CHAPTER 2

PHYSICAL GEOGRAPHY AND CLIMATE

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.

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 *Statistical Yearbook* 1969, 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 the part of the Indian Ocean lying between the southern shores of Australia and Antarctica.

AREA OF AUSTRALIA AND OF OTHER COUNTRIES, *circa* 1968

('000 square miles)

Country	Area
Continental divisions—	
Europe(*a*)	1,903
Asia(*a*)	10,629
U.S.S.R. (Europe and Asia)	8,649
Africa	11,704
North and Central America and West Indies	9,362
South America	6,889
Oceania	3,286
Total, World, excluding Arctic and Antarctic regions	**52,420**
Europe(*a*)—	
France	211
Spain (including possessions)	195
Sweden	174
Finland	130
Norway	125
Poland	121
Italy	116
Yugoslavia	99
Germany, Federal Republic of	96
United Kingdom	94
Romania	92
Other	451
Total, Europe(a)	*1,903*
Asia(*a*)—	
China (mainland)	3,692
India	1,176
Saudi Arabia	830
Iran	636
Mongolia	604
Indonesia	576
Pakistan	366
Trucial Oman	301
Turkey	301
Burma	262
Afghanistan	250
Thailand	198
Iraq	168
Other	1,269
Total, Asia(a)	*10,629*
U.S.S.R.—	
Total, U.S.S.R.	*8,649*
Africa—	
Sudan	967
Algeria	920
Congo, Democratic Republic of	906
Libya	679
Chad	496
Africa—*continued*	
Niger	489
Angola	481
Ethiopia	472
South Africa, Republic of	471
Mali	479
Mauritania	398
United Arab Republic	386
Tanzania, United Republic of	363
Nigeria	357
Namibia	318
Mozambique	302
Zambia	291
Somalia	246
Central African Republic	241
Madagascar	227
Kenya	225
Other	1,990
Total, Africa	*11,704*
North and Central America—	
Canada	3,852
United States of America(*b*)	3,615
Greenland	840
Mexico	762
Nicaragua	50
Cuba	44
Honduras	43
Other	155
Total, North and Central America	*9,362*
South America—	
Brazil	3,286
Argentina	1,072
Peru	496
Colombia (excluding Panama)	440
Bolivia	424
Venezuela	352
Chile	292
Paraguay	157
Ecuador	109
Other	260
Total, South America	*6,889*
Oceania—	
Australia	2,968
New Zealand	104
New Guinea(*c*)	92
Papua	86
Other	36
Total, Oceania	*3,286*

(*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, AND STANDARD TIMES

State or Territory	Area	Percentage of total area	Standard times: Meridian selected	Standard times: Ahead of G.M.T.
	sq miles			hours
New South Wales	309,433	10.43	150° E.	10
Victoria	87,884	2.96	150° E.	10
Queensland	667,000	22.47	150° E.	10
South Australia	380,070	12.81	142°30′ E.	9½
Western Australia	975,920	32.88	120° E.	8
Northern Territory	520,280	17.53	142°30′ E.	9½
Australian Capital Territory	939	0.03	150° E.	10
Mainland	*2,941,526*	*99.11*	..	..
Tasmania	26,383	0.89	150° E.	10
Australia	2,967,909	100.00	..	..

The coastline of Australia is approximately 12,000 miles long—New South Wales, 700 miles; Victoria, 700 miles; Queensland, 3,200 miles; South Australia, 1,500 miles; Western Australia, 4,000 miles; Northern Territory, 1,000 miles; Australian Capital Territory, Jervis Bay area included in New South Wales; Tasmania, 900 miles. These measurements are broadly on a 'direct' basis, but even so they must be regarded as approximate only.

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 Kosciusko, 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 longest two 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.

Weather and climate 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 1970.

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, by the Department of National Development, and by 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 Canberra and 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*) convectional 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.

Annual rainfall. The distributions of the average annual and median annual rainfall over Australia are shown in plates 2 and 3, pages 30–1, while plate 4, page 32, shows the distribution in 1970. The median is the value equalled or exceeded by half of the occurrences, and usually gives a better indication of the rainfall most frequently occurring.

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 many 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 „ „ 20 „ . .	6.8	9.7	4.5	19.7	17.5	15.2	0.7	11.2
20 „ „ 25 „ . .	3.7	6.6	2.2	18.8	14.2	17.9	11.0	9.0
25 „ „ 30 „ . .	3.7	9.3	0.8	11.6	9.1	18.0	11.4	7.2
30 „ „ 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
Total . . .	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(*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 5, page 33.

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 rainfall maximum in the south-western districts of Western Australia in winter—the period of the most active southern depressions and frontal systems in this region.

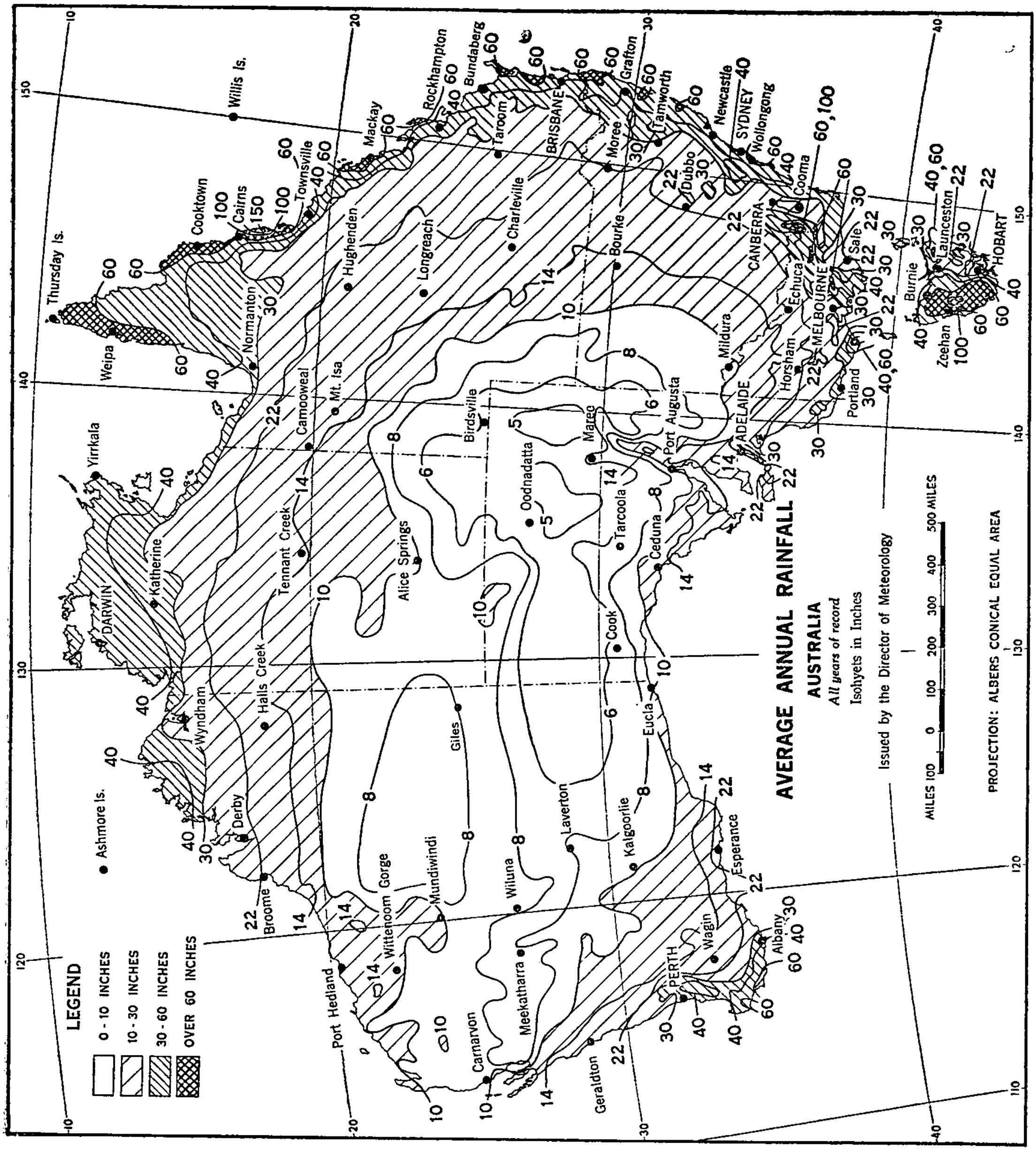

AVERAGE ANNUAL RAINFALL
AUSTRALIA
All years of record
Isohyets in Inches
Issued by the Director of Meteorology
LEGEND
0 - 10 INCHES
10 - 30 INCHES
30 - 60 INCHES
OVER 60 INCHES
MILES 100 0 100 200 300 400 500 MILES
PROJECTION: ALBERS CONICAL EQUAL AREA
DARWIN
BRISBANE
SYDNEY
CANBERRA
MELBOURNE
ADELAIDE
PERTH
HOBART

PLATE 2

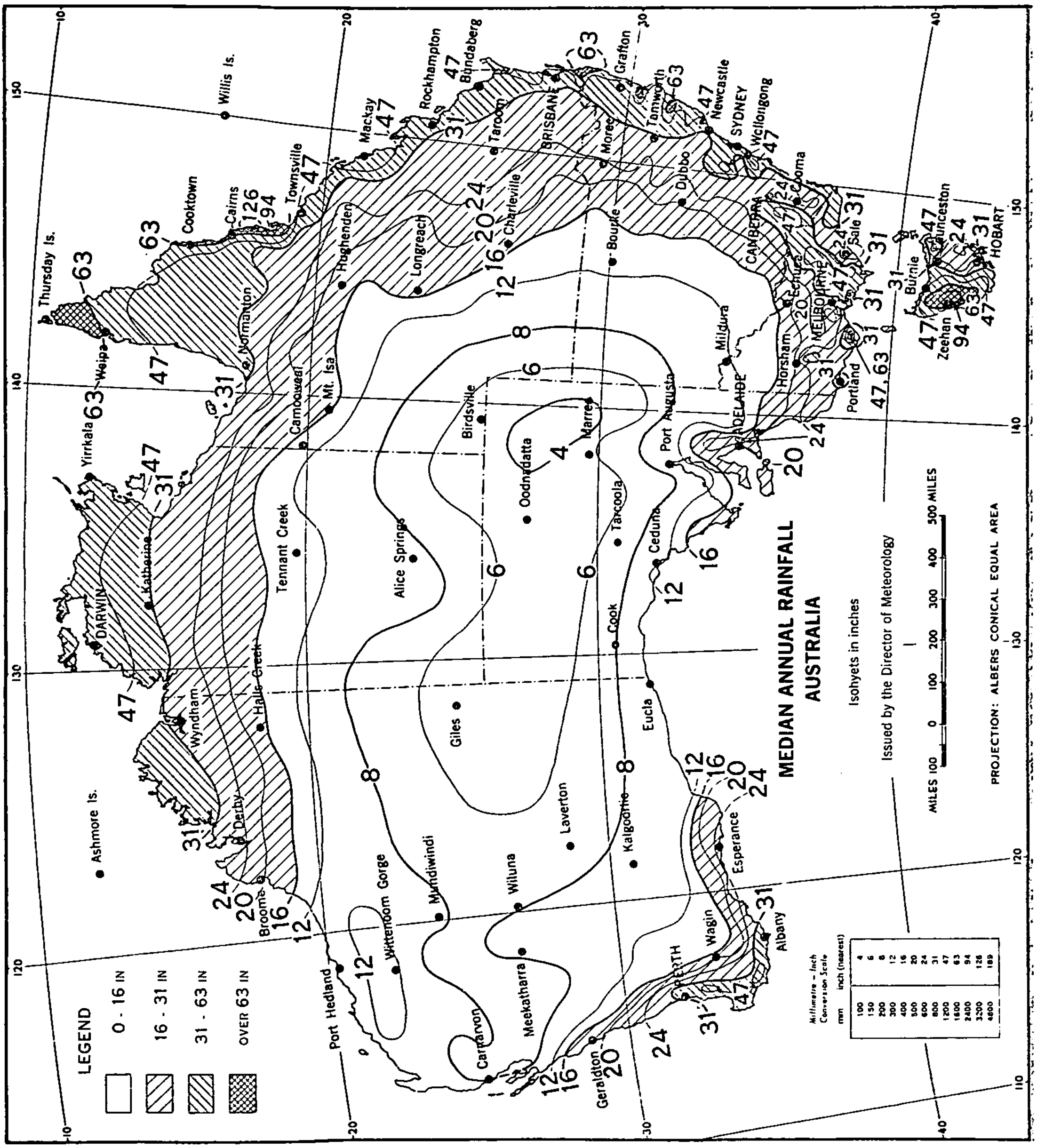

MEDIAN ANNUAL RAINFALL
AUSTRALIA
Isohyets in inches
Issued by the Director of Meteorology
LEGEND
0 - 16 IN
16 - 31 IN
31 - 63 IN
OVER 63 IN
MILES 100 0 100 200 300 400 500 MILES
PROJECTION: ALBERS CONICAL EQUAL AREA
Millimetre - Inch Conversion Scale
DARWIN
BRISBANE
SYDNEY
CANBERRA
MELBOURNE
ADELAIDE
PERTH
HOBART
Alice Springs
Tennant Creek
Kalgoorlie
Birdsville
Oodnadatta
Port Hedland
Carnarvon
Geraldton
Esperance
Albany
Broome
Derby
Wyndham
Katherine
Townsville
Cairns
Cooktown
Rockhampton
Mackay
Longreach
Charleville
Bourke
Dubbo
Newcastle
Mildura
Port Augusta
Ceduna
Eucla
Launceston

PLATE 3

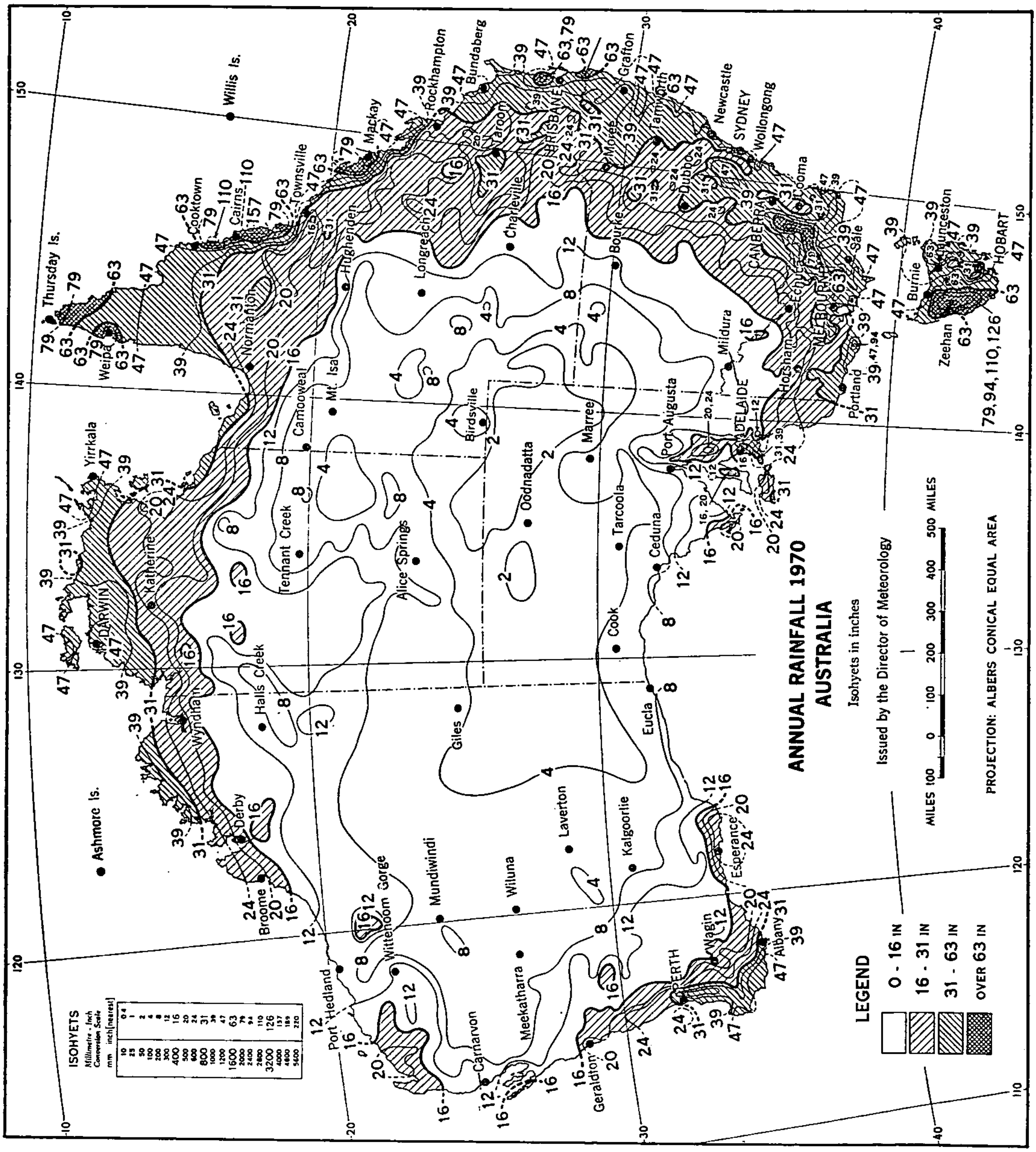
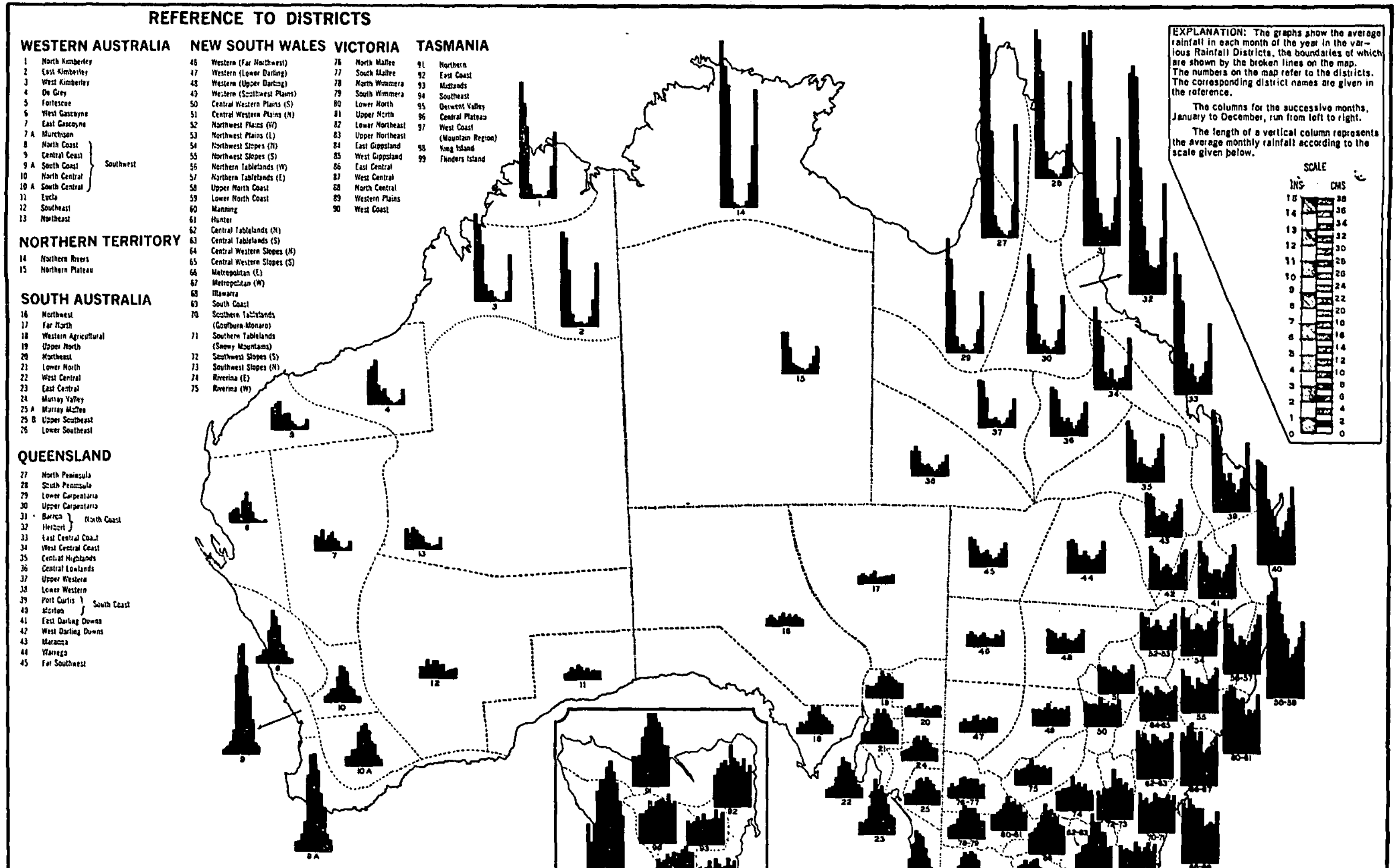

ANNUAL RAINFALL 1970
AUSTRALIA
Isohyets in inches
Issued by the Director of Meteorology
MILES 100 0 100 200 300 400 500 MILES
PROJECTION: ALBERS CONICAL EQUAL AREA
LEGEND
0 - 16 IN
16 - 31 IN
31 - 63 IN
OVER 63 IN
ISOHYETS
Thursday Is.
Willis Is.
Ashmore Is.
Cooktown
Cairns
Townsville
Mackay
Rockhampton
Bundaberg
BRISBANE
Grafton
Tamworth
Newcastle
SYDNEY
Wollongong
CANBERRA
Cooma
Sale
MELBOURNE
Echuca
Horsham
Mildura
Portland
ADELAIDE
Port Augusta
Ceduna
Tarcoola
Cook
Eucla
Esperance
Albany
Wagin
PERTH
Geraldton
Carnarvon
Meekatharra
Wiluna
Mundiwindi
Laverton
Kalgoorlie
Giles
Port Hedland
Wittenoom Gorge
Broome
Derby
Wyndham
Halls Creek
DARWIN
Katherine
Yirrkala
Tennant Creek
Alice Springs
Oodnadatta
Marree
Birdsville
Camooweal
Mt. Isa
Normanton
Weipa
Hughenden
Longreach
Charleville
Taroom
Moree
Dubbo
Bourke
Burnie
Launceston
Zeehan
HOBART

PLATE 4



MONTHLY DISTRIBUTION OF RAINFALL OVER AUSTRALIA
ALL YEARS OF RECORD TO 1957

PLATE 5

13627/71—2

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.

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, 1940 TO 1969

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*
	in		in		in		in		in		in		in	
1940	20.00	98	16.16	116	42.37	93	39.34	125	14.65	67	19.83	126	17.17	135
1941	34.74	122	22.56	126	31.50	105	26.74	129	21.33	93	31.78	157	23.49	145
1942	39.24	140	25.44	133	44.01	125	48.29	121	25.18	108	29.79	148	19.42	163
1943	31.46	117	17.84	135	50.68	126	50.74	136	22.82	141	18.80	150	20.84	149
1944	27.39	123	17.13	114	27.85	100	31.04	115	11.96	82	21.32	143	26.23	151
1945	52.67	137	17.85	105	48.16	130	46.47	136	23.76	92	19.22	152	16.92	157
1946	41.47	122	22.59	135	38.66	83	36.05	111	20.53	102	29.80	177	39.45	193
1947	43.42	137	21.89	146	60.30	146	41.45	137	26.30	121	30.47	163	38.61	181
1948	34.75	126	21.40	122	41.54	106	38.83	131	31.49	104	20.98	155	23.42	178
1949	27.15	126	18.23	119	47.18	121	66.26	149	25.42	115	31.41	163	22.85	157
1950	32.27	122	16.06	91	63.93	152	86.63	183	41.79	124	26.18	147	19.25	131
1951	34.14	127	25.44	135	33.89	87	53.15	143	18.97	95	29.85	155	24.57	163
1952	39.28	123	19.99	128	33.49	122	59.19	130	37.98	143	34.39	177	30.35	165
1953	37.14	119	20.00	121	43.60	101	40.86	110	19.42	110	28.38	148	28.06	162
1954	28.05	112	16.73	109	61.36	142	41.29	134	18.00	80	33.53	139	27.20	143
1955	46.52	138	24.58	134	50.41	136	72.46	160	28.92	128	30.70	160	22.32	168
1956	37.35	107	27.24	154	59.18	120	67.33	155	34.90	159	30.96	188	36.63	175
1957	33.40	117	16.71	110	20.58	80	27.13	110	13.39	78	20.68	146	28.66	129
1958	32.08	107	17.57	121	46.61	115	59.19	144	23.51	106	26.98	155	36.55	166
1959	24.23	114	11.32	88	45.84	146	59.67	164	35.07	106	25.84	131	19.28	136
1960	28.21	112	23.07	129	27.51	103	51.01	152	31.98	128	33.50	162	29.35	140
1961	32.27	133	14.91	122	42.36	134	57.08	161	30.42	109	22.05	129	18.03	156
1962	28.75	123	17.96	125	41.39	131	44.90	137	25.71	122	23.06	140	25.40	161
1963	39.14	140	24.43	118	49.09	134	80.11	169	24.32	126	29.04	149	15.51	129
1964	38.40	127	21.89	135	48.18	112	43.30	99	25.29	106	27.80	166	28.06	169
1965	40.98	128	13.34	111	41.02	113	36.01	118	15.72	87	23.24	122	20.98	158
1966	30.45	116	19.49	123	43.80	111	48.40	130	27.22	117	26.81	156	27.52	145
1967	41.26	104	10.11	89	70.80	137	52.78	141	13.84	72	13.06	106	19.23	130
1968	36.63	136	25.72	141	33.50	93	24.56	113	20.26	103	20.96	141	18.64	152
1969	22.59	87	20.68	112	41.15	115	56.94	140	29.83	121	24.60	137	28.35	156
Average	34.78	121	20.82	121	44.45	124	47.81	149	24.70	108	25.80	143	24.77	164
No. of years	94	94	131	131	118	118	130	130	31	31	114	114	87	87
Standard 30 years' normal(c)	35.02	119	20.60	126	43.00	115	47.48	141	(d)25.76	(d)106	27.21	155	26.27	163

(a) Fairbairn Aerodrome; records in issues of the Year Book prior to No. 36 were for the station at Acton which closed down in 1939, while from Year Book No. 36 to Year Book No. 53 records were for the Commonwealth Forestry Bureau station. (b) Records taken from present site commenced 1883. (c) 1931–1960. (d) Commonwealth Forestry Bureau.

Prolonged dry spells are fairly common in much of Australia, particularly in inland areas. A discussion of droughts in Australia may be found in Gibbs W. J. and Maker J. V. *Rainfall Deciles as Drought Indicators*, Bureau of Meteorology Bulletin No. 48 (1967). A shorter account of droughts in Australia will be found in a special article in Year Book No. 45, pages 51–6. A more recent account is included with Chapter 22—Water Conservation and Irrigation in Year Book No. 54 of 1968.

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. The highest rainfalls recorded in a period of twenty-four hours up to 1968 for each State and Territory were: Western Australia, Whim Creek, 29.41 inches, 3 April 1898; Northern Territory, Roper Valley, 21.44 inches, 15 April 1963; South Australia, Ardrossan, 8.10 inches, 18 February 1946; Queensland, Crohamhurst, 35.71 inches, 3 February 1893; New South Wales, Dorrigo, 25.04 inches, 24 June 1950; Australian Capital Territory, Jervis Bay, 7.15 inches, 29 April 1963; Victoria, Balook, 10.81 inches, 18 February 1951; and Tasmania, Mathinna, 13.25 inches, 5 April 1929. 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. For other very heavy falls at various localities reference may be made to Year Books No. 14, pages 60–4, No. 22, pages 46–8, No. 29, pages 43, 44 and 51, and No. 53, pages 32–4.

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 utilised 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 galvanised 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 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

Conditions 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 concerned* 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 reached 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 minimised.

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 6 to 9, pages 38–9, show the normal daily maximum and minimum temperatures 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 49–58 for the capital cities and more important country towns of the Commonwealth.

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* *See* Year Book No. 53, page 35.

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.

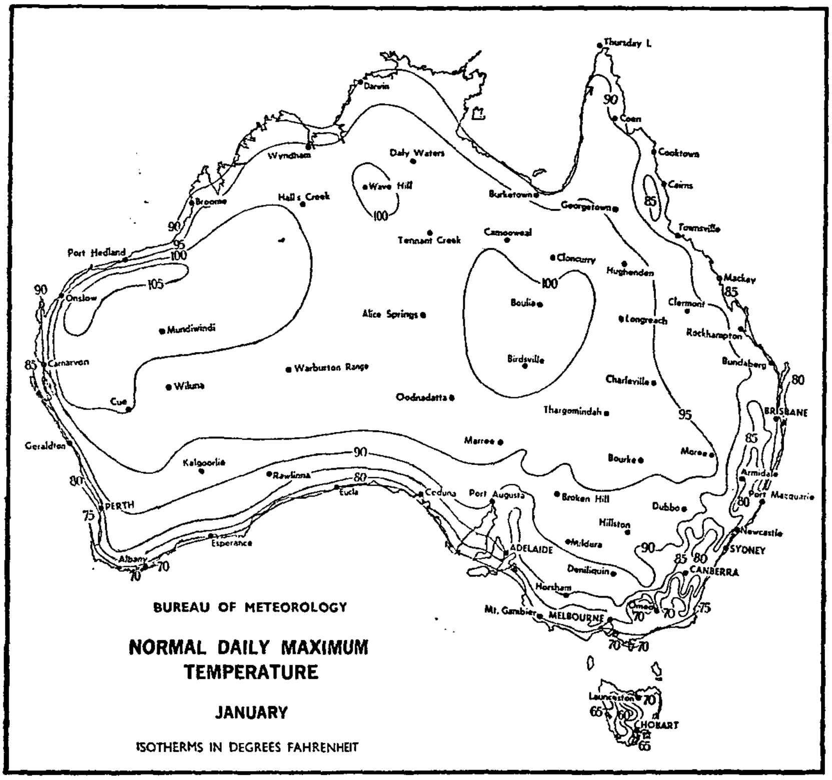
The marked change of maximum temperature in summer with distance from the sea, in areas close to the coasts, particularly along the Great Australian Bight and the Indian Ocean coast of Western Australia, is due to the penetration inland of the vigorous sea breezes which are initiated by the considerable 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.

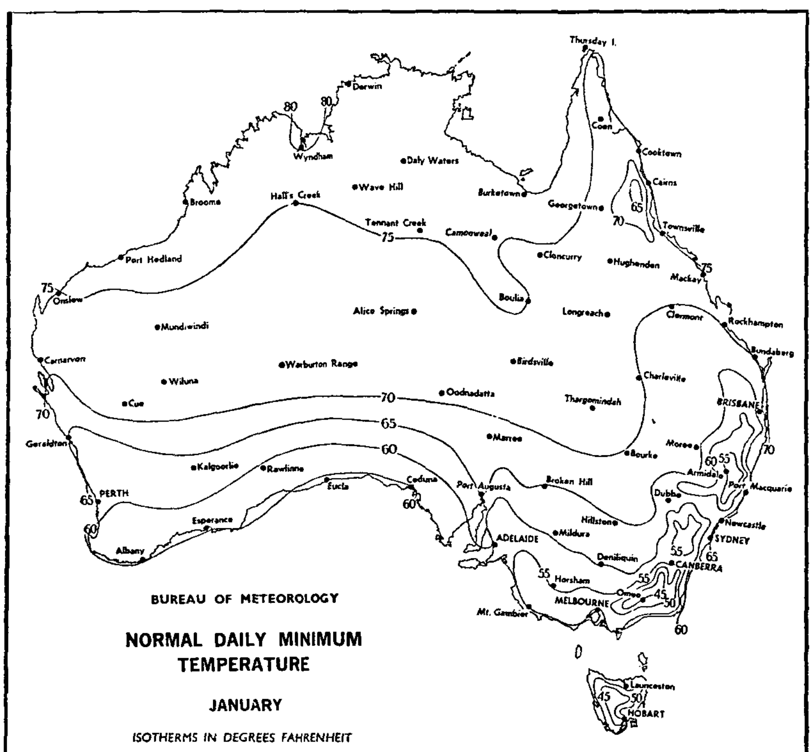
In January the mean minimum temperatures in the tropics, except for some highland regions, exceed 72° F., with a gradual decrease southward to values of 55° F. in Victoria and 50° F. in Tasmania. Highland regions in the south have mean values of 45° F. and lower. In July a more regular latitudinal distribution 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.

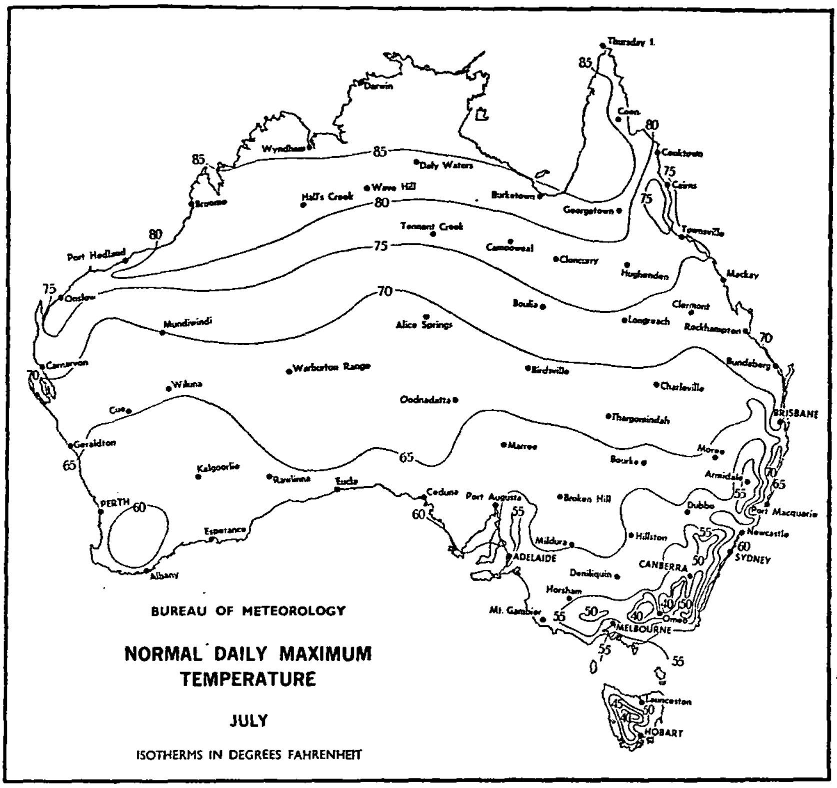
High temperature. Heat waves with a number of successive days higher than 100° F. are relatively common in many parts of Australia. With the exception of the north-western coast of Western Australia, however, most coastal areas do not usually experience more than a few days in succession of such conditions. 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 10, page 42. 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.





PLATES 6 and 7

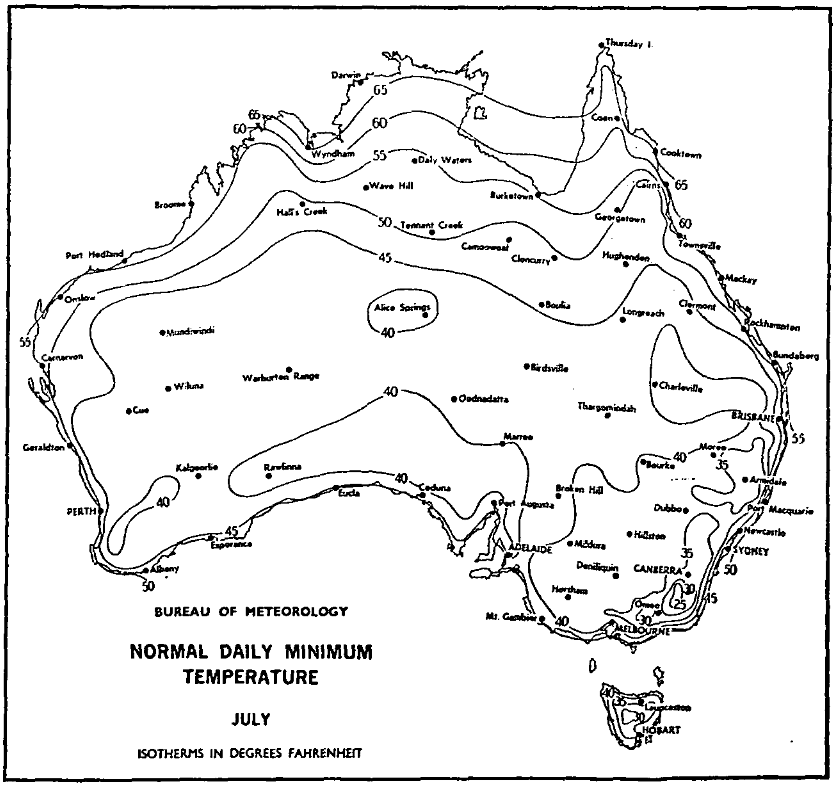


BUREAU OF METEOROLOGY

NORMAL DAILY MAXIMUM TEMPERATURE

JULY

ISOTHERMS IN DEGREES FAHRENHEIT



BUREAU OF METEOROLOGY

NORMAL DAILY MINIMUM TEMPERATURE

JULY

ISOTHERMS IN DEGREES FAHRENHEIT

PLATES 8 and 9

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 in which frosts may occur at any time of the year comprise most of Tasmania, large areas of the tablelands of New South Wales, much of inland Victoria, particularly the north-east, and a small part in the extreme south-west of 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 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 49–56, 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 Darwin, Sydney, Canberra, Melbourne, Brisbane, Hobart, Perth, and Adelaide.

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-western 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

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 11, page 42, 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 portion of the continent experience evaporation far in excess of their rainfall. Vegetation over these areas is characterised 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 has also resulted in the

* *Vapour pressure*—the pressure exerted by the water vapour of the atmosphere. † *Relative humidity*—the ratio of the existing vapour pressure to the saturated vapour pressure at the existing temperature, expressed as a percentage. ‡ *Saturation deficit*—the difference between the saturation vapour pressure and the actual vapour pressure. *See* Year Book No. 53, page 37 for further information.

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 12 and 13, page 43 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 49–56, 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.

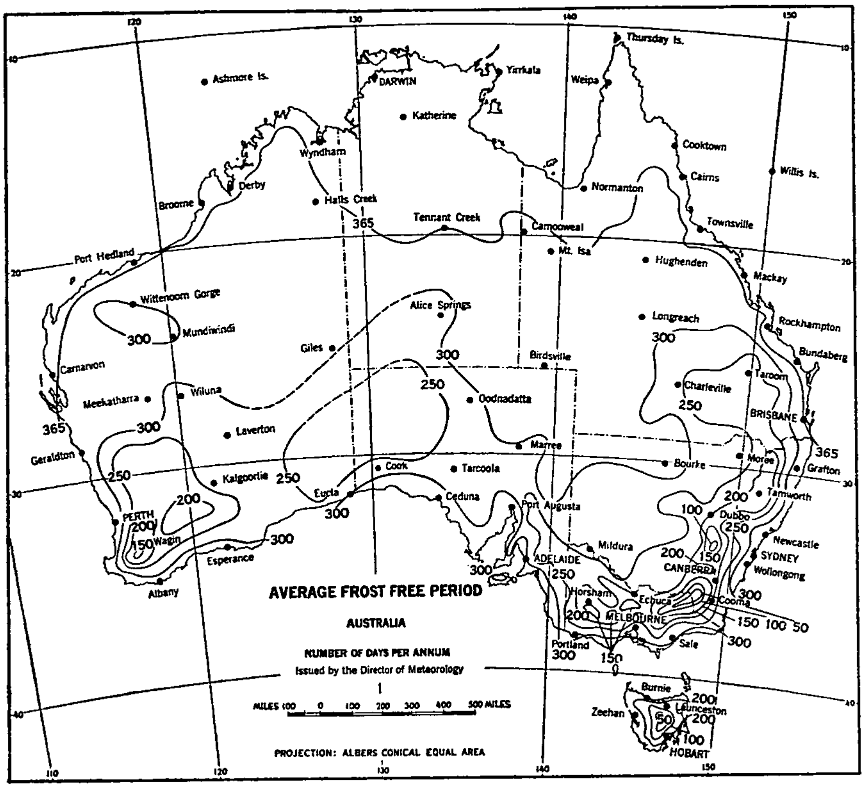
Wind

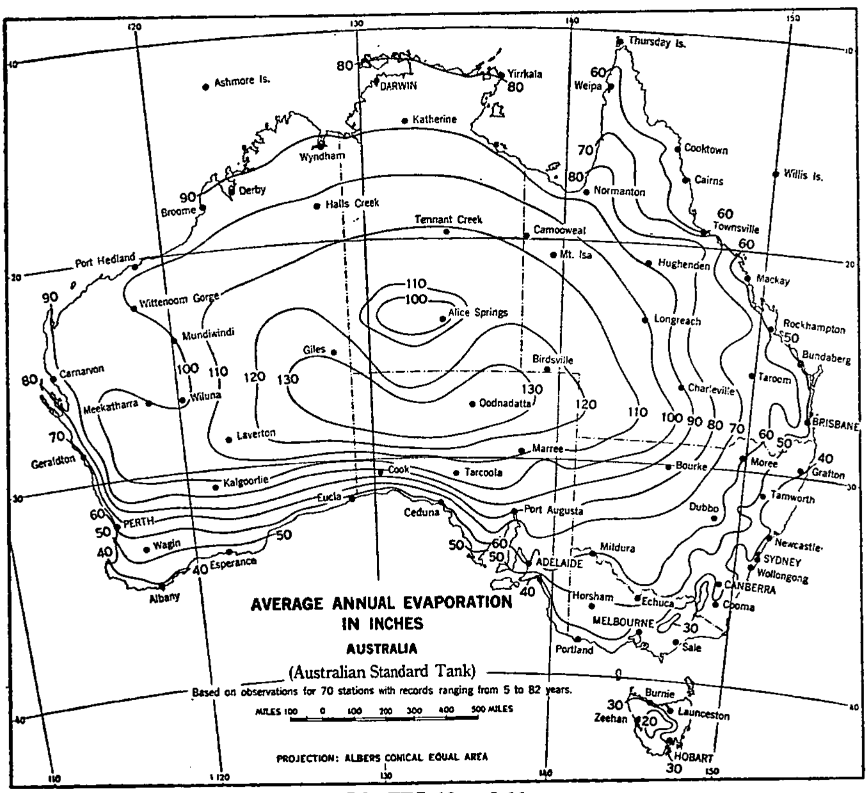
Australia lies in those latitudes of the southern hemisphere where it is influenced largely by two wind systems:

(*a*) the south-east trade winds blowing on the equatorial side of the mid-latitude anticyclones; and

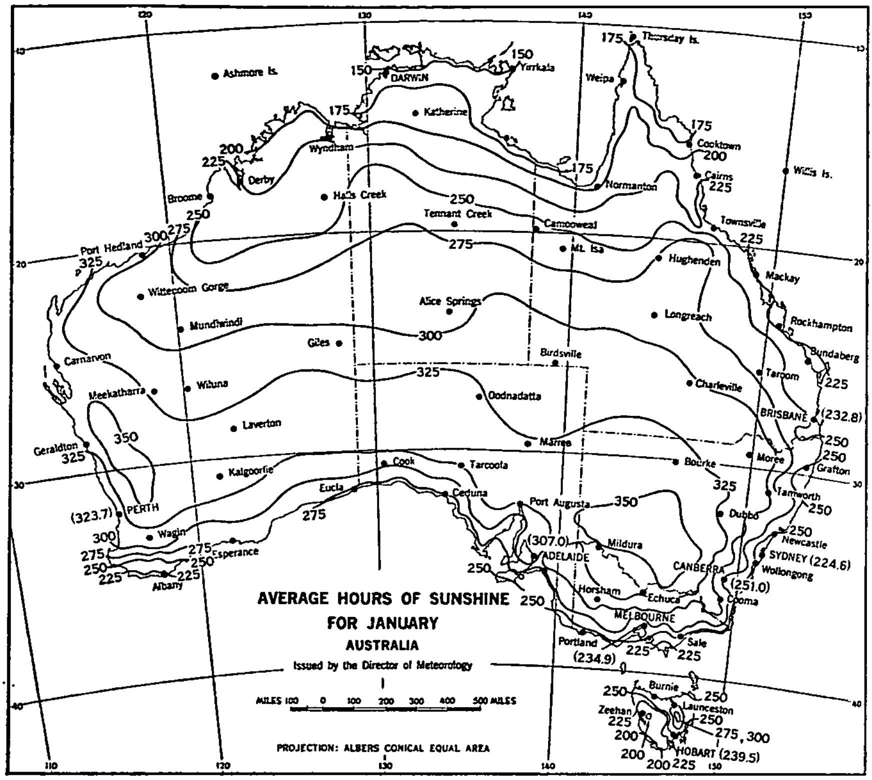
(*b*) the westerlies south of the mid-latitude anticyclones in which successive low pressure systems move eastward over the Southern Ocean.

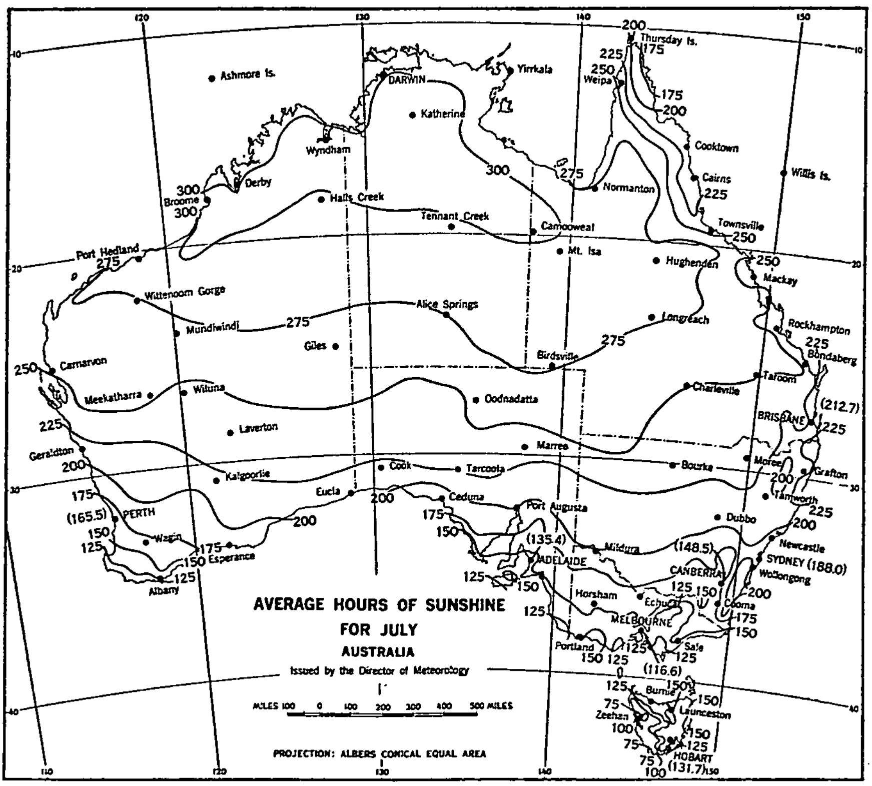
The only pronounced seasonal variations of atmospheric pressure in the middle and high latitudes of the southern hemisphere are related to the latitudinal shift in the axes of the sub-tropical high pressure systems and to the change in the tracks of the migratory anticyclones. The latter systems move generally from west to east in the Australian region between the semi-permanent oceanic anti-cyclones 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





PLATES 10 and 11





PLATES 12 and 13

continent. During the summer months, when the anti-cyclones 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 14 and 15, pages 45–6. 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 generalised 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 characterised 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 mph) to the coastal regions.

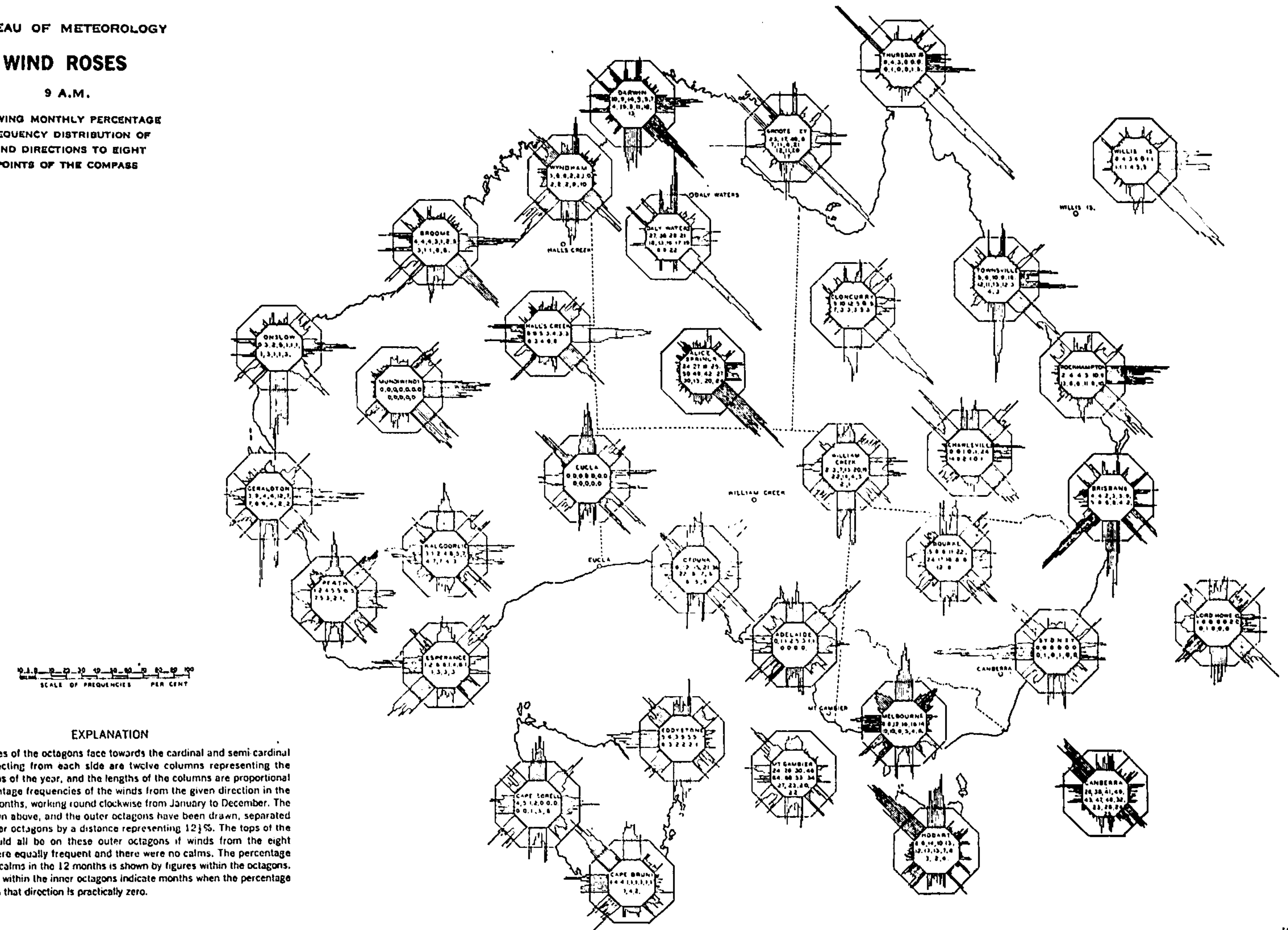
Similar systems affect the north-west coast of Western Australia where they bear the local name of 'willy willies', a name which is, however, often used generally in Australia for minor local whirlwinds or dust devils. The season in this region generally lasts from November to April, the storms originating 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 southwards following the coast,

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 12½%. 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.

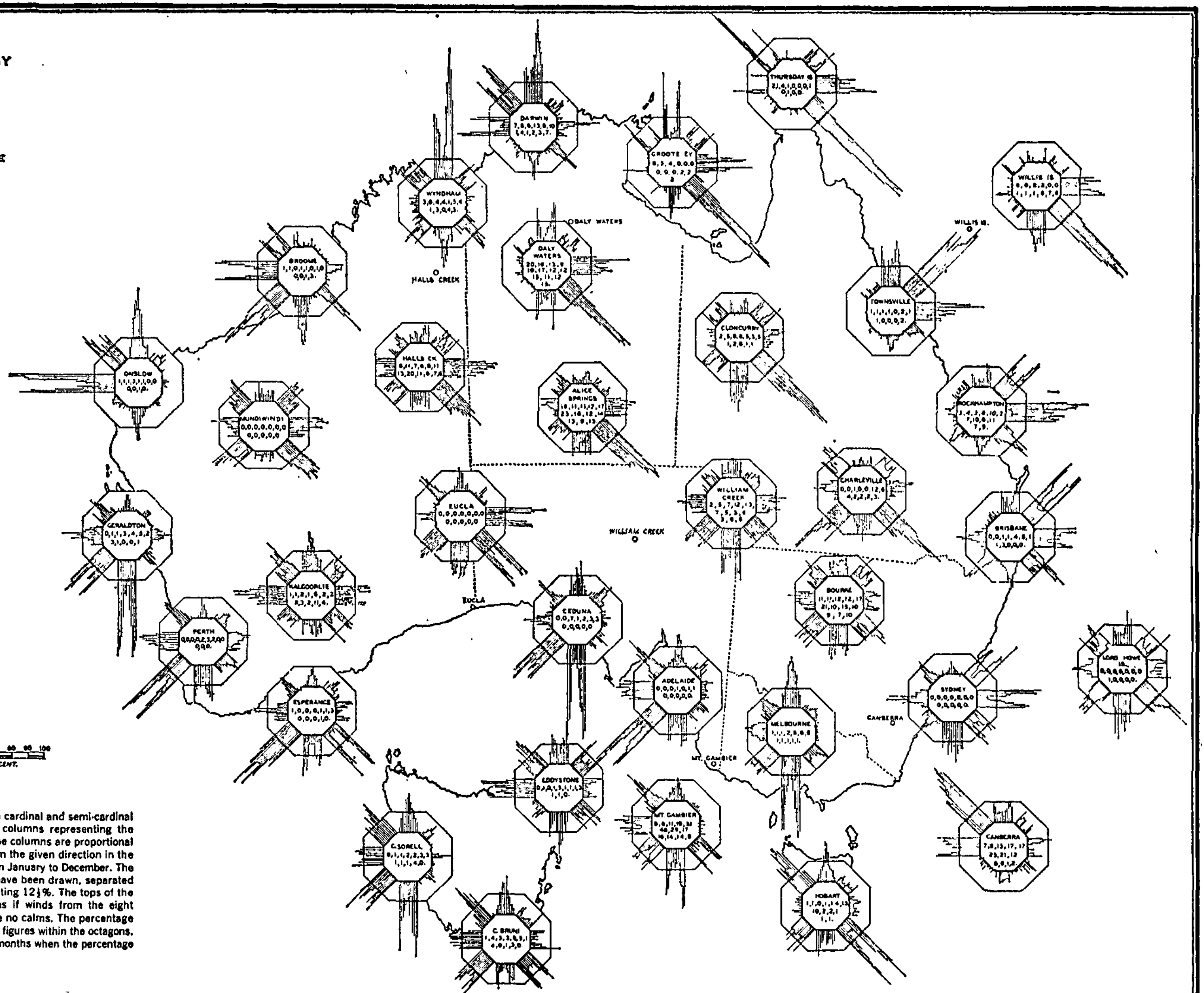
PLATE 14

BUREAU OF METEOROLOGY

WIND ROSES

3 P.M.

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



10 5 0 10 20 30 40 50 60 70 80 90 100

SCALE, OF FREQUENCIES PER. CENT.

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 12½%. 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.

PLATE 15

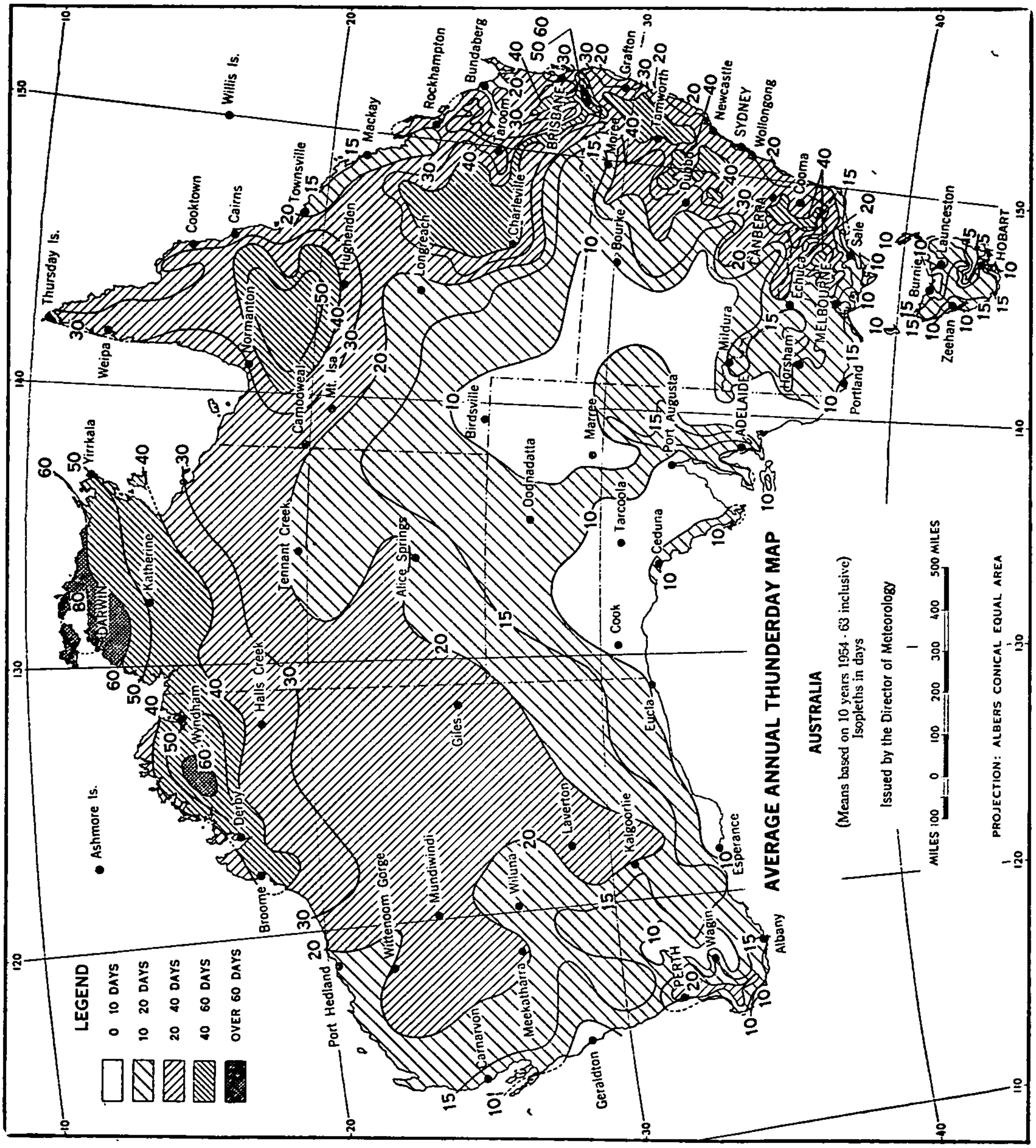

AVERAGE ANNUAL THUNDERDAY MAP
AUSTRALIA
(Means based on 10 years 1954-63 inclusive)
Isopleths in days
Issued by the Director of Meteorology
LEGEND
0 10 DAYS
10 20 DAYS
20 40 DAYS
40 60 DAYS
OVER 60 DAYS
MILES 100 0 100 200 300 400 500 MILES
PROJECTION: ALBERS CONICAL EQUAL AREA
DARWIN
BRISBANE
SYDNEY
CANBERRA
MELBOURNE
ADELAIDE
PERTH
HOBART

PLATE 16

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 16, page 47, 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 1969 (data for Canberra up to 1970) are given in the following pages, together with more limited data for the larger country towns of the Commonwealth.

Barometric and vapour pressure data, which were expressed in inches of mercury in years before 1966, are now expressed in millibars (1 millibar = 0.02953 inches of mercury).

The following points apply, except where otherwise stated. Where records are available, prevailing winds have been determined over a standard period of thirty years from 1911 to 1940. Other averages and extremes, including evaporation, temperature, and rainfall records for which thirty years normals have been published for a number of years past, have, since 1965, 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° 52′ E. Height above M.S.L. 51 ft)

BAROMETER, WIND, EVAPORATION, THUNDER, 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 (m.bars)*	*Wind (height of anemometer 71 ft)* Average miles per hour	Highest mean speed in one day (mph)	Highest gust speed (mph)	Prevailing direction 9 a.m.	Prevailing direction 3 p.m.	*Mean amt evaporation (in)*	*No. days thunder*	*Mean amt clouds 9 a.m., 3 p.m., 9 p.m. (a)*	*No. clear days*
No. of years of observations	85	30(*b*)	70	55	30(*b*)	30(*b*)	71	73	30(*b*)	30(*b*)
January	1,012.6	10.9	26.3 *27/98*	50	E	SSW	10.37	1.0	2.3	14
February	1,013.0	10.7	21.5 6/08	54	ENE	SSW	8.77	1.0	2.5	13
March	1,015.3	10.1	21.5 6/13	70	E	SSW	7.64	1.0	2.8	12
April	1,017.9	8.5	31.5 25/00	63	ENE	SSW	4.66	1.0	3.4	9
May	1,017.9	8.4	27.3 29/32	74	NE	WSW	2.81	2.0	4.3	6
June	1,017.6	8.4	30.2 17/27	80	N	NW	1.88	2.0	4.7	5
July	1,018.9	8.8	33.5 20/26	85	NNE	W	1.82	1.0	4.5	5
August	1,018.8	9.4	31.9 15/03	97	N	WNW	2.47	1.0	4.5	6
September	1,018.4	9.4	28.5 11/05	68	ENE	SSW	3.56	1.0	3.9	8
October	1,017.0	10.0	26.7 6/16	65	SE	SW	5.48	1.0	3.8	8
November	1,015.5	10.7	25.7 *18/97*	63	E	SW	7.61	1.0	3.1	9
December	1,013.4	11.0	25.6 6/22	64	E	SSW	9.71	1.0	2.6	13
Year — Totals	..	..	.. ..	..	..	..	66.78	14.0	..	108
Year — Averages	1,016.4	9.7	.. ..	..	E	SSW	..	..	3.5	..
Year — Extremes	..	..	33.5 20/7/26	97	..	..	..	..	..	..

(*a*) Scale 0–8. (*b*) Standard thirty years normal (1911–1940).

TEMPERATURE AND SUNSHINE

Month	*Mean temperature (°Fahr.)* Mean max.	Mean min.	Mean	*Extreme shade temperature (°Fahr.)* Highest	Lowest	*Extreme temperature (°Fahr.)* Highest in sun	Lowest on grass	*Mean daily hours sunshine*
No. of years of observations	73	73	73	73	73	63(*a*)	71	72
January	85.0	63.6	74.3	110.7 29/56	48.6 20/25	177.3 22/14	39.5 20/25	10.4
February	85.5	63.8	74.7	112.2 8/33	47.7 1/02	173.7 4/34	39.8 1/13	10.0
March	81.9	61.6	71.7	106.4 14/22	45.8 8/03	167.0 19/18	36.7 (*b*)	8.8
April	76.0	57.3	66.7	99.7 9/10	39.3 20/14	157.0 8/16	30.8 26/60	7.2
May	69.1	52.7	60.9	90.4 2/07	34.3 11/14	146.0 4/25	25.0 31/64	5.8
June	64.5	49.8	57.1	81.7 2/14	34.9 22/55	135.5 9/14	25.9 27/46	4.7
July	62.9	47.9	55.4	76.4 21/21	34.2 7/16	133.2 13/15	25.1 30/20	5.3
August	64.1	48.2	56.1	82.0 21/40	35.4 31/08	145.1 29/21	26.6 18/66	6.2
September	66.8	50.1	58 5	90.9 30/18	36.7 6/56	153.6 29/16	27.2 (*c*)	7.1
October	70.0	52.5	61.3	99.1 29/67	39.6 6/68	161.2 19/54	29.8 16/31	8.2
November	76.1	56.8	66.5	104.6 24/13	42.0 1/04	167.0 30/25	34.8 1/68	9.6
December	81.1	60.8	70.9	108.1 31/68	47.5 29/57	168.8 11/27	38.0 29/57	10.4
Year — Averages	73.6	55.4	64.5	.. ..	.. ..	.. ..	.. ..	7.8
Year — Extremes	..	..	..	112.2 8/2/33	34.2 7/7/16	177.3 22/1/14	25.0 31/5/64	..

(*a*) Records discontinued 1963. (*b*) 8/1903 and 16/1967. (*c*) 8/1952 and 6/1956.

HUMIDITY, RAINFALL, AND FOG

Month	*Vapour pressure mean 9 a.m. (m.bars)*	*Rel. hum. (%) at 9 a.m.* Mean	Highest mean	Lowest mean	*Rainfall (inches)* Mean mthly	Mean No. of days of rain	Greatest monthly	Least monthly	Greatest in one day	*Fog Mean No. days*
No. of years of observations	30(*a*)	30(*a*)	73	73	94	94	94	94	94	73
January	14.8	51	63	41	0.33	3	2.17 1879	Nil (*b*)	1.74 *27/79*	0
February	14.7	51	65	43	0.43	3	6.55 1955	Nil (*b*)	3.43 17/55	0
March	14.7	57	66	46	0.80	4	5.71 1934	Nil (*b*)	3.03 9/34	1
April	13.4	61	75	51	1.81	8	5.85 1926	Nil 1920	2.62 30/04	1
May	12.4	70	81	61	4.95	14	12.13 1879	0.77 1949	3.00 17/42	1
June	11.4	75	85	68	7.37	17	18.75 1945	2.16 1877	3.90 10/20	1
July	10.9	76	88	69	6.86	18	16.73 1958	2.42 1876	3.00 *4/91*	1
August	10.7	71	83	62	5.52	18	12.53 1945	0.46 1902	2.91 14/45	1
September	11.6	66	75	58	3.15	14	7.84 1923	0.34 1916	1.86 18/66	0
October	11.7	60	75	52	2.15	12	7.87 1890	0.15 1946	1.97 4/67	0
November	12.7	52	66	41	0.82	6	2.78 1916	Nil 1891	1.54 29/56	0
December	13.9	51	63	39	0.58	4	3.17 1951	Nil (*b*)	1.84 3/51	0
Year — Totals	..	..	..	..	34.77	121	.. ..	.. ..	.. ..	6
Year — Averages	12.7	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.

Figures such as *27/98*, 29/56, etc. indicate, in respect of the month of reference, the day and year of the occurrence. 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, THUNDER, 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 (m.bars)	Wind (height of anemometer 117 ft) Average miles per hour	Highest mean speed in one day (mph)	Highest gust speed (mph)	Prevailing direction 9 a.m.	Prevailing direction 3 p.m.	Mean amt evaporation (in)	No. days thunder	Mean amt clouds 9 a.m., 3 p.m., 9 p.m. (a)	No. clear days
No. of years of observations	85	15	..	17 (b)	..	..	9	30	30	30
January	1,006.1	6.1	..	66	NW & S	W & NW	6.04	13.0	5.7	1
February	1,006.3	6.7	..	63	W & S	W & NW	5.61	10.0	5.6	1
March	1,007.2	5.3	..	98	SE	W & NW	6.14	10.0	5.0	3
April	1,009.2	6.1	..	42	SE	E	6.49	4.0	2.8	11
May	1,010.9	6.5	..	39	SE	E	7.27	0.2	1.7	19
June	1,012.2	6.5	..	40	SE	E & SE	6.97	0.0	1.3	22
July	1,012.7	6.2	..	39	SE	E & SE	7.05	0.0	1.1	23
August	1,012.6	5.9	..	45	SE	NW & N	7.73	0.0	1.0	22
September	1,011.7	6.2	..	40	SE & S	NW & N	8.07	1.0	1.6	18
October	1,010.5	6.2	..	53	S	NW & N	9.17	5.0	2.6	10
November	1,008.7	5.5	..	73	W & S	NW & N	8.20	12.0	3.8	4
December	1,006.9	6.2	..	66	NW & S	NW & N	7.18	14.0	4.8	2
Year Totals	..	..	..	..	..	..	85.92	69.2	..	137
Year Averages	1,009.6	6.1	..	..	SE	NW	..	..	3.1	..
Year Extremes	..	..	..	98	..	..	..	..	..	..

(a) Scale 0–8. (b) Several incomplete years.

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.) Mean max.	Mean min.	Mean	Extreme shade temperature (°Fahr.) Highest	Lowest	Extreme temperature (°Fahr.) Highest in sun	Lowest on grass	Mean daily hours sunshine
No. of years of observations	85	85	85	86(a)	86(a)	26(b)	..	15
January	89.9	77.0	83.5	100.0 *2/82*	68.0 *20/92*	168.0 26/42	..	5.8
February	89.5	76.6	83.1	100.9 *20/87*	63.0 25/49	163.6 (c)	..	6.2
March	90.4	76.6	83.5	102.0 (d)	66.6 31/45	165.6 23/38	..	6.9
April	91.7	75.5	83.6	104.0 *7/83*	60.8 11/43	163.0 1/38	..	8.3
May	90.2	72.2	81.2	102.3 *8/84*	57.5 28/67	160.0 5/20	..	9.5
June	87.7	68.9	78.3	98.6 17/37	53.8 23/63	155.2 2/16	..	9.8
July	86.9	67.2	77.1	98.0 *17/88*	50.7 29/42	156.0 28/17	..	9.8
August	88.7	69.3	79.0	98.0 19/00	56.4 11/63	156.2 28/16	..	10.4
September	90.9	73.6	82.3	102.0 *20/82*	62.1 9/63	157.0 (e)	..	9.9
October	92.6	77.0	84.8	104.8 *17/92*	66.9 8/66	160.5 30/38	..	9.5
November	92.9	77.6	85.3	103.3 *9/84*	66.8 4/50	170.4 14/37	..	8.2
December	91.7	77.6	84.7	102.0 *9/83*	65.0 4/60	169.0 26/23	..	6.9
Year Averages	90.3	74.1	82.2	.. ..	.. ..	.. ..	..	8.4
Year Extremes	..	..	..	104.8 17/10/1892	50.7 29/7/42	170.4 14/11/37	..	..

(a) Years 1882–1941 at Post Office, 1942–1966 at Aerodrome; sites not strictly comparable. (b) Records discontinued 1942. (c) 5/1938 and 23/1938. (d) 26/1883 and 27/1883. (e) 28/1916 and 3/1921.

HUMIDITY, RAINFALL, AND FOG

Month	Vapour pressure mean 9 a.m. (m.bars)	Rel. hum. (%) at 9 a.m. Mean	Highest mean	Lowest mean	Rainfall (inches) Mean mthly	Mean No. of days of rain	Greatest monthly	Least monthly	Greatest in one day	Fog Mean No. days
No. of years of observations	85	85	57(a)	57(a)	86(b)	69	100(c)	100(c)	100(c)	30
January	31.1	80	89	69	15.40	19	27.86 1896	2.67 1906	11.67 *7/97*	0.0
February	31.1	81	88	71	13.00	18	28.23 1956	0.53 1931	11.00 18/55	0.0
March	30.7	80	84	69	10.24	17	23.42 1965	0.81 1911	7.18 6/19	0.0
April	27.0	72	80	60	4.05	8	23.74 1891	Nil 1950	6.22 4/59	0.0
May	21.8	65	76	49	0.56	1	10.27 1882	Nil (d)	2.19 6/22	0.0
June	18.7	63	75	52	0.12	0	1.53 1902	Nil (d)	1.32 10/02	0.4
July	17.6	62	71	47	0.05	0	2.56 1900	Nil (d)	1.71 2/00	1.1
August	20.6	66	73	53	0.06	0	3.30 1947	Nil (d)	3.15 22/47	0.7
September	24.7	68	73	54	0.51	2	4.26 1942	Nil (d)	2.78 21/42	0.2
October	27.7	68	72	60	1.98	5	13.34 1954	Nil (d)	3.74 18/56	0.0
November	29.3	70	75	62	4.96	11	15.72 1938	0.40 1870	4.73 9/51	0.0
December	30.5	75	83	65	9.55	16	22.94 1965	0.98 1934	7.87 28/10	0.0
Year Totals	..	..	..	..	60.48	97	.. ..	.. ..	.. ..	2.4
Year Averages	25.9	71	..	..	..	..	.. ..	.. ..	.. ..	..
Year Extremes	..	..	89	47	..	..	28.23 2/1956(f)	Nil (e)	11.67 7/1/1897	..

(a) 1882 to 1938 at Post Office. (b) 1869 to 1962 at Post Office, eight years missing. (c) The figures below are the highest or lowest recorded at either the Post Office or Aerodrome sites. (d) Various years. (e) April to October, various years. (f) 30.65 inches were recorded February 1967 at Darwin Regional Office. Records from this office will be incorporated in future tables.

Figures such as *2/82*, 26/42, etc. indicate, in respect of the month of reference, the day and year of the occurrence. 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, THUNDER, 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 (m.bars)	Wind (height of anemometer 75 ft) Average miles per hour	Highest mean speed in one day (mph)	Highest gust speed (mph)	Prevailing direction 9 a.m.	Prevailing direction 3 p.m.	Mean amt evaporation (in)	No. days thunder	Mean amt clouds 9 a.m., 3 p.m., 9 p.m. (a)	No. clear days
No. of years of observations	113	18(b)	18(b)	53	30(c)	30(c)	95(d)	98	102	55
January	1,013.2	7.8	18.2 3/55	72	SW	SW	9.29	1.5	2.9	12.4
February	1,014.3	7.4	17.8 25/67	66	NE	SW	7.52	1.0	3.0	10.8
March	1,017.2	6.9	19.1 24/64	78	S	SW	6.26	0.8	3.2	10.8
April	1,019.9	6.9	23.2 10/56	81	NE	SW	3.78	1.0	4.1	6.6
May	1,020.1	7.0	23.5 19/53	70	NE	NW	2.30	1.0	4.7	4.6
June	1,019.8	7.3	18.4 12/53	67	NE	N	1.47	0.9	5.0	4.0
July	1,020.0	7.2	20.4 13/64	92	NE	NW	1.47	0.8	4.8	3.6
August	1,019.1	7.8	23.7 8/55	75	NE	SW	2.09	1.1	4.2	4.9
September	1,017.6	8.0	21.7 16/65	69	NNE	SW	3.18	1.4	4.3	5.8
October	1,016.0	8.3	22.0 1/68	75	NNE	SW	5.03	1.9	4.2	5.7
November	1,015.1	8.4	22.5 14/68	81	SW	SW	6.78	2.0	3.9	6.6
December	1,013.3	8.2	17.9 6/52	75	SW	SW	8.62	1.5	3.4	9.0
Year — Totals	..	..	.. ..	..	..	..	57.79	14.9	..	84.8
Year — Averages	1,017.1	7.6	.. ..	..	NE	SW	..	..	4.0	..
Year — Extremes	..	..	23.7 8/8/55	92	..	..	..	..	..	..

(a) Scale 0–8. (b) Records taken from a Munro Anemometer 1952–1969. (c) Standard thirty years normal (1931–1960). (d) Measured by Australian tank (1870–1962).

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.) Mean max.	Mean min.	Mean	Extreme shade temperature (°Fahr.) Highest	Lowest	Extreme temperature (°Fahr.) Highest in sun	Lowest on grass	Mean daily hours sunshine
No. of years of observations	113	113	113	113	113	54(a)	109	88
January	85.4	61.5	73.5	117.7 12/39	45.1 *21/84*	180.0 *18/82*	36.5 *14/79*	10.0
February	84.9	61.7	73.3	113.6 *12/99*	45.5 23/18	170.5 10/00	35.8 23/26	9.2
March	80.5	59.0	69.7	110.5 9/34	43.9 21/33	174.0 *17/83*	32.1 21/33	7.8
April	72.9	54.6	63.7	98.6 5/38	39.6 *15/59*	155.0 *1/83*	28.0 14/63	6.0
May	65.6	50.4	58.0	89.5 4/21	36.9 (b)	148.2 *12/79*	25.6 19/28	4.8
June	60.5	46.9	53.7	78.1 4/57	32.5 (c)	138.8 *18/79*	21.0 24/44	4.2
July	58.9	44.9	51.9	74.0 11/06	32.0 24/08	134.5 *26/90*	22.1 30/29	4.3
August	61.6	46.0	53.8	85.0 31/11	32.3 *17/59*	140.0 *31/92*	22.8 11/29	5.3
September	66.1	48.1	57.1	95.1 30/61	32.7 *4/58*	160.5 *23/82*	25.0 25/27	6.1
October	71.8	51.5	61.7	102.9 21/22	36.1 *20/58*	162.0 30/21	26.6 22/66	7.2
November	77.5	55.2	66.3	113.5 *21/65*	40.8 2/09	166.9 *20/78*	31.5 2/09	8.5
December	82.2	58.8	70.5	114.6 29/31	43.0 (d)	175.7 *7/99*	32.5 *4/84*	9.4
Year — Averages	72.3	53.2	62.7	.. ..	.. ..	.. ..	.. ..	6.9
Year — Extremes	..	..	..	117.7 12/1/39	32.0 24/7/08	180.0 18/1/1882	21.0 24/6/44	..

(a) Records incomplete 1931–1934. Discontinued 1934. (b) 26/1895 and 24/1904. (c) 27/1876 and 24/1944. (d) 16/1861 and 4/1906.

HUMIDITY, RAINFALL, AND FOG

Month	Vapour pressure mean 9 a.m. (m.bars)	Rel. hum. (%) at 9 a.m. Mean	Highest mean	Lowest mean	Rainfall (inches) Mean mthly	Mean No. of days of rain	Greatest monthly	Least monthly	Greatest in one day	Fog Mean No. days
No. of years of observations	102	102	102	102	131	131	131	131	131	70
January	11.9	40	59	29	0.76	4	3.31 1941	Nil (a)	2.30 *2/89*	0.0
February	12.3	43	57	30	0.79	4	6.09 1925	Nil (a)	5.57 7/25	0.0
March	11.7	47	62	29	0.94	5	4.59 1878	Nil (a)	3.50 *5/78*	0.0
April	11.3	56	72	37	1.71	10	5.81 1938	Nil 1945	3.15 *5/60*	0.0
May	10.8	67	76	49	2.72	13	7.75 1875	0.10 1934	2.75 *1/53*	0.4
June	9.9	75	84	63	2.87	15	8.58 1916	0.23 1958	2.11 1/20	1.1
July	9.4	76	87	66	2.61	16	5.44 1890	0.39 1899	1.75 *10/65*	1.3
August	9.7	70	78	54	2.43	16	6.20 1852	0.33 1944	2.23 *19/51*	0.6
September	9.9	60	72	44	2.00	13	5.83 1923	0.27 1951	1.59 20/23	0.2
October	10.3	51	67	29	1.73	11	5.24 1949	0.04 1969	2.24 16/08	0.0
November	10.5	44	58	31	1.21	8	4.45 1839	0.05 1967	2.96 12/60	0.0
December	11.1	40	56	31	1.04	6	3.98 1861	Nil 1904	2.42 23/13	0.0
Year — Totals	..	..	..	..	20.81	121	.. ..	.. ..	.. ..	3.6
Year — Averages	10.7	56	..	..	..	..	.. ..	.. ..	.. ..	..
Year — Extremes	..	..	87	29	..	..	8.58 6/1916	Nil (b)	5.57 7/2/25	..

(a) Various years. (b) December to April, various years.

Figures such as 3/55, *21/84*, etc. indicate, in respect of the month of reference, the day and year of the occurrence. 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, THUNDER, 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 (m.bars)	Wind (height of anemometer 105 ft) Average miles per hour	Highest mean speed in one day (mph)	Highest gust speed (mph)	Prevailing direction 9 a.m.	Prevailing direction 3 p.m.	Mean amt evaporation (in)	No. days thunder	Mean amt clouds 9 a.m., 3 p.m., 9 p.m. (a)	No. clear days
No. of years of observations	83	54	54	54	30(b)	30(b)	61	83	78	62
January	1,011.7	7.7	19.7 23/47	68	SE	NE	6.95	4.6	4.6	3.4
February	1,012.5	7.5	23.2 21/54	67	SE	NE	5.52	3.8	4.7	2.4
March	1,014.7	7.2	20.3 1/29	66	S	E	5.26	2.2	4.3	5.5
April	1,017.3	6.5	16.7 3/25	64	S	E	4.34	1.5	3.6	7.9
May	1,018.4	6.2	17.9 17/26	54	SW	SE	3.41	0.6	3.3	9.9
June	1,018.5	6.3	19.0 14/28	59	SW	W & SW	2.74	0.5	3.3	10.3
July	1,018.7	6.1	22.0 13/54	69	SW	W & SW	2.94	0.4	2.9	13.2
August	1,018.9	6.3	14.8 4/35	62	SW	NE	3.78	1.5	2.6	13.5
September	1,017.5	6.5	16.1 1/48	63	SW	NE	4.63	2.8	2.7	12.7
October	1,015.9	6.9	15.7 1/41	62	S	NE	5.84	4.4	3.4	8.5
November	1,014.2	7.3	15.5 10/28	69	SE & N	NE	6.57	5.7	3.9	6.1
December	1,012.0	7.5	19.5 15/26	79	SE	NE	7.25	6.9	4.3	4.2
Year: Totals	..	..	.. ..	..	..	..	59.23	34.9	..	97.6
Year: Averages	1,015.9	6.8	.. ..	..	SW	NE	..	..	3.6	..
Year: Extremes	..	..	23.2 21/2/54	79	..	..	..	..	..	..

(a) Scale 0–8. (b) Standard thirty years normal (1911–1940).

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.) Mean max.	Mean min.	Mean	Extreme shade temperature (°Fahr.) Highest	Lowest	Extreme temperature (°Fahr.) Highest in sun	Lowest on grass	Mean daily hours sunshine
No. of years of observations	83	83	83	83	83	50(a)	82	61
January	84.9	68.9	76.9	109.8 26/40	58.8 *4/93*	169.0 2/37	49.9 *4/93*	7.6
February	84.2	68.7	76.5	105.7 21/25	58.5 23/31	165.2 6/10	49.1 22/31	7.1
March	82.1	66.6	74.3	101.8 13/65	52.4 29/13	162.5 6/39	45.4 29/13	6.8
April	78.8	61.6	70.2	95.2 (b)	44.4 25/25	153.8 11/16	36.7 24/25	7.1
May	73.6	55.6	64.6	90.3 21/23	40.6 30/51	147.0 1/10	29.8 *8/97*	6.8
June	69.4	51.3	60.3	88.9 19/18	36.3 29/08	136.0 3/18	25.4 *23/88*	6.5
July	68.4	48.9	58.8	84.3 23/46	36.1 (c)	146.1 20/15	23.9 *11/90*	7.1
August	71.2	50.2	60.7	91.0 14/46	36.9 13/64	141.9 20/17	27.1 *9/99*	7.9
September	75.2	54.8	65.0	100.9 22/43	40.7 *1/96*	155.5 26/03	30.4 *1/89*	8.3
October	79.0	60.1	69.6	105.3 30/58	43.3 *3/99*	157.4 31/18	34.9 *8/89*	8.3
November	82.0	64.3	73.2	106.1 18/13	48.5 2/05	162.3 *7/89*	38.8 1/05	8.3
December	84.5	67.4	75.8	105.9 *26/93*	56.3 5/55	165.9 28/42	49.1 *3/94*	8.1
Year: Averages	77.8	59.9	68.8	.. ..	.. ..	.. ..	.. ..	7.5
Year: Extremes	..	..	..	109.8 26/1/40	36.1 (c)	169.0 2/1/37	23.9 11/7/1890	..

(a) From 1887 to March 1947, excluding 1927 to 1936. (b) 9/1896 and 5/1903. (c) 12/1894 and 2/1896.

HUMIDITY, RAINFALL, AND FOG

Month	Vapour pressure mean 9 a.m. (m.bars)	Rel. hum. (%) at 9 a.m. Mean	Highest mean	Lowest mean	Rainfall (inches) Mean mthly	Mean No. of days of rain	Greatest monthly	Least monthly	Greatest in one day	Fog Mean No. days
No. of years of observations	64(a)	83	82	82	118	110	117(b)	117(b)	117(b)	83
January	21.7	66	79	53	6.28	13	27.72 1895	0.32 1919	18.31 *21/87*	0.5
February	22.0	69	82	55	6.30	13	40.39 1893	0.58 1849	10.61 6/31	0.6
March	20.9	71	85	56	5.74	15	34.04 1870	Nil 1849	11.18 14/08	1.2
April	17.5	71	80	56	3.46	12	15.28 1867	0.04 1944	5.46 5/33	2.3
May	14.3	71	85	59	2.75	9	13.85 1876	Nil 1846	5.62 *9/79*	3.2
June	12.1	72	84	54	2.80	8	25.49 1967	Nil 1847	11.12 12/67	3.0
July	11.1	70	88	53	2.18	7	9.10 1965	Nil (c)	7.60 20/65	3.1
August	11.7	67	80	53	1.88	7	14.67 1879	Nil (d)	4.89 *12/87*	3.6
September	13.8	63	76	47	1.93	8	5.43 1886	0.10 1907	3.13 12/65	2.6
October	16.0	60	72	48	2.74	9	11.41 1949	0.03 1948	5.34 25/49	1.2
November	18.1	59	72	45	3.65	10	12.40 1917	Nil 1842	5.61 *8/66*	0.5
December	20.1	61	70	51	5.05	12	17.36 1942	0.35 1865	6.60 *28/71*	0.4
Year: Totals	..	..	..	..	44.76	123	.. ..	.. ..	.. ..	22.2
Year: Averages	16.6	67	..	..	..	..	.. ..	.. ..	.. ..	..
Year: Extremes	..	..	88	45	..	..	40.39 2/1893	Nil (e)	18.31 21/1/1887	..

(a) All records up to and including 1950. (b) Records incomplete for various years between 1846 and 1859. (c) 1841 and 1951. (d) 1862, 1869, and 1880. (e) Various months in various years.

Figures such as 23/47, *4/93*, etc. indicate, in respect of the month of reference, the day and year of the occurrence. 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, THUNDER, 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 (m.bars)*	*Wind (height of anemometer 58 ft)* Average miles per hour	Highest mean speed in one day (mph)	Highest gust speed (mph)	Prevailing direction 9 a.m.	Prevailing direction 3 p.m.	*Mean amt evaporation (in)*	*No. days thunder*	*Mean amt clouds 9 a.m., 3 p.m., 9 p.m. (a)*	*No. clear days*
No. of years of observations	60	25(b)	25(b)	25(b)	25(b)	25(b)	86	50	108	59
January	1,012.7	7.6	18.8 10/49	93	NE	NE	5.32	3.3	4.7	5.0
February	1,014.0	7.2	18.8 18/57	63	NE	ENE	4.20	2.6	4.8	4.7
March	1,016.4	6.5	20.7 10/44	58	WNW	ENE	3.65	1.7	4.4	5.8
April	1,018.2	6.3	22.5 24/44	72	W	ENE	2.71	1.4	4.1	7.3
May	1,018.6	6.5	21.0 18/55	63	W	ENE	1.93	1.0	3.9	7.8
June	1,018.9	7.2	22.4 10/47	84	W	WSW	1.49	0.8	4.0	8.1
July	1,018.4	7.1	21.3 20/51	66	W	WSW	1.56	0.9	3.5	10.4
August	1,017.9	7.5	24.6 9/51	68	WNW	WNW	2.02	1.5	3.3	10.5
September	1,017.0	7.2	21.8 23/42	70	WNW	NE	2.75	1.9	3.5	9.1
October	1,015.1	7.6	24.5 1/57	95	WNW	ENE	3.91	2.9	4.1	6.6
November	1,013.4	7.7	19.8 21/54	71	WNW	ENE	4.70	3.7	4.5	5.5
December	1,012.0	7.6	22.5 11/52	75	NE	ENE	5.38	4.0	4.6	4.9
Year Totals	..	..	.. ..	..	..	..	39.62	25.7	..	85.8
Year Averages	1,016.1	7.2	.. ..	..	WNW	ENE	..	..	4.2	..
Year Extremes	..	..	24.6 9/8/51	95	..	..	..	..	..	..

(*a*) Scale 0–8. (*b*) Years 1938–1962 inclusive.

TEMPERATURE AND SUNSHINE

Month	*Mean temperature (°Fahr.)* Mean max.	Mean min.	Mean	*Extreme shade temperature (°Fahr.)* Highest	Lowest	*Extreme temperature (°Fahr.)* Highest in sun	Lowest on grass	*Mean daily hours sunshine*
No. of years of observations	111	111	111	111	111	84(a)	111	49
January	78.2	65.0	71.6	113.6 14/39	51.1 18/49	164.3 26/15	43.7 6/25	7.2
February	77.8	65.2	71.5	107.8 8/26	49.3 *28/63*	168.3 14/39	42.8 22/33	6.6
March	76.1	63.2	69.6	102.6 *3/69*	48.8 *14/86*	158.3 10/26	39.9 17/13	6.3
April	71.8	58.1	64.9	91.4 (*b*)	44.6 *27/64*	144.1 *10/77*	33.3 24/09	6.1
May	66.2	52.2	59.2	86.0 1/19	40.2 *22/59*	129.7 *1/96*	29.3 25/17	5.8
June	61.8	48.4	55.1	80.4 11/31	35.7 22/32	125.5 2/23	28.0 22/32	5.2
July	60.5	46.1	53.3	78.3 22/26	35.9 *12/90*	124.7 *19/77*	24.0 *4/93*	6.1
August	63.3	47.7	55.5	86.8 24/54	36.8 *3/72*	149.0 *30/78*	26.1 4/09	6.8
September	67.3	51.4	59.3	94.2 26/65	40.8 2/45	142.2 *12/78*	30.1 17/05	7.2
October	71.4	55.9	63.7	99.4 4/42	42.2 6/27	152.2 20/33	32.7 9/05	7.3
November	74.4	59.6	67.0	104.5 6/46	45.8 1/05	158.5 *28/99*	35.4 *21/67*	7.6
December	76.9	62.9	69.9	108.0 20/57	48.4 3/24	164.5 *27/89*	41.4 3/24	7.4
Year Averages	70.5	56.3	63.4	.. ..	.. ..	.. ..	.. ..	6.6
Year Extremes	..	..	..	113.6 14/1/39	35.7 22/6/32	168.3 14/2/39	24.0 4/7/1893	..

(*a*) Records discontinued 1946. (*b*) 1/36 and 10/69.

HUMIDITY, RAINFALL, AND FOG

Month	*Vapour pressure mean 9 a.m. (m.bars)*	*Rel. hum. (%) at 9 a.m.* Mean	Highest mean	Lowest mean	*Rainfall (inches)* Mean mthly	Mean No. of days of rain	Greatest monthly	Least monthly	Greatest in one day	*Fog Mean No. days*
No. of years of observations	94	94	94	94	111	111	111	111	111	49
January	18.7	68	78	58	3.72	13	15.26 1911	0.25 1932	7.08 13/11	0.3
February	19.3	70	81	60	4.43	13	22.22 1956	0.12 1939	8.90 *25/73*	0.7
March	18.4	74	85	62	5.00	14	20.52 1942	0.42 1876	11.05 28/42	1.6
April	15.0	74	87	63	5.05	13	24.49 1861	0.06 1868	7.52 *29/60*	2.3
May	12.1	77	90	63	4.93	13	23.03 1919	0.14 1957	8.36 *28/89*	3.3
June	10.3	75	89	63	5.21	12	25.30 1950	0.16 1962	5.17 *16/84*	2.7
July	9.3	74	88	59	4.26	11	13.23 1950	0.10 1946	7.80 7/31	2.2
August	9.6	69	84	54	3.18	11	14.89 1899	0.04 1885	5.33 *2/60*	1.9
September	11.3	65	79	49	2.73	11	14.05 1879	0.08 1882	5.69 *10/79*	1.0
October	13.1	62	77	46	2.96	12	11.13 (*a*)	0.21 1867	6.37 13/02	0.6
November	15.0	62	79	42	3.07	12	20.36 1961	0.07 1915	5.24 27/55	0.5
December	17.4	65	77	51	3.09	12	15.82 1920	0.23 1913	4.75 13/10	0.4
Year Totals	..	..	..	..	47.63	147	.. ..	.. ..	.. ..	17.5
Year Averages	14.1	69	..	..	..	..	.. ..	.. ..	.. ..	..
Year Extremes	..	..	90	42	..	..	25.30 6/1950	0.04 8/1885	11.05 28/3/42	..

(*a*) 1916 and 1959.

Figures such as 10/49, *28/63*, etc. indicate, in respect of the month of reference, the day and year of the occurrence. Dates in italics relate to nineteenth century.

CLIMATOLOGICAL DATA: CANBERRA, AUSTRALIAN CAPITAL TERRITORY

(Lat. 35° 19′ S., Long. 149° 11′ E. Height above M.S.L., 1,872 ft)

BAROMETER, WIND, EVAPORATION, THUNDER, 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 (m.bars)	Wind (height of anemometer 33 ft) Average miles per hour	Highest mean speed in one day (mph)		Highest gust speed (mph)	Prevailing direction 9 a.m.	Prevailing direction 3 p.m.	Mean amt evaporation (in)	No. days thunder	Mean amt clouds 9 a.m., 3 p.m., 9 p.m. (a)	No. clear days
No. of years of observations	31	40(b)		40(b)	31(c)	31(c)	31(c)	38(d)	31	31	31(e)
January	1,012.2	4.2	14.9	23/33	65	NW	NW	7.77	3.2	4.0	8.0
February	1,012.9	3.8	15.3	24/33	65	NW	NW	6.12	2.8	4.2	6.9
March	1,016.0	3.3	18.2	28/42	69	SE	NW	5.13	1.5	4.1	8.3
April	1,018.7	3.1	18.6	8/45	66	NW	NW	3.14	0.9	4.1	7.1
May	1,018.8	2.7	13.2	27/58	65	NW	NW	1.89	0.5	4.4	6.8
June	1,020.9	3.0	16.1	2/30	60	NW	NW	1.24	0.2	4.6	6.7
July	1,020.3	3.1	23.4	7/31	63	NW	NW	1.23	0.1	4.4	7.2
August	1,018.8	3.7	15.7	25/36	70	NW	NW	1.75	0.7	4.3	7.1
September	1,017.3	3.7	17.4	28/34	62	NW	NW	2.78	1.2	4.1	8.0
October	1,015.0	4.0	14.7	12/57	74	NW	NW	4.26	2.0	4.4	6.2
November	1,012.0	4.3	17.2	28/42	79	NW	NW	5.71	3.3	4.4	5.9
December	1,010.9	4.3	16.1	11/38	66	NW	NW	7.22	3.5	4.1	7.5
Year — Totals	..	..	..	..	..	..	..	48.24	19.9	..	85.7
Year — Averages	1,016.1	3.6	..	..	..	NW	NW	..	..	4.3	7.1
Year — Extremes	..	..	23.4	7/7/31	79	..	..	..	..	..	..

(a) Scale 0–8. (b) Recorded at Forestry and Timber Bureau, Yarralumla, where a cup anemometer is installed. (c) Recorded at Meteorological Office, R.A.A.F. Fairbairn, where a Dines Pressure Tube anemometer is installed. (d) Australian tank, Yarralumla, 1929–66. (e) 1940–70. Formerly assessed over 37-year period at Yarralumla.

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.) Mean max.	Mean min.	Mean	Extreme shade temperature (°Fahr.) Highest		Lowest		Extreme temperature (°Fahr.) Highest in sun	Lowest on grass		Mean daily hours sunshine
No. of years of observations	31	31	31		31		31			19	33
January	81.8	55.0	68.4	(a)106.6	31/68	35.3	1/56	..	31.2	1/56	9.1
February	80.0	54.6	67.3	108.0	1/68	37.4	16/62	..	32.4	17/70	8.3
March	76.0	50.7	63.3	97.6	9/40	30.1	24/67	..	24.8	(b)	7.5
April	67.3	43.7	55.5	90.7	12/68	27.0	24/69	..	17.0	24/69	6.9
May	58.5	36.9	47.7	76.1	10/67	18.8	16/57	..	13.3	26/69	5.5
June	53.5	33.7	43.6	68.2	3/57	16.7	8/57	..	9.8	16/59	4.6
July	51.7	31.5	41.6	61.4	(c)	16.3	5/57	..	9.0	16/70	5.1
August	54.6	33.4	44.0	71.0	24/54	18.1	11/69	..	9.0	11/69	6.0
September	60.3	36.8	48.5	83.4	26/65	22.0	5/40	..	15.0	24/69	7.4
October	66.2	42.3	54.3	90.8	13/46	26.0	4/57	..	20.8	4/57	8.0
November	72.1	46.7	59.5	101.8	19/44	28.8	28/67	..	20.7	28/67	8.8
December	78.5	51.8	65.1	101.9	21/53	34.0	18/64	..	25.0	18/64	9.8
Year — Averages	66.7	43.1	54.9	..	..	..	..	..	..	..	7.2
Year — Extremes	..	..	..	108.0	1/2/68	16.3	5/7/57	..	9.0	(d)	..

(a) A temperature of 109.0 was recorded at the former Acton station on 11.1.39. (b) 30/58 and 24/67. (c) 2/46 and 9/54. (d) 11/8/69 and 16/7/70.

HUMIDITY, RAINFALL, AND FOG

Month	Vapour pressure mean 9 a.m. (m.bars)	Rel. hum. (%) at 9 a.m. Mean	Highest mean	Lowest mean	Rainfall (inches) Mean mthly	Mean No. of days of rain	Greatest monthly		Least monthly		Greatest in one day		Fog Mean No. days
No. of years of observations	31(a)	31	31	31	31	31		31		31		31	31
January	13.1	58	75	42	2.27	8	6.46	1941	0.04	1947	3.74	12/45	0.6
February	13.8	65	81	53	2.09	7	5.70	1948	Nil	1963	2.07	3/46	0.8
March	12.5	67	81	53	2.11	7	12.29	1950	0.05	1954	2.60	5/59	1.7
April	10.3	73	84	38	1.97	7	6.06	1940	0.08	1942	2.96	2/59	2.6
May	8.4	83	96	73	2.09	9	5.89	1953	0.06	1961	3.77	3/48	6.9
June	7.1	85	97	73	1.58	10	4.96	1956	0.26	1944	1.78	25/56	7.0
July	6.6	83	93	68	1.49	11	4.07	1960	0.16	1970	1.38	10/57	6.9
August	7.0	78	92	58	1.70	12	4.18	1955	0.28	1944	1.11	3/51	4.0
September	8.2	72	82	55	1.96	10	4.55	1970	0.23	1946	1.62	16/62	2.7
October	9.7	66	82	50	2.75	11	5.81	1959	0.25	1949	4.13	21/59	2.0
November	10.4	57	76	38	2.44	9	5.31	1961	0.52	1940	2.51	9/50	0.6
December	11.9	56	74	43	2.33	8	6.31	1960	Nil	1967	3.41	30/48	0.1
Year — Totals	..	..	..	..	24.78	109	..	..	..	..	..	..	35.9
Year — Averages	9.9	69	..	..	..	..	..	..	..	..	..	..	..
Year — Extremes	..	..	97	38	..	..	12.29	3/50	Nil	(b)	4.13	21/10/59	..

(a) Formerly assessed over 38-year period at Forestry and Timber Bureau, Yarralumla. (b) 12/67 and 2/68.

Data shown in the above tables relate to the Meteorological Office, R.A.A.F., Fairbairn, except where otherwise indicated, and cover years up to 1964. Figures such as 23/33, 31/68, etc. indicate, in respect of the month of reference, the day and year of the occurrence.

CLIMATOLOGICAL DATA: MELBOURNE, VICTORIA

(Lat. 37° 49′ S., Long. 144° 58′ E. Height above M.S.L., 114 ft)

BAROMETER, WIND, EVAPORATION, THUNDER, 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 (m.bars)	Wind (height of anemometer 93 ft) Average miles per hour	Highest mean speed in one day (mph)	Highest gust speed (mph)	Prevailing direction 9 a.m.	Prevailing direction 3 p.m.	Mean amt evaporation (in)	No. days thunder	Mean amt clouds 9 a.m., 3 p.m., 9 p.m. (a)	No. clear days
No. of years of observations	114	30(b)	57	60	51	51	94(c)	62	113	62
January	1,012.8	8.3	21.1 27/41	66	S	S	6.49	1.7	4.1	6.7
February	1,014.2	8.1	19.0 13/47	74	S & SW	S	5.08	2.0	4.0	5.9
March	1,016.8	7.3	18.0 3/61	66	N	S	4.12	1.3	4.4	5.4
April	1,019.0	7.0	19.9 16/43	67	N	S	2.50	0.7	4.8	4.1
May	1,019.1	7.3	20.5 4/61	72	N	N & S	1.55	0.4	5.2	2.9
June	1,018.9	7.3	22.8 16/47	64	N	N	1.15	0.2	5.3	2.8
July	1,018.6	8.0	22.7 22/60	68	N	N	1.13	0.2	5.1	2.6
August	1,017.7	7.8	21.3 20/42	65	N	N & S	1.52	0.6	5.0	2.8
September	1,016.0	8.0	21.1 15/64	69	N	S	2.36	0.8	4.8	3.6
October	1,014.8	8.1	18.9 6/68	69	N	S	3.40	1.6	4.8	3.5
November	1,013.9	8.5	21.2 13/58	71	SW	S	4.52	2.0	4.9	3.1
December	1,012.4	8.4	21.0 12/52	61	S & SW	S	5.78	2.2	4.5	4.4
Year Totals	..	..	.. ..	..	..	..	39.60	13.7	..	47.8
Year Averages	1,016.2	7.8	.. ..	..	N	S	..	..	4.7	..
Year Extremes	..	..	22.8 16/6/47	74	..	..	..	..	..	..

(a) Scale 0–8. (b) Early records not comparable. (c) Records to 1966.

TEMPERATURE AND SUNSHINE

Month	Mean temperature (°Fahr.) Mean max.	Mean min.	Mean	Extreme shade temperature (°Fahr.) Highest	Lowest	Extreme temperature (°Fahr.) Highest in sun	Lowest on grass	Mean daily hours sunshine
No. of years of observations	114	114	114	114	114	86(a)	110	52(c)
January	78.5	56.9	67.7	114.1 13/39	42.0 *28/85*	178.5 *14/62*	30.2 *28/85*	8.1
February	78.1	57.4	67.8	109.5 7/01	40.2 24/24	167.5 *15/70*	30.9 *6/91*	7.5
March	74.8	55.0	64.9	107.0 11/40	37.1 *17/84*	164.5 *1/68*	28.9 (b)	6.6
April	68.1	50.8	59.4	94.8 5/38	34.8 *24/88*	152.0 *8/61*	25.0 *23/97*	5.1
May	61.6	46.9	54.3	83.7 7/05	29.9 29/16	142.6 *2/59*	21.1 26/16	3.9
June	56.9	43.9	50.4	72.3 2/57	28.0 *11/66*	129.0 *11/61*	19.9 30/29	3.4
July	55.8	42.1	49.0	69.3 22/26	27.0 *21/69*	125.8 *27/80*	20.5 12/03	3.7
August	58.6	43.4	51.0	77.0 *20/85*	28.3 *11/63*	137.4 *29/69*	21.3 14/02	4.6
September	62.8	45.6	54.2	88.6 28/28	31.0 3/40	142.1 *20/67*	22.8 8/18	5.5
October	67.1	48.5	57.8	98.4 24/14	32.1 *3/71*	154.3 *28/68*	24.8 22/18	5.9
November	71.3	51.4	61.4	105.7 *27/94*	36.5 *2/96*	159.6 *29/65*	24.6 *2/96*	6.5
December	75.4	54.5	65.0	110.7 *15/76*	40.0 *4/70*	170.3 *20/69*	33.2 1/04	7.3
Year Averages	67.4	49.7	58.6	.. ..	.. ..	.. ..	.. ..	5.7
Year Extremes	..	..	..	114.1 13/1/39	27.0 21/7/1869	178.5 14/1/1862	19.9 30/6/29	..

(a) Records discontinued 1945. (b) 17/1884 and 20/1897. (c) Discontinued 1967.

HUMIDITY, RAINFALL, AND FOG

Month	Vapour pressure mean 9 a.m. (m.bars)	Rel. hum. (%) at 9 a.m. Mean	Highest mean	Lowest mean	Rainfall (inches) Mean mthly	Mean No. of days of rain	Greatest monthly	Least monthly	Greatest in one day	Fog Mean No. days
No. of years of observations	62	62	62	62	114	114	114	114	114	112
January	13.0	60	68	50	1.86	8	6.92 1963	0.01 1932	4.25 29/63	0.1
February	14.1	63	77	48	1.86	7	7.72 1939	0.02 1965	3.44 26/46	0.3
March	13.3	66	79	50	2.09	9	7.50 1911	0.14 1934	3.55 5/19	0.7
April	11.7	72	82	66	2.32	11	7.67 1960	Nil 1923	3.15 23/60	1.8
May	10.3	79	88	70	2.25	14	5.60 1942	0.14 1934	1.81 *18/00*	3.7
June	9.3	83	92	73	1.98	14	4.50 1859	0.31 1858	1.71 21/04	4.7
July	8.9	81	86	75	1.93	15	7.02 1891	0.57 1902	2.93 *12/91*	4.4
August	9.1	75	82	65	1.94	15	4.35 1939	0.48 1903	2.14 *17/81*	2.4
September	9.5	68	76	60	2.32	14	7.93 1916	0.52 1907	2.31 23/16	0.9
October	10.5	63	71	52	2.65	14	7.61 1869	0.29 1914	2.40 21/53	0.4
November	11.3	60	69	52	2.30	12	8.11 1954	0.25 1895	2.86 21/54	0 2
December	12.5	59	69	48	2.28	10	7.18 1863	0.11 1904	3.92 4/54	0 2
Year Totals	..	..	..	..	25.78	143	.. ..	.. ..	.. ..	19.8
Year Averages	11.1	69	..	..	..	..	.. ..	.. ..	.. ..	..
Year Extremes	..	..	92	48	..	..	8.11 11/1954	Nil 4/1923	4.25 29/1/63	..

Figures such as 27/41, *28/85*, etc. indicate, in respect of the month of reference, the day and year of the occurrence. 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, THUNDER, 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 (m.bars)*	*Wind (height of anemometer 40 ft)* Average miles per hour	Highest mean speed in one day (mph)		Highest gust speed (mph)	Prevailing direction 9 a.m.	Prevailing direction 3 p.m.	*Mean amt evaporation (in)*	*No. days thunder*	*Mean amt clouds 9 a.m., 3 p.m., 9 p.m. (a)*	*No. clear days*
No. of years of observations	84	59		59	79	30(*b*)	30(*b*)	56	58	84	30(*b*)
January	1,010.6	7.7	20.8	30/16	81	NNW	SSE	4.91	1.0	5.1	1.9
February	1,012.9	7.0	25.2	4/27	75	NNW	SSE	3.74	1.0	5.0	2.3
March	1,014.4	6.7	21.4	13/38	79	NW	SSE	3.20	0.7	4.8	2.4
April	1,015.7	6.7	24.1	9/52	74	NW	W	2.06	0.4	5.1	1.7
May	1,015.3	6.4	22.0	21/65	84	NNW	NW	1.38	Nil	5.0	2.4
June	1,015.4	6.3	23.7	27/20	82	NW	NW	0.93	0.1	5.0	2.4
July	1,014.0	6.5	22.9	22/53	80	NNW	NNW	0.93	Nil	4.8	2.0
August	1,012.7	6.8	25.5	19/26	87	NNW	NW	1.29	0.1	4.9	2.1
September	1,011.8	7.7	26.7	28/65	93	NNW	NW	2.00	0.1	4.9	1.5
October	1,010.6	7.8	20.2	3/65	87	NWN	SW	2.94	0.4	5.3	1.0
November	1,009.9	8.0	21.2	18/15	84	NNW	S	3.75	0.6	5.4	1.3
December	1,009.5	7.6	23.4	1/34	76	NNW	SSE	4.40	0.8	5.4	1.1
Year Totals	..	..	..	..	..	..	..	31.53	5.2	..	22.1
Year Averages	1,012.7	7.1	..	..	..	NNW	W	..	..	5.1	..
Year Extremes	..	..	26.7	28/9/65	93	..	..	..	..	..	..

(*a*) Scale 0–8. (*b*) Standard thirty years normal (1911–1940).

TEMPERATURE AND SUNSHINE

Month	*Mean temperature (°Fahr.)* Mean max.	Mean min.	Mean	*Extreme shade temperature (°Fahr.)* Highest		Lowest		*Extreme temperature (°Fahr.)* Highest in sun		Lowest on grass		*Mean daily hours sunshine*
No. of years of observations	86	86	86		86		86		57(*a*)		82	74
January	70.5	52.6	61.5	105.0	(*b*)	40.1	(*c*)	160.0	(*d*)	30.6	*19/97*	7.5
February	70.6	53.0	61.8	104.4	*12/99*	39.0	*20/87*	165.0	*24/98*	28.3	*—/87*	6.7
March	67.9	50.9	59.4	99.1	13/40	35.2	31/26	150.9	26/44	27.5	30/02	6.0
April	62.6	47.5	55.0	87.1	1/41	33.2	14/63	142.0	*18/93*	25.0	*—/86*	4.8
May	57.5	44.0	50.7	77.8	5/21	29.2	20/02	128.0	(*e*)	20.0	19/02	4.2
June	53.1	41.2	47.1	69.2	1/07	29.2	28/44	122.0	*12/94*	18.1	24/63	3.7
July	52.5	39.9	46.2	66.1	14/34	27.7	*11/95*	121.0	*12/93*	18.7	*16/86*	4.2
August	55.1	41.1	48.1	71.6	28/14	28.8	5/62	129.0	*—/87*	20.1	7/09	4.8
September	58.8	43.1	51.0	81.7	23/26	31.0	*16/97*	138.0	*23/93*	18.3	16/26	5.5
October	62.3	45.5	53.9	92.0	24/14	32.0	*12/89*	156.0	*9/93*	23.8	(*f*)	5.9
November	65.3	48.1	56.7	98.3	26/37	35.0	16/41	154.0	*19/92*	26.0	1/08	6.8
December	68.3	50.8	59.6	105.2	*30/97*	38.0	3/06	161.5	10/39	27.2	*—/86*	6.9
Year Averages	62.0	46.5	54.3	..	..	..	..	..	..	..	..	5.6
Year Extremes	..	..	..	105.2	30/12/1897	27.7	11/7/1895	165.0	24/2/1868	18.1	24/6/63	..

(*a*) Period 1934–1938 not comparable; records discontinued 1946. (*b*) 1/1900 and 19/1959. (*c*) 9/1937 and 11/1937. (*d*) 5/1886 and 13/1905. (*e*) —/1899 and —/1893. (*f*) 1/1886 and 1/1899.

HUMIDITY, RAINFALL, AND FOG

Month	*Vapour pressure mean 9 a.m. (m.bars)*	*Rel. hum. (%) at 9 a.m.* Mean	Highest mean	Lowest mean	*Rainfall (inches)* Mean mthly	Mean No. of days of rain	Greatest monthly		Least monthly		Greatest in one day		*Fog Mean No. days*
No. of years of observations	76	76	76	76	87	87		87		87		87	47(*a*)
January	11.0	58	81	45	1.90	11	5.91	1893	0.17	(*b*)	2.96	30/16	0.1
February	11.7	62	83	49	1.62	10	6.72	1964	0.11	1914	2.20	1/54	0.0
March	11.0	65	78	52	1.85	11	10.05	1946	0.29	1943	3.47	17/46	0.3
April	10.0	70	84	57	2.18	12	9.75	1960	0.07	1904	5.25	23/60	0.2
May	8.8	75	86	61	1.93	14	8.43	1958	0.14	1913	1.75	*2/93*	0.6
June	7.9	78	91	61	2.35	15	9.38	1954	0.28	1886	5.80	7/54	1.1
July	7.6	78	87	72	2.09	15	6.12	1967	0.17	1950	2.51	18/22	0.8
August	7.9	73	86	59	1.90	16	6.32	1946	0.30	1892	2.28	*14/90*	0.5
September	8.3	66	81	52	2.06	15	7.93	1957	0.38	1951	6.15	15/57	0.3
October	9.1	62	74	52	2.49	17	7.60	1947	0.39	1914	2.58	4/06	0.1
November	9.6	58	73	49	2.18	14	7.39	1885	0.33	1921	3.70	*30/85*	0.1
December	10.6	58	73	42	2.23	13	7.72	1916	0.17	1931	3.33	5/41	0.2
Year Totals	..	..	..	..	24.77	163	..	..	..	..	..	..	4.3
Year Averages	9.5	67	..	..	..	..	..	..	..	..	..	..	..
Year Extremes	..	..	91	42	..	..	10.05	3/1946	0.07	4/1904	6.15	15/9/57	..

(*a*) 1922–1968. (*b*) 1915 and 1958.

Figures such as 30/16, *12/99*, etc. indicate, in respect of the month of reference, the day and year of the occurrence. 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

	Rainfall		*Temperature*				*Relative humidity*			
Town	*Average annual rainfall (inches)*	*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 3p.m., January (%)*	*Mean 3p.m., July (%)*
				WESTERN AUSTRALIA						
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
				NORTHERN TERRITORY						
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
				SOUTH AUSTRALIA						
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	..	..
				QUEENSLAND						
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 footnotes *see* next page.

CLIMATOLOGICAL DATA FOR SELECTED AUSTRALIAN COUNTRY TOWNS—*continued*

Town	*Rainfall*		*Temperature*				*Relative humidity*			
	Average annual rainfall (inches)	*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 3p.m., January (%)*	*Mean 3p.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	88	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—*contd*			
Albany	34° 57′	117° 48′	226	Toowoomba	27° 33′	151° 57′	1,921
Broome	17° 57′	122° 13′	39	Townsville	19° 15′	146° 46′	10
Bunbury	33° 19′	115° 38′	3				
Carnarvon	24° 53′	113° 39′	12	New South Wales—			
Esperance	33° 51′	121° 53′	14	Albury	36° 06′	146° 54′	600
Geraldton	28° 48′	114° 42′	92	Armidale	30° 32′	151° 38′	3,215
Kalgoorlie	30° 46′	121° 27′	1,180	Bega	36° 40′	149° 50′	50
Meekatharra	26° 36′	118° 29′	1,697	Bourke	30° 05′	145° 58′	350
Narrogin	32° 54′	117° 09′	1,150	Broken Hill	31° 57′	141° 28′	978
Port Hedland	20° 23′	118° 37′	20	Cooma	36° 13′	149° 08′	2,749
Wyndham	15° 31′	128° 09′	20	Dubbo	32° 10′	148° 37′	861
				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
				Moree	29° 28′	149° 51′	680
				Newcastle	32° 55′	151° 49′	122
South Australia—				Orange	33° 18′	149° 06′	2,850
Ceduna	32° 08′	133° 42′	57	Tamworth	31° 05′	150° 56′	1,279
Mount Gambier	37° 45′	140° 47′	206	Taree	31° 54′	152° 28′	30
Oodnadatta	27° 33′	135° 29′	371	Wagga	35° 08′	147° 25′	719
Port Augusta	32° 33′	137° 47′	14	Wollongong	34° 25′	150° 56′	150
Port Lincoln	34° 47′	135° 53′	13				
Port Pirie	33° 11′	138° 01′	10	Victoria—			
				Ballarat	37° 35′	143° 50′	1,433
Queensland—				Bendigo	36° 46′	144° 17′	730
Atherton	17° 17′	145° 27′	2,466	Geelong	38° 07′	144° 22′	57
Bundaberg	24° 52′	152° 21′	6	Horsham	36° 40′	142° 12′	437
Cairns	16° 35′	145° 44′	10	Mildura	34° 14′	142° 05′	156
Charleville	26° 25′	146° 17′	950	Sale	38° 06′	147° 08′	15
Charters Towers	20° 03′	146° 08′	1,004	Seymour	37° 02′	145° 08′	464
Cloncurry	20° 40′	140° 30′	621	Shepparton	36° 23′	145° 24′	372
Ipswich	27° 38′	152° 44′	64	Wangaratta	36° 22′	146° 19′	493
Longreach	23° 26′	144° 15′	612	Warrnambool	38° 24′	142° 29′	33
Mackay	21° 07′	149° 10′	9				
Maryborough	25° 32′	152° 42′	20	Tasmania—			
Normanton	17° 39′	141° 05′	34	Burnie	41° 04′	145° 54′	13
Rockhampton	23° 23′	150° 29′	26	Launceston	41° 33′	147° 13′	546
Roma	26° 36′	148° 42′	1,000	Zeehan	41° 54′	145° 23′	592

The weather of 1970 (December 1969 to November 1970)

The following is a brief summary of weather experienced during the four seasons ended in November 1970. Plate 4, page 32, shows the rainfall distribution for 1970.

Summer, 1969–70. Rainfall was mainly near average in the western and eastern areas of the continent but large areas of South Australia and the Northern Territory were below average. In Western Australia the season's rainfall was mostly above average and the situation in the drought stricken southern districts was eased to some extent. Although much of Queensland received below average rainfall for the summer the rain was beneficial and eased the drought in many areas of that State. In New South Wales rainfall was near average in the east and below average in the west. Victoria's rainfall was mainly near average except in the North Mallee where falls were significantly below average. Tasmania's rainfall was above average in the east and below average in the west.

Summer mean temperatures were near average generally. Some exceptions were in eastern New South Wales and in the south-east of South Australia where seasonal mean maxima were below average.

Autumn, 1970. Rainfall was markedly deficient in large areas of Queensland, South Australia and the 'Top End' of the Northern Territory. The season's rainfall was notably above average in Victoria, south-central New South Wales and in the Alice Springs district of the Northern Territory, some areas in the latter district receiving twice their normal amounts.

Elsewhere over the continent and in Tasmania seasonal rainfall was mainly average. In Western Australia the season's rainfall was generally average after a dry beginning. The Northern Territory ranged from deficiencies in the north to good rains in the south. Most of South Australia had deficient seasonal rainfall except in south-eastern areas where falls were mainly average. Autumn rainfall was deficient in Queensland notably in central and south-east districts. About two thirds of New South Wales received average rainfall or above in autumn although east coastal areas were well below. In Victoria, rainfall was well above average throughout, being as high as 85 per cent above in some areas. Tasmania's seasonal rainfall was generally average.

Seasonal temperatures were mainly average but there was a large area over inland New South Wales which was markedly below.

Winter, 1970. The absence of depressions off the New South Wales coast caused lack of heavy rain on the coast and drought conditions were established there north from about Jervis Bay. In the wheat-growing areas of northern New South Wales and southern Queensland the acreage sown to wheat was much less than last year because of less than average autumn rainfall and very much less than average winter rainfall. Those crops that were sown were critically in need of rain. In Western Australia the wheat was sown in fair to good conditions but the low rainfall of July and August left crops there in need of rain. Other cereal crops in these areas were in a similar position regarding acreage sown and need of rain at the end of autumn. The situation for cereal crops in South Australia, Victoria and southern New South Wales was greatly improved by good rainfall late in August. In the northern half of Australia winter rainfall was scant and generally very much below average. It was feared that during spring very arduous conditions would spread to all northern areas; many areas were drought-stricken by the end of winter.

Temperatures were mainly average but there were particularly severe frosts in the north-east of New South Wales.

Spring, 1970. Rainfall over Australia was generally average or better except for small areas in South Australia and Victoria. However, the average rainfall in the west of Queensland, the far north-west of New South Wales and northern South Australia was not great enough in amount to give appreciable alleviation of drought conditions which had persisted from the beginning of this year or earlier. In the north of the continent spring rains eased the drought situation but much still depended upon the development of the summer rainy season.

Wheat areas in most of the south had either ideal rainfall, or somewhat more than ideal amounts of rainfall. In Queensland and northern New South Wales spring rains, after autumn and winter drought, made reasonable harvests possible in some areas.

Spring temperatures were mainly below normal and some damage was caused by the late frosts. Horticultural conditions were good to excellent although a little late.