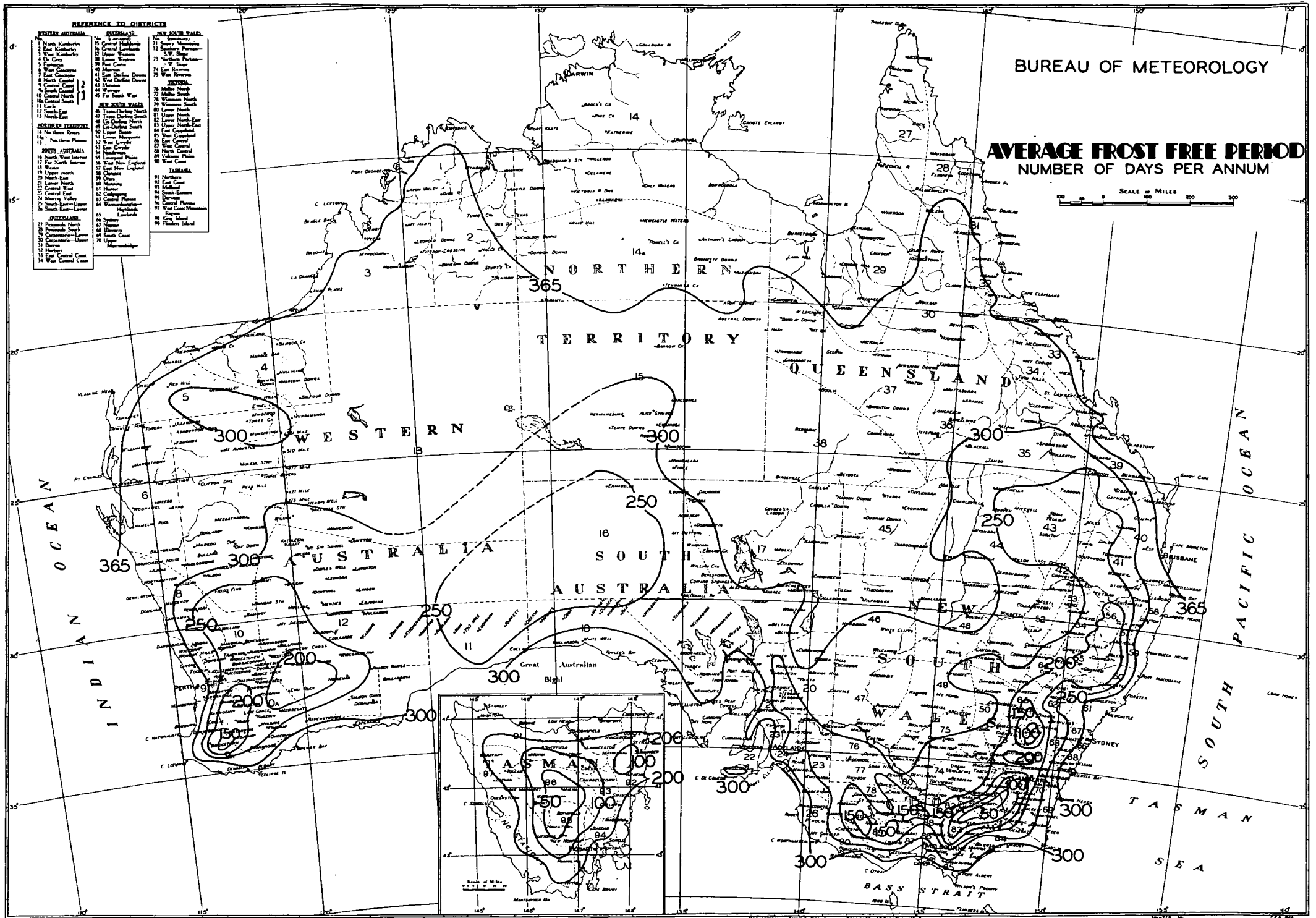
PLATE 5



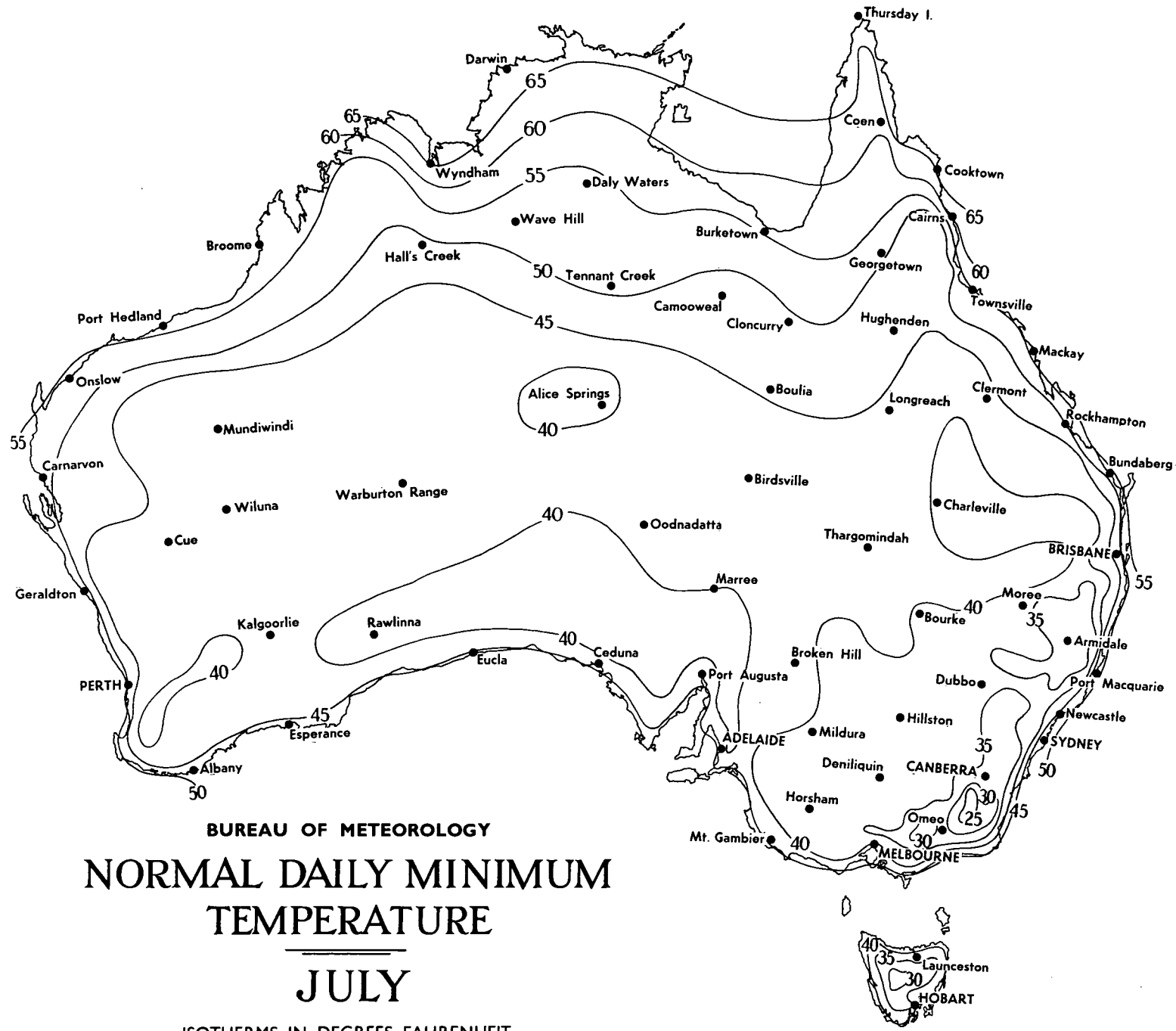


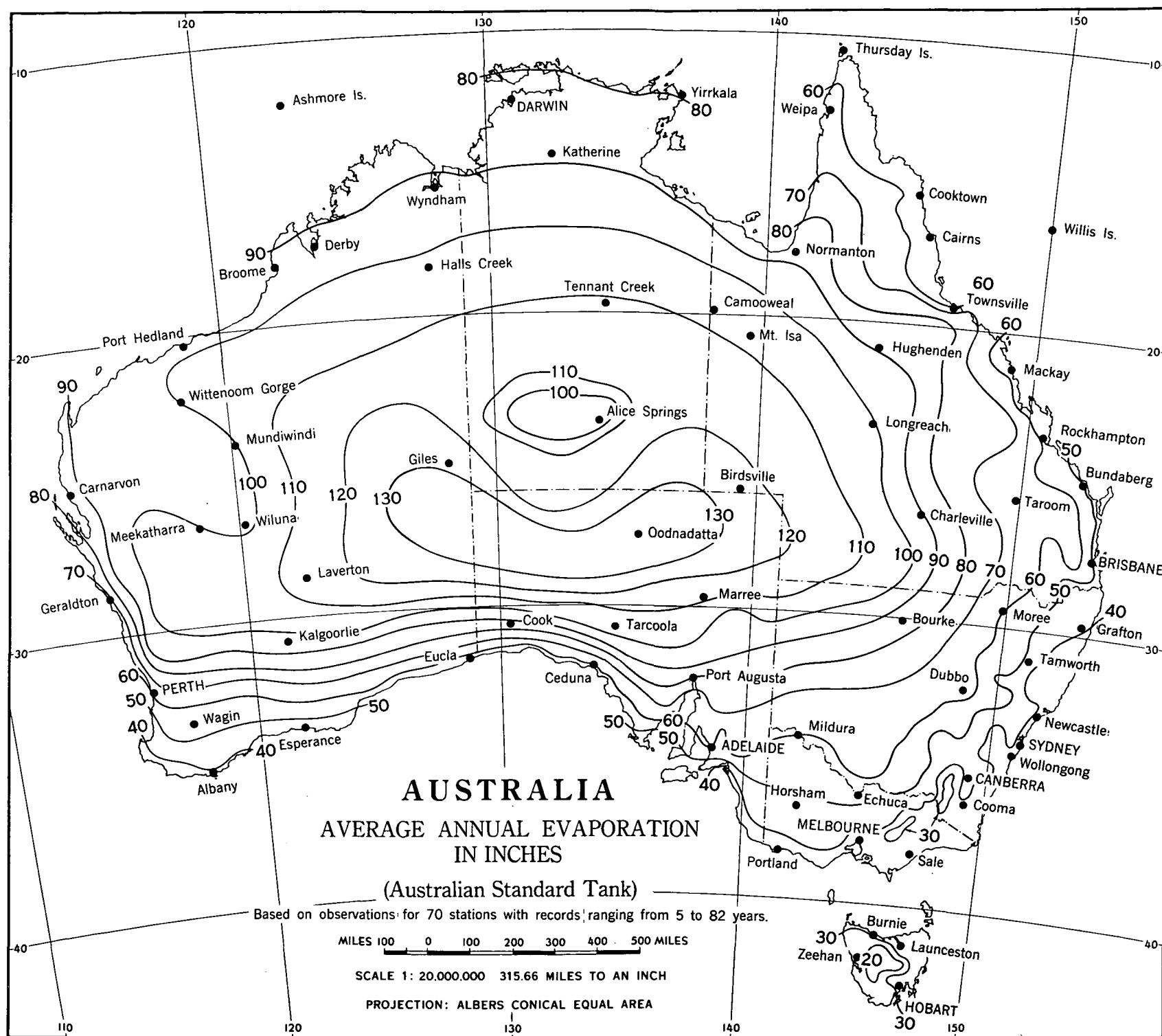
BUREAU OF METEOROLOGY  
**NORMAL DAILY MAXIMUM  
 TEMPERATURE**  
**JULY**

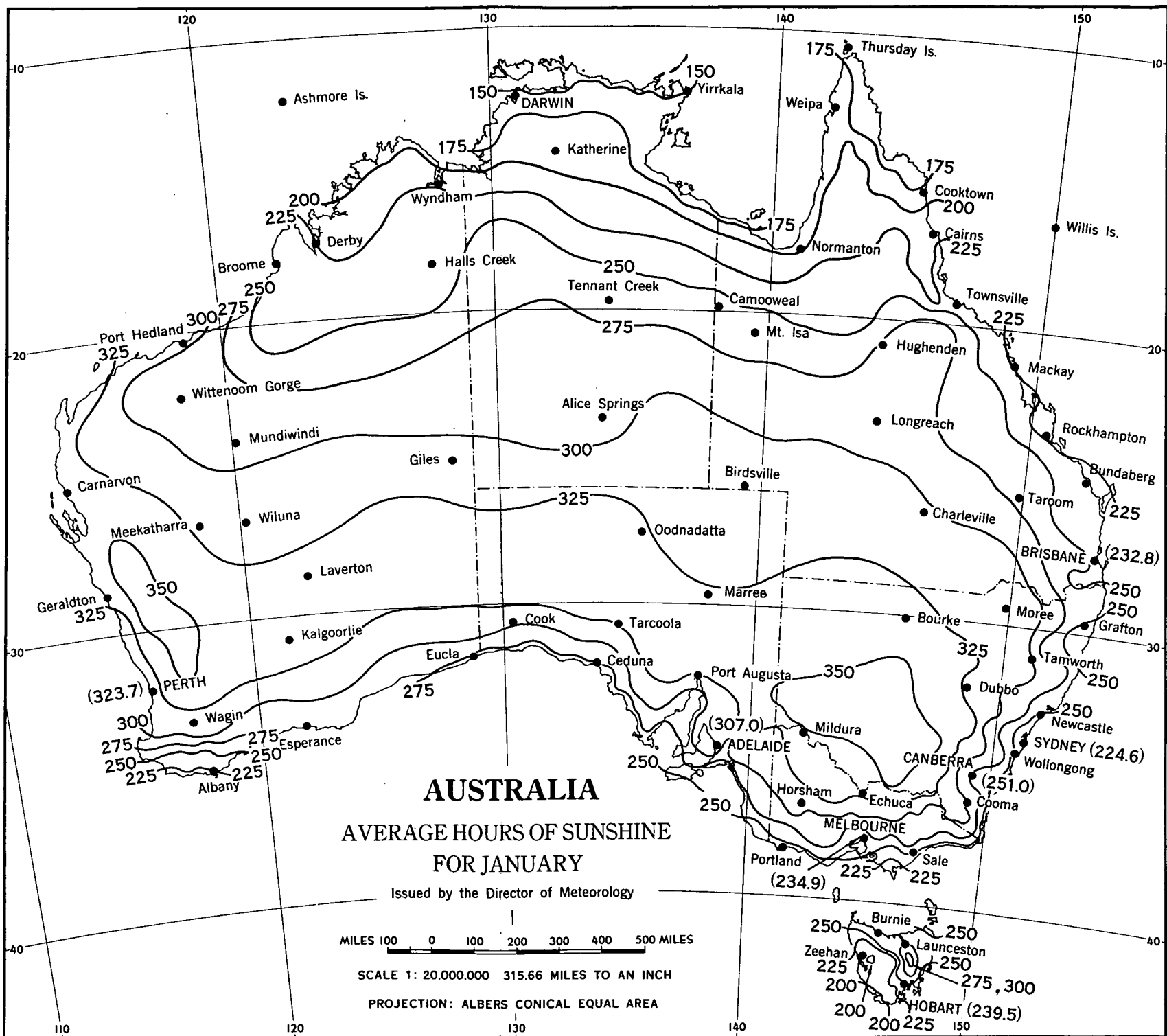
ISOTHERMS IN DEGREES FAHRENHEIT











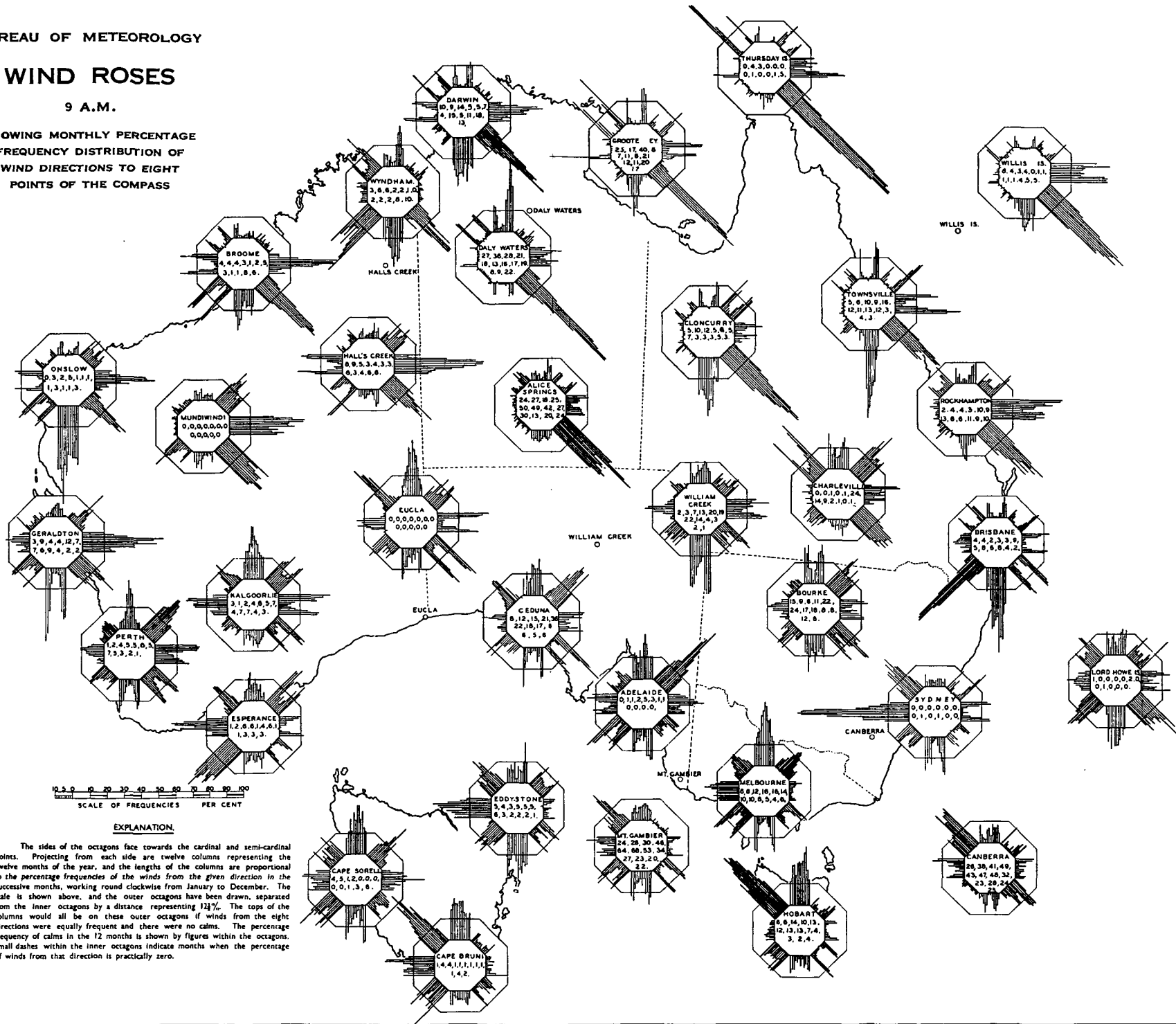


BUREAU OF METEOROLOGY

WIND ROSES

9 A.M.

SHOWING MONTHLY PERCENTAGE  
FREQUENCY DISTRIBUTION OF  
WIND DIRECTIONS TO EIGHT  
POINTS OF THE COMPASS



EXPLANATION.

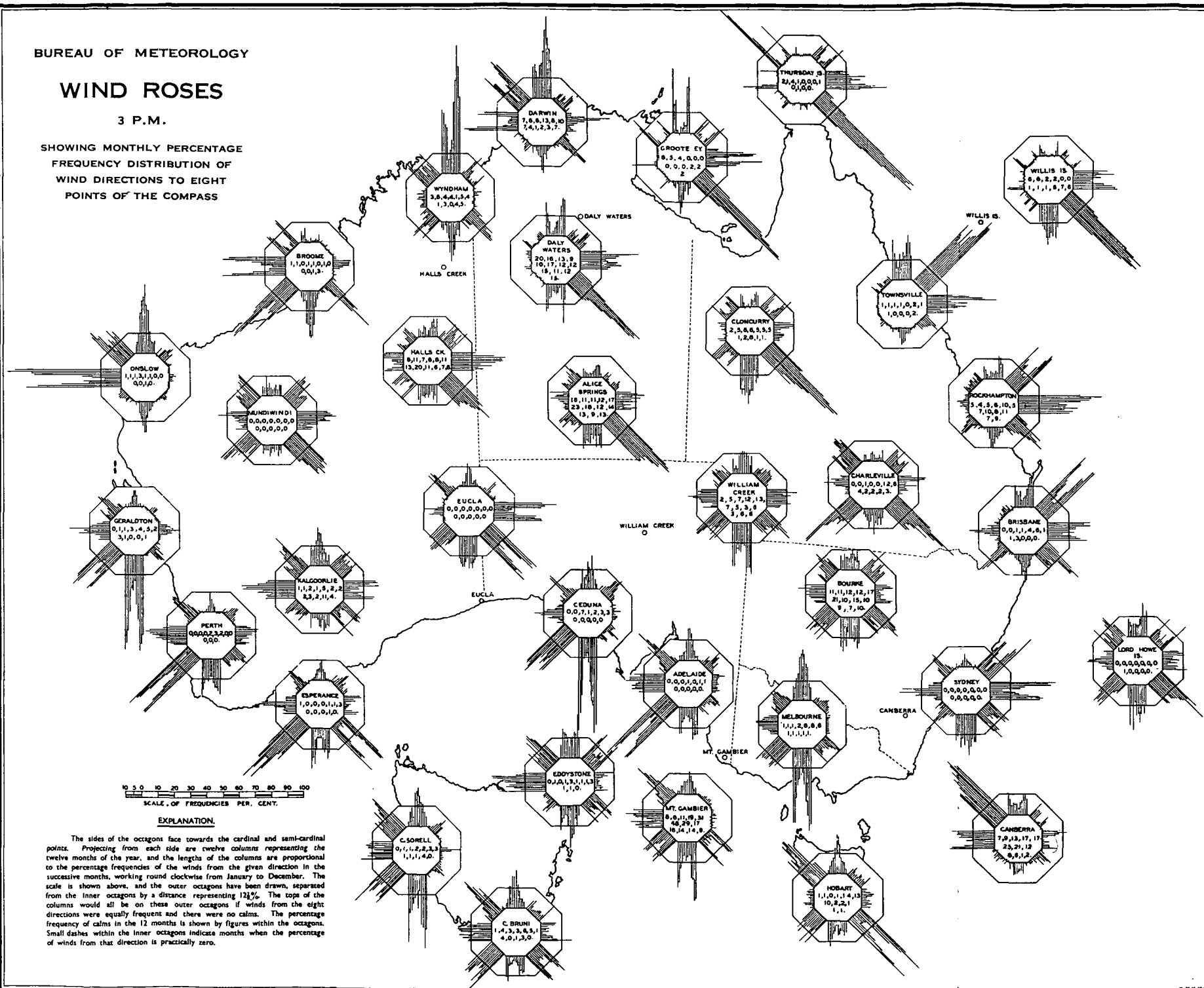
The sides of the octagons face towards the cardinal and semi-cardinal points. Projecting from each side are twelve columns representing the twelve months of the year, and the lengths of the columns are proportional to the percentage frequencies of the winds from the given direction in the successive months, working round clockwise from January to December. The scale is shown above, and the outer octagons have been drawn, separated from the inner octagons by a distance representing 12%. The tops of the columns would all be on these outer octagons if winds from the eight directions were equally frequent and there were no calms. The percentage frequency of calms in the 12 months is shown by figures within the octagons. Small dashes within the inner octagons indicate months when the percentage of winds from that direction is practically zero.

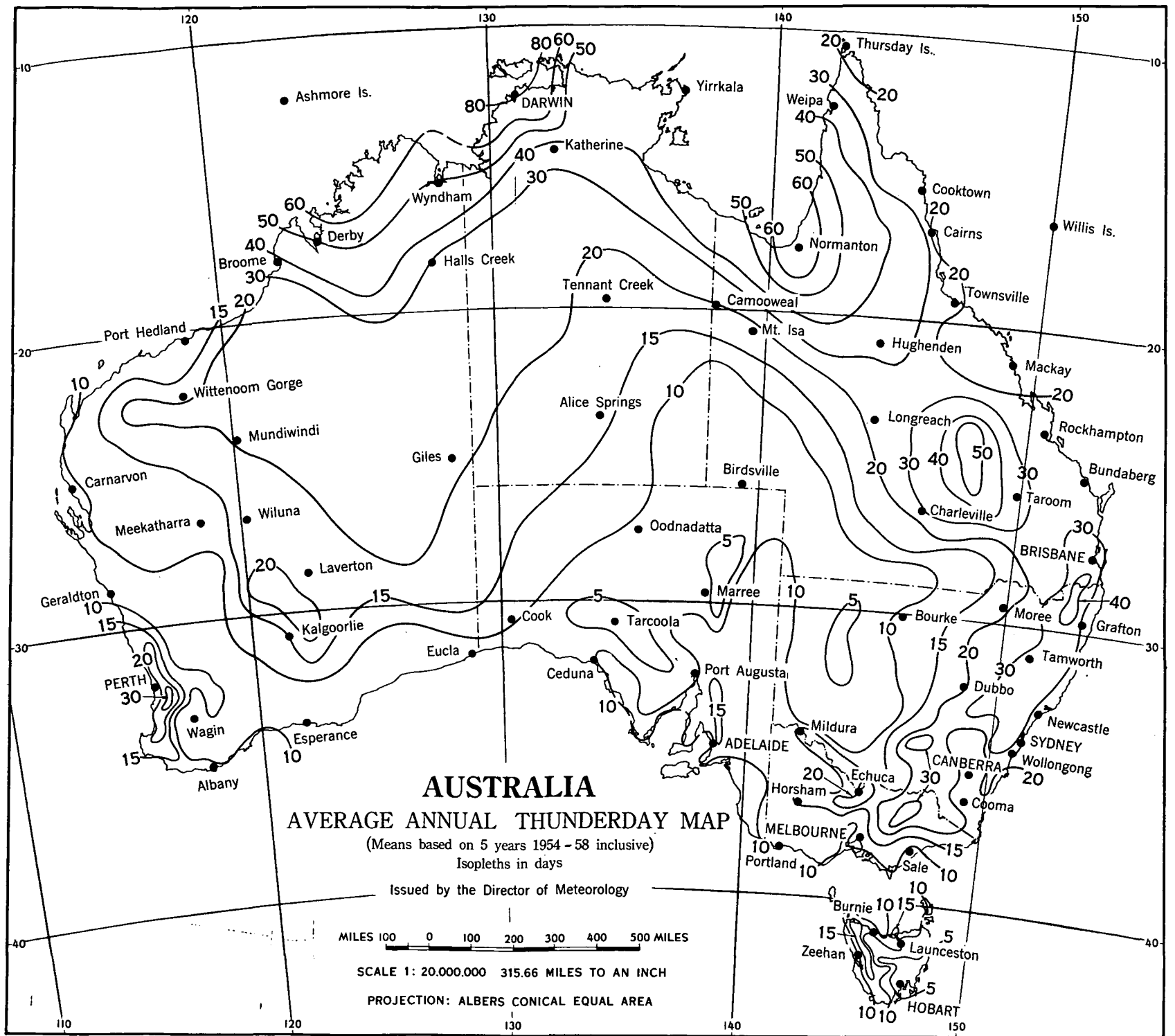
BUREAU OF METEOROLOGY

WIND ROSES

3 P.M.

SHOWING MONTHLY PERCENTAGE  
FREQUENCY DISTRIBUTION OF  
WIND DIRECTIONS TO EIGHT  
POINTS OF THE COMPASS





HEAVY RAINFALLS TO 1964, INCLUSIVE—*continued*

Name of town or locality	Date	Amount (inches)	Name of town or locality	Date	Amount (inches)
--------------------------	------	-----------------	--------------------------	------	-----------------

## AUSTRALIAN CAPITAL TERRITORY

Jervis Bay . . . . .	29 Apr. 1963	7.15	Uriarra (Woodside).	27 May 1925	6.57
Cotter Junction . . . . .	27 May 1925	7.13	Land's End . . . . .	27 May 1925	6.35
Canberra (Acton) . . . . .	27 May 1925	6.84			

## VICTORIA

Balook . . . . .	18 Feb. 1951	10.81	Blackwood (Green-hill) . . . . .	26 Jan. 1941	8.98
Hazel Park . . . . .	1 Dec. 1934	10.50	Tambo Crossing . . . . .	13 July 1925	8.89
Kalorama . . . . .	1 Dec. 1934	10.05	Corinella . . . . .	28 June 1948	8.75
Cann River . . . . .	16 Mar. 1938	9.94	Erica . . . . .	1 Dec. 1934	8.66
Tonghi Creek . . . . .	27 Feb. 1919	9.90	Mt. Buffalo . . . . .	6 June 1917	8.53
Cann River . . . . .	27 Feb. 1919	9.56	Korumburra . . . . .	1 Dec. 1934	8.51
Olinda . . . . .	1 Dec. 1934	9.10			

## TASMANIA

Mathinna . . . . .	5 Apr. 1929	13.25	Riana . . . . .	5 Apr. 1929	11.08
Cullenswood . . . . .	5 Apr. 1929	11.12	Triabunna . . . . .	5 June 1923	10.20

*Snow and hail.* For varying periods from late autumn to early spring snow usually covers the ground to a great extent on the Australian Alps above a level of about 4,500 to 5,000 feet, where in both New South Wales and Victoria ski-ing resorts operate throughout the season.

In Tasmania also the highlands are frequently covered above the 3,500 feet level for extended periods of the winter. There are, however, some years when snowfalls are much lighter than normal and even fail completely. Light snow has been known to fall occasionally as far north as the New England plateau in New South Wales (latitude 31° S.), and in exceptional seasons much of the dividing range from Victoria to Toowoomba (Queensland) has been covered above a level of about 4,000 feet. In ravines around Mount Kosciusko small areas of snow may persist throughout the summer after a heavy winter fall. This winter snowfall of south-eastern Australia is important in aiding the reliable flow of many streams which are utilized in the hydro-electric schemes of the Snowy Mountains, northern Victoria, and Tasmania. Snowfall at low terrain elevations occurs from time to time, particularly in Tasmania and Victoria, but falls are usually light and rarely lie more than a few days.

Hail is most frequent in winter and spring along the south-eastern coastal region of the continent and in Tasmania, where it is usually of a relatively small size. Summer storms, however, which are quite frequent, particularly in the highland plateau regions of eastern Australia, often produce stones of large size and of destructive intensity. Very large stones capable of piercing light gauge galvanized iron are reported from time to time, and damage to fruit crops in south-eastern Australia from large hail stones is quite frequent.

*Floods.* In general, flooding in Australia is most pronounced on the shorter streams flowing from the Great Dividing Range into the Pacific Ocean along the seaboard of Queensland and New South Wales. These floods are particularly destructive on the more densely populated coast of New South Wales. The chief rivers in this area are the Tweed, Richmond, Clarence, McLeay, Nepean, Hawkesbury, Hunter and Shoalhaven, all of which experience quite frequent and considerable flooding. These floods occur chiefly in summer but may occur at any time of the year.



The great Fitzroy and Burdekin river systems in Queensland are also subject to floods during the summer wet season, while much of the heavy monsoon rain in northern Queensland flows southward through the normally dry channels of the network of rivers draining into Lake Eyre. This water may cause extensive floods over a vast area, but it is soon lost by seepage and evaporation and rarely reaches the lake in any quantity. The Condamine and the other tributaries of the Darling also carry considerable volumes of water south through western New South Wales to the Murray, and flooding along their courses occurs from time to time.

Flooding also occurs from time to time, usually in autumn, winter and spring, in the Murray-Murrumbidgee system of New South Wales and Victoria and on the smaller coastal streams of southern Victoria. In Tasmania, flooding of the north coast streams, particularly the South Esk system, is common in the same seasons. In South Australia, some flooding has occurred in the lower reaches of the Murray owing to rainfall as far away as Queensland and south-eastern New South Wales. In the north of Western Australia and the Northern Territory, flooding of the coastal streams occurs frequently in summer but is not of such economic importance as the flooding of the eastern coastal streams of the continent, where many localities are more vulnerable to damage.

### Temperature

The accurate measurement of the temperature of the air is not easy, as temperature sensitive devices also absorb radiant heat or can lose heat by radiation. Following international practice, air temperature measurements in Australia are made by thermometers freely exposed in a double louvred box (the Stevenson screen). Maximum and minimum air temperatures during each day are measured by means of special thermometers exposed in the Stevenson screen. The minimum air temperature at the surface of the earth as the ground cools at night by outgoing radiation (the terrestrial or grass minimum) is also measured at many stations. Such temperature recordings measure a theoretical physical quantity which bears only an indirect relation to the comfort or discomfort a person feels. Temperature measurements alone may be regarded only as a first approximation to a measurement of personal comfort. The actual degree of personal comfort is related to a number of meteorological factors such as air temperature, windspeed, humidity, exposure to the sun's rays, and the temperature of surrounding surfaces (i.e. the radiation balance of the body).

In addition to these quantities which are all physically measurable, a number of personal quantities are involved which vary greatly from person to person and which cannot be precisely expressed, e.g., race and acclimatization, age and state of health, type of clothing, and degree of physical activity in work and recreation. Conditions thus vary greatly for a particular individual even in a fixed location, so that it is difficult to describe general comfort variability uniquely throughout a region as varied climatically as Australia. A number of indexes which attempt to incorporate some of the factors described above have been used experimentally from time to time, and further research continues on this very difficult problem. Generally speaking, there is an increase in discomfort northwards within the tropical regions of Australia in summer, owing to the heat and high absolute humidity which reach a maximum in the extreme north of the continent. Such conditions are, however, ameliorated to a large extent in highland areas such as the Atherton Tableland in Queensland. No part of Australia is uncomfortably hot in winter, and only in a small area of the Australian Alps and highland Tasmania does bodily strain due to cold exist in winter. The history of the settlement of the northern regions of Queensland and the Northern Territory indicates that with accelerating development of studies and experience in the arrangement of living and working accommodation, clothing, and general way of life, the effects of extremes of climate can be minimized.

For some further discussion of the problems of temperature and comfort conditions reference may be made to Ashton, H. T., *Meteorological Data for Air Conditioning in Australia*, Bureau of Meteorology Bulletin No. 47 (1964).

*Average seasonal temperature distribution.* Plates 5 to 8 show the normal daily maximum and minimum temperature for January and July, which may be taken as indicative respectively of the summer and winter seasons in Australia. Further detailed temperature data are presented on pages 40-49 for the capital cities and more important country towns of the Commonwealth.

On the basis of average annual mean temperatures, and latitude for latitude, Australia is somewhat cooler than the other land masses of the southern hemisphere and considerably cooler than the same latitudes in the large continental areas of the northern hemisphere. This is due to the insular nature of Australia and the stronger general circulation of the atmosphere in the southern hemisphere resulting in the transport of higher latitude (cooler) air into the subtropical regions.

July is the month with the lowest mean temperature in all parts of the continent, while the month with the highest mean temperature varies from February in Tasmania and southern Victoria to December in the northern part of the continent and November in Darwin. The

lateness of the month of highest average temperature in the extreme south of the continent is due in part to the effect of the Southern Ocean, where the sea surface temperature reaches its maximum in February. The cooler period of the late summer in the north is due largely to increased cloudiness associated with the inflow of north-west winds with the onset of the monsoon season.

In January average maximum temperatures exceed 95° F. over a vast area of the interior of the continent, and over large areas exceed 100° F. The hottest part of Australia is situated in the north of Western Australia around the Marble Bar and Nullagine area, where the daily maximum screen temperature during the summer frequently exceeds 100° F. for weeks at a time.

The marked change of maximum temperature in summer with distance from the sea, in areas close to the coasts, particularly along the Great Australian Bight and the Indian Ocean coast of Western Australia, is due to the penetration inland of the vigorous sea breezes which are initiated by the considerable temperature contrast between land and sea surface temperatures. The 75° F. isotherm of January mean maximum temperature skirts the southern coast of the continent from south-western Western Australia to Gippsland.

In January the mean minimum temperatures in the tropics, except for some highland regions, exceed 72° F., with a gradual decrease southward to values of 55° F. in Victoria and 50° F. in Tasmania. Highland regions in the south have mean values of 45° F. and lower. In July a more regular latitudinal distribution of mean maximum temperature is evident, only the extreme north of the continent having mean maxima higher than 80° F. Values lower than 60° F. are general over the south-eastern part of the continent, with mean maxima falling below 40° F. in small alpine areas. Average night minimum temperatures in July fall below 45° F. in areas south of the tropics and away from the coast. Alpine regions again record the lowest temperatures with some areas experiencing means lower than 25° F.

*Extreme variation and daily range.* Only at a few inland places in Australia does the absolute range of temperature (i.e. the range from the highest maximum to the lowest minimum) exceed 100° F. Generally it is in the range 70° F. to 90° F. in the inland areas and somewhat less on the coasts. The highest temperature recorded in Australia was 127.5° F. at Cloncurry (Queensland) on 16 January 1889 and the lowest -8° F. at Charlotte Pass in the southern Alps on 14 July 1945 and again on 22 August 1947. The world record maximum temperature is 136° F. at Azizia (Tripoli) on 13 August 1922 and the world record minimum temperature -126.9° F. at Vostok on the Antarctic plateau on 24 August 1960.

*High temperatures.* Heat waves with a number of successive days higher than 100° F. are relatively common in many parts of Australia. With the exception of the north-western coast of Western Australia, however, most coastal areas do not usually experience more than a few days in succession of such conditions. The frequency of such conditions increases inland, and periods of up to twenty days have been recorded over most of the settled areas. This figure increases in western Queensland and north-western Western Australia to more than sixty days in places. The central part of the Northern Territory and the Marble Bar-Nullagine area of Western Australia have recorded the most prolonged heat waves for the Australian region. The longest consecutive period of daily maxima greater than 100° F. was 160 consecutive days recorded in Marble Bar during the summer of 1923-24.

*Frosts.* Injury to the tissues of growing plants is not caused until the temperature has fallen considerably below the freezing point of water (32° F.), and a ground frost is regarded as having occurred when the grass thermometer has fallen below 30.4° F. However, as terrestrial minima are not recorded at all stations, it is usual for statistical purposes to regard the registration of a screen thermometer of 36° F. as indicating a 'light' frost. A map showing frequency of days with screen minima higher than 36° F. (i.e. the frost free period) is reproduced in plate 9. A 'heavy' frost is taken as a screen reading of less than 32° F. A 'black' frost occurs with a combination of low temperature and low humidity, and, although frost crystals are not observed on the ground, damage takes place to the plant cells by the freezing and expansion of the moisture they contain.

The frequency of frost depends largely on altitude, latitude, and proximity to the sea, and locally, to a very large extent, on even minor variations in contour of the land. The parts of Australia which are most subject to frost are the eastern highlands from north-eastern Victoria to the western Darling Downs in southern Queensland. Most stations in this region experience more than ten nights a month with readings of 32° F. or under for three to five months of the year. On Tasmania's Central Plateau similar conditions occur for three to six months of the year. Heavy frosts are comparatively infrequent in Western Australia, except in parts of the south and south-west. In South Australia frosts are most frequent in the agricultural areas of the south-east.

Frosts may occur within a few miles of the coast over the whole continent except the Northern Territory and most of north Queensland. Regions subject to frost at all times of the year comprise the whole of Tasmania, the tablelands of New South Wales, much of inland Victoria, particularly the north-east, and a small part of south-western Western Australia. Over most of the interior of the continent, and on the highlands of Queensland as far north as the Atherton Plateau, frosts commence in April and end in September, but they are infrequent in these months. Minimum temperatures below 32° F. are experienced in most of the sub-tropical interior in June and July.

For further details of frost conditions in Australia reference should be made to Foley, J. C., *Frost in the Australian Region*, Bureau of Meteorology Bulletin No. 32 (1945).

#### Humidity and saturation deficit

The amount of water vapour in the atmosphere is determined mainly by the temperature. The higher the temperature the more water vapour may be contained in a given mass of air. Vapour pressure is the pressure exerted by the water vapour of the atmosphere. At any given temperature there is a definite upper limit to the amount of water that can exist as vapour in the air. When this limit is reached the air is said to be saturated and the pressure of the water vapour is the saturation vapour pressure. Both these quantities may be expressed in millibars or in inches of mercury. The usual measure of humidity or moistness of the air is the relative humidity (which is measured by means of wet and dry bulb screen thermometers). This term is applied to the ratio of the existing vapour pressure to the saturated vapour pressure at the existing temperature and expressed as a percentage. However, from the point of view of physical comfort and in many industrial and agricultural problems, the more important measure of atmospheric water vapour is the absolute humidity or the actual mass of moisture contained in a fixed mass of air.

The annual variation of vapour pressure for regions outside the tropics closely follows that of temperature. However, the mean relative humidity in the temperate regions is generally highest in winter and lowest during the summer. In northern Australia the highest relative humidity occurs during the rainy summer season. The relative humidity variation during the day closely follows the diurnal variation of temperature, being highest with low temperatures and lowest with high temperatures. The relative humidity at 9 a.m. for Australian conditions may be considered as a close approximation to the mean for the whole day. In the tables for the capital cities, pages 40-47, the mean monthly vapour pressure and relative humidity for 9 a.m., together with the monthly extremes, are listed. The order of the stations in descending values of mean annual vapour pressure at 9 a.m. is Darwin, Brisbane, Sydney, Perth, Melbourne, Adelaide, Canberra, and Hobart, while the annual mean of the 9 a.m. relative humidities diminishes in the order Hobart, Melbourne, Sydney, Darwin, Brisbane, Canberra, Perth, and Adelaide.

Another method of humidity measurement which may be employed is the saturation vapour deficit. This may be defined as the difference between the saturation vapour pressure and the actual vapour pressure both referred to the dry bulb temperature. It is thus a measure of the drying power of the air and like vapour pressure may be expressed in millibars or inches of mercury.

In January the mean saturation deficit at the mean temperature for the month has a maximum value of over 0.90 inches in the central parts of Western Australia and in south-eastern Queensland. Gradual decreases occur towards the coast, where values close to the north, east, and south coastlines are around 0.20 inches. On the western coast values are somewhat higher, and a strong gradient exists in the saturation deficit in the narrow region bordering the Indian Ocean. In July the variation is less, with maxima of 0.40 inches in the dry north of the Northern Territory and Western Australia, slowly decreasing generally to the south, with values over most of the south-east and extreme south-west of the continent being less than 0.10 inches. Extremely low values (less than 0.025 inches) exist in July over the highlands of south-eastern Australia and Tasmania.

#### Evaporation

Evaporation is a process which results in the transfer of water vapour from the surface of the earth into the atmosphere and takes place from free water surfaces, from moist soil, and by the process of transpiration from plants. The figures quoted in this section, however, refer to evaporation as measured from an Australian standard evaporation tank. This instrument consists of a copper tank surrounded by a 6-inch water jacket sunk in the ground to a depth of 36 inches and exposing at ground level a water surface 36 inches in diameter from which the evaporation loss of water is measured. Earlier estimates of Australian evaporation data were supplemented by calculations based on an empirical formula dependent on saturation deficit, but more recent measurements have enabled charts of monthly and annual evaporation to be constructed wholly

from observational records. Such a map is plate 10. The rate and quantity of evaporation in any territory are influenced by the net radiation, prevailing temperature, vapour pressure, and turbulent diffusion by wind.

In Australia the study of evaporation is of great importance, since in its drier regions water conservation must be practised by the use of tanks and dams. The magnitude of the economic loss by evaporation may be appreciated from plate 10, which shows that the yearly amount varies from 20 inches over the highland areas of central Tasmania to more than 130 inches in the northern and north-western part of South Australia.

Over an area of some 70 per cent of the continent, comprising most inland districts and extending to the coast in the north-west of Western Australia and to the head of the Great Australian Bight, the rainfall does not exceed the evaporation loss in any month of the year. The central and north-western portions of the continent experience evaporation far in excess of their rainfall. Vegetation over these areas is characterized by acacia, scrub steppe, and arid scrub, while many areas are merely sand hills and stony desert. Over many of the drier areas, however, particularly in the inland areas of south-eastern Australia, the loss of rainfall by evaporation is made good to some extent by the development of irrigation schemes. Some of these schemes, such as those at the Murrumbidgee Irrigation Area in New South Wales and at Mildura in Victoria and Renmark in South Australia, have been very successful. The Snowy Mountains Hydro-electric Scheme will also result in the large scale supply of water from the south-eastern highlands of Australia for use in the drier areas to the west of the ranges in New South Wales and Victoria. The future development of such schemes as these holds promise for the reclamation of many marginal areas in Australia, which because of low rainfall and high evaporation are at present of little economic value.

Since the loss by evaporation depends largely on the net radiation absorbed and consequently on the extent of the exposed area, tanks and dams so designed that the surface area shall be a minimum are advantageous. Further, the more protected they are from the direct rays of the sun and from winds by means of suitable tree planting the less will be the evaporation loss. The Mansfield process for the treatment of tanks and dams by a mono-molecular chemical film which materially reduces evaporation is a recent development which is already giving beneficial results, particularly on large water storage areas. Such improvements are of considerable importance to the pastoralists of the drier regions of Australia and to water supply authorities.

Further information on evaporation may be found in Hounam, C. E., *Evaporation in Australia*, Bureau of Meteorology Bulletin No. 44 (1961).

### Sunshine and cloud

The proportion of the sky covered by cloud is of considerable meteorological and climatological importance. A cloud cover inhibits both incoming and outgoing radiation and thus profoundly affects the temperature distribution and other factors at the earth's surface. Cloud amount is measured in eighths of the sky covered.

In Australia the seasonal changes in cloudiness correspond closely to that of rainfall. In the southern or more temperate parts of the continent, particularly in the coastal and low lying areas, the winter months are generally more cloudy than the summer. This is due to the formation of extensive areas of stratiform cloud and fog during the colder months, when the structure of the lower layers of the atmosphere favours the physical processes resulting in this type of cloud. A particularly strong annual periodicity exists in the monsoonal regions of northern Australia, where it is heavily clouded during the summer wet season and practically cloudless during the winter 'dry'. Cloudiness is higher near coasts and on the windward slopes of the mountains of eastern Australia and is least over the dry interior parts of the continent.

A close relationship exists between cloud amount and number of sunshine hours, and it is possible to estimate from cloud data the equivalent number of sunshine hours over a given period. These data can be incorporated with records of direct measurement of sunshine hours, and approximate distribution maps produced for Australia. Maps of the mean sunshine distribution for January and July are reproduced in plates 11 and 12 and indicate the main features of the variation over Australia in these months.

Except for Tasmania and a narrow fringe bordering the southern, eastern and northern coasts, the greater part of the continent receives more than 3,000 hours of sunshine each year, and in Central Australia and the mid-western coast of Western Australia, totals in excess of 3,500 hours occur. The extreme south coast receives in the main 2,000 to 2,500 hours annually, while the east coast regions of New South Wales and Queensland receive 2,500 to 3,000 hours. A minimum of less than 1,750 hours occurs on the west coast and highlands of Tasmania.

Mean amounts of cloud for each month at the capital cities are included in the tables on pages 40-47, as are the mean daily hours of sunshine. The latter figure is a good single measure of the relative climatic characteristics of the individual cities for different months of the year.

### Wind

Australia lies in those latitudes of the southern hemisphere where it is influenced largely by two wind systems:

- (a) the south-east trade winds blowing on the equatorial side of the mid-latitude anticyclones; and
- (b) the westerlies south of the mid-latitude anticyclones in which successive low pressure systems move eastward over the Southern Ocean.

The only pronounced seasonal variations of atmospheric pressure in the middle and high latitudes of the southern hemisphere are related to the latitudinal shift in the axes of the sub-tropical high pressure systems and to the change in the tracks of the migratory anticyclones. The latter systems move generally from west to east in the Australian region between the semi-permanent oceanic anticyclones of the Indian and Pacific Oceans. The mean path of these systems lies over southern Australia during the summer but moves northwards during the winter with the thermal equator. The movement is only of a few degrees of latitude but it is of very great importance to the climate of the Australian continent. During the summer months, when the anticyclones move on a more southerly track, the south-east trades affect the whole coast of eastern Australia north of around latitude 30° S., the westerlies retreating to higher latitudes, and conditions are more settled over southern Australia which then lies close to the axis of the anticyclones. In winter the anticyclones move further north, the trades affect only the northern parts of the continent, and southern Australia is exposed to the westerlies of the Southern Ocean.

In summer, with the retreat of the anticyclones to the south, the whole of northern and north-western Australia is exposed initially to light wind systems, and then during the period from December to April to the effects of the north-west monsoon. This process, which is associated with an inflow of north-west winds and intensive rains, is not as regular or persistent as the south-west monsoon of south-east Asia. However, it is a sufficiently regular feature of the climate of northern Australia to be designated as the north-west season, or, as it is best known in the area, 'the wet'. Its influence affects areas as far south as central Queensland, but southern Queensland and the area east of the Great Dividing Range are largely still under the influence of the south-east trades. Fringe or marginal areas on the southern limits of the monsoonal penetration over the continent have a shorter and more uncertain 'wet' season, which in some years fails to appear at all. With the northward advance of the anticyclones in autumn, the monsoon gives way again to the trades, and 'the dry' of northern and north-western Australia commences.

The general features of these wind patterns may be seen in the wind rose diagrams of plates 13 and 14. It is important, however, to note the dynamic nature of the atmosphere, and that the continual growth, decay and motion of the pressure systems result in a wide diversity of wind-flow types. Descriptions of wind conditions for particular geographical areas and seasons can thus be only of a very generalized kind. Further, local features can also be imposed on the overall wind pattern — channelling of winds due to topography (e.g. the high frequency of north-west winds in Hobart) and the marked summer sea breeze characteristics of most of the Australian coast, particularly near the Great Australian Bight as shown in the diagrams of 3 p.m. wind frequencies.

### Storms and tropical cyclones

In general there are two types of weather systems in Australia which produce very strong winds and heavy rainfalls over large areas of the continent:

- (a) the active depressions which move westwards over the Southern Ocean; and
- (b) the tropical cyclones or hurricanes of north-eastern and north-western Australia.

During the winter the southern shores of the continent are subject to the deep depressions of the southern low pressure belt. They are felt most severely over the south-west of Western Australia, the south-east of South Australia, southern Victoria, and Tasmania, and may move inland in all these regions bringing strong winds and heavy rainfall. Further extensions of this type of system frequently develop close to the coast of New South Wales, often bringing severe weather to this region and to southern Queensland. These are generally known as 'east coast lows'.

The frontal systems (i.e. the narrow zones characterized by cloud and bad weather separating two air masses of different density) which are associated with these depressions vary widely in character. A common type in south-east Australia is a cold front located in a  $\wedge$  shaped trough. Such a system usually brings very strong north to north-west winds in advance of the front with a very abrupt backing of the wind to colder west to south-westerly winds after the frontal passage. Such frontal passages are, in their most severe form, associated with thunderstorms and line squalls, heavy rain, and a change to cold winds and showers. These violent changes with the passage of a cold front and strong southerly winds frequently affect the New South Wales coast as far north as Newcastle during the winter, and are popularly known as 'southerly busters'.

The most extensive rains of inland Australia occur when moist tropical air which has moved inland is lifted by convergence ahead of a slow moving colder air mass moving from the southern Ocean. The coast of Queensland, particularly the section from Cooktown to Mackay and the adjacent waters, is subject to visitations by tropical cyclones (the 'hurricanes' of the Caribbean and 'typhoons' of the China Sea). These destructive systems can affect this region from December to April, normally forming in the Coral Sea, moving south-west close to the coast and then passing away to the south-east into the Pacific. They may, however, cross the coast from time to time and bring torrential rain and violent winds (often more than 100 m.p.h.) to the coastal regions.

Similar systems affect the north-west coast of Western Australia where they bear the local name of 'willy willies', a name which is, however, often used generally in Australia for minor local whirlwinds or dust devils. The season in this region generally lasts from November to April, the storms originating in the Timor or Arafura Seas travelling usually south-west and approaching the coast most commonly between latitudes 20° S. and 22° S. Thence the systems may move southward following the coast, or sometimes cross inland bringing high rainfalls to the otherwise dry interior of the continent. A further region which is affected somewhat less frequently by tropical cyclones is the coast of Arnhem Land in the Northern Territory and the waters and coasts of the Gulf of Carpentaria.

Tropical cyclones, in general, soon lose their intensity on crossing from sea to land, but, although the wind force rapidly abates, they are still capable of producing the heavy rainfall which leads to flooding of coastal rivers, damage to stock and property, and general disruption of transport.

Thunderstorms which bring local heavy rain and strong winds are common to most of Australia. They are also of particular importance because of the lightning damage which they cause to power transmission lines, and have been extensively studied for the purpose of siting electrical installations as far as possible in areas of low thunderstorm occurrence. Plate 15 shows the number of days annually on which thunder is heard, which is a better observational criterion than lightning observed. The region of maximum thunderstorm activity is the extreme north-west of the continent and the region south-east of the Gulf of Carpentaria. In the more settled areas, maximum thunderstorm occurrence is in central western and south-eastern Queensland and the highland areas of New South Wales. The minimum number of storms occur over the interior of South Australia, western New South Wales, and eastern Tasmania.

#### **Climatological tables**

The averages and extremes for a number of elements which have been determined from long series of observations at the Australian capitals up to and including the year 1963 are given in the following pages, together with more limited data for the larger country towns of the Commonwealth. The following points apply throughout:

- (a) Where records are available, mean or average values have been calculated on a standard period of thirty years from 1911 to 1940.
- (b) Extreme values have been extracted from all available years of actual record, but the number of years quoted does not include intervening periods when observations were temporarily discontinued.

CLIMATOLOGICAL DATA: PERTH, WESTERN AUSTRALIA

(Lat. 31° 57' S., Long. 115° 51' E. Height above M.S.L. 210 ft.)

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS AND CLEAR DAYS

Month	Bar. corrected to 32° F., m.n. sea level and standard gravity from 9 a.m. and 3 p.m. readings	Wind (Height of anemometer 71 feet)					Mean amount of evaporation (inches)	No. of days of lightning	Mean amount of clouds, 9 a.m., 3 p.m., 9 p.m.(c)	No. of clear days	
		Average miles per hour	Highest mean speed in one day (miles per hour)	Highest gust speed (miles per hour)	Prevailing direction						
					9 a.m.	3 p.m.					
No. of years of observations.	30(b)	30(b)	67	52	30(b)	30(b)	30(b)	30(b)	30(b)		
January	29.897	10.9	26.3	27/98	50	E	SSW	10.37	2	2.9	14
February	29.922	10.7	21.5	6/08	54	ENE	SSW	8.63	2	3.1	13
March	29.976	10.1	21.5	6/13	70	E	SSW	7.52	2	3.5	12
April	30.071	8.5	31.5	25/00	63	ENE	SSW	4.62	2	4.2	9
May	30.062	8.4	27.3	29/32	74	NE	WSW	2.80	3	5.4	6
June	30.068	8.4	30.2	17/27	80	N	NW	1.82	3	5.9	5
July	30.082	8.8	33.5	20/26	85	NNE	W	1.76	2	5.6	5
August	30.084	9.4	31.9	15/03	97	N	WNW	2.37	2	5.6	6
September	30.073	9.4	28.5	11/05	68	ENE	SSW	3.44	1	4.9	8
October	30.033	10.0	26.7	6/16	65	SE	SW	5.38	1	4.8	8
November	29.989	10.7	25.7	18/97	63	E	SW	7.65	2	3.9	9
December	29.923	11.0	25.6	6/22	64	E	SSW	9.69	2	3.2	13
Year { Totals	..	..	..	..	..	..	..	66.05	23	..	108
Year { Averages	30.015	9.7	..	..	..	E	SSW	..	..	4.4	..
Year { Extremes	..	..	33.5	20/7/26	97	..	..	..	..	..	..

(a) Scale 0-10. (b) Standard thirty years' normal (1911-1940).

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.)			Extreme shade temperature (°Fahr.)		Extreme range	Extreme temperature (°Fahr.)		Mean daily hours of sunshine				
	Mean max.	Mean min.	Mean	Highest	Lowest		Highest in sun	Lowest on grass					
										No. of years over which observation extends.			
No. of years over which observation extends.	30(a)	30(a)	30(a)	68	68	68	63(c)	66	30(a)				
January	84.6	63.3	73.9	110.7	29/56	48.6	20/25	62.1	177.3	22/14	39.5	20/25	10.4
February	85.1	63.5	74.3	112.2	8/33	47.7	1/02	64.5	173.7	4/34	39.8	1/13	9.8
March	81.3	61.5	71.4	106.4	14/22	45.8	8/03	60.6	167.0	19/18	36.7	8/03	8.8
April	76.3	57.4	66.8	99.7	9/10	39.3	20/14	60.4	157.0	8/16	31.0	20/14	7.5
May	69.0	52.8	60.9	90.4	2/07	34.3	11/14	56.1	146.0	4/25	25.3	11/14	5.7
June	64.4	49.8	57.1	81.7	2/14	34.9	22/55	46.8	135.5	9/14	25.9	27/46	4.8
July	62.8	48.0	55.4	76.4	21/21	34.2	7/16	42.2	133.2	13/15	25.1	30/20	5.4
August	63.8	48.4	56.1	82.0	21/40	35.4	31/08	46.6	145.1	29/21	26.7	24/35	6.0
September	66.8	50.4	58.6	90.9	30/18	36.7	6/56	54.2	153.6	29/16	27.2	(b)	7.2
October	69.7	52.6	61.1	99.0	26/61	40.0	16/31	59.0	161.2	19/54	29.8	16/31	8.1
November	76.7	57.3	67.0	104.6	24/13	42.0	1/04	62.6	167.0	30/25	35.0	3/47	9.6
December	81.2	60.9	71.0	107.9	20/04	47.5	29/57	60.4	168.8	11/27	38.0	29/57	10.4
Year { Averages	73.5	55.5	64.5	..	..	..	..	..	177.3	22/1/14	25.1	30/7/20	7.8
Year { Extremes	..	..	..	112.2	8/2/33	34.2	7/7/16	78.0	..	..	..	..	..

(a) Standard thirty years' normal (1911-1940). (b) 8/1952 and 6/1956. (c) Records discontinued 1963.

HUMIDITY, RAINFALL AND FOG

Month	Vapour pressure (inches)	Rel. hum. (%) at 9 a.m.			Rainfall (inches)				Fog				
		Mean	Highest mean	Lowest mean	Mean monthly	Mean No of days of rain	Greatest monthly	Least monthly		Greatest in one day			
											No. of years over which observation extends.		
No. of years over which observation extends.	30(a)	30(a)	68	68	30(a)	30(a)	89	89	89	30(a)			
January	0.438	51	63	41	0.33	3	2.17	1879	Nil (b)	1.74	27/79	0	
February	0.434	51	65	43	0.50	3	6.55	1955	Nil (b)	3.43	17/55	0	
March	0.432	57	66	46	0.90	5	5.71	1934	Nil (b)	3.03	9/34	0	
April	0.397	61	75	51	1.75	8	5.85	1926	Nil	1920	2.62	30/04	1
May	0.365	70	81	61	5.14	15	12.13	1879	0.77	1949	3.00	17/42	2
June	0.337	75	85	68	7.55	17	18.75	1945	2.16	1877	3.90	10/20	2
July	0.322	76	88	69	7.08	19	16.73	1958	2.42	1876	3.00	4/91	2
August	0.316	71	83	62	5.78	19	12.53	1945	0.46	1902	2.91	14/45	1
September	0.341	66	75	58	3.37	15	7.84	1923	0.34	1916	1.82	4/31	0
October	0.345	60	75	52	2.30	12	7.87	1890	0.15	1946	1.73	3/33	0
November	0.374	52	63	41	0.75	7	2.78	1916	Nil	1891	1.54	29/56	0
December	0.409	51	63	39	0.54	5	3.17	1951	Nil	(b)	1.84	3/51	0
Year { Totals	..	..	..	..	35.99	128	..	..	..	..	..	..	8
Year { Averages	0.376	62	..	..	..	..	..	..	..	..	..	..	..
Year { Extremes	..	..	88	39	..	..	18.75	6/1945	Nil(c)	..	3.90	10/6/20	..

(a) Standard thirty years' normal (1911-1940). (b) Various years. (c) November to April, various years. Dates in italics relate to nineteenth century.

CLIMATOLOGICAL DATA: DARWIN, NORTHERN TERRITORY

(Lat. 12° 28' S., Long. 130° 51' E. Height above M.S.L. 97 ft.)

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS AND CLEAR DAYS

Month	Bar. corrected to 32° F. min. sea level and standard gravity from 9 a.m. and 3 p.m. readings	Wind					Mean amount of evaporation (inches)	No. of days of lightning	Mean amount of clouds, 9 a.m. - 3 p.m., 9 p.m. (g)	No. of clear days
		Average miles per hour	Highest mean speed in one day (miles per hour)	Highest gust speed (miles per hour)	Prevailing direction					
					9 a.m.	3 p.m.				
No. of years of observations.	30	14	..	14(b)	..	..	7	30	30	30
January	29.706	6.1	..	66	NW & S	W & NW	5.94	16	7.1	1
February	29.728	6.7	..	54	W & S	W & NW	5.57	16	7.0	1
March	29.751	5.3	..	98	SE	W & NW	6.30	14	6.2	3
April	29.809	6.1	..	42	SE	E	6.44	6	3.5	11
May	29.859	6.5	..	37	SE	E	7.34	1	2.1	19
June	29.892	6.5	..	37	SE	E & SE	7.01	0	1.6	22
July	29.911	6.2	..	38	SE	E & SE	7.05	0	1.4	23
August	29.914	5.9	..	40	SE	NW & N	7.91	0	1.3	23
September	29.886	6.2	..	36	SE & S	NW & N	8.05	1	2.0	18
October	29.850	6.2	..	46	S	NW & N	9.29	8	3.2	10
November	29.797	5.5	..	57	W & S	NW & N	8.00	17	4.8	4
December	29.738	6.2	..	66	NW & S	NW & N	7.37	17	6.0	2
Year { Totals	..	..	..	..	..	..	..	96	..	137
Year { Averages	29.820	6.1	..	..	SE	NW	7.19	..	3.9	..
Year { Extremes	..	..	..	98	..	..	..	..	..	..

(a) Scale 0-10. (b) No records 1943-1958 inclusive.

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.)			Extreme shade temperature (°Fahr.)		Extreme range	Extreme temperature (°Fahr.)		Mean daily hours of sunshine			
	Mean max.	Mean min.	Mean	Highest	Lowest		Highest in sun	Lowest on grass				
No. of years over which observation extends.	30	30	30	84(a)	84(a)	84	25(d)	..	13			
January	89.9	77.3	83.6	100.0	2/82	68.8	16/59	31.2	168.0	26/42	..	5.7
February	89.8	77.1	83.4	100.9	20/87	63.0	25/49	37.9	163.6	23/38	..	6.0
March	90.2	77.1	83.6	102.0	(b)	66.6	31/45	35.4	165.6	23/38	..	7.1
April	91.9	75.9	83.9	104.0	7/83	60.8	11/43	43.2	163.0	1/38	..	8.1
May	90.1	72.6	81.4	102.3	8/84	59.2	8/49	43.1	160.0	5/20	..	9.5
June	87.5	69.5	78.5	98.6	17/37	53.8	23/63	44.8	155.2	2/16	..	9.8
July	86.6	67.8	77.2	98.0	17/88	50.7	29/42	47.3	156.0	28/17	..	9.8
August	88.5	69.7	79.1	98.0	19/00	56.4	11/63	41.6	156.2	28/16	..	10.4
September	91.0	73.9	82.5	102.0	20/82	62.1	9/63	39.9	157.0	(c)	..	9.5
October	92.6	77.2	84.9	104.9	17/92	68.5	26/45	36.4	160.5	30/38	..	9.8
November	93.2	78.2	85.7	103.3	9/84	66.8	4/50	36.5	170.4	14/37	..	8.1
December	92.0	78.1	85.0	102.0	9/83	68.5	24/41	33.5	169.0	26/23	..	7.1
Year { Averages	90.3	74.5	82.4	..	..	..	..	..	..	..	..	8.4
Year { Extremes	..	..	..	104.9	17/10/1892	50.7	29/7/42	54.2	170.4	14/11/37	..	..

(a) Years 1882-1941 at Post Office, 1942-1963 at Aerodrome; sites not strictly comparable. (b) 26/1883 and 27/1883. (c) 28/1916 and 3/1921. (d) Records discontinued 1941.

HUMIDITY, RAINFALL AND FOG

Month	Vapour pressure (inches)	Rel. hum. (%) at 9 a.m.			Rainfall (inches)					Fog			
		Mean 9 a.m.	Mean	Highest mean	Lowest mean	Mean monthly	Mean No of days of rain	Greatest monthly	Least monthly		Greatest in one day		
No. of years over which observation extends.	57(a)	57(a)	57(a)	57(a)	30	21	96(b)	96(b)	96(b)	30			
January	0.925	78	89	69	16.18	20	27.86	1896	2.70	1930	11.67	7/97	0.0
February	0.920	79	88	71	12.37	18	28.23	1956	0.53	1911	11.00	18/55	0.0
March	0.912	78	84	69	11.18	17	21.88	1898	0.81	1911	7.18	6/19	0.0
April	0.800	69	80	60	3.08	6	23.74	1891	Nil	1950	6.22	4/59	0.0
May	0.652	63	76	49	0.33	1	10.27	1882	Nil	(c)	2.19	6/22	0.0
June	0.545	61	75	52	0.09	1	1.53	1902	Nil	(c)	1.32	10/02	0.4
July	0.522	59	71	47	0.01	0	2.56	1900	Nil	(c)	1.71	2/00	1.1
August	0.613	63	73	53	0.02	0	3.30	1947	Nil	(c)	3.15	22/47	0.7
September	0.732	65	73	54	0.60	2	4.26	1942	Nil	(c)	2.78	21/42	0.2
October	0.832	65	72	60	1.93	5	13.34	1954	Nil	(c)	3.74	18/56	0.0
November	0.868	68	75	62	4.32	10	15.72	1938	0.40	1870	4.73	9/51	0.0
December	0.890	73	83	65	8.57	15	22.38	1910	0.98	1934	7.87	28/10	0.0
Year { Totals	..	..	..	..	58.68	95	..	..	..	..	..	..	2.4
Year { Averages	0.768	68	80	68	..	..	28.23	2/56	Nil	(d)	11.67	7/1/1897	..
Year { Extremes	..	..	89	47	..	..	..	..	..	..	..	..	..

(a) 1882 to 1938 at Post Office. (b) The figures below are the highest or lowest recorded at either the Post Office or Aerodrome sites. (c) Various years. (d) April to October, various years. Dates in italics relate to nineteenth century.



CLIMATOLOGICAL DATA: ADELAIDE, SOUTH AUSTRALIA

(Lat. 34° 56' S., Long. 138° 35' E. Height above M.S.L. 140 ft.)

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS AND CLEAR DAYS

Month	Bar. corrected to 32° F., m. sea level and standard gravity from 9 a.m. and 3 p.m. readings	Wind (Height of anemometer 75 feet)				Mean amount of evaporation (inches)	No. of days of lightning	Mean amount of clouds, 9 a.m., 3 p.m., 9 p.m.(c)	No. of clear days		
		Average miles per hour	Highest mean speed in one day (miles per hour)	Highest gust speed (miles per hour)	Prevailing direction						
					9 a.m.					3 p.m.	
No. of years of observations.	30(b)	13(c)	13(c)	48	30(b)	30(b)	30(b)	30(b)			
January	29.917	7.8	18.2	3/55	72	SW	SW	9.27	2.3	3.6	12.9
February	29.953	7.5	17.7	1/64	66	NE	SW	7.56	2.0	3.7	11.2
March	30.037	6.9	19.1	24/64	78	S	SW	6.39	1.8	4.0	10.6
April	30.119	6.9	23.2	10/56	81	NE	SW	3.78	1.5	5.2	7.2
May	30.131	7.0	23.5	19/53	70	NE	NW	2.27	1.3	5.8	4.9
June	30.119	7.4	18.4	12/53	67	NE	N	1.37	1.3	6.1	4.1
July	30.111	7.3	20.4	13/64	60	NE	NW	1.34	1.5	6.0	4.3
August	30.084	7.9	23.7	8/55	75	NE	SW	1.99	2.0	5.5	5.6
September	30.050	8.0	21.0	25/60	69	NNE	SW	3.05	2.0	5.3	5.8
October	30.007	8.4	21.9	6/62	75	NNE	SW	5.03	2.8	5.3	5.7
November	29.990	8.4	20.6	8/52	81	SW	SW	6.89	3.3	4.9	7.2
December	29.922	8.2	17.9	6/52	75	SW	SW	8.74	2.2	4.2	9.5
Year { Totals								57.68	24.0	..	89.0
Year { Averages	30.037	7.7	..	..	..	NE	SW	..	..	..	..
Year { Extremes			23.78/1955	81				..	..	5.0	..

(a) Scale 0-10. (b) Standard thirty years' normal (1911-1940). (c) Records taken from a Munro Anemometer, 1952-1964.

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.)			Extreme shade temperature (°Fahr.)		Extreme range	Extreme temperature (°Fahr.)		Mean daily hours of sunshine				
	Mean max.	Mean min.	Mean	Highest	Lowest		Highest in sun	Lowest on grass					
										No. of years over which observation extends			
No. of years over which observation extends.	30(a)	30(a)	30(a)	108	108	108	54(b)	104	30(a)				
January	84.8	61.0	72.9	117.7	12/39	45.1	21/84	72.6	180.0	18/82	36.5	14/79	10.0
February	85.7	61.8	73.7	113.6	12/99	45.5	23/18	68.1	170.5	10/00	35.8	23/26	9.3
March	81.3	59.1	70.2	110.5	9/34	43.9	21/33	66.6	174.0	17/83	32.1	21/33	7.9
April	73.0	54.4	63.7	98.6	5/38	39.6	15/59	59.0	155.0	1/83	28.0	14/63	6.0
May	66.8	50.8	58.8	89.5	4/21	36.9	(c)	52.6	148.2	12/79	25.6	19/28	4.8
June	61.0	46.6	53.8	78.1	4/57	32.5	(d)	45.6	138.8	18/79	21.0	24/44	4.2
July	59.9	45.4	52.7	74.0	11/06	32.0	24/08	42.0	134.5	26/90	22.1	30/29	5.4
August	62.3	46.2	54.3	85.0	31/11	32.3	17/59	52.7	140.0	31/92	22.8	11/29	4.3
September	66.8	48.3	57.5	95.1	30/61	32.7	4/58	62.4	160.5	23/82	25.0	25/27	6.3
October	72.5	51.7	62.1	102.9	21/22	36.1	20/58	66.8	162.0	30/21	27.8	(e)	7.3
November	78.1	55.4	66.7	113.5	21/65	40.8	2/09	72.7	166.9	20/78	31.5	2/09	8.6
December	82.6	58.9	70.7	114.6	29/31	43.0	(f)	71.6	175.7	7/99	32.5	4/84	9.5
Year { Averages	72.9	53.3	63.1	..	..	..	..	..	..	..	..	..	..
Year { Extremes				117.7	12/139	32.0	24/7/08	85.7	180.0	18/1/1882	21.0	24/6/44	7.0

(a) Standard thirty years' normal (1911-1940). (b) Records incomplete, 1931-1934. Discontinued, 1934. (c) 26/1895 and 24/1904. (d) 27/1876 and 24/1944. (e) 4/1931 and 2/1918. (f) 4/1906 and 16/1861.

HUMIDITY, RAINFALL AND FOG

Month	Vapour pressure (inches)	Rel. hum. (%) at 9 a.m.				Rainfall (inches)				Fog Mean No. of days of fog			
		Mean 9 a.m.	Highest mean	Lowest mean	Mean monthly	Mean No. of days of rain	Greatest monthly	Least monthly	Greatest in one day				
											No. of years over which observation extends.		
No. of years over which observation extends.	30(a)	30(a)	97	97	30(a)	30(a)	126	126	126	30(a)			
January	0.327	39	59	29	0.76	5	3.31	1941	Nil (b)	2.30	2/89	0.0	
February	0.352	41	57	30	1.10	5	6.09	1925	Nil (b)	5.57	7/25	0.0	
March	0.332	44	58	29	0.87	5	4.59	1878	Nil (b)	3.50	3/78	0.0	
April	0.329	55	72	37	1.45	10	5.81	1938	Nil 1945	3.15	3/60	0.0	
May	0.313	64	76	49	2.49	13	7.75	1875	0.10	1934	2.75	1/53	0.6
June	0.294	75	84	63	2.93	15	8.58	1916	0.23	1958	2.11	1/20	1.1
July	0.282	75	87	66	2.49	16	5.44	1890	0.39	1899	1.75	10/65	1.4
August	0.282	68	78	54	2.58	16	6.20	1852	0.33	1944	2.23	19/51	0.4
September	0.289	59	72	44	2.39	13	5.83	1923	0.27	1951	1.59	20/23	0.2
October	0.287	48	67	29	1.54	10	5.24	1949	0.17	1914	2.24	16/08	0.0
November	0.292	41	58	31	1.22	8	4.45	1839	0.08	1922	2.96	12/60	0.0
December	0.322	40	56	31	1.27	6	3.98	1861	Nil	1904	2.42	23/13	0.0
Year { Totals					21.09	122							3.7
Year { Averages	0.308	54	..	..	..	..	..	..	..	..	..	..	..
Year { Extremes			87	29	..	..	8.58	6/1916	Nil(c)	5.57	7/2/25	..	..

(a) Standard thirty years' normal (1911-1940). (b) Various years. (c) December to April, various years. Dates in italics relate to nineteenth century.

CLIMATOLOGICAL DATA: BRISBANE, QUEENSLAND  
(Lat. 27° 28' S., Long. 153° 2' E. Height above M.S.L. 134 ft.)

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS AND CLEAR DAYS

Month	Bar. corrected to 32° F. m. sea level and standard gravity from 9 a.m. and 3 p.m. readings	Wind (Height of anemometer 105 feet)					Mean amount of evaporation (inches)	No. of days of lightning	Mean amount of clouds, 9 a.m., 3 p.m., 9 p.m. (g)	No. of clear days	
		Average miles per hour	Highest mean speed in one day (miles per hour)	Highest gust speed (miles per hour)	Prevailing direction						
					9 a.m.	3 p.m.					
No. of years of observations.	30(b)	30(b)	50	50	30(b)	30(b)	30(b)	30(b)	30(b)	30(b)	
January	29.865	6.8	19.7	23/47	58	SE	NE	6.74	9.8	5.7	3.5
February	29.912	7.0	23.2	21/54	67	SE	NE	5.49	6.5	5.6	2.4
March	29.975	6.5	20.3	1/29	66	S	E	5.05	5.9	5.1	5.4
April	30.035	5.9	16.7	3/25	64	S	E	4.05	5.0	4.3	7.8
May	30.083	5.8	17.9	17/26	49	SW	SE	3.09	4.1	4.3	8.3
June	30.091	5.7	19.0	14/28	59	SW	W & SW	2.45	2.9	4.4	9.2
July	30.090	5.6	22.0	13/54	67	SW	W & SW	2.69	2.8	3.8	12.4
August	30.105	5.8	14.8	4/35	62	SW	NE	3.51	3.8	3.1	13.1
September	30.067	5.9	16.1	1/48	63	SW	NE	4.51	5.8	3.3	13.0
October	30.019	6.3	15.7	1/41	62	S	NE	5.81	7.1	4.2	8.5
November	29.958	6.7	15.5	10/28	69	SE & N	NE	6.32	9.5	4.9	5.9
December	29.890	7.0	19.5	15/26	79	SE	NE	7.02	10.6	5.3	3.8
Year { Totals	30.007	6.3	..	..	..	SW	NE	56.73	73.8	..	93.3
Year { Averages	..	..	..	..	..	..	..	..	..	..	..
Year { Extremes	..	..	23.2	21/2/54	79	..	..	..	..	4.5	..

(a) Scale 0-10. (b) Standard thirty years' normal (1911-1940).

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.)			Extreme shade temperature (°Fahr.)		Extreme range	Extreme temperature (°Fahr.)		Mean daily hours of sunshine				
	Mean max.	Mean min.	Mean	Highest	Lowest		Highest in sun	Lowest on grass					
										No. of years over which observation extends.			
No. of years over which observation extends.	30(a)	30(a)	30(a)	78	78	78	50(b)	78	30(a)				
January	85.5	69.1	77.3	109.8	26/40	58.8	4/93	51.0	169.0	2/37	49.9	4/93	7.6
February	84.6	68.7	76.6	105.7	21/25	58.5	23/31	47.2	165.2	6/10	49.1	22/31	7.4
March	82.3	66.2	74.3	99.4	5/19	52.4	29/13	47.0	162.5	6/39	45.4	29/13	7.0
April	79.1	61.5	70.3	95.2	(c)	44.4	25/25	50.8	153.8	11/16	36.7	24/25	7.1
May	73.7	55.6	64.7	90.3	21/23	40.6	30/51	49.7	147.0	1/10	29.8	8/97	6.6
June	69.4	51.5	60.5	88.9	19/18	36.3	29/08	52.6	136.0	3/18	25.4	23/88	6.3
July	68.6	49.4	59.0	84.3	23/46	36.1	(d)	48.2	146.1	20/15	23.9	11/90	6.8
August	71.1	50.0	60.6	91.0	14/46	36.9	13/64	54.1	141.9	20/17	27.1	9/99	7.9
September	75.5	54.8	65.1	100.9	22/43	40.7	1/96	60.2	155.5	26/03	30.4	1/89	8.2
October	79.2	60.3	69.8	105.3	30/58	43.3	3/99	62.0	157.4	31/18	34.9	8/89	8.4
November	82.3	64.6	73.4	106.1	18/13	48.5	2/05	57.6	162.3	7/89	38.8	1/05	8.2
December	84.5	67.5	76.0	105.9	26/93	56.3	5/55	49.6	165.9	28/42	49.1	3/94	8.2
Year { Averages	78.0	59.9	69.0	109.8	26/1/40	36.1	(d)	73.7	169.0	2/1/37	23.9	11/7/1890	7.5
Year { Extremes	..	..	..	..	..	..	..	..	..	..	..	..	..

(a) Standard thirty years' normal (1911-1940). (b) From 1887 to March 1947, excluding 1927-1936. (c) 9/1896 and 5/1903. (d) 12/7/1894 and 2/7/1896.

HUMIDITY, RAINFALL AND FOG

Month	Vapour pressure (inches)	Rel. hum. (%) at 9 a.m.			Rainfall (inches)					Fog			
		Mean	Highest mean	Lowest mean	Mean monthly	Mean No. of days of rain	Greatest monthly	Least monthly	Greatest in one day				
											No. of years over which observation extends.		
No. of years over which observation extends.	30(a)	30(a)	78	78	30(a)	30(a)	113(b)	113(b)	113(b)	30(a)			
January	0.636	66	79	53	5.72	12	27.72	1895	0.32	1919	18.31	21/87	0.6
February	0.644	69	82	55	5.47	12	40.39	1893	0.58	1849	10.61	6/31	0.9
March	0.606	72	85	56	4.97	14	34.04	1870	Nil	1840	11.18	14/08	1.0
April	0.512	71	80	56	3.68	11	15.28	1867	0.04	1944	5.46	5/33	4.6
May	0.420	71	85	59	2.35	9	13.85	1876	Nil	1846	5.62	9/79	5.4
June	0.357	73	84	54	2.75	8	14.03	1873	Nil	1847	6.41	15/48	4.5
July	0.331	71	88	53	1.88	8	8.60	1950	Nil	1841	3.54	(c)	4.9
August	0.338	67	80	53	1.07	7	14.67	1879	Nil	(d)	4.89	12/87	5.9
September	0.396	62	76	47	1.69	7	5.43	1886	0.10	1907	2.46	2/94	2.8
October	0.459	59	72	48	2.27	8	11.41	1949	0.03	1948	5.34	25/49	1.6
November	0.533	61	73	45	4.00	10	12.40	1917	Nil	1842	4.46	16/86	0.7
December	0.589	62	70	51	4.24	11	17.36	1942	0.35	1865	6.60	28/71	0.4
Year { Totals	..	..	..	..	40.09	117	..	..	..	..	..	..	33.3
Year { Averages	0.485	67	..	..	..	..	..	..	..	..	..	..	..
Year { Extremes	..	..	88	45	..	..	40.39	2/1893	Nil	(e)	18.31	21/1/1887	..

(a) Standard thirty years' normal (1911-1940). (b) Records incomplete for various years between 1846 and 1859. (c) 15/1876 and 16/1889. (d) 1862, 1869 and 1880. (e) Various months in various years. Dates in italics relate to nineteenth century.

CLIMATOLOGICAL DATA: SYDNEY, NEW SOUTH WALES

(Lat. 33° 52' S., Long. 151° 12' E. Height above M.S.L. 138 ft.)

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS AND CLEAR DAYS

Month	Bar. corrected to 32° F., min. sea level and standard gravity from 9 a.m. and 3 p.m. readings	Wind (Height of anemometer 58 feet)				Mean amount of evaporation (inches)	No. of days of lightning	Mean amount of clouds, 9 a.m., 3 p.m., 9 p.m.(g)	No. of clear days		
		Average miles per hour	Highest mean speed in one day (miles per hour)	Highest gust speed (miles per hour)	Prevailing direction						
					9 a.m.					3 p.m.	
No. of years of observations.	30(b)	26(c)	51	48	26(c)	26(c)	26(c)	30(d)	30(b)	30(b)	
January	29.875	8.9	24.9	2/22	93	S	ENE	5.71	4.8	5.7	4.8
February	29.942	8.1	20.1	14/18	63	NE	ENE	4.68	3.3	5.5	5.4
March	30.009	7.5	20.7	10/44	58	W	ENE	4.08	2.8	5.3	5.8
April	30.063	7.0	23.4	19/27	72	W	NE	2.94	2.4	5.0	7.0
May	30.098	6.8	21.1	18/55	63	W	S	2.17	1.6	4.9	7.4
June	30.078	7.1	22.4	10/47	84	W	W	1.61	1.5	4.8	8.3
July	30.070	7.2	26.6	6/31	68	W	W	1.30	2.1	3.9	11.1
August	30.060	7.4	24.6	9/51	68	W	NE	2.00	2.0	4.2	10.0
September	30.018	8.0	22.3	19/17	70	W	NE	3.17	3.9	4.9	7.4
October	29.976	8.2	24.5	1/57	95	W & E	ENE	4.97	4.5	5.5	5.7
November	29.935	8.5	22.5	14/30	71	W	ENE	5.64	5.4	5.8	4.8
December	29.881	8.9	25.0	10/20	75	S	ENE	5.64	5.4	5.8	4.8
Year { Totals	30.000	7.8	..	..	..	..	NE	42.90	36.4	..	87.8
Year { Averages	..	..	..	..	..	..	..	..	..	..	..
Year { Extremes	..	..	26.6	6/7/31	95	W	..	..	..	5.0	..

(a) Scale 0-10. (b) Standard thirty years' normal (1911-1940). (c) 1915-1940. (d) 1921-1950.

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fabr.)			Extreme shade temperature (°Fabr.)		Extreme range	Extreme temperature (°Fabr.)		Mean daily hours of sunshine				
	Mean max.	Mean min.	Mean	Highest	Lowest		Highest in sun	Lowest on grass					
										No. of years over which observation extends.			
No. of years over which observation extends.	30(a)	30(a)	30(a)	106	106	106	84(b)	106	30(c)				
January	78.6	65.1	71.8	113.6	14/39	51.1	18/49	62.5	164.3	26/15	43.7	6/25	7.5
February	78.7	65.5	72.1	107.8	8/26	49.3	28/63	58.5	168.3	14/39	42.8	22/33	7.0
March	76.6	62.9	69.8	102.6	3/69	48.8	14/86	53.8	158.3	10/26	39.9	17/13	6.4
April	72.0	57.7	64.9	91.4	1/36	44.6	27/64	46.8	144.1	10/77	33.3	24/09	6.1
May	67.0	52.4	59.7	86.0	1/19	40.2	22/59	45.8	129.7	1/96	29.3	25/17	5.7
June	62.8	48.1	55.5	80.4	11/31	35.7	22/32	44.7	125.5	2/23	28.0	22/32	5.3
July	61.8	46.4	54.1	78.3	22/26	35.9	12/90	42.4	124.7	19/77	24.0	4/93	6.1
August	64.3	47.6	56.0	86.8	24/54	36.8	3/72	50.0	149.0	30/78	26.1	4/09	7.0
September	68.3	51.4	59.9	92.3	27/19	40.8	2/45	51.5	142.2	20/33	30.1	17/05	7.3
October	71.7	55.9	63.8	99.4	4/42	42.2	6/27	57.2	152.2	20/33	32.7	9/05	7.5
November	74.5	59.8	67.1	104.5	6/46	45.8	1/05	58.7	158.5	28/99	36.0	6/06	7.5
December	76.9	63.2	70.1	108.0	20/57	48.4	3/24	59.6	164.5	27/89	41.4	3/24	7.5
Year { Averages	71.1	56.3	63.7	..	..	..	..	..	..	..	..	..	..
Year { Extremes	..	..	..	113.6	14/1/39	35.7	22/6/32	77.9	168.3	14/2/39	24.0	4/7/1893	6.7

(a) Standard thirty years' normal (1911-1940). (b) Records discontinued 1946. (c) 1921-1950 (different exposure prior to 1921).

HUMIDITY, RAINFALL AND FOG

Month	Vapour pressure (inches)	Rel. hum. (%) at 9 a.m.			Rainfall (inches)					Fog				
		Mean 9 a.m.	Mean	Highest mean	Lowest mean	Mean monthly	Mean No of days of rain	Greatest monthly	Least monthly		Greatest in one day			
												No. of years over which observation extends.		
No. of years over which observation extends.	30(a)	30(a)	89	89	30(a)	30(a)	106	106	106	44				
January	0.537	65	78	58	3.86	13	15.26	1911	0.25	1932	7.08	13/11	0.3	
February	0.560	68	81	60	3.15	12	22.22	1956	0.12	1939	8.90	25/73	0.7	
March	0.527	71	85	62	4.44	13	20.52	1942	0.42	1876	11.05	28/42	1.7	
April	0.441	73	87	63	5.65	14	24.49	1861	0.06	1868	7.52	29/60	2.4	
May	0.362	75	90	63	4.98	12	23.03	1919	0.14	1957	8.36	28/89	3.5	
June	0.303	76	89	63	3.68	11	25.30	1950	0.16	1962	5.17	16/84	2.4	
July	0.282	74	88	63	4.89	12	13.23	1950	0.10	1946	7.80	7/31	2.4	
August	0.288	68	84	54	2.41	10	14.89	1899	0.04	1885	5.33	2/60	2.0	
September	0.325	62	79	49	2.77	11	14.05	1879	0.08	1882	5.69	10/79	1.0	
October	0.378	60	77	46	2.80	11	11.13	(b)	0.21	1867	6.37	13/02	0.5	
November	0.433	60	79	42	2.54	11	20.36	1961	0.07	1915	5.24	27/55	0.5	
December	0.501	63	77	51	3.63	13	15.82	1920	0.23	1913	4.75	13/10	0.4	
Year { Totals	..	..	..	..	..	..	..	..	..	..	..	..	..	
Year { Averages	0.411	68	..	..	44.80	143	..	..	..	..	..	..	18.2	
Year { Extremes	..	..	90	42	..	..	25	30	6/1950	0.04	8/1885	11.05	28/3/42	..

(a) Standard thirty years' normal (1911-1940). (b) 1916 and 1959.

Dates in italics relate to nineteenth century.

CLIMATOLOGICAL DATA: CANBERRA, AUSTRALIAN CAPITAL TERRITORY  
(Lat. 35° 18' S., Long. 149° 6' E. Height above M.S.L., 1,906 ft.)

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS AND CLEAR DAYS

Month	Bar. corrected to 32° F., mn. sea level and standard gravity from 9 a.m. and 3 p.m. readings	Wind (Height of anemometer 20 feet)					Mean amount of evaporation (inches)	No. of days of lightning	Mean amount of clouds, 9 a.m. and 3 p.m. (g)	No. of clear days
		Average miles per hour	Highest mean speed in one day (miles per hour)	Highest gust speed (miles per hour)	Prevailing direction					
					9 a.m.	3 p.m.				
No. of years of observations.	26	27	35	26(b)	27	27	28	20	26	27
January	29.856	4.7	14.9 23/33	65	NW	NW	8.31	1.5	4.9	7.3
February	29.900	4.2	15.3 24/33	64	E	NW	6.42	2.3	5.1	6.3
March	30.009	3.7	18.2 28/42	52	E	NW	5.20	0.2	5.1	6.9
April	30.059	3.6	18.6 8/45	52	NW	NW	3.28	0.3	5.4	4.7
May	30.126	3.0	13.2 27/58	64	NW	NW	1.95	0.2	5.6	5.8
June	30.120	3.6	16.1 2/30	60	NW	NW	1.29	0.1	6.0	4.5
July	30.133	3.4	23.4 7/31	62	NW	NW	1.27	0.0	5.7	5.6
August	30.065	4.1	15.7 25/36	59	NW	NW	1.81	0.1	5.4	5.7
September	30.057	4.2	17.4 28/34	61	NW	NW	2.87	0.4	5.1	6.1
October	29.954	4.3	14.7 12/57	74	NW	NW	4.43	1.0	5.4	5.2
November	29.885	4.7	17.2 28/42	66	NW	NW	5.87	1.1	5.5	4.5
December	29.834	4.7	16.1 11/38	66	NW	NW	7.64	0.7	5.0	6.3
Year { Totals							50.34	7.9		68.9
Year { Averages	30.000	4.0	23.4 7/7/31	74	NW	NW			5.3	
Year { Extremes										

(a) Scale 0-10. (b) At aerodrome.

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.)			Extreme shade temperature (°Fahr.)		Extreme range	Extreme temperature (°Fahr.)		Mean daily hours of sunshine (c)
	Mean max.	Mean min.	Mean	Highest	Lowest		Highest in sun	Lowest on grass	
No. of years over which observation extends.	30(a)	30(a)	30(a)	37	37	37	(b)	37	25
January	82.5	55.9	69.3	107.4 11/39	38.0 1/56	69.4	..	30.1 10/50	8.9
February	80.7	56.1	68.4	99.8 13/33	35.0 (d)	64.8	..	26.5 23/43	8.2
March	76.2	52.6	64.4	99.1 6/38	34.8 31/49	64.3	..	26.4 26/35	7.4
April	66.8	45.4	56.1	89.7 6/38	29.0 29/34	60.7	..	19.0 18/44	6.9
May	59.3	38.9	49.1	72.6 1/36	22.5 (e)	50.1	..	15.6 (f)	5.5
June	52.8	35.7	44.3	64.9 1/54	18.1 20/35	43.9	..	8.9 25/44	4.5
July	51.8	33.7	42.7	63.5 16/34	20.0 (g)	43.5	..	10.8 9/37	5.0
August	55.1	35.4	45.3	71.0 24/54	21.0 3/29	50.0	..	10.1 6/44	6.0
September	61.4	38.9	50.1	81.5 16/34	25.2 6/46	56.3	..	13.0 6/45	7.6
October	67.1	44.2	55.6	90.0 13/46	28.0 26/61	62.0	..	18.2 2/45	8.0
November	73.0	48.7	60.9	101.4 19/44	32.2 11/36	69.2	..	25.9 6/40	9.0
December	79.6	53.4	66.5	103.5 27/38	36.0 24/28	67.5	..	28.1 11/64	9.1
Year { Averages	67.2	44.9	56.1	107.4 11/1/39	18.1 20/6/35	89.3	..	8.9 25/6/44	7.2
Year { Extremes									

(a) Thirty year period 1928-1957. (b) No record. (c) 1911-1920 at Westridge, 1934-1936 at Acton, subsequently at Forestry School. (d) 22/1931 and 23/1931. (e) 9/1929 and 15/1957. (f) 13/1937 and 15/1946. (g) 19/1929, 9/1937 and 27/1943.

HUMIDITY, RAINFALL AND FOG

Month	Vapour pressure (inches)	Rel. hum. (%) at 9 a.m.			Rainfall (inches)				Fog	
		Mean	Highest mean	Lowest mean	Mean monthly	Mean No of days of rain	Greatest monthly	Least monthly		Greatest in one day
No. of years over which observation extends.	26	28	28	28	30(a)	30(a)	37	37	37	25
January	0.370	53	69	39	2.09	7	6.69 1941	0.02 1932	3.22 30/58	0.1
February	0.388	59	71	40	2.15	7	6.03 1948	0.01 1933	3.24 17/28	0.2
March	0.378	66	82	48	2.43	7	12.69 1950	0.01 1940	2.72 1/61	1.0
April	0.315	71	81	54	2.12	8	5.19 1952	0.07 1942	2.52 9/45	1.4
May	0.254	79	89	67	2.00	7	6.13 1948	0.06 1935	3.88 3/48	4.8
June	0.212	81	90	72	1.89	9	6.09 1931	0.18 1944	2.32 25/56	5.8
July	0.196	81	91	73	1.63	10	5.08 1960	0.27 1940	2.02 13/33	5.3
August	0.213	75	88	60	1.98	11	4.71 1939	0.36 (b)	2.07 12/29	2.4
September	0.239	66	78	51	1.58	9	4.52 1960	0.13 1946	1.78 16/62	1.4
October	0.273	60	72	46	2.70	11	6.98 1959	0.34 1940	5.19 21/59	0.4
November	0.301	55	67	38	2.08	9	5.98 1961	0.28 1936	2.45 9/50	0.1
December	0.338	51	70	37	1.88	8	8.80 1947	0.16 1938	2.29 28/29	0.0
Year { Totals					24.53	103				22.9
Year { Averages	0.290	66	79	61	2.09	9	12.69 3/50	0.01 2/33,3/40	5.19 21/10/59	
Year { Extremes		91	91	37						

(a) Thirty year period 1928-1957. (b) 1944 and 1949.

All dates relate to twentieth century. Except where indicated records are those for the Forestry School.

CLIMATOLOGICAL DATA: MELBOURNE, VICTORIA  
(Lat. 37° 49' S., Long. 144° 58' E. Height above M.S.L., 114 ft.)

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS AND CLEAR DAYS

Month	Bar. corrected to 32° F., mn. sea level and standard gravity from 9 a.m. and 3 p.m. readings	Wind (Height of anemometer 93 feet)					Mean amount of evaporation (inches)	No. of days of lightning	Mean amount of clouds 9 a.m. to 3 p.m. p.m.(c)	No. of clear days
		Average miles per hour	Highest mean speed in one day (miles per hour)	Highest gust speed (miles per hour)	Prevailing direction					
					9 a.m.	3 p.m.				
No. of years of observations.	30(b)	15(c)	52	55	30(b)	30(b)	30(b)	30(b)	30(b)	30(b)
January	29.897	8.8	21.1 27/41	66	S & SW	S	6.55	1.8	4.9	6.8
February	29.950	8.4	19.0 13/47	74	N & S	S	5.10	2.3	4.8	6.4
March	30.025	7.8	18.0 3/61	66	N	S	4.26	1.8	5.3	5.5
April	30.092	7.1	19.9 16/43	67	N	S	2.53	1.2	5.9	4.6
May	30.113	7.4	20.5 4/61	72	N	S	1.57	0.5	6.1	3.4
June	30.097	7.2	22.8 16/47	64	N	S	1.18	0.4	6.5	2.7
July	30.079	8.7	22.7 22/60	68	N	S	1.16	0.3	6.3	2.9
August	30.048	8.2	21.3 20/42	65	N	S	1.54	0.9	6.0	3.1
September	30.001	8.5	21.1 15/64	69	N & W	N & S	2.41	1.3	5.9	3.3
October	29.968	8.4	18.6 12/52	69	N	S	3.54	1.8	6.1	3.8
November	29.951	8.6	21.2 13/58	71	S & SW	S	4.62	2.3	6.0	3.6
December	29.896	8.7	21.0 11/52	61	S & SW	S	5.85	1.9	5.6	4.5
Year { Totals	30.010	8.1	..	..	N	S	40.31	16.5	..	50.6
Year { Averages	..	..	..	..	..	..	..	..	..	..
Year { Extremes	..	..	22.8 16/6/47	74	..	..	..	..	..	..

(a) Scale 0-10. (b) Standard thirty years' normal (1911-1940). (c) Early records not comparable.

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.)			Extreme shade temperature (°Fahr.)		Extreme range	Extreme temperature (°Fahr.)		Mean daily hours of sunshine
	Mean max.	Mean min.	Mean	Highest	Lowest		Highest in sun	Lowest on grass	
No. of years over which observation extends.	30(a)	30(a)	30(a)	109	109	109	86(b)	105	49(c)
January	77.7	56.9	67.3	114.1 13/39	42.0 28/85	72.1	178.5 14/62	30.2 28/85	8.1
February	78.6	58.0	68.3	109.5 7/01	40.2 24/24	69.3	167.5 15/70	30.9 6/91	7.5
March	74.9	55.2	65.1	107.0 11/40	37.1 17/84	69.9	164.5 1/68	28.9 (d)	6.6
April	67.9	50.8	59.3	94.8 5/38	34.8 24/88	60.0	152.0 8/61	25.0 2/97	5.0
May	62.0	46.9	54.5	83.7 7/05	29.9 29/16	53.8	142.6 2/59	21.1 26/16	3.9
June	56.8	43.8	50.3	72.3 2/57	28.0 11/66	44.3	129.0 11/61	19.9 30/29	3.3
July	56.2	42.6	49.4	69.3 22/26	27.0 21/69	42.3	125.8 27/80	20.5 12/03	3.7
August	58.7	43.7	51.2	77.0 20/85	28.3 11/63	48.7	137.4 29/69	21.3 14/02	4.6
September	63.3	46.0	54.7	88.6 28/28	31.0 3/40	57.6	142.1 20/67	22.8 8/18	5.5
October	67.9	48.7	58.3	98.4 24/14	32.1 3/71	66.3	154.3 28/68	24.8 22/18	5.9
November	71.3	51.8	61.5	105.7 27/94	36.5 2/96	69.2	159.6 29/65	24.6 2/96	6.4
December	75.4	55.3	65.3	110.7 15/76	40.0 4/70	70.7	170.3 20/69	33.2 1/04	7.3
Year { Averages	67.6	50.0	58.8	114.1 13/1/39	27.0 21/7/1869	87.1	178.5 14/1/1862	19.9 30/6/29	5.7
Year { Extremes	..	..	..	..	..	..	..	..	..

(a) Standard thirty years' normal (1911-1940). (b) Records discontinued, 1946. (c) 1916-1964. (d) 17/1884 and 20/1897.

HUMIDITY, RAINFALL AND FOG

Month	Vapour pressure (inches)	Rel. hum. (%) at 9 a.m.			Rainfall (inches)				Fog	
		Mean	Highest mean	Lowest mean	Mean monthly	Mean No of days of rain	Greatest monthly	Least monthly		Greatest in one day
No. of years over which observation extends.	30(a)	30(a)	57	57	30(a)	30(a)	109	109	109	30(a)
January	0.382	58	68	50	1.88	9	6.92 1963	0.01 1932	4.25 29/63	0.1
February	0.417	62	77	48	2.00	8	7.72 1939	0.03 1870	3.44 26/46	0.3
March	0.385	64	79	50	2.22	9	7.50 1911	0.14 1934	3.55 5/19	1.1
April	0.351	72	82	66	2.30	13	7.67 1960	Nil 1923	3.15 23/60	2.3
May	0.311	79	88	70	1.94	14	5.60 1942	0.14 1934	1.85 7/91	6.8
June	0.276	83	92	73	2.06	16	4.51 1859	0.61 1958	1.74 21/04	6.5
July	0.264	82	86	75	1.93	17	7.02 1891	0.57 1902	2.71 12/91	6.5
August	0.271	76	82	65	2.02	17	4.35 1939	0.48 1903	1.94 26/24	3.7
September	0.288	68	76	60	2.20	15	7.93 1916	0.52 1907	2.62 12/80	1.3
October	0.307	62	71	52	2.63	14	7.61 1869	0.29 1914	3.00 17/69	0.3
November	0.336	60	69	52	2.33	13	8.11 1954	0.25 1895	2.86 21/54	0.3
December	0.373	59	69	48	2.38	11	7.18 1863	0.11 1904	3.92 4/54	0.2
Year { Totals	..	..	..	..	25.89	156	..	..	..	29.4
Year { Averages	0.330	69	..	..	..	..	..	..	..	..
Year { Extremes	..	..	92	48	..	..	8.11 11/1954	Nil 4/1923	4.25 29/1/63	..

(a) Standard thirty years' normal (1911-1940). Dates in italics relate to nineteenth century.

CLIMATOLOGICAL DATA: HOBART, TASMANIA  
(Lat. 42° 53' S., Long. 147° 20' E. Height above M.S.L. 177 ft.)

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS AND CLEAR DAYS

Month	Bar. corrected to 32° F., mn. sea level and standard gravity from 9 a.m. and 3 p.m. readings	Wind (Height of anemometer 40 feet)					Mean amount of evaporation (inches)	No. of days of lightning	Mean amount of clouds, 9 a.m., 3 p.m., 9 p.m.(g)	No. of clear days	
		Average miles per hour	Highest mean speed in one day (miles per hour)	Highest gust speed (miles per hour)	Prevailing direction						
					9 a.m.	3 p.m.					
No. of years of observations.	30(b)	30(b)	72	74	30(b)	30(b)	30(b)	30(b)	30(b)		
January	29.819	8.0	20.8	30/16	71	NNW	SSE	4.84	0.9	6.4	1.9
February	29.913	7.2	25.2	4/27	69	NNW	SSE	3.71	1.0	6.2	2.3
March	29.961	6.8	21.4	13/38	79	NNW	SSE	3.10	1.2	6.1	2.4
April	29.997	6.7	24.1	9/52	74	NW	W	1.98	0.7	6.5	1.7
May	30.009	6.3	20.2	20/36	84	NNW	NW	1.37	0.4	6.1	2.4
June	29.986	6.2	23.7	27/20	75	NW	NW	0.91	0.4	6.2	2.4
July	29.958	6.5	22.9	22/53	80	NNW	NNW	0.94	0.3	6.1	2.0
August	29.906	6.8	25.5	19/26	87	NNW	NW	1.28	0.4	6.1	2.1
September	29.860	7.9	21.5	26/15	80	NNW	NW	1.97	0.7	6.3	1.5
October	29.833	8.2	19.2	8/12	74	NNW	SW	3.05	0.6	6.6	1.0
November	29.831	7.9	21.2	18/15	84	NNW	S	3.77	0.7	6.4	1.3
December	29.816	7.6	23.4	1/34	81	NNW	SSE	4.37	0.5	6.8	1.1
Year { Totals	29.907	7.2	..	..	..	NNW	W	31.29	7.8	..	22.1
Year { Averages	..	..	..	..	..	..	..	..	..	..	..
Year { Extremes	..	..	25.5	19/8/26	87	..	..	..	..	..	..

(a) Scale 0-10. (b) Standard thirty years' normal (1911-1940).

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.)			Extreme shade temperature (°Fahr.)		Extreme range	Extreme temperature (°Fahr.)		Mean daily hours of sunshine
	Mean max.	Mean min.	Mean	Highest	Lowest		Highest in sun	Lowest on grass	
No. of years over which observation extends.	30(a)	30(a)	30(a)	95(b)	95(b)	95(b)	57(c)	77(b)	30(i)
January	69.8	52.4	61.0	105.0 (d)	40.1 (e)	64.9	160.0 (f)	30.6 19/97	7.7
February	70.6	53.7	62.2	104.4 12/99	39.0 20/87	65.4	165.0 24/98	28.3 —/87	7.1
March	67.5	51.3	59.4	99.1 13/40	35.2 31/26	63.9	150.9 26/44	27.5 30/02	6.4
April	62.2	48.0	55.1	87.1 1/41	33.2 14/63	53.9	142.0 18/93	25.0 —/86	5.0
May	57.8	44.6	51.2	77.8 5/21	29.2 20/02	48.6	128.0 (g)	20.0 19/02	4.4
June	52.8	41.2	47.0	69.2 1/07	29.2 28/44	40.0	122.0 12/94	18.1 24/63	4.0
July	52.7	40.6	46.6	66.1 14/34	27.7 11/95	38.4	121.0 12/93	18.7 16/86	4.4
August	55.4	41.7	48.7	71.6 28/14	28.9 9/51	42.7	129.0 —/87	20.1 7/09	5.1
September	59.0	43.7	51.4	81.7 23/26	31.0 16/97	50.7	138.0 23/93	18.3 16/26	5.9
October	62.5	46.1	54.3	92.0 24/14	32.0 12/89	60.0	156.0 9/93	23.8 (h)	6.1
November	65.0	48.2	56.6	98.3 26/37	35.0 16/41	63.3	154.0 19/92	26.0 1/08	7.2
December	67.9	51.3	59.6	105.2 30/97	38.0 3/06	67.2	161.5 10/39	27.2 —/86	7.4
Year { Averages	61.9	46.9	54.4	105.2	27.7	77.5	165.0	18.1 24/6/63	5.9
Year { Extremes	..	..	..	105.2	27.7	77.5	165.0	18.1 24/6/63	..

(a) Standard thirty years' normal (1911-1940). (b) Records 1855-1882 not comparable. (c) Period 1934-1938 not comparable; records discontinued, 1946. (d) 1/1900 and 19/1959. (e) 9/1937 and 11/1937. (f) 5/1886 and 13/1905. (g) —/1899 and —/1893. (h) 1/1886 and —/1899. (i) 1921-1950.

HUMIDITY, RAINFALL AND FOG

Month	Vapour pressure (inches)	Rel. hum. (%) at 9 a.m.			Rainfall (inches)					Fog
		Mean	Highest mean	Lowest mean	Mean monthly	Mean No. of days of rain	Greatest monthly	Least monthly	Greatest in one day	
No. of years over which observation extends.	30(a)	55	71	71	30(a)	30(a)	82(b)	82(b)	82(b)	30(c)
January	0.309	59	72	46	1.82	13	5.91 1893	0.17 (d)	2.96 30/16	0.0
February	0.342	63	77	48	1.68	10	5.15 1954	0.11 1914	2.20 1/54	0.0
March	0.323	67	77	52	2.13	13	10.05 1946	0.29 1943	3.47 17/46	0.3
April	0.290	72	84	58	2.31	14	9.77 1960	0.07 1904	5.25 23/60	0.2
May	0.263	78	89	65	1.71	14	8.43 1958	0.14 1913	1.75 2/93	0.9
June	0.233	80	91	68	2.25	16	9.38 1954	0.28 1886	5.80 7/54	0.8
July	0.227	80	94	72	2.14	17	6.02 1922	0.17 1950	2.51 18/22	1.0
August	0.232	76	92	60	1.82	18	6.32 1946	0.30 1892	2.28 14/90	0.4
September	0.240	67	85	58	1.90	17	7.93 1957	0.38 1951	6.15 15/57	0.1
October	0.258	63	73	51	2.52	18	7.60 1947	0.39 1914	2.58 4/06	0.0
November	0.274	60	72	50	2.23	16	7.39 1885	0.33 1921	3.70 30/85	0.1
December	0.306	58	67	45	2.52	14	7.72 1916	0.17 1931	3.33 5/41	0.0
Year { Totals	..	..	..	..	25.03	180	..	..	..	3.8
Year { Averages	0.275	69	..	..	..	..	..	..	..	..
Year { Extremes	..	..	94	45	..	..	10.05 3/1946	0.07 4/1904	6.15 15/9/57	..

(a) Standard thirty years' normal (1911-1940). (b) Records prior to 1883 not comparable. (c) 1922-1951. (d) 1915 and 1958.

Dates in italics relate to nineteenth century.

## Rainfall and temperatures, various cities

Year Book No. 34, page 28, shows rainfall and temperature, and No. 38, page 42, temperature, for various important cities throughout the world and for the Australian capitals.

## Climatological data for selected Australian country towns

The following table shows some of the more important climatological data for selected Australian country towns, based on standard thirty years' normals (1911-1940).

## CLIMATOLOGICAL DATA FOR SELECTED AUSTRALIAN COUNTRY TOWNS

Town	Rainfall		Temperature				Relative humidity			
	Average annual rainfall	Average number of wet days	Mean maximum, January (°F.)	Mean maximum, July (°F.)	Mean minimum, January (°F.)	Mean minimum, July (°F.)	Average index of mean relative humidity, (a) January	Average index of mean relative humidity, (a) July	Mean 3 p.m., January (%)	Mean 3 p.m., July (%)
<b>WESTERN AUSTRALIA</b>										
Albany . . . . .	39.67	172	73.8	60.9	58.5	46.3	73	76	65	70
Broome . . . . .	22.87	38	91.3	81.8	79.2	57.0	75	52	67	43
Bunbury . . . . .	33.22	125	82.1	62.5	59.1	47.1	66	78	57	71
Carnarvon . . . . .	9.01	35	87.2	71.7	72.1	51.6	64	66	61	57
Esperance . . . . .	26.73	124	76.6	62.1	59.9	45.4	70	77	63	65
Geraldton . . . . .	18.58	80	84.5	67.7	66.3	51.7	61	68	60	60
Kalgoorlie . . . . .	9.46	62	93.2	62.5	64.2	42.9	43	66	27	50
Meekatharra . . . . .	9.17	36	100.4	67.5	73.1	44.0	31	59	21	44
Narrogin . . . . .	21.38	108	87.3	57.9	56.3	41.3	..	..	..	..
Port Hedland . . . . .	11.01	20	94.3	79.3	79.4	55.6	67	49	63	47
Wyndham . . . . .	25.15	55	95.9	85.0	80.2	66.2	66	38	54	35
<b>NORTHERN TERRITORY</b>										
Alice Springs . . . . .	9.93	31	95.3	66.9	69.8	38.9	33	49	26	32
Tennant Creek . . . . .	13.85	30	98.5	75.4	75.9	51.1	41	36	27	25
<b>SOUTH AUSTRALIA</b>										
Ceduna . . . . .	10.50	68	81.5	62.6	58.8	43.8	..	..	..	..
Mount Gambier . . . . .	26.86	192	74.2	56.2	53.5	42.4	65	79	50	69
Oodnadatta . . . . .	4.44	20	99.0	66.4	72.1	42.7	27	49	17	34
Port Augusta . . . . .	9.28	62	89.5	62.8	65.3	43.9	50	66	33	52
Port Lincoln . . . . .	18.24	119	77.4	60.2	58.5	46.4	64	76	53	70
Port Pirie . . . . .	12.99	78	89.2	61.7	62.6	45.4	51	72	..	..
<b>QUEENSLAND</b>										
Atherton . . . . .	53.99	116	83.8	70.9	65.0	50.0	78	79	..	..
Bundaberg . . . . .	42.37	84	86.1	71.6	69.7	49.2	74	72	63	55
Cairns . . . . .	86.35	140	89.7	78.1	74.2	61.0	77	74	69	63
Charleville . . . . .	17.97	49	97.6	68.3	70.8	40.1	44	61	28	39
Charters Towers . . . . .	23.26	59	92.9	76.0	71.3	51.6	65	64	46	47
Cloncurry . . . . .	16.89	35	98.7	76.4	76.5	51.5	40	40	30	27
Ipswich . . . . .	28.97	76	90.4	70.0	67.8	43.8	65	65	..	..
Longreach . . . . .	15.54	37	99.6	73.2	73.3	44.3	49	56	29	35
Mackay . . . . .	63.16	116	86.2	71.0	73.6	53.4	80	77	..	..
Maryborough . . . . .	45.43	122	87.9	71.5	68.8	47.6	73	74	..	..
Normanton . . . . .	37.56	56	94.3	84.0	77.0	58.6	70	48	52	34
Rockhampton . . . . .	37.36	93	90.0	73.7	72.3	51.2	68	65	55	45
Roma . . . . .	20.43	52	94.4	67.4	68.3	39.3	51	64	32	40
Toowoomba . . . . .	35.19	105	82.7	61.1	61.2	40.7	73	79	..	..
Townsville . . . . .	43.06	75	87.3	76.0	76.2	59.8	75	64	69	59

For footnote see next page.

CLIMATOLOGICAL DATA FOR SELECTED AUSTRALIAN COUNTRY TOWNS  
—continued

Town	Rainfall		Temperature				Relative humidity			
	Average annual rainfall	Average number of wet days	Mean maximum, January (°F.)	Mean maximum, July (°F.)	Mean minimum, January (°F.)	Mean minimum, July (°F.)	Average index of mean relative humidity, (a) January	Average index of mean relative humidity, (a) July	Mean 3 p.m., January (%)	Mean 3 p.m., July (%)

## NEW SOUTH WALES

Albury . . . . .	27.66	99	89.9	56.4	59.8	38.2	47	74	29	64
Armidale . . . . .	28.98	107	80.8	54.0	56.5	33.8	60	61	44	57
Bega . . . . .	35.92	80	81.2	62.9	57.3	34.5	72	70	..	..
Bourke . . . . .	11.74	44	98.0	63.8	69.3	40.8	37	64	24	48
Broken Hill . . . . .	9.20	46	90.5	59.5	64.5	41.2	36	67	24	49
Cooma . . . . .	18.85	38	78.8	50.4	52.2	30.2	55	67	38	56
Dubbo . . . . .	20.91	72	92.1	59.7	63.8	37.5	48	74	32	56
Goulburn . . . . .	24.27	112	81.5	52.4	56.2	35.8	59	74	43	67
Grafton . . . . .	34.68	105	89.1	70.6	67.2	43.9	..	..	..	..
Katoomba . . . . .	53.17	126	73.9	48.4	54.6	36.7	61	71	54	68
Leeton . . . . .	15.76	78	88.9	56.8	63.2	38.9	44	76	..	..
Moree . . . . .	21.43	56	96.0	64.8	67.4	39.0	..	..	..	..
Newcastle . . . . .	41.36	132	77.7	61.4	66.6	47.7	74	70	69	61
Orange . . . . .	31.52	95	83.9	51.6	53.7	31.4	..	..	..	..
Tamworth . . . . .	24.41	67	91.0	60.4	63.4	36.8	..	..	..	..
Taree . . . . .	47.48	110	83.9	64.5	62.0	42.7	..	..	..	..
Wagga . . . . .	21.42	86	89.8	57.1	61.5	37.8	50	77	31	65
Wollongong . . . . .	44.04	112	78.4	61.7	62.6	47.1	78	71	..	..

## VICTORIA

Ballarat . . . . .	27.38	170	75.7	49.8	50.5	38.4	60	81	41	75
Bendigo . . . . .	20.27	111	83.0	54.2	56.5	39.4	47	75	30	64
Geelong . . . . .	21.32	133	76.2	56.5	55.4	42.0	65	81	52	70
Horsham . . . . .	17.57	104	85.1	56.0	55.2	38.8	50	77	33	67
Mildura . . . . .	10.37	61	89.8	59.5	61.0	40.5	48	71	..	..
Sale . . . . .	23.70	128	77.5	56.8	54.4	38.6	65	79	51	68
Seymour . . . . .	22.17	94	84.7	55.2	54.6	37.4	56	79	..	..
Shepparton . . . . .	19.94	103	86.3	55.7	58.8	39.3	49	77	32	63
Wangaratta . . . . .	25.57	104	86.7	55.2	58.5	38.1	41	75	26	66
Warrnambool . . . . .	25.79	153	69.9	55.6	54.7	43.6	73	83	69	77

## TASMANIA

Burnie . . . . .	38.99	170	67.6	53.7	51.9	41.7	70	82	65	74
Launceston . . . . .	28.56	149	75.8	53.7	52.1	36.9	60	77	..	..
Zeehan . . . . .	94.06	246	66.3	51.6	48.0	38.2	73	81	61	74

(a) The average index of mean relative humidity has been derived from the ratio of the average 9 a.m. vapour pressure to the saturation vapour pressure at the average mean temperature of the month. Being thus related to the mean temperature this value of relative humidity is a good approximation to the daily mean.

The table on the next page gives the latitude, longitude, and altitude of the weather recording station at each of the above towns.



## LOCATION CO-ORDINATES FOR SELECTED AUSTRALIAN COUNTRY TOWNS

Station	Lat.	Long.	Altitude (ft.)	Station	Lat.	Long.	Altitude (ft.)
Western Australia—				Queensland— <i>continued</i>			
Albany . . . . .	34° 57'	117° 48'	226	Toowoomba . . . . .	27° 33'	151° 57'	1,921
Broome . . . . .	17° 57'	122° 13'	39	Townsville . . . . .	14° 15'	146° 46'	10
Bunbury . . . . .	33° 19'	115° 38'	3	New South Wales—			
Carnarvon . . . . .	24° 53'	113° 39'	12	Albury . . . . .	36° 06'	146° 54'	600
Esperance . . . . .	33° 51'	121° 53'	14	Armidale . . . . .	30° 32'	151° 38'	3,215
Geraldton . . . . .	28° 48'	114° 42'	92	Bega . . . . .	36° 40'	149° 50'	50
Kalgoorlie . . . . .	30° 46'	121° 27'	1,180	Bourke . . . . .	30° 05'	145° 58'	350
Meekatharra . . . . .	26° 36'	118° 29'	1,697	Broken Hill . . . . .	31° 57'	141° 28'	978
Narrogin . . . . .	32° 54'	117° 09'	1,150	Cooma . . . . .	36° 13'	149° 08'	2,749
Port Hedland . . . . .	20° 23'	118° 37'	20	Dubbo . . . . .	32° 10'	148° 37'	861
Wyndham . . . . .	15° 31'	128° 09'	20	Goulburn . . . . .	34° 45'	149° 43'	2,074
Northern Territory—				Grafton . . . . .	29° 41'	152° 56'	21
Alice Springs . . . . .	23° 48'	133° 53'	1,790	Katoomba . . . . .	33° 43'	150° 19'	3,280
Tennant Creek . . . . .	19° 38'	134° 11'	1,229	Leeton . . . . .	34° 33'	146° 24'	496
South Australia—				Moree . . . . .	29° 28'	149° 51'	680
Ceduna . . . . .	32° 08'	133° 42'	57	Newcastle . . . . .	32° 55'	151° 49'	122
Mount Gambier . . . . .	37° 45'	140° 47'	206	Orange . . . . .	33° 18'	149° 06'	2,850
Oodnadatta . . . . .	27° 33'	135° 29'	371	Tamworth . . . . .	31° 05'	150° 56'	1,279
Port Augusta . . . . .	32° 33'	137° 47'	14	Taree . . . . .	31° 54'	152° 28'	30
Port Lincoln . . . . .	34° 47'	135° 53'	13	Wagga . . . . .	35° 08'	147° 25'	719
Port Pirie . . . . .	33° 11'	138° 01'	10	Wollongong . . . . .	34° 25'	150° 56'	150
Queensland—				Victoria—			
Atherton . . . . .	17° 17'	145° 27'	2,466	Ballarat . . . . .	37° 35'	143° 50'	1,433
Bundaberg . . . . .	24° 52'	152° 21'	6	Bendigo . . . . .	36° 46'	144° 17'	730
Cairns . . . . .	16° 35'	145° 44'	10	Geelong . . . . .	38° 07'	144° 22'	57
Charleville . . . . .	26° 25'	146° 17'	950	Horsham . . . . .	36° 40'	142° 12'	437
Charters Towers . . . . .	20° 03'	146° 08'	1,004	Mildura . . . . .	34° 14'	142° 05'	156
Cloncurry . . . . .	20° 40'	140° 30'	621	Sale . . . . .	38° 06'	147° 08'	15
Ipswich . . . . .	27° 38'	152° 44'	64	Seymour . . . . .	37° 02'	145° 08'	464
Longreach . . . . .	23° 26'	144° 15'	612	Shepparton . . . . .	36° 23'	145° 24'	372
Mackay . . . . .	21° 07'	149° 10'	9	Wangaratta . . . . .	36° 22'	146° 19'	493
Maryborough . . . . .	25° 32'	152° 42'	20	Warrnambool . . . . .	38° 24'	142° 29'	33
Normanton . . . . .	17° 39'	141° 05'	34	Tasmania—			
Rockhampton . . . . .	23° 23'	150° 29'	26	Burnie . . . . .	41° 04'	145° 54'	13
Roma . . . . .	26° 36'	148° 42'	1,000	Launceston . . . . .	41° 33'	147° 13'	546
				Zeehan . . . . .	41° 54'	145° 23'	592

## The weather of 1965 (December 1964 to November 1965)

The following is a brief summary of weather experienced during the four seasons ended in November 1965. Plate 3 showing the rainfall distribution for 1965 is to be found between pages 32 and 33.

In the summer of 1964–65 the trend of pressure distributions in the Australian continental region was mostly normal, but there were some abnormalities in the Tasman–New Zealand area and southward to Macquarie Island. The outstanding meteorological feature of 1964–65 summer was the very low rainfall over most of the continent, particularly in the northern and western parts. Rainfall generally was less than 80 per cent of the normal, while many areas in the north received less than 50 per cent of the normal. Temperatures were about normal, or slightly above normal, for the season, but were mostly below normal in the southern parts during December. There was no great incidence of bush fires, but the fire hazard remained high. The frequency of tropical cyclone developments was slightly below normal and the tracks of these systems did not favour the incidence of widespread general rains over the north. The outstanding feature of the pastoral and agricultural situation was that the wheat crop for 1964–65 was harvested under excellent weather conditions. The outlook for stock in the tropical pastoral areas was becoming serious and drought conditions became widespread. In the southern areas the pastoral and agricultural season was mostly good, although rain was needed in some areas to replenish pastures.

In autumn, rainfall in Western Australia was above normal in the extreme north and parts of the north-west and south-west, but elsewhere falls were normal to below normal. In most of South Australia rainfall in autumn was generally below normal grading from about 60 per cent deficit in the southern divisions to almost 100 per cent deficit in the extreme north of the State.

In the northern half of the Northern Territory rainfall was well above normal during the season. However, in the southern half rainfall was below normal, deficits becoming progressively larger towards the interior, exceeding 90 per cent deficit near the Northern Territory–South Australian border. In Queensland autumn rainfall was well below normal in the south and west, near normal in central districts and generally above normal in the north. In New South Wales rainfall for the season was well below normal. Severe drought conditions persisted in most

districts. In the southern divisions of Victoria seasonal rainfall was mostly normal to above normal, but in the northern divisions departures below normal generally ranged from 40-60 per cent. In Tasmania the rainfall was above normal for the season, nearly all divisions receiving 20 per cent or more above normal. The rainfall situation over the inland pastoral areas of the continent was generally serious, drought conditions being widespread particularly in western New South Wales, south-west Queensland and the interiors of South Australia and the Northern Territory. Temperatures generally were about normal over the continent during the season.

In winter abundant rains fell over much of Western Australia. In Queensland rainfall was above normal in the south-east corner of the State and a few northern districts, but elsewhere falls were well below average. Falls in New South Wales were mainly below average, except in the south-west of the State and in the North Coast and Metropolitan Districts. In Victoria rainfall was below average in some districts while in Tasmania below average conditions were experienced generally. Rainfall in South Australia was average to above average. Temperatures in Western Australia, Queensland and New South Wales during winter were mostly about normal. In Victoria temperatures were in the main below average while in Tasmania conditions were above normal in most areas. A storm in Queensland in July caused damage to crops and structures in south-eastern districts.

In Western Australia the outlook for crops and pastures was generally good to excellent. Useful rains in the eastern Darling Downs area and light rains in other southern and south-west districts brought some relief from the drought in Queensland, but generally pastures were slow in response and stock conditions continued to deteriorate in many areas of the State. Wheat and sugar prospects for Queensland were below average. In New South Wales the outlook for stock and crops in some areas was poor. The outlook for pastures and crops in Victoria and Tasmania was generally fair to good. Similarly in South Australia good general rains enhanced the prospects for crops and pastures, but follow-up rains were needed to consolidate the situation.

In spring, rainfall in the southern half of Western Australia was mainly above normal. Little rain was received in the northern half. In the Northern Territory and South Australia rainfall was below normal except over the north-west interior of South Australia extending across the border into the Northern Territory. Queensland rainfall was considerably below normal, particularly in northern and south-western areas. Spring rainfall in New South Wales was chiefly below normal, particularly in the north-west and parts of the north-east. In Victoria seasonal rainfall was below average in most of the State. Tasmania's rainfall was mostly below normal except in the south-west. Temperatures in Western Australia were variable but chiefly above normal. Queensland experienced temperatures above normal throughout with several hot spells. In New South Wales temperatures were above normal with an exceptionally hot spell over the State during the last week in September. Similarly in Victoria temperatures were above normal throughout and in Tasmania temperatures were normal to slightly above. Serious bushfires occurred in New South Wales during the season and there were outbreaks in parts of Victoria also.