CHAPTER II.

PHYSIOGRAPHY.

§ 1. General Description of Australia.

1. **Geographical Position.**—(i) *General.* The Australian Commonwealth, which includes the island continent of Australia proper and the island of Tasmania, is situated in the Southern Hemisphere, and comprises in all an area of about 2,974,581 square miles, the mainland alone containing about 2,948,366 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 39° 8′ S., or, including Tasmania, 43° 39′ S. On its north are the Timor and Arafura Seas and Torres Strait—on its south the Southern Ocean and Bass Strait. The extreme points are "Steep Point" on the west, "Cape Byron" on the east, "Cape York" on the north, "Wilson's Promontory" on the south, or, if Tasmania be included, "South-East Cape."

(ii) *Tropical and Temperate Regions.* Of the total area of Australia nearly 40 per cent. lies within the tropics. Assuming, as is usual, that the latitude of the Tropic of Capricorn is 23° 30′ S. (its mean value for 1949 was 23° 26′ 45.30″), the areas within the tropical and temperate zones are approximately as follows :—

AUSTRALIA : AREAS OF TROPICAL AND TEMPERATE REGIONS.

Area.	N.S.W. (a)	Vic.	Qld.	S. Aust.	W. Aust.	Tas.	N. Terr.	Total.
Within Tropical Zone sq. miles	..	..	359,000	..	364,000	..	426,320	1,149,320
Within Temperate Zone sq. miles	310,372	87,884	311,500	380,070	611,920	26,215	97,300	1,825,261
Total Area sq. miles	310,372	87,884	670,500	380,070	975,920	26,215	523,620	2,974,581
Ratio of Tropical part to whole State	..	..	0.535	..	0.373	..	0.814	0.386
Ratio of Temperate part to whole State	1	1	0.465	1	0.627	1	0.186	0.614

(a) Includes Australian Capital Territory.

Thus the tropical part is roughly about five-thirteenths of the whole of Australia (0.386) or, of the three territories with areas within the tropical zone, about one-half (0.530).

2. **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, four-fifths of that of Canada, more than one-fifth of the area of the British Commonwealth, nearly three-fourths of the whole area of Europe, and about 25 times as large as Great Britain and

Ireland. This great area, coupled with a limited population, renders the solution of the problem of Australian development a particularly difficult one. The areas of Australia and of certain other countries are shown in the following table :—

AREA OF AUSTRALIA AND OF OTHER COUNTRIES, *Circa* 1947.

Country.	Area.
Continental Divisions—	Sq. miles.
Europe (*a*)	1,913,000
Asia (*a*)	10,349,000
U.S.S.R. (Europe and Asia)	8,599,000
Africa	11,620,000
North and Central America and West Indies	8,666,000
South America	6,927,000
Oceania, etc.	3,305,000
Total, excluding Arctic and Antarctic Conts.	51,379,000
Europe(*a*)—	
France	213,000
Spain (incl. possessions)	195,000
Sweden	173,000
Germany	138,000
Finland	130,000
Norway	125,000
Poland	120,000
Italy	116,000
Yugoslavia	99,000
United Kingdom	94,000
Rumania	92,000
Other	418,000
Total	1,913,000
Asia(*a*)—	
China and Dependencies	3,759,000
India	1,220,000
Indonesia(*b*)	735,000
Iran	628,000
Mongolian Peoples' Republic	626,000
Saudi Arabia	597,000
Pakistan	361,000
Turkey	287,000
French Indo-China	272,000
Burma	262,000
Afghanistan	251.000
Siam	198,000
Other	1,153,000
Total	10,349,000
U.S.S.R.	8,599,000
Africa—	
French West Africa	1,805.000
French Equatorial Africa	969.000
Anglo-Egyptian Sudan	967,000
Belgian Congo	905,000
Algeria	851,000
Libya	679,000

Country.	Area.
Africa—*continued*.	sq. miles.
Angola	481,000
Union of South Africa	472,000
Egypt	386,000
Nigeria and Protectorate	373,000
Tanganyika Territory	363,000
Ethiopia	350,000
South-West Africa	318,000
Mozambique	298,000
Northern Rhodesia	290,000
Bechuanaland Protectorate	275,000
Madagascar	229,000
Kenya Colony and Protectorate	225,000
Other	1,384,000
Total	11,620,000
North and Central America—	
Canada	3,690,000
United States of America	3,022,000
Mexico	760,000
Alaska	586,000
Newfoundland and Labrador	153,000
Nicaragua	59,000
Honduras	57,000
Other	339,000
Total	8,666,000
South America—	
Brazil	3,288,000
Argentine Republic	1,079,000
Peru	482,000
Colombia (excl. of Panama)	440,000
Bolivia	415,000
Venezuela	352,000
Chile	286,000
Ecuador	176,000
Paraguay	157,000
Other	262,000
Total	6,927,000
Oceania, etc.—	
Commonwealth of Australia	2,975,000
New Zealand and Dependencies	104,000
New Guinea	93,000
Papua	91,000
Other	42,000
Total	3,305,000
British Commonwealth	13,258,000

(*a*) Excludes U.S.S.R., shown below. (*b*) Includes Dutch New Guinea.

The countries and areas shown in the table are obtained from the *Demographic Yearbook*, 1948, published by the United Nations.

3. **Areas of Political Subdivisions.**—As already stated, Australia consists of six States and the Northern and Australian Capital Territories. The areas of these, and their proportions of the total of Australia, are shown in the following table :—

AUSTRALIA : AREA OF STATES AND TERRITORIES.

State or Territory.	Area.	Percentage on Total.
	Sq. miles.	%
New South Wales	309,433	10.40
Victoria	87,884	2.96
Queensland	670,500	22.54
South Australia..	380,070	12.78
Western Australia	975,920	32.81
Tasmania	26,215	0.88
Northern Territory	523,620	17.60
Australian Capital Territory ..	939	0.03
Total	2,974,581	100.00

4. **Coastal Configuration**—(i) *General.* There are no striking features in the configuration of the coast ; the most remarkable indentations are the Gulf of Carpentaria on the north and the Great Australian Bight on the south. The Cape York Peninsula on the extreme north is the only other remarkable feature in the outline. In Official Year Book No. 1 an enumeration is given of the features of the coast-line of Australia (*see* pp. 60–68).

(ii) *Coast-line.* The lengths of coast-line, excluding minor indentations, of each State and of the whole continent, and the area per mile of coast-line, are shown in the following table :—

AUSTRALIA : COAST-LINE AND AREA PER MILE THEREOF.

State.	Coast-line.	Area per Mile of Coast-line.	State.	Coast-line.	Area per Mile of Coast-line.
	Miles.	Sq. miles.		Miles.	Sq. miles.
New South Wales(*a*)	700	443	Western Australia	4,350	224
Victoria.. ..	680	129	Northern Territory	1,040	503
Queensland ..	3,000	223	Continent (*b*) ..	11,310	261
South Australia ..	1,540	247	Tasmania ..	900	29

(*a*) Includes Australian Capital Territory. (*b*) Area 2,948,366 square miles.

For the entire Commonwealth of Australia this gives a coast-line of 12,210 miles and an average of 244 square miles for one mile of coast-line. According to Strelbitski, Europe has only 75 square miles of area to each mile of coast-line, and, according to more recent figures, England and Wales have only one-third of this, 25 square miles.

(iii) *Historical Significance of Coastal Names.* It is interesting to trace the voyages of some of the early navigators by the names bestowed by them on various coastal features—thus Dutch names are found on various points of the Western Australian coast, in Nuyts' Archipelago, in the Northern Territory, and in the Gulf of Carpentaria ; Captain Cook can be followed along the coasts of New South Wales and Queensland ; Flinders' track is easily recognized from Sydney southwards, as far as Cape Catastrophe, by the numerous Lincolnshire names bestowed by him ; and the French navigators of the end of the eighteenth and the beginning of the nineteenth century have left their names all along the Western Australian, South Australian and Tasmanian coasts.

5. **Geographical Features of Australia.**—In separate issues of earlier Official Year Books fairly complete information has been given concerning some special geographical element. The nature of this information and its position in the various issues can be readily ascertained on reference to the special index following the index to maps and graphs at the end of this issue.

6. **Fauna, Flora, Geology and Seismology of Australia.**—Special articles dealing with these features have appeared in previous issues of the Official Year Book, but limits of space naturally preclude their repetition in each volume. As pointed out in par. 5, however, the nature and position of these articles can be readily ascertained from the special index.

§ 2. Climate and Meteorology of Australia.*

1. **Introductory.**—In Official Year Book No. 3, pp. 79 and 80, some account is given of the history of Australian meteorology, including a reference to the development of magnetic observations. In Official Year Book No. 4, pp. 84 and 87, will be found a short sketch of the creation and organization of the Commonwealth Bureau of Meteorology, and a résumé of the subjects dealt with at the Meteorological Conference in 1907.

2. **Organization of the Meteorological Service.**—The Meteorological Branch is organized with a head-quarters' staff at the Central Meteorological Bureau, Melbourne, and Divisional Meteorological Bureaux at Adelaide, Brisbane, Hobart, Sydney, and Perth. Aviation services are provided by Forecasting and Observer Stations at the main terminals and at staging stations along the national air routes. At international airports, forecasting stations, working to agreed procedures, maintain integrated services with the staging stations in adjoining territories.

The Central Meteorological Bureau is organized in specializing sections, which include :—

(i) *Aviation and Transport Section.*—For the administration and supervision of Aviation Meteorological Offices at Royal Australian Air Force and civil aerodromes.

(ii) *Climatological and Statistical Section.*—For the organization of the climatological network of the Commonwealth, and the receipt and compilation of climatological statistics for a wide variety of purposes. These are applied to departmental, public, economic, and scientific purposes by the climatologists of the Section in the form of publications and special papers issued from time to time.

(iii) *Central Analysis and Weather Development Section.*—For the preparation of analyses and advisory statements (distributed daily amongst all meteorological offices in the Commonwealth, and transmitted overseas for the benefit of International Meteorological Services), and the development of practising procedures for the application of new meteorological theories and techniques as they arise.

(iv) *Training and Publications Section.*—For the organization and supervision of all training activities throughout the Meteorological Service, and the editing, collation and publication of Meteorological manuals, pamphlets, and papers. In addition, this Section attends to the meteorological training of Civil Aviation pilots. and to the associated examinations for promotion within the Australian Aviation Services.

(v) *Special Investigations Section.*—For investigation of problems referred by departmental and public interests, and for the preparation of reports on special aspects in applied meteorology.

(vi) *Seasonal Forecasting Research Section.*—For investigation of methods and techniques for extended range forecasting.

(vii) *Works and Laboratory.*—For the design, specification, maintenance and repair of meteorological equipment and supplies.

(viii) *Administrative Section.*—For the general administration of the Departmental Services.

Divisional Bureaux in the capital cities of the various States are responsible for the administration of Meteorological and Climatological Services within the region of the State, and provide all necessary forecasting and advisory services for the public and other interests and attend to climatological problems in respect of the region which they control.

The Aviation Service, co-ordinated by the Aviation Section at Central Office, is responsible for all meteorological services required for aviation over the routes and route sections of the regions in which they are located.

* Prepared from data supplied by the Director, Commonwealth Meteorological Bureau.

3. **Meteorological Publications.**—Reference to publications issued by the Central Meteorological Bureau appears in Official Year Book No. 22, pp. 40 and 41, and No. 34, p. 11. The following publications have since been issued :—Bulletin No. 28, " Duststorms in Australia " ; Bulletin No. 29, " Report on the Divergence Theory of the Formation of Cyclones " ; Bulletin No. 30, " Synoptic Analysis over South-West Pacific Area " ; Bulletin No. 31, " Coastal Fogs in Australia " ; Bulletin No. 32, " Frost in the Australian Region " ; Bulletin No. 33, " Discussion of Seven Years of Aerological Observations by Aeroplane at Sydney " ; Bulletin No. 34, " Bradfield Scheme for Watering the Inland " ; Bulletin No. 35, " A Study of Average Hourly Values of Temperature, Relative Humidity and Saturation Deficit in the Australian Region from Records of Capital City Bureaux " ; Bulletin No. 36, " Weather Conditions Affecting Aviation over the Tasman Sea "—Part IV., " Flying Conditions over the Tasman Sea " (1940–44) ; Bulletin No. 37, " Discussion of Four Years of Aerological Observations obtained by means of Aeroplanes near Perth " ; Studies in Applied Climatology, Western Australia—Pamphlet No. 1, " Climate of the West Australian Wheat Belt with Special Reference to Rainfall over Marginal Areas " ; Pamphlet No. 2, " Climate of the South-West Wheat Belt of New South Wales " ; Bulletin No. 40, " Meteorology of the Indian Ocean Area between Australia and India " ; " Analysis and Forecasting in the South-West Pacific Area " ; and " Set of Typical Summer and Winter Weather Charts (for use in Schools) ".

4. **Equipment.**—The determination of the climatological data has been made by records of the following instruments :—

(i) *Rainfall.* Rainfall has been measured by a cylindrical gauge generally 8 inches in diameter.

(ii) *Temperature.* Extreme daily temperatures have been recorded by means of self-registering maximum and minimum thermometers which are read and set daily.

(iii) *Humidity.* Humidities have been determined by the aid of tables from readings of dry and wet bulb thermometers.

(iv) *Atmospheric Pressure.* Pressures have been measured by mercurial barometers of the Kew (or Fortin) pattern.

(v) *Evaporation.* The standard evaporimeter in use consists of a cylindrical galvanized iron tank 3 feet in diameter and 3 feet deep, with a water jacket. Concrete tanks of similar form and dimensions are also used.

(vi) *Wind.* Data concerning wind have been obtained either by " Robinson " cup anemometer, " Dines " pressure tube anemometer or by " Machin " cup anemometer.

5. **General Description of Australia.**—A considerable portion (0.530) of three divisions of Australia is north of the tropic of Capricorn—that is to say, within Queensland, Western Australia and the Northern Territory, no less than 1,149,320 square miles belong to the tropical zone and 1,020,720 to the temperate zone. The whole area of Australia within the temperate zone, however, is 1,825,261 square miles ; thus the tropical part is about 0.386, or about five-thirteenths of the whole, or the " temperate " region is half as large again as the " tropical " (more accurately 1.588). By reason of its insular geographical position and the absence of striking physical features whether in marine gulfs or in important mountains, Australia is, on the whole, less subject to extremes of weather than are regions of similar area in other parts of the globe, and latitude for latitude Australia is, on the whole, more temperate.

The average elevation of the surface of the land is low, probably close to 900 feet above the sea. The altitudes range up to a little over 7,300 feet, hence its climate embraces a great many features, from the characteristically tropical to what is essentially alpine, a fact indicated in some measure by the name Australian Alps given to the southern portion of the Great Dividing Range.

On the coast, the rainfall is often abundant and the atmosphere moist, but in some portions of the interior is very limited, and the atmosphere dry. The distribution of forest, therefore, with its climatic influence, is very uneven. In the interior, in places, there are fine belts of trees, but there are large areas also which are treeless, and here the air is hot and parching in summer. Again, on the coast, even so far south as latitude 35°, the vegetation is tropical in its luxuriance, and to some extent also in character. Climatologically, therefore, Australia may be said to present a great variety of features.

6. **Meteorological Divisions.**—Reference to the divisions adopted by the Commonwealth Meteorologist will be found in Official Year Book No. 22, p. 41.

7. **Temperature.**—(i) *Effective Temperature.* When a meteorologist speaks of temperature he means the temperature of the air indicated by a thermometer sheltered from precipitation, from direct rays of the sun and from radiation of heat from the ground and neighbouring objects, yet freely exposed to the circulation of the air. In other words, he means temperature measured under conditions standardized as near as possible in a Stevenson Screen, which is the standard housing for meteorological thermometers.

This shade temperature as measured by a " dry bulb " thermometer shows only the actual temperature experienced by dry inorganic substances, not the *sensible* temperatures felt by organic bodies. In the case of human beings, sensible temperature is affected by the rate of conduction of heat to or from the body by moving air and also by the rate of cooling due to evaporation from the skin and respiratory passages. The wind and humidity therefore determine the sensible temperature.

The humidity (relative humidity) is determined from the readings of the dry and wet bulb thermometers. Of late years, however, with increasing interest in human comfort in tropical climates, another term, *effective* temperature, has come into use. It may be defined as " the temperature of a still, saturated atmosphere which would on the average produce the same feeling of warmth or cold as the atmosphere in question ".*

Later investigations have established "comfort zones"† bounded by limits of effective temperature within which people will feel comfortable. American research workers have determined the following figures :—‡

COMFORT ZONES : EFFECTIVE TEMPERATURES.

Season.	No subjects feel comfortable below—	Fifty per cent. of subjects feel comfortable between—	No subjects feel comfortable above—
Winter	60° F.	63° and 71° F.	74° F.
Summer	64° F.	66° and 75° F.	79° F.

Isotherms of effective temperature (not corrected for altitude) have been determined for Australia.§ A map showing effective temperature for Australia for January (9 a.m.) will be found on page 33.

It will be seen that the 80° F. isotherm is confined to a very narrow tract of country on the north-west coast of Western Australia. The 75° F. isotherm extends broadly from Onslow on the north-west coast of Western Australia to Daly Waters to Camooweal to Moreton in Cape York Peninsula following in a general way the coastline of Northern Australia but from 100 to 300 miles inland.

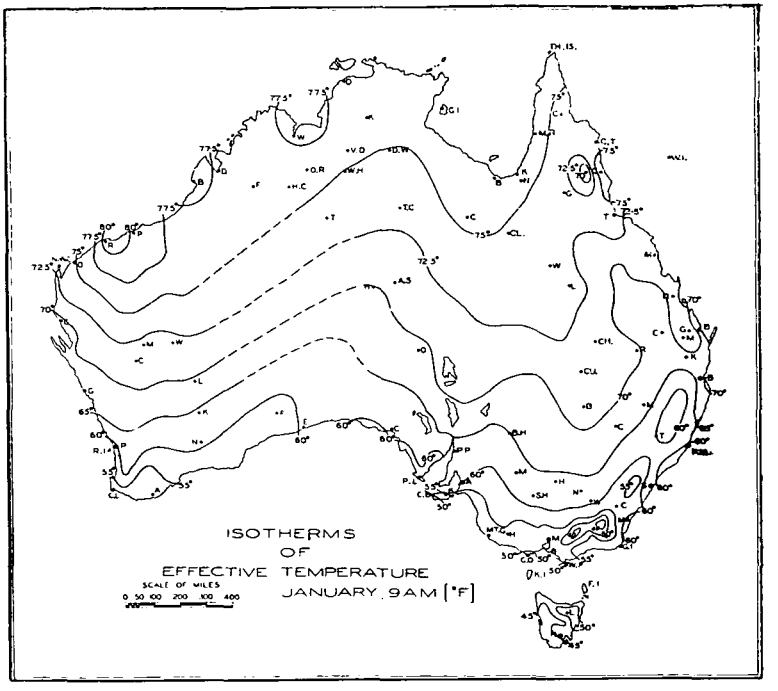
Queensland investigators¶ in recent years have divided some towns of Queensland into three classes on the basis of deviation from comfort :—

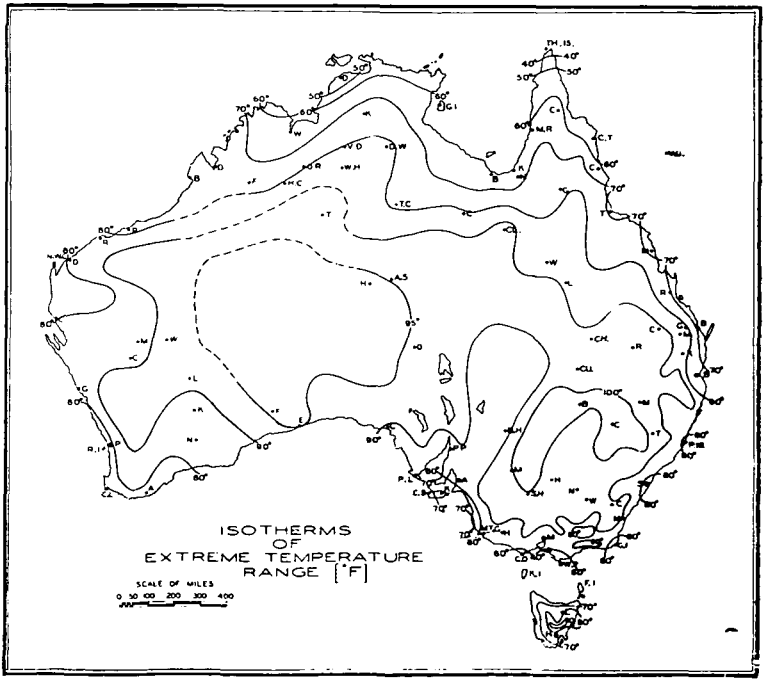
Class 1 (Sub-tropics).—Quite suitable for Caucasian habitation—Rockhampton, Bundaberg, Brisbane, Longreach, Charleville.

Class 2 (Marginal tropics).—Suitable for Caucasian habitation, but requires adaptation in summer—Mackay, Townsville.

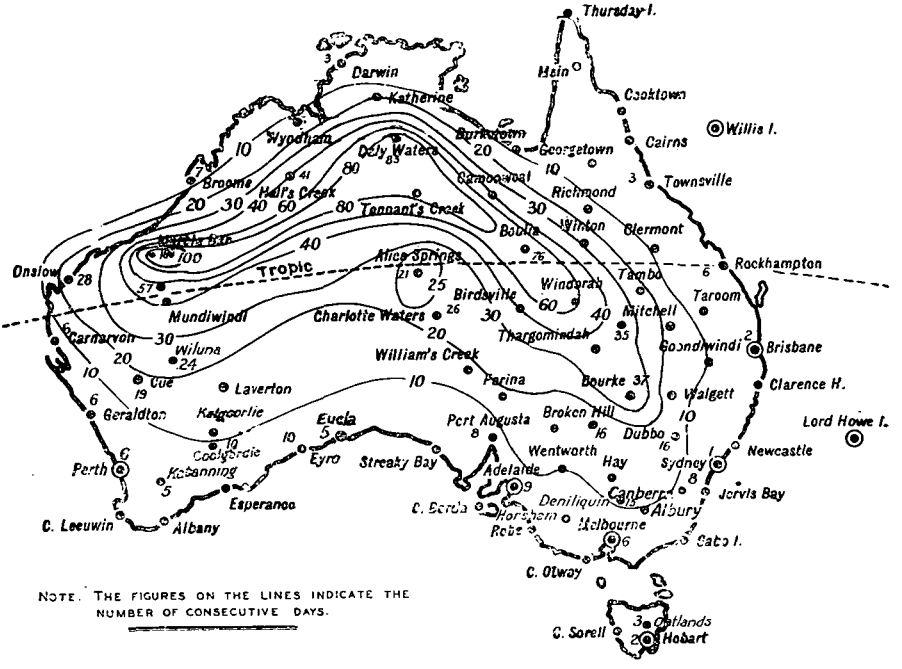
Class 3 (Tropics).—(*a*) Permissible for Caucasian habitation but requires selection and marked adaptation—Cardwell, Cairns, Cloncurry. (*b*) Not suitable for continuous Caucasian habitation—Cape York, Burketown.

* Houghton, F. C., Teague, W. W. and Miller, W. E. (1926) Amer. Soc. Heat. Vent. Engns. † Yaglou, C. P. (1926) J. Industr. Hyg. ‡ Yaglou, C. P. (1927) Ibid. § Hounam, C. E. Effective Temp. Data, C.W.B. unpublished. ¶ Lee, D. H. K. Trans. Roy. Soc. Trop. Med. and Hyg. (1940) Vol. XXXII.


ISOTHERMS
OF
EFFECTIVE TEMPERATURE
JANUARY. 9 AM [°F]
SCALE OF MILES
0 50 100 200 300 400

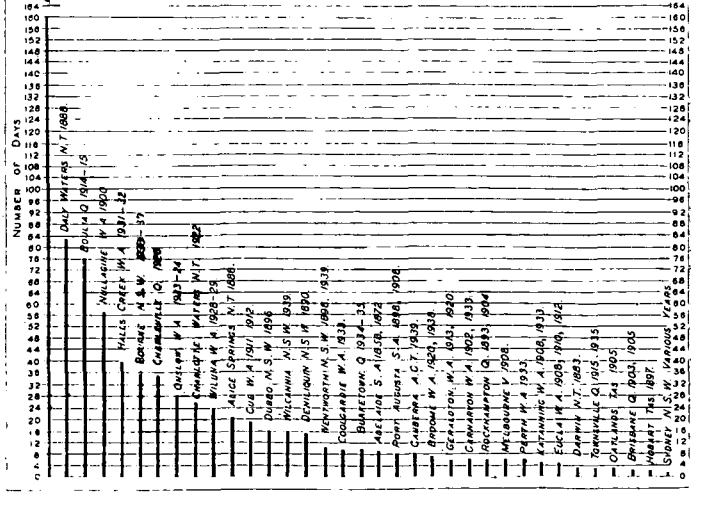

ISOTHERMS
OF
EXTREME TEMPERATURE
RANGE [°F]
SCALE OF MILES
0 50 100 200 300 400

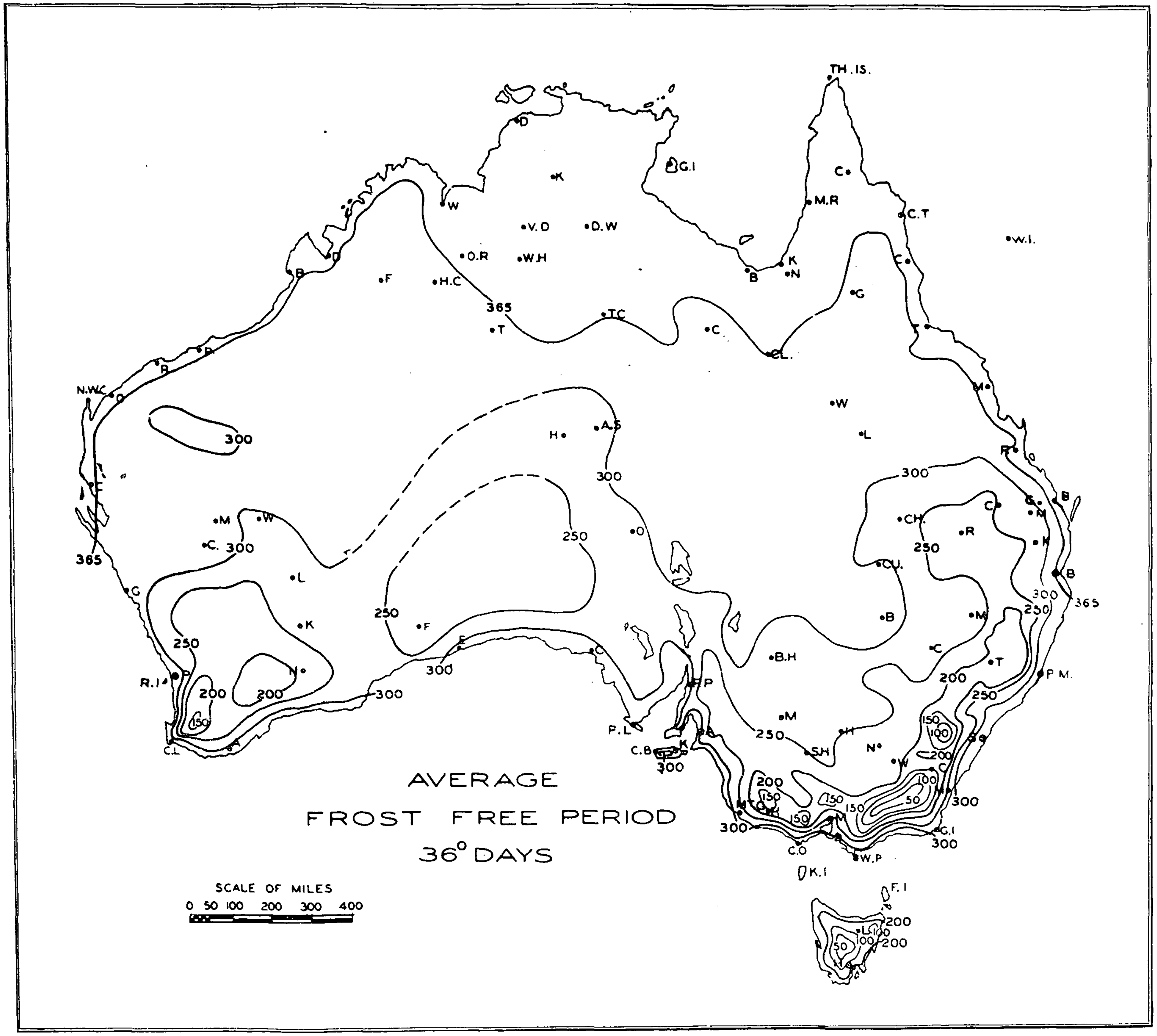
AREA AFFECTED AND PERIOD OF DURATION OF THE LONGEST HEAT WAVES WHEN THE MAXIMUM TEMPERATURE FOR CONSECUTIVE 24 HOURS REACHED OR EXCEEDED 100°F.

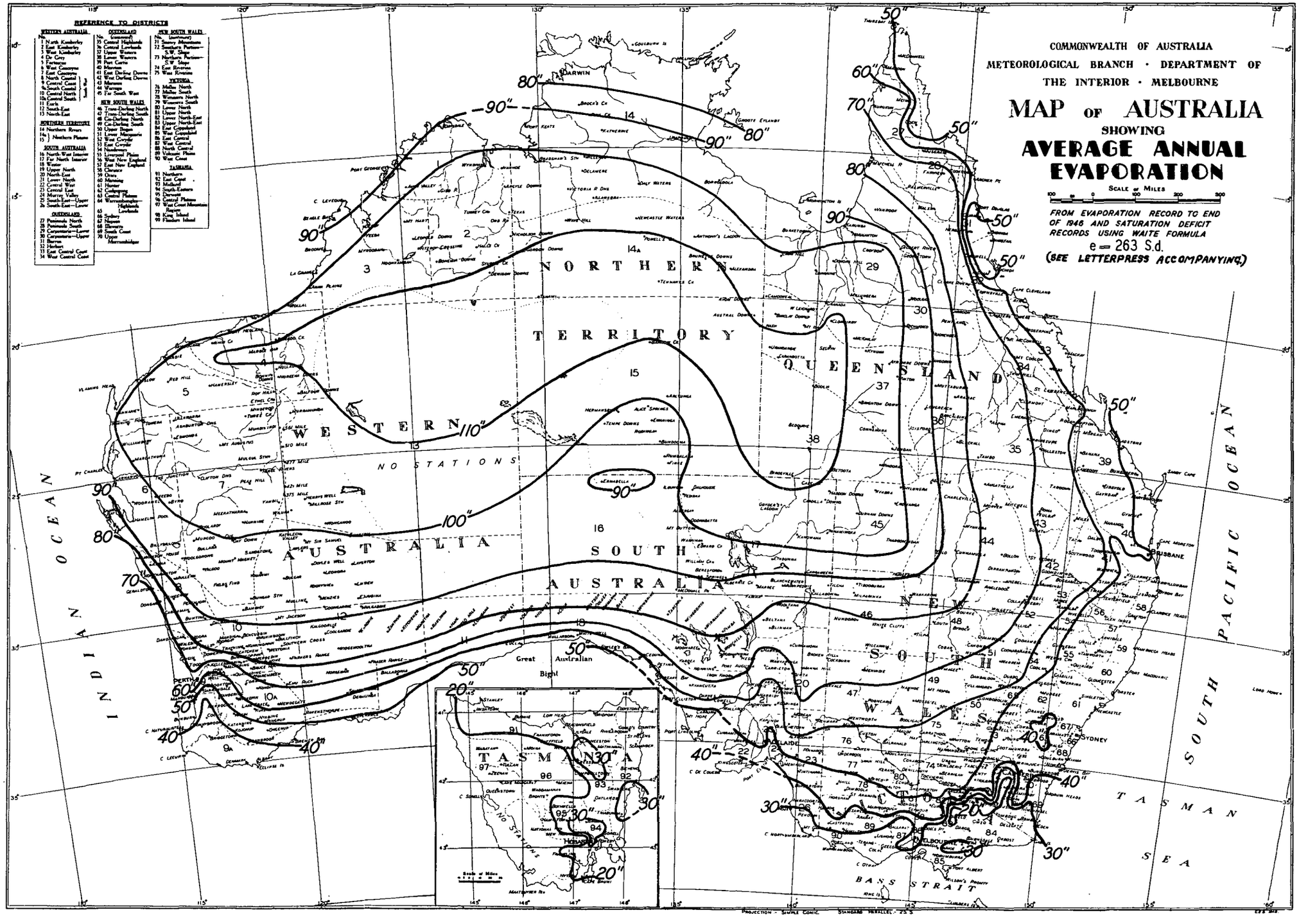


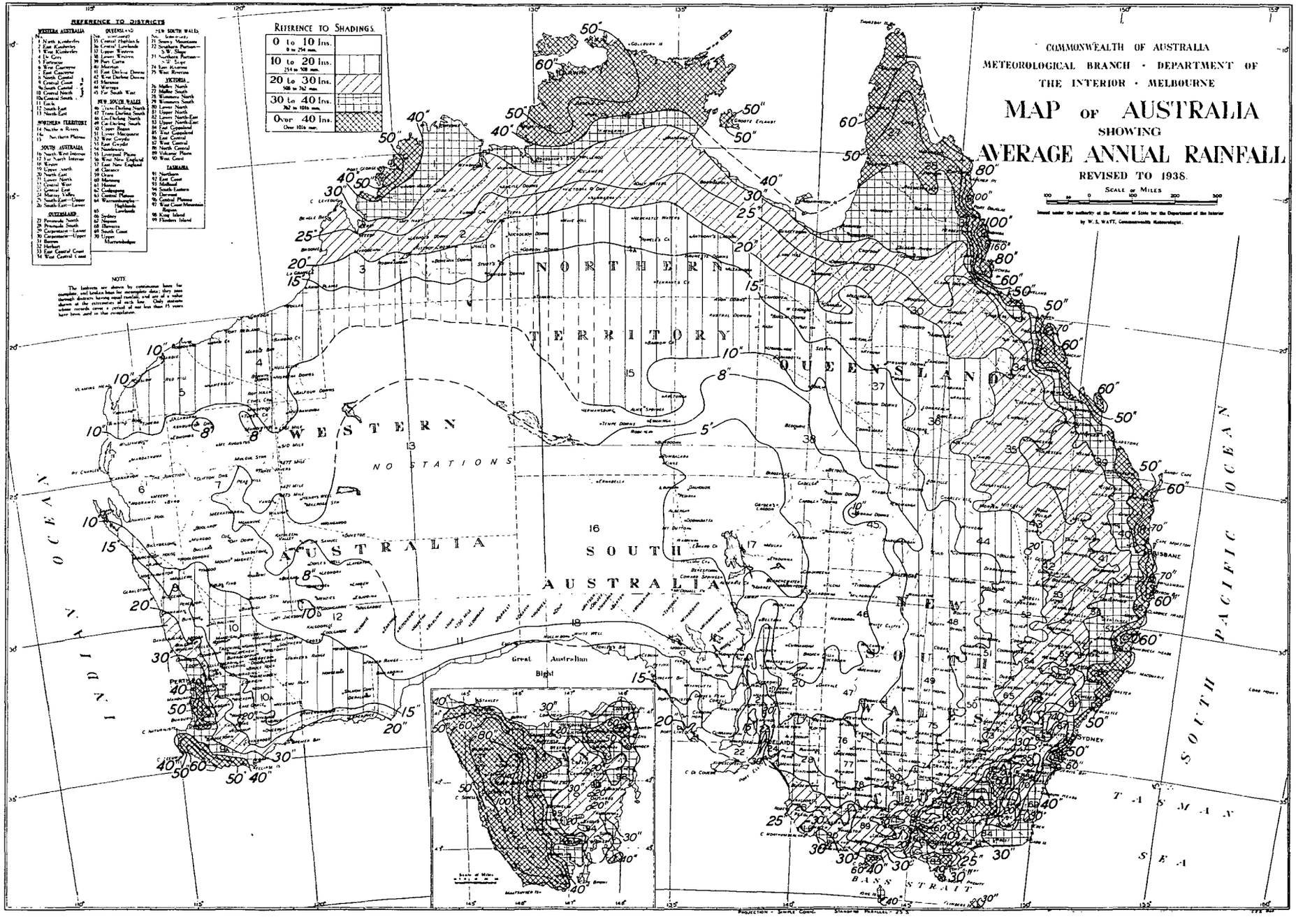
NOTE. THE FIGURES ON THE LINES INDICATE THE NUMBER OF CONSECUTIVE DAYS.

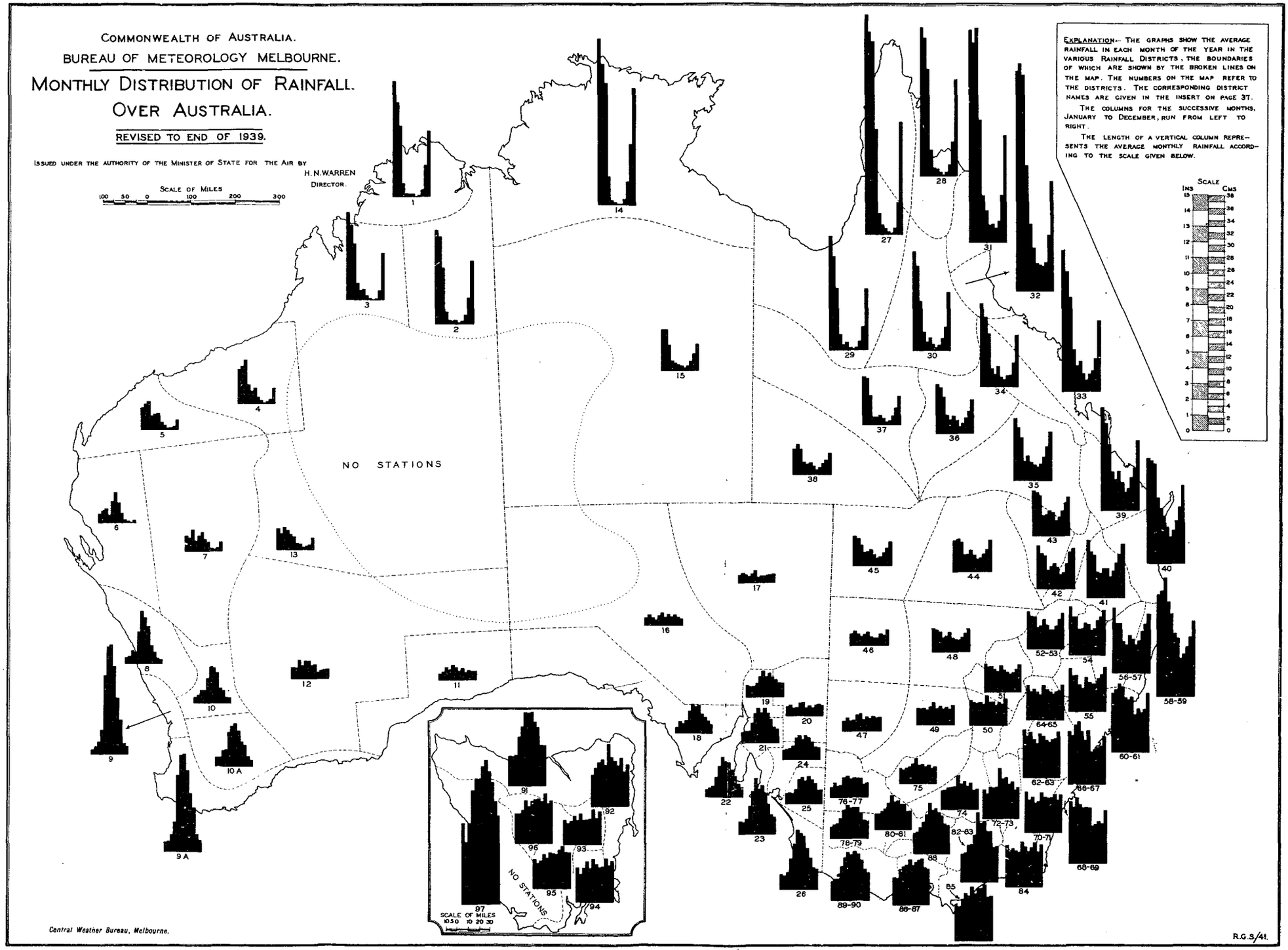
GREATEST NUMBER OF CONSECUTIVE DAYS ON WHICH THE SHADE TEMPERATURE WAS 100°FAHR OR OVER AT THE PLACES INDICATED.




AVERAGE
FROST FREE PERIOD
36° DAYS
SCALE OF MILES
0 50 100 200 300 400


COMMONWEALTH OF AUSTRALIA
METEOROLOGICAL BRANCH · DEPARTMENT OF THE INTERIOR · MELBOURNE
MAP OF AUSTRALIA
SHOWING
AVERAGE ANNUAL EVAPORATION
SCALE OF MILES
FROM EVAPORATION RECORD TO END OF 1946 AND SATURATION DEFICIT RECORDS USING WAITE FORMULA
e = 263 S.d.
(SEE LETTERPRESS ACCOMPANYING)
REFERENCE TO DISTRICTS
WESTERN AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
SOUTH AUSTRALIA
NORTHERN TERRITORY
TASMANIA
NORTHERN TERRITORY
WESTERN AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
INDIAN OCEAN
SOUTH PACIFIC OCEAN
TASMAN SEA
BASS STRAIT
Great Australian Bight
NO STATIONS
DARWIN
PERTH
ADELAIDE
BRISBANE
SYDNEY
MELBOURNE
HOBART
PROJECTION - SIMPLE CONIC STANDARD PARALLEL - 25 S


COMMONWEALTH OF AUSTRALIA
METEOROLOGICAL BRANCH · DEPARTMENT OF THE INTERIOR · MELBOURNE
MAP OF AUSTRALIA
SHOWING
AVERAGE ANNUAL RAINFALL
REVISED TO 1938.
Scale of Miles
Issued under the authority of the Minister of State for the Department of the Interior
by W. S. WATT, Commonwealth Meteorologist.
REFERENCE TO SHADINGS.
0 to 10 Ins.
10 to 20 Ins.
20 to 30 Ins.
30 to 40 Ins.
Over 40 Ins.
REFERENCE TO DISTRICTS
WESTERN AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
NORTHERN TERRITORY
SOUTH AUSTRALIA
NOTE
NORTHERN TERRITORY
WESTERN AUSTRALIA
QUEENSLAND
SOUTH AUSTRALIA
NEW SOUTH WALES
VICTORIA
TASMANIA
NO STATIONS
Great Australian Bight
INDIAN OCEAN
SOUTH PACIFIC OCEAN
TASMAN SEA
BASS STRAIT
PERTH
ADELAIDE
BRISBANE
SYDNEY


COMMONWEALTH OF AUSTRALIA.
BUREAU OF METEOROLOGY MELBOURNE.
MONTHLY DISTRIBUTION OF RAINFALL.
OVER AUSTRALIA.
REVISED TO END OF 1939.
ISSUED UNDER THE AUTHORITY OF THE MINISTER OF STATE FOR THE AIR BY
H. N. WARREN
DIRECTOR.
SCALE OF MILES
100 50 0 100 200 300
EXPLANATION:- THE GRAPHS SHOW THE AVERAGE RAINFALL IN EACH MONTH OF THE YEAR IN THE VARIOUS RAINFALL DISTRICTS, THE BOUNDARIES OF WHICH ARE SHOWN BY THE BROKEN LINES ON THE MAP. THE NUMBERS ON THE MAP REFER TO THE DISTRICTS. THE CORRESPONDING DISTRICT NAMES ARE GIVEN IN THE INSERT ON PAGE 37.
THE COLUMNS FOR THE SUCCESSIVE MONTHS, JANUARY TO DECEMBER, RUN FROM LEFT TO RIGHT.
THE LENGTH OF A VERTICAL COLUMN REPRESENTS THE AVERAGE MONTHLY RAINFALL ACCORDING TO THE SCALE GIVEN BELOW.
SCALE
INS
CMS
NO STATIONS
NO STATIONS
SCALE OF MILES
1050 10 20 30
Central Weather Bureau, Melbourne.
R.G.S/41.

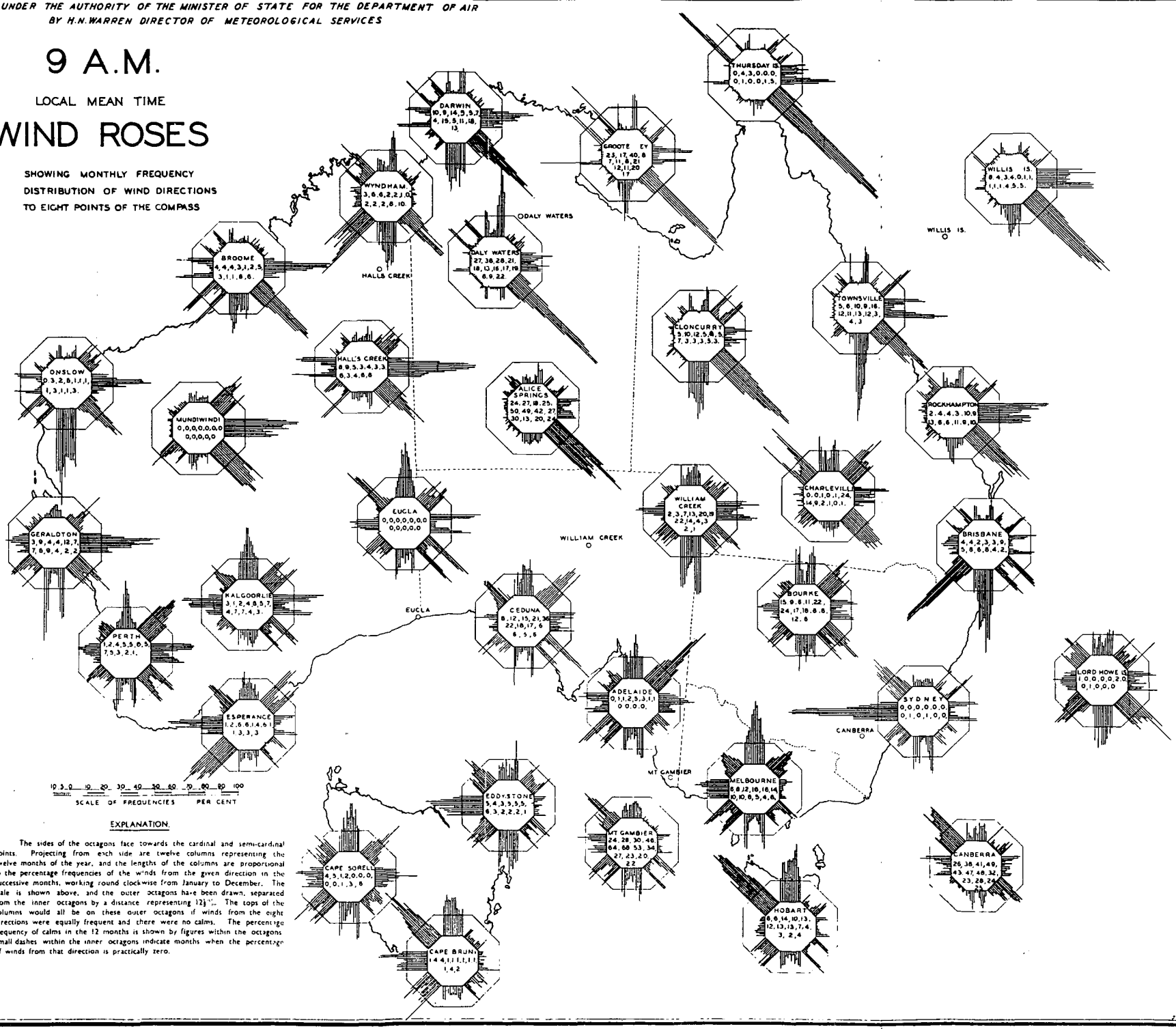
ISSUED UNDER THE AUTHORITY OF THE MINISTER OF STATE FOR THE DEPARTMENT OF AIR
BY H.N.WARREN DIRECTOR OF METEOROLOGICAL SERVICES

9 A.M.

LOCAL MEAN TIME

WIND ROSES

SHOWING MONTHLY 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.

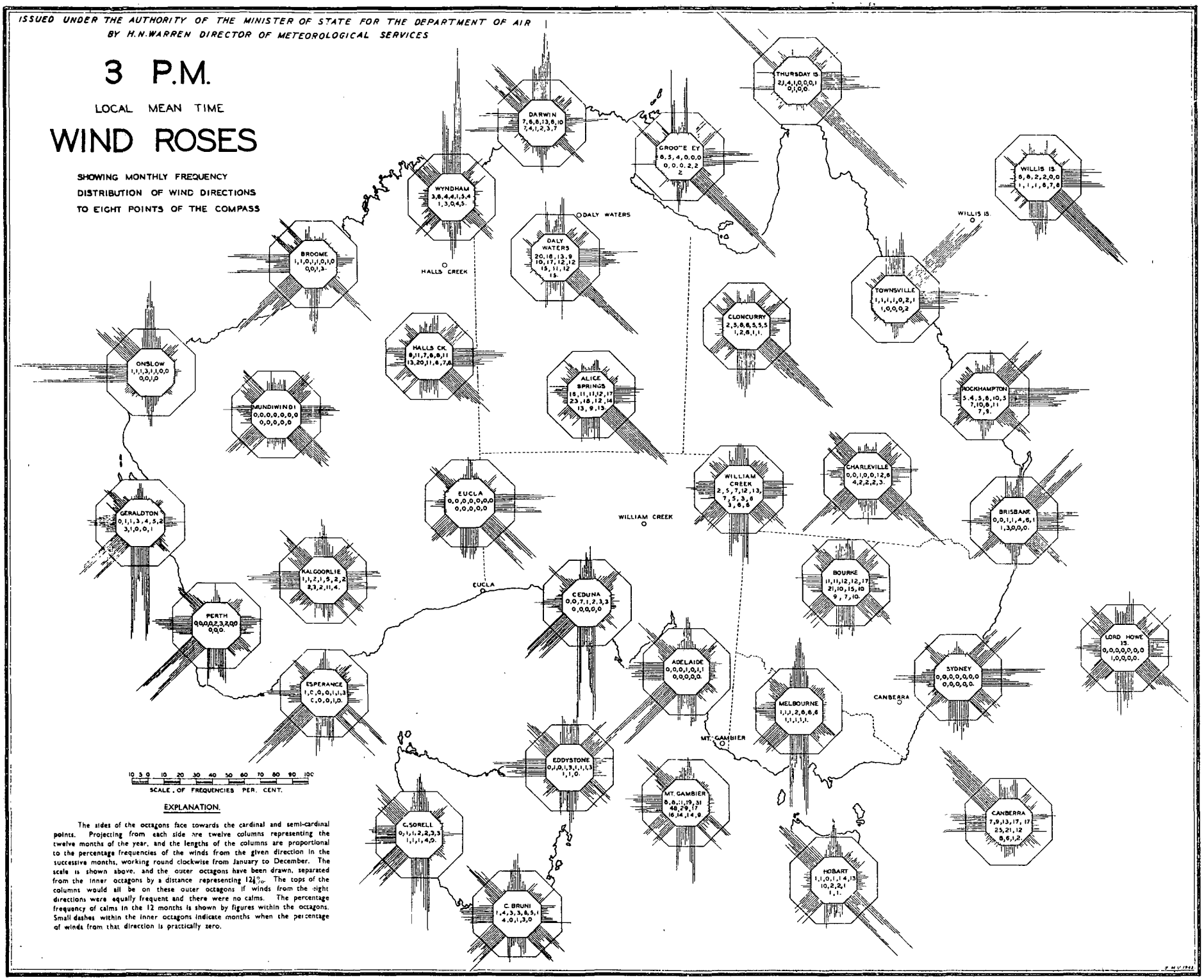
ISSUED UNDER THE AUTHORITY OF THE MINISTER OF STATE FOR THE DEPARTMENT OF AIR
BY H.N.WARREN DIRECTOR OF METEOROLOGICAL SERVICES

3 P.M.

LOCAL MEAN TIME

WIND ROSES

SHOWING MONTHLY 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.

These results of recent years bear out investigations made previously in Australia* in which the atmospheric vapour pressure was used as a measure of comfort, its value for this purpose being that it has equal effect in both indoor and outdoor climates. The limits of comfort range from .2 to .5 inch of vapour pressure. After drawing isopleths for effective temperature (not corrected for altitude), mean vapour pressure reduced to a logarithmic scale, and mean wet bulb, it is found that there is close agreement in defining zones of relative discomfort.

(ii) *Seasons.* The Australian seasons are:—Summer, December to February; autumn, March to May; winter, June to August; spring, September to November. In most parts of Australia, January is the hottest month, but in Tasmania and southern Victoria, February is the hottest; in the tropical north, probably because the cooling "monsoon" rains occur in late summer, December is the hottest month, and at Darwin, November.

On a rainfall basis, in the tropical north the year is divisible into "wet" and "dry" seasons, but on the basis of temperature and physical comfort the "dry" season can be further sub-divided into two parts—"cool dry" and "warm dusty". †

(*a*) "*Cool dry*" *Season.* From May to August. The average maximum temperature ranges from 80° to 85° F., the relative humidity is low and in inland areas cold nights are experienced when the temperature drops to 40° F. The skies generally are cloudless, but in about one year in three during June or July one to two inches of rain fall.

(*b*) "*Warm dusty*" *Season.* From the end of August temperatures rise and reach a maximum in October or the beginning of November. Temperatures of over 120° F. have been recorded.

(*c*) "*Wet*" *Season.* After the first of the heavy storms, the maximum temperatures fall but still remain high with high relative humidity. At Wyndham during January, 1944 the minimum temperature did not drop below 75° F. for fourteen consecutive days. A maximum of over 100° F. was recorded on each rainless day.

In Central as in Northern Australia during the hottest months, the average temperatures range from 80° to 85° F., whereas in Southern Australia they vary from 65° to 70°.

Throughout Australia the coldest month is July, when only a very narrow strip of the northern sea-board has an average temperature as high as 75°. Over the southern half of the continent, July temperatures range from 55° to 45° at elevations below 1,500 feet and fall as low as 35° on the Australian Alps. Here the temperature seldom, if ever, reaches 100° even in the hottest of seasons. Hotham Heights (6,100 feet above Mean Sea Level) recorded the highest maximum of 94.0° on 18th December, 1934. In winter, readings slightly below zero are occasionally recorded on the extreme heights.

Tasmania as a whole enjoys a moderate and equable range of temperature throughout the year, although occasionally hot winds may cause the temperature to rise to 100° in the eastern part of the State.

(iii) *Comparisons with other Countries.* In respect of Australian temperatures generally, it may be pointed out that the mean annual isotherm for 70° F. extends in South America and South Africa as far south as latitude 33°, while in Australia it reaches only as far south as latitude 30°, thus showing that, on the whole, Australia has, latitude for latitude, a more temperate climate than other places in the Southern Hemisphere.

The comparison is even more favourable when the Northern Hemisphere is included, for in the United States of America the 70° isotherm extends in several of the western States as far north as latitude 41°. In Europe, the same isotherm reaches almost to the southern shores of Spain, passing afterwards, however, along the northern shores of Africa till it reaches the Red Sea, when it bends northward along the eastern shore of the Mediterranean till it reaches Syria. In Asia, nearly the whole of the land area south of latitude 40° N. has a higher temperature than 70°.

* Barkley, H. Zones of Relative Physical Comfort in Australia. Met. Bull. 20, 1934.
† Maze, W. H. Austn. Geog. June, 1945. Settlement in E. Kimberleys.

The extreme range of temperature is less than 100° over practically the whole of Australia, that figure being only slightly exceeded at a very few places; it is mostly 70° to 90° over inland areas, and somewhat less on the coast. In parts of Asia and North America, the extreme range exceeds 130° and 150° in some localities.

Along the northern shores of Australia the temperatures are very equable. At Darwin, for example, the difference in the means for the hottest and coldest month is only 8.4°, and the extreme readings for the year, or the highest maximum on record and the lowest minimum, show a difference of under 50°.

The highest temperature recorded in Australia was 127.5° F. at Cloncurry on 16th January, 1889. The world's highest (136° F.) was recorded at Azizia (Tripoli) on 13th August, 1922. The lowest temperature ever recorded in Australia was —8° F. at Charlotte Pass on 14th June, 1945, and again on 22nd July, 1947, as contrasted with the world's lowest recorded temperature of —90° F. at Verkhoyansk (Siberia) on 5th and 7th February, 1892.

A comparison of the mean temperatures and the range from the extreme maximum to the extreme minimum temperatures (in whole degrees) of the capital cities of Australia with those of the main cities of some other countries is shown in the following table :—

TEMPERATURE OF AUSTRALIAN CAPITAL CITIES COMPARED WITH THAT OF THE MAIN CITIES OF OTHER COUNTRIES.

Locality.	Height Above Mean Sea Level.	Latitude.	Longitude.	Mean Annual Temperature (° Fahr.)	Extreme Temperature (° Fahr.).		Extreme Range (° Fahr.)
					Maximum.	Minimum.	
	Feet.	Deg. Min.	Deg. Min.				
Adelaide	140	34 56S	138 35E	63.0	118	32	86
Berlin	196	52 45N	13 24E	48.2	99	—15	114
Bombay	37	18 55N	72 54E	80.6	100	56	44
Buenos Aires	82	34 36S	58 22W	61.0	103	28	75
Brisbane	134	27 28S	153 2E	68.9	110	36	74
Cairo	380	29 52N	31 20E	70.2	113	31	82
Canberra	1,906	35 18S	149 6E	56.1	107	18	89
Capetown	40	33 56S	18 29E	62.3	104	31	73
Darwin	97	12 28S	130 51E	82.6	104	56	48
Dublin	155	53 21N	6 16W	50.0	85	7	78
Hobart	177	42 53S	147 20E	54.4	105	28	77
Khartoum	1,280	15 37N	32 33E	84.6	117	41	76
Leningrad	16	59 56N	30 16E	39.2	97	—39	136
London	18	51 28N	0 19W	49.7	100	4	96
Melbourne	114	37 49S	144 58E	58.5	114	27	87
New York	314	40 43N	74 0W	51.8	102	—14	116
Paris	405	48 18N	2 7E	50.3	101	—14	115
Perth	210	31 57S	115 51E	64.4	112	34	78
Rome	207	41 54N	12 29E	59.7	104	21	83
San Francisco	155	37 48N	122 26W	55.0	101	27	74
Sydney	138	33 52S	151 12E	63.2	114	36	78
Tokyo	19	35 41N	139 46E	56.9	98	15	83
Vienna	66	48 15N	16 22E	49.3	97	—4	101
Warsaw	436	52 13N	21 1E	46.2	98	—28	126
Wellington	10	41 16S	174 46E	55.3	88	29	59

(iv) *Hottest and Coldest Parts.* A comparison of the temperatures recorded at coast and inland stations shows that, in Australia, as in other continents, the range increases, within certain limits, with increasing distance from the coast. This is clearly illustrated by the map of extreme temperature range (page 33.)

In the interior of Australia, and during exceptionally dry summers, the temperature occasionally reaches or exceeds 120° in the shade. The hottest area of the continent is situated in the northern part of Western Australia about the Marble Bar and Nullagine gold-fields, where the maximum shade temperature during the summer sometimes exceeds 100° continuously for days and weeks. The longest recorded period was 160 days from 31st October, 1923 to 7th April, 1924.

The area affected and the period of duration of the longest heat waves in Australia are shown in the map and diagram on page 34.

(v) *Tabulated Data for Selected Climatological Stations in Australia.* The following tables show normal mean temperature, extreme temperature and normal rainfall for each month for selected climatological stations in each State :—

TABULATED DATA FOR SELECTED CLIMATOLOGICAL STATIONS : NEW SOUTH WALES.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
GRAFTON.													
Normal Mean Temperature—													
Maximum °F.	89.1	87.9	85.2	81.7	76.1	70.9	70.6	73.3	78.6	82.6	85.7	88.0	80.8
Minimum ,,	66.4	66.3	63.7	57.9	51.0	45.7	43.3	45.1	50.4	56.3	61.3	64.5	56.0
Extreme Temperature—													
Maximum .. °F.	114.0	113.0	108.0	97.0	91.0	88.0	87.5	95.0	99.0	105.0	111.0	113.5	114.0
Minimum .. ,,	50.0	50.0	41.0	33.0	33.0	28.0	24.9	24.0	32.0	35.0	43.0	45.0	24.0
Normal Rainfall ins.	4.56	4.19	3.72	3.15	2.77	2.44	2.03	0.93	1.83	2.23	3.31	3.52	34.68
ARMIDALE.													
Normal Mean Temperature—													
Maximum °F.	80.8	79.5	75.3	68.4	61.2	55.3	54.0	57.2	63.8	70.4	76.1	79.3	68.4
Minimum ,,	56.5	55.8	52.1	45.6	39.2	34.9	33.8	34.4	38.9	45.1	50.3	54.3	45.1
Extreme Temperature—													
Maximum .. °F.	103.4	95.0	94.0	86.2	80.0	76.0	68.2	78.2	83.0	90.5	97.5	99.8	103.4
Minimum .. ,,	40.0	38.0	31.0	25.0	20.0	17.0	14.0	18.0	22.0	26.0	32.0	36.0	14.0
Normal Rainfall ins.	3.88	2.81	2.26	1.87	1.46	2.33	2.11	1.54	2.09	2.35	2.87	3.41	28.98
PORT MACQUARIE.													
Normal Mean Temperature—													
Maximum °F.	78.6	78.7	77.1	73.2	68.8	64.9	64.0	65.8	68.5	71.2	74.0	76.4	71.8
Minimum ,,	64.4	64.3	61.8	56.8	50.8	46.3	44.8	45.4	49.2	54.8	59.0	62.5	55.0
Extreme Temperature—													
Maximum .. °F.	104.0	105.8	97.0	92.8	84.0	79.6	84.0	91.3	89.4	97.4	104.0	98.8	105.8
Minimum .. ,,	51.3	48.0	43.5	40.0	34.6	30.5	29.5	31.0	32.5	38.0	41.2	48.0	29.5
Normal Rainfall ins.	4.89	6.48	6.45	7.37	5.76	5.08	4.35	2.64	3.55	3.67	3.22	3.98	57.44
BROKEN HILL.													
Normal Mean Temperature—													
Maximum °F.	90.5	90.2	84.6	74.7	66.7	59.9	59.5	63.6	70.1	77.3	83.3	88.6	75.8
Minimum ,,	64.5	64.7	60.1	52.6	47.1	42.5	41.2	43.2	47.6	52.9	58.1	62.6	53.1
Extreme Temperature—													
Maximum .. °F	114.9	115.9	113.9	99.9	87.8	79.0	80.0	84.0	94.0	103.9	110.9	113.9	115.9
Minimum .. ,,	45.0	42.0	40.0	34.0	30.5	27.0	28.5	29.0	33.0	36.0	41.0	41.8	27.0
Normal Rainfall ins.	0.59	0.96	0.56	0.65	0.94	0.92	0.72	0.63	0.67	0.84	0.86	0.86	9.20
DUBBO.													
Normal Mean Temperature—													
Maximum °F.	92.1	91.3	85.7	76.9	68.0	61.0	59.7	63.5	70.3	78.5	85.3	89.6	76.8
Minimum ,,	63.8	63.8	58.9	50.8	43.5	39.3	37.5	38.3	42.7	49.3	56.4	61.3	50.5
Extreme Temperature—													
Maximum .. °F.	114.9	113.9	104.5	97.9	90.9	79.9	77.8	87.0	92.9	104.9	110.0	115.4	115.4
Minimum .. ,,	40.9	35.7	37.7	30.0	23.4	19.9	16.9	17.9	20.9	27.9	30.9	37.9	16.9
Normal Rainfall ins.	2.00	1.49	1.99	1.77	1.44	2.24	1.87	1.51	1.31	1.49	1.93	1.87	20.91

TABULATED DATA FOR SELECTED CLIMATOLOGICAL STATIONS: NEW SOUTH WALES—*continued.*

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
NEWCASTLE.													
Normal Mean Temperature—													
Maximum °F.	77.6	77.7	76.1	72.2	67.2	62.9	61.7	64.0	68.1	71.3	73.9	76.0	70.7
Minimum „	66.6	67.1	64.7	59.5	53.7	49.5	47.7	48.8	52.6	57.2	61.3	64.3	57.7
Extreme Temperature—													
Maximum .. °F.	112.0	105.3	101.5	94.9	85.0	80.0	79.4	88.3	96.4	100.0	105.0	108.0	112.0
Minimum .. „	54.5	54.0	50.0	42.0	41.0	38.0	37.5	37.0	39.0	42.0	47.8	49.0	37.0
Normal Rainfall ins.	3.01	2.96	3.84	5.33	4.64	3.66	4.44	2.34	2.97	2.51	2.21	3.45	41.36
BATHURST.													
Normal Mean Temperature—													
Maximum °F.	83.9	83.7	78.8	69.9	62.1	55.2	53.9	57.4	64.2	70.9	76.7	81.6	69.9
Minimum „	55.6	55.5	51.0	44.0	38.2	34.8	34.0	34.5	38.1	43.4	48.4	53.5	44.2
Extreme Temperature—													
Maximum .. °F.	112.9	106.4	100.2	90.0	80.0	71.0	70.0	76.4	86.0	96.0	103.5	107.7	112.9
Minimum .. „	37.0	35.0	30.0	22.0	20.0	15.7	13.0	18.7	21.0	25.0	31.0	35.0	13.0
Normal Rainfall ins.	2.18	1.73	1.99	1.51	1.39	1.86	2.07	1.68	1.55	2.10	2.04	2.49	22.56
LEETON.													
Normal Mean Temperature—													
Maximum °F.	88.9	88.7	82.6	72.6	64.8	57.7	56.8	60.3	66.8	73.8	81.2	86.4	73.4
Minimum „	63.2	63.4	59.0	51.2	45.0	40.5	38.9	40.5	44.1	49.7	55.6	60.8	51.0
Extreme Temperature—													
Maximum .. °F.	117.0	110.5	107.0	94.5	82.4	74.5	71.0	81.9	92.5	103.5	107.0	112.0	117.0
Minimum .. „	44.0	41.2	40.0	33.0	29.9	24.9	25.3	25.0	26.5	34.0	35.5	41.8	24.9
Normal Rainfall ins.	1.22	0.86	1.03	1.47	1.38	1.84	1.36	1.67	1.31	1.49	1.26	1.24	16.13
JERVIS BAY.(*a*)													
Normal Mean Temperature—													
Maximum °F.	74.5	75.0	73.3	68.8	64.4	60.2	58.9	61.0	64.3	67.7	70.2	73.0	67.6
Minimum „	63.0	64.0	62.7	58.5	53.8	50.5	48.6	49.5	52.2	55.3	58.3	61.3	56.5
Extreme Temperature—													
Maximum .. °F.	109.0	100.0	98.0	89.0	83.0	77.0	75.0	80.0	87.0	96.0	96.0	100.0	109.0
Minimum .. „	43.0	50.0	46.0	42.0	39.0	37.0	33.0	31.0	40.0	41.0	47.0	42.0	31.0
Normal Rainfall ins.	4.11	3.25	4.46	5.07	5.22	4.32	4.89	2.72	3.06	2.57	2.64	3.82	46.13
ALBURY.													
Normal Mean Temperature—													
Maximum °F.	89.9	90.4	84.3	73.6	64.9	57.4	56.4	60.4	67.2	73.8	81.3	87.4	73.9
Minimum „	59.8	60.2	55.2	47.8	42.3	39.3	38.2	39.9	43.2	47.7	52.9	57.5	48.7
Extreme Temperature—													
Maximum .. °F.	117.3	114.3	107.3	94.8	83.0	76.0	74.0	79.0	94.8	101.5	107.0	112.6	117.3
Minimum .. „	39.0	42.0	39.0	30.0	28.0	25.7	25.0	26.0	29.0	30.0	33.0	41.0	25.0
Normal Rainfall ins.	1.59	1.95	1.81	1.96	2.28	3.32	2.91	3.01	2.30	2.52	1.76	2.25	27.66
COOMA.													
Normal Mean Temperature—													
Maximum °F.	78.8	79.0	73.8	65.0	57.3	50.9	50.4	54.5	61.0	67.5	72.6	77.2	65.7
Minimum „	52.2	52.4	48.3	41.7	35.3	31.7	30.2	31.5	36.1	40.9	45.8	50.1	41.3
Extreme Temperature—													
Maximum .. °F.	112.0	107.0	104.6	92.7	77.7	69.2	72.9	75.7	86.9	95.7	102.1	110.0	112.0
Minimum .. „	29.8	33.0	28.2	22.8	13.0	13.4	11.0	12.0	14.3	22.0	25.8	28.8	11.0
Normal Rainfall ins.	2.34	1.86	1.88	1.46	1.11	1.22	1.27	0.98	1.27	1.51	1.72	2.23	18.85

(*a*) Australian Capital Territory.

TABULATED DATA FOR SELECTED CLIMATOLOGICAL STATIONS: VICTORIA.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
MILDURA.													
Normal Mean Temperature—													
Maximum °F.	89.8	90.0	84.4	74.5	66.9	60.4	59.5	63.9	69.9	76.5	83.2	88.2	75.6
Minimum ,,	61.0	61.7	57.2	50.5	45.6	41.3	40.5	42.5	46.1	50.9	55.4	59.6	51.0
Extreme Temperature—													
Maximum .. °F.	123.5	118.0	112.0	99.0	90.0	80.0	78.0	86.9	95.0	104.0	113.0	121.5	123.5
Minimum .. ,,	40.0	43.0	37.0	34.0	27.0	26.0	24.0	29.0	29.0	34.0	35.0	40.0	24.0
Normal Rainfall ins.	0.73	0.90	0.70	0.55	1.01	1.05	0.91	1.01	0.96	1.00	0.84	0.71	10.37
BENALLA.													
Normal Mean Temperature—													
Maximum °F.	87.6	88.7	82.4	72.3	64.3	56.5	55.7	58.9	65.1	72.4	79.5	84.8	72.3
Minimum ,,	58.9	59.6	55.1	48.0	42.6	39.1	38.2	39.7	43.6	48.3	52.1	56.5	48.5
Extreme Temperature—													
Maximum .. °F.	114.0	112.0	108.0	97.0	89.0	70.0	70.0	76.0	88.0	102.0	104.0	111.0	114.0
Minimum .. ,,	40.0	37.0	36.0	32.0	26.0	25.0	27.0	27.9	30.0	33.0	36.0	38.0	25.0
Normal Rainfall ins.	1.58	1.66	1.60	1.99	2.30	3.09	2.78	2.72	2.36	2.41	1.65	1.77	25.91
BENDIGO.													
Normal Mean Temperature—													
Maximum °F.	83.0	83.9	78.1	68.4	61.3	54.8	54.2	57.0	62.5	68.9	75.2	80.5	69.0
Minimum ,,	56.5	58.3	54.0	48.2	43.7	40.7	39.4	40.2	43.0	46.7	50.9	54.9	48.0
Extreme Temperature—													
Maximum .. °F.	117.4	111.6	104.7	94.7	80.0	77.3	73.0	75.7	90.0	99.7	106.5	111.5	117.4
Minimum .. ,,	37.0	40.0	38.0	33.4	27.3	25.0	23.5	26.0	29.0	32.0	35.0	37.0	23.5
Normal Rainfall ins.	1.14	1.50	1.27	1.49	1.97	2.26	2.21	2.11	2.04	1.70	1.25	1.33	20.27
HORSHAM.													
Normal Mean Temperature—													
Maximum °F.	85.1	86.3	80.2	70.7	63.0	56.6	56.0	59.0	64.1	70.2	77.2	82.7	70.9
Minimum ,,	55.2	55.9	51.9	47.0	42.9	40.2	38.8	39.9	41.9	45.1	49.6	53.2	46.8
Extreme Temperature—													
Maximum .. °F.	120.0	113.0	108.0	97.0	87.0	74.0	71.0	78.0	94.0	100.0	108.0	115.0	120.0
Minimum .. ,,	39.0	37.0	35.0	31.0	25.0	22.0	21.0	24.0	24.0	25.0	29.0	34.0	21.0
Normal Rainfall ins.	0.75	1.21	0.74	1.23	1.78	1.98	1.89	1.90	1.98	1.48	1.26	1.37	17.57
BALLARAT.													
Normal Mean Temperature—													
Maximum °F.	75.7	76.9	71.6	63.0	56.3	50.4	49.8	52.5	57.1	62.4	67.4	72.5	63.0
Minimum ,,	50.5	52.9	50.1	45.8	42.6	39.5	38.4	39.4	41.2	43.6	46.0	49.3	44.9
Extreme Temperature—													
Maximum .. °F.	108.5	104.9	102.1	91.2	75.0	63.0	63.0	69.6	83.0	92.5	100.0	102.0	108.5
Minimum .. ,,	36.0	36.2	31.0	31.0	28.0	23.0	26.0	26.3	26.6	29.0	31.5	35.0	23.0
Normal Rainfall ins.	1.26	1.79	1.83	2.13	2.43	2.67	2.68	2.92	2.84	2.41	2.08	2.34	27.38
BAIRNSDALE.													
Normal Mean Temperature—													
Maximum °F.	75.3	76.1	73.0	67.5	62.5	57.5	57.0	59.5	63.2	67.5	70.6	74.0	67.0
Minimum ,,	53.5	54.5	51.7	46.9	42.5	38.8	38.1	39.6	42.7	46.1	49.0	52.4	46.3
Extreme Temperature—													
Maximum .. °F.	112.0	109.0	105.5	95.0	86.0	75.0	76.0	84.0	92.6	101.0	103.0	111.0	112.0
Minimum .. ,,	35.0	39.0	32.0	29.0	25.0	22.0	21.0	19.0	26.0	27.0	30.0	32.0	19.0
Normal Rainfall ins.	2.48	2.09	2.64	2.02	1.59	2.16	2.06	1.73	2.08	2.68	2.19	2.63	26.35

TABULATED DATA FOR SELECTED CLIMATOLOGICAL STATIONS: QUEENSLAND.

CAIRNS.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	89.7	89.0	87.1	84.9	81.6	78.8	78.1	79.5	82.6	85.6	87.9	89.7	84.5
Minimum ,,	74.2	73.9	72.6	70.0	66.2	63.5	61.0	61.1	63.8	67.4	70.4	72.9	68.1
Extreme Temperature—													
Maximum .. °F.	109.8	108.0	100.0	94.5	92.0	92.1	95.1	98.1	94.1	98.1	99.1	105.0	109.8
Minimum .. ,,	63.5	64.0	59.8	57.0	52.2	44.6	43.0	43.2	46.0	54.5	52.0	60.2	43.0
Normal Rainfall ins.	16.51	17.00	17.59	10.76	4.37	2.87	1.56	1.46	1.43	2.40	3.05	7.35	86.35

TOWNSVILLE.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	87.3	87.0	86.6	84.7	81.2	77.3	76.0	77.6	80.3	83.1	85.2	87.0	82.8
Minimum ,,	76.2	75.6	73.9	70.6	65.4	61.9	59.8	61.5	65.8	70.5	73.8	75.6	69.2
Extreme Temperature—													
Maximum .. °F.	102.4	110.2	98.0	97.0	88.5	86.5	85.0	89.0	92.5	94.7	99.5	101.1	110.2
Minimum .. ,,	68.2	64.5	65.4	53.9	49.7	47.0	45.3	48.0	52.0	60.2	64.2	66.0	45.3
Normal Rainfall ins.	10.03	9.90	5.15	2.57	0.92	1.41	0.77	0.60	0.49	1.19	2.03	4.63	39.69

CLONCURRY.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	98.7	96.3	94.6	89.9	82.9	77.3	76.4	81.4	88.4	95.1	98.6	100.4	90.0
Minimum ,,	76.5	75.4	73.0	66.9	59.7	54.1	51.5	54.3	61.0	68.2	73.5	76.2	65.9
Extreme Temperature—													
Maximum .. °F.	127.5	115.5	110.5	108.0	98.5	99.1	96.0	102.5	106.0	112.0	118.5	125.5	127.5
Minimum .. ,,	59.3	58.0	53.3	48.0	41.3	32.0	34.2	34.5	40.5	49.8	54.0	50.0	32.0
Normal Rainfall ins.	4.73	3.96	1.86	0.62	0.48	0.80	0.23	0.12	0.15	0.44	1.59	1.90	16.88

MACKAY.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	86.2	85.5	83.6	80.7	76.1	72.2	71.0	72.8	77.0	81.3	83.9	86.2	79.7
Minimum ,,	73.6	73.2	71.2	66.6	60.8	56.2	53.4	54.8	59.9	65.5	69.4	72.3	64.7
Extreme Temperature—													
Maximum .. °F.	99.8	99.4	98.0	94.0	88.8	85.9	86.0	87.0	92.0	97.0	97.5	99.9	99.9
Minimum .. ,,	60.1	60.3	56.0	49.2	41.6	37.0	35.1	36.1	39.6	44.0	46.6	60.0	35.1
Normal Rainfall ins.	13.56	12.65	10.95	4.64	3.36	2.75	1.57	1.12	1.14	1.55	3.12	6.75	63.16

LONGREACH.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	99.6	96.9	94.1	87.8	80.4	74.3	73.2	77.9	85.4	92.8	97.0	99.7	88.3
Minimum ,,	73.3	71.7	68.1	60.1	52.1	46.7	44.3	46.5	53.7	61.5	67.5	71.5	59.8
Extreme Temperature—													
Maximum .. °F.	118.3	113.4	113.0	103.0	96.8	92.0	92.0	96.8	104.2	109.2	114.5	115.6	118.3
Minimum .. ,,	43.9	55.1	48.2	38.1	35.1	26.7	26.7	31.0	31.0	39.0	41.0	43.9	26.7
Normal Rainfall ins.	2.31	3.12	2.10	1.01	0.52	0.94	0.80	0.30	0.52	0.84	1.26	1.82	15.54

ROCKHAMPTON.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	90.0	88.7	87.2	84.2	79.3	74.4	73.7	76.7	81.7	85.9	88.5	90.0	83.4
Minimum ,,	72.3	72.1	69.8	64.8	58.3	54.0	51.2	52.9	58.3	63.8	68.0	70.9	63.0
Extreme Temperature—													
Maximum .. °F.	106.8	105.2	104.8	98.0	94.3	88.2	88.8	95.9	100.2	102.8	107.9	111.6	111.6
Minimum .. ,,	60.0	60.8	50.3	43.4	39.8	32.7	34.6	36.3	39.8	43.0	54.0	59.2	32.7
Normal Rainfall ins.	6.70	7.28	3.54	2.66	1.26	2.80	1.77	0.82	0.94	1.99	2.63	4.97	37.36

TABULATED DATA FOR SELECTED CLIMATOLOGICAL STATIONS: QUEENSLAND—*continued.*

CHARLEVILLE.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	97.6	96.1	91.7	84.5	76.4	69.3	68.3	72.9	80.4	88.2	93.6	96.4	84.6
Minimum „	70.8	70.1	65.1	55.7	47.2	42.3	40.1	42.1	49.0	57.7	64.4	68.5	56.1
Extreme Temperature—													
Maximum .. °F.	116.6	115.0	110.0	101.8	92.0	87.8	86.5	93.7	102.0	109.8	117.0	118.0	118.0
Minimum .. „	52.4	50.0	41.0	34.0	27.5	23.0	23.0	24.0	29.0	34.5	40.0	48.0	23.0
Normal Rainfall ins.	2.65	2.36	1.54	0.95	0.69	1.46	1.32	0.75	0.95	1.02	1.68	2.60	17.97

TOOWOOMBA.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	82.7	81 0	78.2	73.5	67.2	62.0	61.1	64.5	70.5	76.2	80.2	82.2	73.3
Minimum „	61.2	61.0	58.7	52.5	46.6	42.4	40.7	41.9	46.8	52.3	56.6	59.5	51.7
Extreme Temperature—													
Maximum .. °F.	103.6	100.7	99.0	88.2	84.2	80.5	78.2	86.0	89.5	96.0	101.0	105.0	105.0
Minimum .. „	45.5	46.0	33.0	31.0	29.6	22.0	22.5	25.0	30.0	32.4	39.4	42.8	22.0
Normal Rainfall ins.	5.15	4.29	3.36	2.62	1.85	2.54	2.06	1.16	1.69	2.39	3.34	4.74	35.19

TABULATED DATA FOR SELECTED CLIMATOLOGICAL STATIONS: SOUTH AUSTRALIA.

STREAKY BAY.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	84.8	85.2	81.8	74.2	67.9	62.0	61.0	63.3	67.7	73.2	78.6	82.0	73.5
Minimum „	60.1	60.5	58.5	54.1	51.4	48.2	46.9	47.8	49.2	52.4	55.6	58.3	53.6
Extreme Temperature—													
Maximum .. °F.	114.2	114.2	109.0	96.0	88.3	79.0	73.0	83.0	91.0	104.2	113.8	117.0	117.0
Minimum .. „	46.2	44.8	43.5	41.0	34.0	31.0	31.2	32.2	33.9	38.0	39.5	42.5	31.0
Normal Rainfall ins.	0.30	0.68	0.57	0.76	1.72	2.64	2.29	2.19	1.21	1.01	0.69	0.56	14.62

PORT PIRIE.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	89.2	89.6	86.4	76.8	69.5	62.8	61.7	64.8	71.2	77.1	82.9	86.2	76.5
Minimum „	62.9	63.2	61.1	55.2	50.9	46.5	45.5	46.5	49.2	53.4	57.4	60.9	54.4
Extreme Temperature—													
Maximum .. °F.	117.1	113.0	111.0	99.0	85.0	77.0	76.0	83.0	95.0	103.0	109.0	114.2	117.1
Minimum .. „	48.2	48.2	47.0	41.0	36.0	30.0	31.0	33.0	35.0	37.0	43.0	46.0	30.0
Normal Rainfall ins.	0.75	0.83	0.70	0.78	1.40	1.54	1.25	1.48	1.23	1.17	0.92	0.94	12.99

YONGALA.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	85.9	85.8	80.7	70.5	62.4	55.5	54.5	57.6	63.8	71.2	78.3	83.5	70.8
Minimum „	55.8	56.3	51.7	45.1	40.9	37.6	36.1	36.9	39.4	43.4	49.0	53.7	45.5
Extreme Temperature—													
Maximum .. °F.	111.2	107.6	105.0	95.0	83.0	71.8	72.4	79.2	91.0	98.2	104.0	107.0	111.2
Minimum .. „	38.0	39.0	35.2	28.4	23.5	19.0	19.0	24.0	25.8	24.0	30.2	35.0	19.0
Normal Rainfall ins.	0.80	0.86	0.60	0.88	1.37	1.53	1.62	1.87	1.54	1.23	1.10	1.16	14.56

MT. GAMBIER.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	74.2	75.9	72.7	66.5	61.4	57.0	56.2	58.1	61.1	65.0	68.3	71.9	65.7
Minimum „	53.5	54.8	52.4	49.5	46.4	43.5	42.4	43.1	45.1	46.9	49.6	52.0	48.3
Extreme Temperature—													
Maximum .. °F.	112.6	109.6	106.3	98.2	82.6	72.0	70.5	77.0	89.0	95.0	104.0	107.6	112.6
Minimum .. „	33.0	34.0	33.0	29.8	26.2	23.4	23.7	27.5	28.4	30.4	31.0	34.0	23.4
Normal Rainfall ins.	0.93	1.22	1.17	2.14	2.90	3.55	3.49	3.44	2.91	2.10	1.56	1.45	26.86

TABULATED DATA FOR SELECTED CLIMATOLOGICAL STATIONS : WESTERN AUSTRALIA.

WYNDHAM.

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	95.9	95.5	95.3	94.7	90.1	85.8	85.0	88.5	93.5	96.9	98.5	97.6	93.1
Minimum ,,	80.2	79.7	79.5	77.2	72.4	68.0	66.2	69.5	74.8	79.7	81.4	81.2	75.8
Extreme Temperature—													
Maximum .. °F.	113.5	108.3	106.0	104.6	102.4	97.5	96.0	102.0	106.0	110.2	111.6	109.5	113.5
Minimum .. ,,	67.5	64.0	65.0	63.5	55.2	53.5	48.0	56.1	60.1	65.0	68.0	67.0	48.0
Normal Rainfall ins.	6.79	6.30	5.22	0.50	0.14	0.20	0.08	0.02	0.05	0.38	1.55	3.92	25.15

GERALDTON.

Normal Mean Temperature—													
Maximum °F.	84.5	85.2	83.6	80.5	74.2	69.7	67.7	68.8	71.4	73.6	78.5	82.0	76.6
Minimum ,,	66.3	66.5	65.0	60.9	56.9	53.8	51.7	52.1	53.0	55.4	60.0	63.4	58.7
Extreme Temperature—													
Maximum .. °F.	112.0	115.5	110.8	102.8	93.8	83.8	81.0	86.0	96.5	104.6	108.8	113.0	115.5
Minimum .. ,,	49.8	51.0	47.0	41.8	38.6	33.6	33.4	37.3	38.3	41.0	44.0	48.0	33.4
Normal Rainfall ins.	0.30	0.42	0.78	0.89	2.58	4.84	3.77	2.57	1.21	0.79	0.27	0.16	18.5

KALGOORLIE.

Normal Mean Temperature—													
Maximum °F.	93.2	93.0	86.3	78.4	70.1	63.6	62.5	66.0	73.6	79.0	86.3	91.1	78.6
Minimum ,,	64.2	64.4	61.3	55.2	48.9	44.6	42.9	43.9	48.2	52.7	58.3	62.3	53.9
Extreme Temperature—													
Maximum .. °F.	114.4	115.0	111.0	102.5	92.0	81.8	81.0	87.0	96.0	102.3	110.6	113.0	115.0
Minimum .. ,,	47.1	48.0	41.6	37.0	34.6	31.0	30.0	30.0	31.6	33.4	38.2	46.0	30.0
Normal Rainfall ins.	0.69	0.65	1.26	0.97	0.98	0.98	0.81	0.88	0.38	0.58	0.61	0.67	9.46

COLLIE.

Normal Mean Temperature—													
Maximum °F.	86.4	85.7	80.4	74.3	65.9	61.3	59.8	61.0	64.8	68.8	77.2	83.0	72.4
Minimum ,,	55.6	54.9	52.5	47.1	42.9	40.4	39.1	39.8	42.5	45.3	49.7	53.1	46.9
Extreme Temperature—													
Maximum .. °F.	107.8	110.2	104.0	98.0	86.8	76.0	72.4	78.8	86.6	96.4	101.8	106.2	110.2
Minimum .. ,,	37.7	35.2	32.3	29.6	28.0	24.8	25.0	26.2	28.0	31.0	32.6	35.0	24.8
Normal Rainfall ins.	0.67	0.70	0.98	1.85	5.24	6.91	7.84	6.10	4.44	3.06	1.12	0.69	39.60

ALBANY.

Normal Mean Temperature—													
Maximum °F.	73.8	74.2	72.3	70.3	65.9	62.2	60.9	61.7	63.6	65.7	69.2	72.0	67.6
Minimum ,,	58.5	58.8	57.5	54.5	50.7	47.8	46.3	46.6	48.3	50.0	53.6	56.5	52.4
Extreme Temperature—													
Maximum .. °F.	106.0	112.6	105.4	99.6	95.3	76.2	73.5	80.0	87.0	97.2	106.0	106.0	112.6
Minimum .. ,,	42.3	41.0	38.7	39.5	35.1	35.0	32.2	34.3	34.0	36.2	40.6	41.2	32.2
Normal Rainfall ins.	1.36	1.03	1.78	2.93	5.30	5.44	6.00	5.42	4.25	3.28	1.65	1.23	39.67

TABULATED DATA FOR CLIMATOLOGICAL STATIONS : TASMANIA.

BURNIE.

Particulars. [a]	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Normal Mean Temperature—													
Maximum °F.	66.7	66.9	64.6	61.1	57.9	54.3	52.9	53.7	55.7	57.9	61.6	65.3	59.9
Minimum ,,	50.9	52.9	49.4	47.4	44.5	43.2	40.5	41.3	41.8	43.7	47.1	49.7	46.1
Extreme Temperature—													
Maximum .. °F.	83.5	80.3	80.0	71.3	70.5	60.4	59.8	60.6	63.0	72.7	74.5	76.0	83.5
Minimum .. ,,	39.5	38.7	36.0	35.5	33.0	34.0	30.5	30.0	31.0	32.0	36.0	36.5	30.0
Normal Rainfall ins.	1.52	1.73	1.88	3.23	3.53	4.55	4.92	4.88	3.83	3.65	2.62	2.65	38.99

LAUNCESTON.

Normal Mean Temperature—													
Maximum °F.	75.8	76.7	72.0	65.3	59.5	54.6	53.7	56.3	60.0	64.2	69.2	73.1	65.0
Minimum ,,	52.1	52.7	49.7	45.3	41.1	38.4	36.9	38.4	41.4	44.1	47.2	50.3	44.8
Extreme Temperature—													
Maximum .. °F.	100.0	101.0	98.5	84.0	74.8	66.2	66.2	68.0	75.0	88.8	92.0	97.6	101.0
Minimum .. ,,	34.0	33.7	31.0	27.0	24.0	22.0	21.0	24.5	24.0	25.0	32.0	31.5	21.0
Normal Rainfall ins.	1.52	1.49	1.71	2.38	2.71	3.11	3.10	3.12	2.81	2.67	1.82	2.12	28.56

ZEEHAN.

Normal Mean Temperature—													
Maximum °F.	66.3	68.6	65.2	59.9	56.0	52.3	51.6	53.0	55.9	58.9	61.4	64.7	59.5
Minimum ,,	48.0	49.4	47.3	45.1	42.4	39.2	38.2	39.7	41.0	42.8	44.6	46.8	43.7
Extreme Temperature—													
Maximum .. °F.	94.7	99.2	92.5	81.9	74.6	67.3	62.6	69.3	80.0	85.9	94.0	97.0	99.2
Minimum .. ,,	32.2	30.7	28.0	25.0	23.0	20.5	21.1	22.6	23.0	26.6	30.0	31.2	20.5
Normal Rainfall ins.	5.75	4.37	5.77	8.25	8.69	9.21	9.90	10.30	9.34	8.59	7.43	6.46	94.06

SWANSEA.

Normal Mean Temperature—													
Maximum °F.	70.9	71.4	68.7	63.9	59.4	55.3	54.7	56.5	59.9	63.3	66.8	69.2	63.3
Minimum ,,	52.1	53.0	50.3	46.6	42.4	40.0	38.9	39.5	42.3	44.9	47.9	50.6	45.7
Extreme Temperature—													
Maximum .. °F.	104.1	100.7	99.7	85.0	83.9	67.0	67.0	72.6	80.0	92.0	95.0	100.2	104.1
Minimum .. ,,	38.8	38.0	27.0	31.4	27.0	24.0	26.4	25.0	27.2	29.0	32.0	36.0	24.0
Normal Rainfall ins.	1.60	1.89	2.48	2.30	1.65	2.52	1.97	1.37	1.51	2.17	1.84	2.49	23.79

TABULATED DATA FOR SELECTED CLIMATOLOGICAL STATIONS : NORTHERN TERRITORY.

DARWIN.

Normal Mean Temperature—													
Maximum °F.	89.9	89.8	90.2	91.9	90.1	87.5	86.6	88.5	91.0	92.6	93.2	92.0	90.3
Minimum ,,	77.3	77.1	77.1	75.9	72.6	69.5	67.8	69.7	73.9	77.2	78.2	78.1	74.5
Extreme Temperature—													
Maximum .. °F.	100.0	100.9	102.0	104.0	102.3	98.6	98.0	98.0	102.0	104.9	103.3	102.0	104.9
Minimum .. ,,	68.0	68.9	68.0	65.7	60.2	55.9	55.8	58.1	63.0	68.7	68.8	69.4	55.8
Normal Rainfall ins.	16.18	12.37	11.18	3.08	0.33	0.09	0.01	0.02	0.60	1.93	4.32	8.57	58.68

TABULATED DATA FOR SELECTED CLIMATOLOGICAL STATIONS : NORTHERN TERRITORY—*continued.*

Particulars.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
DALY WATERS.													
Normal Mean Temperature—													
Maximum °F.	97.5	96.6	94.9	93.2	88.0	84.0	83.9	89.1	95.6	100.7	102.1	101.1	93.9
Minimum ,,	75.6	74.4	72.6	67.1	61.0	56.9	54.0	56.4	63.9	71.0	74.8	75.9	67.0
Extreme Temperature—													
Maximum .. °F.	113.0	111.0	110.3	106.2	101.0	97.8	98.0	102.4	108.1	112.0	113.0	116.1	116.1
Minimum .. ,,	61.2	61.3	55.2	49.0	43.0	35.1	30.2	39.0	41.2	48.3	56.5	61.2	30.2
Normal Rainfall ins.	6.77	5.11	4.24	0.94	0.27	0.14	0.03	0.03	0.12	0.68	2.41	3.98	24.72
ALICE SPRINGS.													
Normal Mean Temperature—													
Maximum °F.	95.3	94.7	90.1	81.3	73.3	67.1	66.9	72.5	80.1	87.6	91.7	94.7	82.9
Minimum ,,	69.8	68.3	62.8	53.8	46.0	41.2	38.9	43.2	49.2	58.5	64.0	68.2	55.3
Extreme Temperature—													
Maximum .. °F.	116.0	114.0	113.0	102.8	101.0	87.0	88.0	96.4	99.7	113.1	115.0	117.0	117.0
Minimum .. ,,	50.0	48.8	39.0	35.4	27.0	22.0	19.0	25.0	30.0	36.4	40.0	46.0	19.0
Normal Rainfall ins.	1.74	1.32	1.09	0.39	0.60	0.52	0.29	0.31	0.28	0.71	1.15	1.53	9.93

(vi) *Frosts.** The Observer's Handbook of the Meteorological Office, London, gives the following definition :—" 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 thermometer on the grass has fallen to 30.4° F. or below ".

In Australia this definition is adopted for stations equipped with terrestrial minimum thermometers. However, these are few in number, so although many rainfall observers record " hoar frost " when seen, for statistical purposes a screen temperature of 36° F. is taken as indicating light frosts at ground level. For heavy frosts a screen temperature of 32° F. is taken.

In America a " killing " frost is defined as a frost " that is generally destructive of vegetation ". A " black frost " is the phenomenon arising out of a combination of low temperature and low humidity causing rupturing of plant cells by expansion, when freezing takes place, of the water which they contain, though frost crystals are not formed on the ground.

The parts of Australia most subject to low temperature are the eastern highlands from about Omeo in Victoria northward to Cambooya and Bybera in Queensland. Most stations in this region experience more than ten nights per month with readings of 32° F. or under for three to five months of the year. In Tasmania, districts on the Central Plateau are subject to such conditions for three to six months of the year. Minimum temperatures of 32° F. are comparatively infrequent in Western Australia except in parts of the south and south-west. In South Australia the Yongala district is much more subject to such temperatures than other parts of the State. Much of the south-east of Queensland has a higher frequency of such readings than South Australia. Generally speaking, the frequency is controlled mainly by altitude, latitude and, to a lesser degree, by proximity to the sea.

Frosts may occur within a few miles of the coastline over the whole continent, except in the Northern Territory and a considerable area of Northern Queensland. Regions subject to frost in all months of the year comprise portions of the tablelands of New South Wales, the Eastern Highlands and parts of the Central Divide and Western district in Victoria, practically the whole of Tasmania and a small area in the south-west of Western Australia.

* Foley, J. C. Frost in the Australian Region (Bull. 32, 1945).

A map showing the average annual number of frost-free days (i.e. days on which the temperature does not fall below 36° F.) appears on page 35.

Over most of the interior of the continent and on the Highlands in Queensland as far north as the Atherton Plateau frosts appear in April and end in September, but they are infrequent in these months. Minimum temperatures of 32° F. are experienced in most of the sub-tropical interior in June and July.

8. **Humidity.**—After temperature, humidity is the most important element of climate, particularly as regards its effects on human comfort, rainfall supply, and conservation and related problems.

In this publication the humidity of the air has been expressed by the relative humidity which is the quotient of the vapour pressure divided by the saturation vapour pressure and multiplied by one hundred. The mean 9 a.m. relative humidity, as well as its highest and lowest recorded mean values at 9 a.m., are shown in the tables of climatological data for the capital cities (par. 19). The mean monthly vapour pressure has also been added to these tables.

The annual curve of vapour pressure derived from the normal monthly values for this element is comparable with the maximum and minimum temperature curves, but the relative humidities consisting as they do of the extremes for each month do not show the normal annual fluctuation which would be approximately midway between the extremes.

The order of stations in descending values of 9 a.m. vapour pressure is Darwin, Brisbane, Sydney, Perth, Melbourne, Adelaide, Canberra, Hobart and Alice Springs, while the relative humidity diminishes in the order, Sydney, Canberra, Melbourne, Darwin, Hobart, Brisbane, Perth, Adelaide and Alice Springs.

Further reference to humidity will be found in the section on effective temperature (page 32).

9. **Evaporation.**—(i) *General.* The rate and quantity of evaporation in any territory is influenced by the prevailing temperature, and by atmospheric humidity, pressure and wind movement. In Australia the question is, perhaps, of more than ordinary importance, since in its drier regions water has often to be conserved in " tanks " and dams. The magnitude of the economic loss by evaporation will be appreciated from the map reproduced herein (*see* page 36) which shows that the yearly amount varies from about 20 inches over Western Tasmania to more than 100 inches over the central and north-western parts of Australia. Over an area of 70 per cent. of the continent, comprising most inland districts and extending to the coast in the North-West and Eucla divisions of Western Australia, during no month of the year does the rainfall exceed the evaporation. The central and north-western portions of the continent, comprising 46 per cent. of the total land mass, experience evaporation more than twice as great as their rainfall; it is noteworthy that the vegetation over most of this region is characterised by acacia, semi-desert, shrub steppe and porcupine grass. Since the loss by evaporation depends largely on the exposed area, tanks and dams so designed that the surface shall be a minimum are advantageous. Further, the more they are protected from the direct rays of the sun and from winds by means of suitable tree planting, the less will be the loss by evaporation. These matters are naturally of more than ordinary concern in the drier districts of Australia.

(ii) *Comments on Map of Average Annual Evaporation.* The map of average annual evaporation in Australia (*see* page 36) has been compiled on the basis of records obtained from a number of evaporimeters supplemented by estimates derived from records of saturation deficit by applying the Waite Institute factor of 263.* Some modification of the latter values was found to be necessary in comparison with recordings of evaporimeters.

The standard evaporation tank used in Australia is cylindrical in form and is 36 inches in diameter and 36 inches deep. It is surrounded by a 6-inch water jacket and the whole is sunk into the ground so that the water surface is approximately at ground level.

* Prescott, J. A. " Atmospheric Saturation Deficit in Australia " (Trans. Royal Society, S.A. Vol. lv., 1931).

Saturation deficit is obtained from readings of dry and wet bulb thermometers exposed in a standard Stevenson thermometer shelter. Saturation deficit is the difference between the vapour pressure indicated by the dry and wet bulb readings, and the saturation vapour pressure corresponding to the dry bulb temperature.

The Waite formula, $e = 263$ s.d., is not an exact relationship, but it takes account of one of the major factors in evaporation, i.e., the difference between saturation vapour pressures at the mean dew point and at the mean air temperature. Errors in the formula are found to be fairly consistent in considerable areas of Australia and corrections have been applied accordingly. No evaporation records are available north of latitude 20°, and corrections have been extrapolated for these areas. The evaporation stations on which estimates for the tropics have been based are Alice Springs (N.T.) and Winton (Q'land), and to a lesser degree Blackall (Q'land) and Marble Bar (W.A.).

The map thus presents an estimate of evaporation for which allowance should be made for a certain margin of error (perhaps 10 per cent. or so) on the conservative side. In the absence of definite information, such a map should serve a useful purpose as a basis for many climatic studies.

For graphs and tables of mean monthly evaporation and rainfall at certain selected stations *see* Official Year Book No. 37, pp. 34-35.

10. **Rainfall.**—(i) *General.* The rainfall of any region is determined mainly by the direction and route of the prevailing winds, by the varying temperatures of the earth's surface over which they blow, and by its physiographical features.

Australia lies within the zones of the south-east trades and "prevailing" westerly winds. The southern limit of the south-east trade strikes the eastern shores at about 30° south latitude, and, with very few exceptions, the heaviest rains of the Australian continent are precipitated along the Pacific slopes to the north of that latitude, the varying quantities being more or less regulated by the differences in elevation of the shores and of the chain of mountains from the New South Wales northern border to Thursday Island, upon which the rain-laden winds blow. The converse effect is exemplified on the north-west coast of Western Australia, where the prevailing winds, blowing from the interior of the continent instead of from the ocean, result in the lightest coastal rain in Australia.

The westerly winds, which skirt the southern shores, are responsible for the reliable, generally light to moderate rains enjoyed by the south-western portion of Western Australia, the agricultural areas of South Australia, a great part of Victoria, and the whole of Tasmania.

(ii) *Distribution of Rainfall.* The average annual rainfall map of Australia (page 37) shows that the heaviest yearly falls occur on the north coast of Queensland (up to more than 160 inches) and in Western Australia (up to 140 inches), while from 50 to over 60 inches are received on parts of the eastern seaboard from Jervis Bay (New South Wales) to the northern part of Cape York Peninsula, also around Darwin (Northern Territory), on the West Kimberley coast, near Cape Leeuwin (Western Australia), about the Australian Alps in eastern Victoria and New South Wales, and on the north-eastern highlands in Tasmania. A great part of the interior of the continent, stretching from the far west of New South Wales and the south-west of Queensland to the vicinity of Shark Bay in Western Australia, has a very low average rainfall of less than 10 inches a year. Between these two regions of heavy and very low rainfall are the extensive areas which experience useful to good rains, and in the southern and eastern parts of which are found the best country and most of the population and primary production.

(iii) *Factors Determining Occurrence, Intensity and Seasonal Distribution of Rainfall.* Reference has already been made to the frequent rains occurring in the north-eastern coastal districts of Queensland with the prevailing south-east trade winds and to similar rains in the west of Tasmania with the prevailing westerly winds. Other rains in Australia are associated mainly with tropical and southern depressions.

The former chiefly affect the northern, eastern, and to some extent the central parts of the continent and operate in an irregular manner during the warmer half of the year, but principally from December to March. They vary considerably in activity and scope from year to year, occasionally developing into severe storms off the east and north-west

coasts. Tropical rainstorms sometimes cover an extensive area, half of the continent on occasions receiving moderate to very heavy falls during a period of a few days. Rain is also experienced, with some regularity, with thunderstorms in tropical areas, especially near the coast. All these tropical rains, however, favour mostly the northern and eastern parts of the area referred to ; the other parts further inland receive lighter, less frequent and less reliable rainfall. With the exception of districts near the east coast, where some rain falls in all seasons, the tropical parts of the continent receive useful rains only on rare occasions from May to September.

The southern depressions are most active in the winter—June to August—and early spring months. The rains associated with them are fairly reliable and frequent over Southern Australia and Tasmania, and provide during that period the principal factor in the successful growing of wheat. These depressions also operate with varying activity during the remainder of the year, but the accompanying rains are usually lighter. The southern rains favour chiefly the south-west of Western Australia, the agricultural districts of South Australia, Victoria, Tasmania, and the southern parts of New South Wales. They sometimes extend into the drier regions of the interior, but only infrequently and irregularly.

The map showing mean monthly distribution of rainfall over Australia (page 38) gives in graphic form information on the amount and occurrence of rain.

(iv) *Wettest and Driest Regions.* The wettest known part of Australia is on the north-east coast of Queensland, between Port Douglas and Cardwell, where Deeral on the north coast-line has an average annual rainfall of 174.00 inches and Tully on the Tully River 175.32 inches. In addition, three stations situated on, or adjacent to, the Johnstone and Russel Rivers have an average annual rainfall of between 144 and 169 inches. The maximum and minimum annual amounts there are :—Deeral, 287.18 in 1945 and 99.60 inches in 1947, or a range of 187.58 inches ; Tully, 234.37 in 1936 and 104.98 inches in 1943, or a range of 129.39 inches ; Goondi, 241.53 in 1894 and 67.88 inches in 1915, or a range of 173.65 inches ; Innisfail, 211.24 in 1894 and 69.87 inches in 1902, or a range of 141.37 inches ; Harvey Creek, 254.77 in 1921 and 80.47 inches in 1902, or a range of 174.30 inches.

On four occasions more than 200 inches have been recorded at Goondi, the last of these being in 1910, when 204.82 inches were registered. The records at this station cover a period of 62 years.

In twenty-two years of record Tully has exceeded 200 inches on eight occasions, whilst in a record of 28 complete years Harvey Creek has four times exceeded this figure.

In Tasmania the wettest part is in the West Coast region, the average annual rainfall at Lake Margaret being 146.29 inches, with a maximum of 175.12 inches in 1924.

The driest known part of the continent is in an area of approximately 180,000 square miles surrounding Lake Eyre in South Australia, where the annual average is between 4 and 6 inches and where the fall rarely exceeds 10 inches for 12 months.

Records of stations have at times been interrupted, but of the 23 stations in this region which have an annual average of less than 5 inches, six have complete records extending from 30 to 55 years. Of these Mulka has the lowest average of 3.94 inches (30 years), followed by Troudaninna with an average of 4.15 inches in 42 years. Troudaninna in the period 1893 to 1936 had only one year in which the total exceeded 9 inches (11.07 inches in 1894). There have been protracted periods when the average has even been less than 3 inches. From 1895 to 1903 Troudaninna received the following annual totals :—2.78, 0.99, 5.71, 3.04, 3.18, 2.83, 1.80, 1.11, 4.87, an average of 2.91 inches. From 1918 to 1929 the average was only 2.65 inches, and in this period from December, 1924 to November, 1929 the average was only 1.70 inches.

Mulka since 1918 has only once exceeded 10 inches for the annual total (11.72 inches in 1920), and in 30 years on 15 occasions the annual total has been less than 3 inches. In one particular period from October, 1926 to September, 1930, the average was only 1.26 inches (505 points in 48 months). However, at Kanowana, an even lower four year average of 1.12 inches was recorded between 1896 and 1899 with yearly totals of 43, 225, 87 and 94 points. An even smaller total than 43 points was recorded at Mungeranie in 1889 when only 39 points was recorded on 5 days.

The average number of rain days per month in this region is only 1–2 and the annual number ranges between 10 and 20. Oodnadatta (standard 30 years' average rainfall equal to 4.44 inches) has an average of 20 days of rain per year while Cordillo Downs in the extreme north-east corner of the State of South Australia receives 5.16 inches on 12 days per year, averaging about one day of rain each month in the thirty years' period 1911–1940.

No part of the earth, so far as is known, is absolutely rainless, and although at Arica, in northern Chile, the rainfall over a period of 15 years was nil, a further two years in which there were three measurable showers made the " average " for 17 years 0.02 inches.

(v) *Quantities and Distribution of Rainfall.* The general distribution is best seen from the rainfall map (page 37) which shows the areas subject to average annual rainfalls lying between certain limits. The proportions of the total area of each State and of Australia as a whole enjoying varying quantities of rainfall determined from the latest available information are shown in the following table :—

AVERAGE ANNUAL RAINFALL DISTRIBUTION.
(Per Cent.)

Average Annual Rainfall.	N.S.W. (a)	Victoria.	Queensland.	South Australia	Western Australia.	Tasmania. (b)	Northern Territory	Total.
Under 10 inches ..	19.7	Nil	13.0	82.8	58.0	Nil	24.7	37.6
10—15 " ..	23.5	22.4	14.4	9.4	22.4	Nil	32.4	19.9
15—20 " ..	17.5	15.2	19.7	4.5	6.8	0.7	9.7	10.9
20—25 " ..	14.2	17.9	18.8	2.2	3.7	11.0	6.6	9.1
25—30 " ..	9.1	18.0	11.6	0.8	3.7	11.4	9.3	7.3
30—40 " ..	9.9	16.1	11.1	0.3	3.3	20.4	4.7	6.6
Over 40 " ..	6.1	10.4	11.4	Nil	2.1	56.5	12.6	8.6
Total ..	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(a) Includes Australian Capital Territory. (b) Over an area of 2,777 square miles no records are available.

Referring first to the capital cities, the records of which are given in the next table, it will be seen that Sydney, with an average rainfall of 46.21 inches, occupies the chief place : Brisbane, Perth, Melbourne, Hobart, Canberra and Adelaide follow in that order, Adelaide with 21.10 inches being the driest. The extreme range from the wettest to the driest year is greatest at Brisbane (72.09 inches) and least at Adelaide (19.46 inches).

In order to show how the rainfall is distributed throughout the year in various parts of the continent, average figures for the various climatological districts have been selected. (*See* map on p. 38). The figures for Northern Rivers (District 14), show that nearly the whole of the rainfall occurs there in the summer months, while little or none falls in the middle of the year. The figures for the Central Coast, south-west of Western Australia (District 9), are the reverse, for while the summer months are dry, the winter months are very wet. In the districts containing Melbourne and Hobart the rain is fairly well distributed throughout the twelve months, with a maximum in October for both districts. In Queensland, the heaviest rains fall in the summer months, but good averages are also maintained during the other seasons in eastern parts.

On the coast of New South Wales, the first half of the year is the wettest, with heaviest falls in the autumn ; the averages during the last six months are fair, and moderately uniform. Generally it may be said that approximately one-third of the area of the continent, principally in the eastern and northern parts, enjoys an annual average rainfall of from 20 to 50 inches or more, the remaining two-thirds averaging from 5 to 20 inches.

(vi) *Tables of Rainfall.* The table of rainfall for a fairly long period of years for each of the various Australian capitals affords information as to the variability of the fall in successive years, and the list of the more remarkable falls furnishes information as to what may be expected on particular occasions.

RAINFALL : AUSTRALIAN CAPITAL CITIES.

Year.	CANBERRA.(a)		PERTH.		ADELAIDE.		BRISBANE.		SYDNEY.		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.	
1920 ..	..	..	40.35	124	26.70	119	39.72	122	43.42	159	28.27	162	18.00	182
21 ..	..	..	41.09	135	22.64	100	54.31	167	43.34	140	29.76	154	18.04	159
22 ..	..	..	31.86	135	23.20	117	35.82	109	39.35	136	25.02	151	28.27	189
23 ..	..	..	44.47	134	29.79	139	23.27	93	37.01	123	22.64	158	32.93	198
24 ..	..	..	33.79	119	23.44	143	41.08	114	37.01	136	36.48	171	28.76	197
25 ..	..	..	31.41	126	21.91	118	53.10	139	50.35	145	17.57	144	22.67	170
26 ..	..	..	49.22	167	22.20	116	30.82	111	37.07	127	20.51	149	25.79	187
27 ..	..	..	36.59	133	16.92	101	62.08	130	48.56	138	17.98	135	20.13	185
28 ..	18.59	90	44.88	140	19.43	107	52.64	145	40.07	130	24.09	151	30.23	205
29 ..	23.12	70	36.77	132	17.51	119	39.78	118	57.90	129	28.81	168	26.55	194
30 ..	17.33	82	39.80	129	18.65	116	41.22	144	44.47	141	25.41	145	19.38	152
31 ..	24.02	103	39.18	118	22.26	145	66.72	136	49.22	153	28.63	164	27.17	179
32 ..	20.18	118	39.40	121	25.04	141	24.79	97	37.47	146	31.08	179	30.29	155
33 ..	20.78	96	32.47	116	22.12	130	49.71	118	42.71	153	22.28	136	23.18	182
34 ..	35.58	131	40.61	120	20.24	125	54.26	117	64.91	183	33.53	157	23.17	194
35 ..	23.78	95	32.28	129	23.45	140	34.64	111	30.97	131	29.98	183	32.22	196
36 ..	26.24	108	30.64	118	19.34	121	21.77	101	30.22	130	24.30	187	19.60	178
37 ..	20.46	82	35.28	120	23.01	128	34.79	113	52.00	157	21.45	144	20.65	160
38 ..	19.26	79	29.64	111	19.26	119	43.49	110	39.17	132	17.63	131	31.32	169
39 ..	27.63	116	45.70	123	23.29	139	41.43	122	33.67	127	33.11	166	27.23	188
40 ..	17.38	64	20.00	98	16.16	116	42.37	93	39.34	125	19.83	126	17.17	135
41 ..	19.55	91	34.74	122	22.56	126	31.50	105	26.74	129	31.78	157	23.49	145
42 ..	25.76	104	39.24	140	25.44	133	44.01	125	48.29	121	29.79	148	19.42	163
43 ..	24.59	123	31.46	117	17.84	135	50.68	126	50.74	136	18.80	150	20.84	149
44 ..	12.05	75	27.39	123	17.13	114	27.85	100	31.04	115	21.32	143	26.23	151
45 ..	22.35	100	52.67	137	17.85	105	48.16	130	46.47	136	19.22	152	16.92	157
46 ..	22.31	94	41.47	122	22.59	135	38.66	83	36.05	111	29.80	177	39.45	103
47 ..	27.95	135	43.42	137	21.69	145	60.30	146	41.45	137	30.47	163	38.61	181
48 ..	32.11	101	34.75	126	24.70	122	41.54	106	38.83	131	20.98	155	23.42	178
Average No. of Years	22.91	98	35.05	121	21.10	124	44.71	125	46.21	151	25.55	141	24.62	168
Standard 30 years' Normal	21	21	73	73	110	110	97	89	90	90	93	93	66	66
	..	..	35.99	128	21.09	122	40.09	117	44.80	143	25.89	156	25.03	180

(a) Commonwealth Forestry Bureau; records in issues prior to No. 36 were for the station at Acton which closed down in 1939. (b) Records taken from present site commenced 1883.

11. **Remarkable Falls of Rain.**—The following are the most notable falls of rain in the various States and Territories which have occurred within a period of twenty-four hours. For other very heavy falls at various localities reference may be made to Official Year Book No. 14, pp. 60–64, No. 22, pp. 46–48 and No. 29, pp. 43, 44 and 51 :—

HEAVY RAINFALLS : NEW SOUTH WALES, UP TO 1948, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		in.			in.
Bega	27 Feb., 1919	17.88	Morpeth ..	9 Mar., 1893	21.52
Broger's Creek	14 Feb., 1898	20 05	Mt. Kembla ..	13 Jan., 1911	18.25
,, ,, ..	13 Jan., 1911	20.83	Mt. Pleasant ..	5 May, 1925	20.10
Buladelah ..	16 Apr., 1927	19.80	Nimbin ..	6 Feb., 1939	16.26
Burragate ..	27 Feb., 1919	16.38	South Head (Sydney Harbour) ..	16 Oct., 1844	20.41
Candelo ..	27 Feb., 1919	18.58	,, ,, ,,	29 Apr., 1841	20.12
Condong ..	27 Mar., 1887	18.60	Towamba ..	5 Mar., 1893	20.00
Cordeaux River ..	14 Feb., 1898	22.58	Viaduct Creek ..	15 Mar., 1936	20.00
Kembla Heights ..	13 Jan., 1911	17.46			
Madden's Creek ..	13 Jan., 1911	18.68			

HEAVY RAINFALLS: QUEENSLAND, UP TO 1948, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		in.			in.
Babinda (Cairns) ..	2 Mar., 1935	24.14	Kuranda (Cairns)..	2 Apr., 1911	28.80
Banyan (Cardwell)	12 Feb., 1927	24.00	Landsborough ..	2 Feb., 1893	25.15
Buderim Mountain	11 Jan., 1898	26.20	Macnade Mill ..	6 Feb., 1901	23.33
Carruchan ..	24 Jan., 1934	24.00	Plane Creek (Mackay)	26 Feb., 1913	27.73
Crohamhurst (Blackall Range)	2 Feb., 1893	35·71	Port Douglas ..	1 Apr., 1911	31.53
Deeral	2 Mar., 1935	27.60	Sarina	26 Feb., 1913	27.75
Flat Top Island ..	21 Jan., 1918	25.18	Springbrook ..	24 Jan., 1947	27.07
Goondi	30 Jan., 1913	24.10	Tully Mill ..	12 Feb., 1927	23.86
Harvey Creek ..	3 Jan., 1911	27.75	Woodlands (Yepp'n)	3 Jan., 1893	23.07
			Yarrabah ..	2 Apr., 1911	30.65

HEAVY RAINFALLS: WESTERN AUSTRALIA, UP TO 1948, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		in.			in.
Balla Balla ..	21 Mar., 1899	14.40	Pilbara	2 Apr., 1898	14.04
Boodarie ..	21 Mar., 1899	14.53	Roebuck Plains ..	5 Jan., 1917	14.01
Broome	6 Jan., 1917	14.00	,, ,, ..	6 Jan., 1917	22.36
Carlton Hill ..	7 Feb., 1942	12.75	Thangoo	17-19 Feb.'96	24.18
Derby	7 Jan., 1917	16.47	Towrana ..	1 Mar., 1943	12.16
Fortesque ..	3 May, 1890	23.36	Whim Creek ..	3 Apr., 1898	29.41
Jimba Jimba ..	1 Mar., 1943	11.54	Winderrie ..	17 Jan., 1923	14.23
Marble Bar ..	2 Mar., 1941	12.00	Widjip	1 Apr., 1934	19.54

HEAVY RAINFALLS: NORTHERN TERRITORY, UP TO 1948, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		in.			in.
Bathurst Island Mission ..	7 Apr., 1925	11.85	Cape Don ..	13 Jan., 1935	13.58
Borroloola ..	14 Mar., 1899	14.00	Darwin	7 Jan., 1897	11.67
Brock's Creek ..	24 Dec., 1915	14.33	Groote Eylandt ..	9 Apr., 1931	14.29
			Timber Creek ..	5 Feb., 1942	13.65

HEAVY RAINFALLS: SOUTH AUSTRALIA, UP TO 1948, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		in.			in.
Ardrossan ..	18 Feb., 1946	8.10	Mannum ..	25 Jan., 1941	6.84
Cape Willoughby ..	18 Feb., 1946	6.80	Port Victoria ..	18 Feb., 1946	7.08
Carpa	18 Feb., 1946	7.83	Torrens Vale ..	25 Jan., 1941	6.77
Edithburg ..	18 Feb., 1946	7.46	Wilmington ..	1 Mar., 1921	7.12
Hesso	18 Feb., 1946	7.36	Wirrabara ..	7 Mar., 1910	6.80
Maitland ..	18 Feb., 1946	7.21	Wynbring ..	28 Feb., 1921	7.70

HEAVY RAINFALLS: VICTORIA, UP TO 1948, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		in.			in.
Blackwood "Greenhill"	26 Jan., 1941	8.98	Kalorama ..	1 Dec., 1934	10.05
Cann River ..	27 Feb., 1919	9.56	Korumburra ..	1 Dec., 1934	8.51
,, ,, ..	16 Mar., 1938	9.94	Mt. Buffalo ..	6 June, 1917	8.53
Corinella ..	28 June, 1948	8.75	Olinda	1 Dec., 1934	9.10
Erica	1 Dec., 1934	8.66	Tambo Crossing ..	13 July, 1925	8.89
Hazel Park ..	1 Dec., 1934	10.50	Tonghi Creek ..	27 Feb., 1919	9.90

HEAVY RAINFALLS: TASMANIA, UP TO 1948, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date	Amnt.
		in.			in.
Cullenswood ..	5 Apr., 1929	11.12	Riana	5 Apr., 1929	11.08
Gould's Country ..	8-10 Mar.,'11	15.33	The Springs ..	30-31 Jan.,'16	10.75
Lottah	8-10 Mar.,'11	18.10	Triabunna ..	5 June, 1923	10.20
Mathinna ..	5 Apr., 1929	13.25			

HEAVY RAINFALLS: AUSTRALIAN CAPITAL TERRITORY, UP TO 1948, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt
		in.			in.
Canberra (Acton)..	27 May, 1925	6.84	Land's End ..	27 May, 1925	6.35
Cotter Junction ..	27 May, 1925	7.13	Uriarra (Woodside)	27 May, 1925	6.57

12. **Snowfall.**—Light snow has been known to fall occasionally as far north as latitude 31° S., and from the western to the eastern shores of the continent. During exceptional seasons, it has fallen simultaneously over two-thirds of New South Wales, and has extended at times along the whole of the Great Dividing Range, from its southern extremity in Victoria as far north as Toowoomba in Queensland. During the winter, for several months, snow covers the ground to a great extent on the Australian Alps, where also the temperature falls below zero Fahrenheit during the night. In the ravines around Mt. Kosciusko and similar localities the snow never entirely disappears after a severe winter.

13. **Hail.**—Hail falls most frequently along the southern shores of the continent in the winter, and over eastern Australia during the summer months. The size of the hailstones generally increases with distance from the coast. A summer rarely passes without some station experiencing a fall of stones exceeding in size an ordinary hen-egg, and many riddled sheets of light-gauge galvanized iron bear evidence of the weight and penetrating power of the stones.

The hailstones occur most frequently when the barometric readings indicate a flat and unstable condition of pressure. Tornadoes or tornadic tendencies are almost invariably accompanied by hail, and on the east coast the clouds from which the stones fall are frequently of a remarkable sepia-coloured tint.

14. **Barometric Pressures.**—The mean annual barometric pressure (corrected to sea level and standard gravity) in Australia varies from 29.80 inches on the north coast to 29.92 inches over the central and 30.03 inches in the southern parts of the continent. In January, the mean pressure ranges from 29.70 inches in the northern and central areas to 29.95 inches in the southern. The July mean pressure ranges from 29.90 inches at Darwin to 30.12 inches at Alice Springs. Barometer readings corrected to mean sea level and standard gravity have, under anticyclonic conditions, ranged as high as 30.935 inches (at Hobart on 13th July, 1846) and have fallen as low as 27.55 inches. This lowest record was registered at Mackay during a tropical hurricane on 21st January, 1918. An almost equally abnormal reading of 27.88 inches was recorded at Innisfail during a similar storm on 10th March, 1918. For graphs of Mean Barometric Pressure at Capital Cities *see* Official Year Book No. 37, p. 35.

15. **Wind.**—(i) *Trade Winds.* The two distinctive wind currents in Australia are, as previously stated, the south-east trade and the " prevailing " westerly winds. As the belt of the earth's atmosphere in which they blow apparently follows the sun's ecliptic path north and south of the equator, so the area of the continent affected by these winds varies at different seasons of the year. During the summer months the anticyclonic belt travels in high latitudes, thereby bringing the south-east trade winds as far south as 30° south latitude. The " prevailing " westerly winds retreat a considerable distance to the south of Australia, and are less in evidence in the hot months. When the sun passes to the north of the equator, the south-east trade winds follow it, and only operate to the north of the tropics for the greater part of the winter. The westerly winds come into lower latitudes during the same period of the year. They sweep across the southern areas of the continent from Cape Leeuwin to Cape Howe, and during some seasons are remarkably persistent and strong, and occasionally penetrate to almost tropical latitudes.

(ii) *North-west Monsoon.* As the belt of south-east trade winds retreats southward during the summer, it is replaced in the north and north-west of Australia first by a sequence of light variable winds and then by the north-west monsoon. In Australia, the north-west monsoon has not the persistence nor regularity of the Indian south-west

monsoon but is sufficiently characteristic for the summer in the north of Australia to be called the " North-west Season ". In central and eastern Queensland, the north-west monsoon in the summer has comparatively little effect and the trade winds, albeit weakened, are still dominant winds. With the migration of the sun northward in the autumn, the north-west monsoon is itself replaced first by light variable winds and then by the trade winds.

(iii) *Land and Sea Breezes.* The prevailing winds next in order of importance are the land and sea breezes. On the east coast the sea breezes which come in from the north-east, when in full force, frequently reach the velocity of a gale during the afternoon in the summer months, the maximum hourly velocity, ordinarily attained about 3 p.m., not infrequently attaining a rate of 35 to 40 miles per hour. It was formerly thought that this wind did not ordinarily penetrate more than 9 or 12 miles inland. It is now known that coastal air penetrates upwards of 60 miles or more, as in the case of the " sea breeze "which reaches Canberra late on a summer afternoon. Whether this represents a true sea breeze or the movement of a " coastal front " (which is said to penetrate as much as 200 miles inland by late at night) is an open question.

The land breezes on the east coast blow out from a westerly direction during the night.

On the western shores of the continent the directions are reversed. The sea breezes come in from the south-west, and the land breezes blow out from the north-east.

(iv) *Inland Winds.* Inland, the direction of the prevailing winds is largely regulated by the seasonal changes of pressure, so disposed as to cause the winds to radiate spirally outward from the centre of the continent during the winter months, and to circulate spirally from the seaboard to the centre of Australia during the summer months.

(v) *Prevailing Direction at the Capital Cities.* In Canberra at 9 a.m. the air is usually calm, particularly during the winter months, but such winds as do occur are predominantly north-westerly, though a proportion of south-easterly winds occur during the autumn. At 3 p.m. the predominant wind is north-westerly.

In Perth at 9 a.m. east to south-east winds prevail from September to March, while from April to August north-north-east to east winds predominate. At 3 p.m. the prevailing wind is south-south-west from October to May inclusive and westerly at other times.

In Adelaide at 9 a.m. the predominant wind is north-easterly from April to August but during the rest of the year no particular direction is outstanding. At 3 p.m. the predominant wind is south-westerly for all months except May, June and July. Throughout the year winds with an easterly component are rare in the afternoon.

In Brisbane at 9 a.m. the most frequent winds during the colder two-thirds of the year come from the south or south-west, while in the warmer months south to south-east winds are more usual. At 3 p.m. winds with an easterly component predominate, especially north-easterlies during the warmer half of the year.

In Sydney at 9 a.m. by far the most prevailing wind is a westerly, particularly during the colder two-thirds of the year. At 3 p.m., during the warmer two-thirds of the year, winds with an easterly component are most frequent with a smaller proportion of southerlies and westerlies during the winter months.

In Melbourne at 9 a.m. northerlies are the most frequent winds during the period February to October with a moderate proportion of westerlies in the spring. During the summer months, winds with a southerly component are in evidence to a slightly greater degree than any others. At 3 p.m. southerly winds prevail during the warmer two-thirds of the year with the frequency of northerlies increasing during the colder months.

In Hobart at 9 a.m. the most favoured directions are from the north-west and north with a good proportion of south-easterlies showing up at 3 p.m. during the warmer months.

(vi) *Maximum Wind Gusts.* The records of maximum wind gusts have mostly been obtained with the Dines type of anemometer with the head exposed some 30 or 40 feet above the ground. The data are set out in the tables which follow for stations arranged in the following three groups :—

(*a*) *Stations North of Brisbane (Tropical).* Cairns, Townsville, Rockhampton, Willis Island, Darwin, Groote Eylandt, Karumba, Onslow and Cloncurry.

(*b*) *Capital Cities.* Brisbane, Sydney, Melbourne, Hobart, Adelaide and Perth.

(*c*) *Other Stations south of Brisbane (located at Aerodromes).* Archerfield, Lord Howe Island, Richmond, Rathmines, Mascot, Wagga, Canberra, Essendon, Laverton, Western Junction, Oodnadatta, Ceduna, Parafield, Guildford and Kalgoorlie.

PERCENTAGE FREQUENCY OF MAXIMUM GUSTS.
(Per Cent.)

Station Group.	Wind Speed Range (miles per hour).												
	36–40.	41–45.	46–50.	51–55.	56–60.	61–65.	66–70.	71–75.	76–80.	81–85.	86–90.	91–95.	96–100.
Stations North of Brisbane..	2	7	30	24	4	9	13	..	7	..	..	..	4
Capital Cities ..	..	..	..	10	10	21	28	17	12	..	2	..	..
Other Stations South of Brisbane ..	..	..	3	7	13	21	21	16	9	5	2	3	..

PERCENTAGE FREQUENCY OF DIRECTIONS OF THE HIGHEST GUSTS RECORDED THROUGHOUT THE YEAR.
(Per Cent.)

Station Group.	Direction of Maximum Yearly Gusts.							
	South-West.	South.	South-East.	East.	North-East.	North.	North-West.	West.
Stations North of Brisbane	13	11	31	22	4	2	13	4
Capital Cities	18	8	6	..	..	4	27	37
Other Stations South of Brisbane	17	9	2	2	..	19	31	20

HIGHEST MAXIMUM GUST REGISTERED IN EACH CALENDAR MONTH IN EACH REGION.
(Miles per hour.)

Station Group.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Stations North of Brisbane	100	69	100	60	46	43	43	52	52	80	61	78
Capital Cities ..	72	67	68	81	73	80	78	87	84	95	79	79
Other Stations South of Brisbane	91	87	91	82	79	71	76	80	90	80	74	89

From the foregoing tables it is seen that, for Capital Cities (Group 2), maxima of 60 to 75 miles per hour are frequent, with rare higher extremes of possibly up to 95 m.p.h. The most frequent directions of maximum gusts are from the west or north-west with a moderate percentage from the south-west.

At aerodrome stations south from Brisbane (Group 3), the most frequent maxima are from 55 to 75 m.p.h., with rare occurrences up to 95 m.p.h. Here the most frequent directions are from the north-west with moderate percentages of west, north and south-west.

The frequency distribution of maximum yearly gusts at tropical stations (Group 1) is quite different from those further south. Generally, maxima of 45 to 55 m.p.h. predominate, with a generally lower frequency of the higher gusts than in the other regions. However, in cyclones, gusts of 98 and 100 m.p.h. have been recorded, prior, in some cases, to the anemometer mast being blown away. The most frequent directions of the maximum gusts in the group are from the south-east and east.

Maximum yearly " gusts " may arise out of a high general wind, tornado or cyclone or be associated with squalls with the passage of a cold front or thunderstorm.

16. **Meteorology of Australia.**—(i) *General.* Meteorology, as the science of weather, attempts to apply physical principles to an explanation and interpretation of the variations in weather phenomena. The condition and behaviour of the air at a given time and place constitute weather. (Climate is the long-term weather experience of any locality.)

In Australia, certain selected stations, at three hourly intervals, measure or observe :— (*a*) The temperature of the air ; (*b*) pressure ; (*c*) the speed and direction of air movement; (*d*) moisture content ; and (*e*) the state of the sky and the occurrence, present and past, of precipitation. These conditions are summarized by analysis as follows :—

(*a*) *Identification of Air Masses.* An air mass is a widespread body of air which is approximately homogeneous in its horizontal extent, having fairly definite characteristic properties in regard to temperature, humidity, etc., which determine its type.

In the Australian region, the air masses are frequently ill-defined, but as well as the two broad classifications of cold and warm air masses the following primary types may be distinguished :—Equatoral, Tropical, Southern-Maritime, Indian, Pacific and Continental. These are obviously so called because of their sources of origin. In addition, there are sub-types which are modifications of the foregoing.

(*b*) *Demarcation of Air Mass Boundaries.* These are generally exhibited as " fronts " which are zones of rapid change of the air mass properties both at the earth surface and in the upper levels.

There are two main classes of fronts, viz. :—*Cold Fronts*, when a cold air mass is displacing and under-running a warmer one, and *Warm Fronts* when warm air is displacing, and at higher levels moving over, a cold air mass. An " occlusion " occurs when the warm air is lifted bodily and only cold air is found at the surface. Well defined, distinct warm fronts are infrequently found over Australia, being more characteristic of higher latitudes.

(*c*) *Pressure Isolines.* These are drawn joining places of equal pressure, resulting in the familiar pattern of isobars delineating anticyclones (" highs ") and cyclones (" lows ") as seen on the Weather Map appearing in the daily press.

(ii) *The Daily Press Weather Map.* (*a*) *Pressure Gradient.* The distance between the isobars indicates the " pressure gradient ". The gradient is steeper when the isobars are closer together and flatter where the isobars are further apart.

There is a definite relation between the winds and isobars. The winds blow almost parallel to and slightly across the isobars from high to low pressure and clockwise around a "low" and anti-clockwise around a "high" (in the Southern Hemisphere), i.e. "In the Southern Hemisphere an observer standing with his back to the wind will have the lower pressure to his right". The angle at which the wind arrows cross the isobars is very variable. Over the land it averages about 30°, over the sea about 10°.

The winds are strongest where the pressure gradient is steepest or where the isobars are crowded together. In other words, the speed of the wind is proportional to the pressure gradient. The "gradient wind" speed estimated from the closeness of the isobars is found at a height of from 2,000 to 3,000 feet above the surface, and the following table shows the speed for straight isobars of intervals equal to two millibars (one millibar = 0.029 inches of mercury or 1,000 millibars = 29.53 inches).

WIND SPEED IN RELATION TO DISTANCE BETWEEN ISOBARS.

Distance between Isobars representing a pressure difference of 2 millibars.	Wind Speed (miles per hour).	
	Latitude 25°.	Latitude 35°.
Miles—		
180	20	15
110	34	25
75	50	37
55	70	55

If the curvature of the isobars is appreciable, the winds will be underestimated around "highs" and overestimated around "lows".

(*b*) *Isobaric Forms. Cyclones and Storms.* The "elements" in Australia are ordinarily peaceful, and while destructive cyclones have visited various parts, more especially coastal areas, such visitations are rare, and may be properly described as erratic.

During the winter months, the southern shores of the continent are subject to deep depressions of the southern low-pressure belt. They are felt most severely over the south-western parts of Western Australia, to the south-east of South Australia, in Bass Strait, including the coast-line of Victoria, and on the west coast of Tasmania. Apparently the more violent wind pressures from these disturbances are experienced in their northern half, or in that part of them which has a north-westerly to a south-westerly circulation.

The north-east coast of Queensland is occasionally visited by hurricanes from the north-east tropics. During the first four months of the year, these hurricanes appear to have their origin in the neighbourhood of the South Pacific Islands, their path being a parabolic curve first to the south-west and finally towards the south-east.

Very severe cyclones, locally known as "willy willies," are peculiar to the north-west coast of Western Australia from the months of November to April, inclusive. They usually originate over the ocean to the north or north-west of Australia, and travel in a south-westerly direction with continually increasing force, displaying their greatest energy near Cossack and Onslow, between latitudes 20° and 22° South. The winds in these storms, like those from the north-east tropics, are very violent and destructive. The greatest velocities are usually to be found in the south-eastern quadrant of the cyclones, with north-east to east winds. After leaving the north-west coast, these storms either travel southwards, following the coast-line, or cross the continent to the Great Australian Bight. When they take the latter course, their track is marked by torrential rains, as much as 29.41 inches, for example, being recorded in 24 hours at Whim Creek from one such occurrence. Falls of 10 inches and over have frequently been recorded in the northern interior of Western Australia from similar storms.

Some further notes on severe cyclones and on "southerly bursters", a characteristic feature of the eastern part of Australia, appear in previous issues of the Official Year Book (*see* No. 6, pp. 84–86), and a special article dealing with "Australian Hurricanes and Related Storms" appears in Official Year Book No. 16, pp. 80–84.

Depressions vary considerably in their isobaric forms, intensity and other characteristics. Some bring rain in variable quantities, some heat and others mainly wind. A common type in southern Australia is the " ∧ " shaped trough with an abrupt " backing " of the wind or " line squall " as it passes. The cold front is most frequently found through the centre of the " trough " because it is along this line, and extending into the upper levels of the atmosphere that the demarcation of different air masses is so well defined. The best rains occur in inland Australia when extensive masses of warm moist tropical air move into the interior and are forced to rise by convergence of flow or by impact with a cold air stream.

The speed of low pressure systems is very variable, but in general in southern latitudes, the movement is of the order of 500 to 700 miles per day.

Anticyclones. The anticyclone or " high " is usually distinguished by a series of closed isobars of roughly circular or oval form enclosing the region of highest pressure. They usually cover much larger areas than depressions and in a well-defined " high " the winds blow spirally outward with subsidence or sinking of stable air near the centre, where the winds are generally light and variable. Anticyclonic weather is usually regarded as quiet and settled, but actually considerable variations occur according to the activity of neighbouring " lows " and pressure gradients.

The most frequent interval between the passage of successive centres is five days. The general direction of movement is from west to east, but the speed is much slower than that of depressions, averaging in Australian regions about 400 miles per day, but occasionally accelerating, or, on the other hand, exhibiting an apparent retrograde movement.

In winter, the usual path is across the centre of the continent ; in summer, south of the southern coastline.

When the upper air temperatures in an anticyclone are low, that is, when the " high " is of little vertical depth, it usually travels more rapidly than one which is of greater depth and warm in its upper layers. A " wedge " or " tongue " of high pressure is an extension of an anticyclone between two " lows " and thus the opposite of the trough.

Waves of Low Pressure (or series of depressions). This type is frequently experienced in southern Australia in winter and spring. The passage of the waves from the west is accompanied by a " backing " of the wind from about north-west to south-west and " veering " to north-west again as the wave of low pressure passes. Each wind shift may be marked by rain squalls, the effect of which is intensified on the windward slopes of coastal hills.

(c) *Rain Areas.* These are depicted on the press chart by hatched areas and a continuous check on these rain areas from day to day will do much to explain the characteristics of the various wind-streams and cold and warm front precipitation.

Fundamentally, rain is produced by the uplift, and so cooling and condensation, of a moist air mass, by either one or all of the following ways :—(i) *Convection.* Uplift by heating from below. (ii) *Orographical.* Forced uplift due to elevated land barriers. (iii) *Convergence.*—The net result when more air flows into an area than flows out. The excess air will rise and flow outward aloft. There are two main causes—surface friction, which causes a flow of air at the surface from high to low pressure, and convergence in a region of falling pressure owing to a lack of perfect balance between wind and pressure gradients. (iv) *Frontal Rain.* One air mass may be forced to rise over another (warm air over cool air—warm frontal), or one air mass may be lifted by another (cold air lifting up warm air—cold frontal). The warm front is characterized by continuous precipitation (drizzle), the cold front by showery conditions and sometimes thunderstorms.

Two other important methods of condensation are :—(i) *Contact or Conduction Cooling.* Warm air flowing over a cold surface may cause fog or drizzle, occurring mainly on coastal lands in winter and adjacent sea areas in summer. (ii) *Radiation Cooling.* Under anticyclonic conditions this process of cooling may result in radiation fog.

17. **Influences affecting Australian Climate.**—(i) *General.* Australian history does not cover a sufficient period, nor is the country sufficiently occupied, to ascertain whether or not the advance of settlement has materially affected the climate as a whole. Local changes have, however, taken place, a fact which suggests that settlement and the treatment of the land have a distinct effect on local conditions. For example, low-lying lands on the north coast of New South Wales, which originally were seldom subject to frosts, have, with the denudation of the surrounding hills from forests, experienced annual visitations, the probable explanation being that through the absence of trees the cold air of the highlands now flows unchecked and untempered down the sides of the hills to the valleys and lower lands.

(ii) *Influence of Forest on Climate.* As already indicated, forests doubtless exercise a great influence on local climate, and hence, to the extent that forestal undertakings will allow, the weather can be controlled by human agency. The direct action of forests is an equalizing one; thus, especially in equatorial regions, and during the warmest portion of the year, they considerably reduce the mean temperature of the air. They also reduce the diurnal extremes of shade temperatures by altering the extent of radiating surface by evaporation, and by checking the movement of air, and while decreasing evaporation from the ground, they increase the relative humidity. Vegetation greatly diminishes the rate of flow-off of rain and the washing away of surface soil, and when a region is protected by trees, a steadier water supply is ensured, and the rainfall is better conserved. In regions of snowfall, the supply of water to rivers is similarly regulated, and without this and the sheltering influence of ravines and "gullies," watercourses supplied mainly by melting snow would be subject to alternative periods of flooding and dryness. This is borne out in the case of the inland rivers, the River Murray, for example, which has never been known to become dry, deriving its steadiness of flow mainly through the causes indicated.

(iii) *Direct Influence of Forests on Rainfall.* Whether forests have a direct influence on rainfall is a debatable question, some authorities alleging that precipitation is undoubtedly induced by forests, while others take the opposite view.

Sufficient evidence exists, however, to prove that, even if the rainfall has not increased, the beneficial climatic effect of forest lands more than warrants their protection and extension. Rapid rate of evaporation, induced by both hot and cold winds, injures crops and makes life uncomfortable on the plains, and, while it may be doubted that the forest aids in increasing precipitation, it must be admitted that it does check winds and the rapid evaporation due to them. Trees as wind-breaks have been successfully planted in central parts of the United States of America, and there is no reason why similar experiments should not be successful in many parts of the treeless interior of Australia. The belts should be planted at right angles to the direction of the prevailing parching winds, and if not more than half a mile apart will afford shelter to the enclosed areas.

18. **Rainfall and Temperatures, Various Cities.**—The Official Year Book No. 34, p. 28, shows rainfall and temperature for various important cities throughout the world, and for the Australian capitals.

19. **Climatological Tables.**—The averages and extremes for a number of climatological elements, which have been determined from long series of observations at the Australian capitals up to and including the year 1948, are given on pp. 64–70.

NOTE.—The following points apply throughout:—

(i) Where records are available, mean or average values have been calculated on a standard period of 30 years from 1911 to 1940.

(ii) Extreme values have been extracted from all available years of actual record, but the number of years quoted does not include intervening periods when observations were temporarily discontinued.

CLIMATOLOGICAL DATA: CANBERRA, AUSTRALIAN CAPITAL TERRITORY.

LAT. 35° 18′ S., LONG. 149° 06′ E. HEIGHT ABOVE M.S.L. 1,906 FT.

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

Month.	Bar. corrected to 32°F. Mn. Sea Level and Standard Gravity from 9 a.m. and 3 p.m. readings.	Wind. (Height of Anemometer 20 feet.) Average Miles per Hour.	Highest Mean Speed in One Day. (m.p.h.)	Highest Gust Speed (miles per hour).	Prevailing Direction. 9 a.m.	Prevailing Direction. 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days of Lightning.	Mean Amount of Clouds, 9 a.m. and 3 p.m.(a)	No. of Clear Days.
No. of years of observations.	18	20	20	(b)	21	21	20	12	18	18
January ..	29.835	5.1	14.9 23/33	—	NW	NW	8.84	1.0	4.7	7.3
February ..	29.901	4.5	15.3 24/33	—	E	NW	6.95	2.9	4.7	6.5
March ..	30.009	4.2	18.2 28/42	—	E	NW	5.58	0.0	4.9	6.8
April ..	30.066	3.9	18.6 8/45	—	NW	NW	3.41	0.4	5.4	4.4
May	30.158	3.2	12.6 3/30	—	NW	NW	2.08	0.1	5.3	5.7
June	30.141	3.8	16.1 2/30	—	NW	NW	1.33	0.1	6.0	4.3
July	30.121	3.6	23.4 7/31	—	NW	NW	1.33	0.0	5.5	4.9
August ..	30.064	4.4	15.7 25/36	—	NW	NW	1.88	0.1	5.4	5.0
September ..	30.038	4.8	17.4 28/34	—	NW	NW	3.09	0.5	5.0	5.9
October ..	29.969	4.6	12.4 27/40	—	NW	NW	4.79	0.7	5.1	5.4
November ..	29.899	5.0	17.2 28/42	—	NW	NW	6.19	1.3	5.5	4.2
December ..	29.837	5.1	16.1 11/38	—	NW	NW	7.99	1.1	5.1	5.5
Year Totals ..	—	—	—	—	—	—	53.46	8.2	—	65.9
Year Averages	30.003	4.3	—	—	NW	NW	—	—	5.3	—
Year Extremes	—	—	23.4 7/7/31	—	—	—	—	—	—	—

(a) Scale 0–10. (b) No record.

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (°Fahr.). Mean Max.	Mean Min.	Mean	Extreme Shade Temperature (°Fahr.). Highest.	Lowest.	Extreme Range.	Extreme Temperature (°Fahr.). Highest in Sun.	Lowest on Grass.	Mean Daily Hours of Sunshine.
No. of years over which observation extends.	21	21	21	21	21	21	(a)	21	19
January	82.8	56.2	69.5	107.4 11/39	39.5 8/38	67.9	—	32.4 (b)	8.1
February ..	81.3	56.1	68.7	99.8 13/33	35.0 (c)	64.8	—	26.5 23/43	7.6
March	76.1	52.2	64.1	99.1 6/38	36.5 21/32	62.6	—	26.4 26/35	7.3
April	66.5	45.2	55.9	89.7 6/38	29.0 29/34	60.7	—	19.0 18/44	6.6
May	59.6	38.7	49.2	72.6 1/36	22.5 9/29	50.1	—	15.6 (d)	5.2
June	52.5	35.2	43.8	61.0 (e)	18.1 20/35	42.9	—	8.9 25/44	4.3
July	51.7	33.6	42.7	63.5 16/34	20.0 (f)	43.5	—	10.8 9/37	4.8
August	55.1	35.5	45.3	70.5 28/34	21.0 3/29	49.5	—	10.1 6/44	5.8
September	61.2	38.9	50.1	81.5 16/34	25.2 6/46	56.3	—	13.0 6/45	7.2
October	67.6	44.0	55.8	90.0 13/46	29.0 24/28	61.0	—	18.2 2/45	7.8
November	73.7	49.3	61.5	101.4 19/44	32.2 11/36	69.2	—	25.9 6/40	7.9
December	79.7	53.6	66.7	103.5 27/38	36.0 24/28	67.5	—	30.2 (g)	8.1
Year Averages ..	67.3	44.9	56.1	—	—	—	—	—	6.7
Year Extremes ..	—	—	—	107.4 11/1/39	18.1 20/6/35	89.3	—	8.9 25/6/44	—

(a) No record. (b) 8/38 and 18/43. (c) 22 and 23/31. (d) 13/37 and 15/46. (e) 3/27 and 28/30. (f) 19/29, 9/37 and 27/43. (g) 2/39 and 20/48.

HUMIDITY, RAINFALL AND FOG.

Month.	Vapour Pressure (inches) Mean 9 a.m.	Rel. Hum. (%) at 9 a.m. Mean.	Highest Mean.	Lowest Mean.	Rainfall (inches). Mean Monthly.	Mean No. of Days of Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Fog. Mean No. of Days of Fog.
No. of years over which observation extends.	20	20	20	20	21	21	21	21	21	17
January	0.372	53	69	39	2.15	7	6.69 1941	0.02 1932	2.03 20/37	0.0
February	0.390	57	71	40	2.12	6	6.03 1948	0.01 1933	3.24 17/28	0.0
March	0.372	65	76	48	1.79	6	5.22 1932	0.01 1940	1.82 15/32	0.3
April	0.316	71	81	54	2.16	7	3.75 1935	0.07 1942	2.52 9/45	0.7
May	0.253	79	87	67	1.70	7	6.13 1948	0.06 1935	3.88 3/48	4.0
June	0.214	82	90	72	1.68	9	6.09 1931	0.18 1944	1.65 24/31	5.4
July	0.198	81	87	73	1.55	10	4.09 1933	0.27 1940	2.02 13/33	4.6
August	0.211	75	88	60	1.97	11	4.71 1939	0.36 1944	2.07 12/29	1.8
September	0.234	65	72	51	1.50	9	3.03 1937	0.13 1946	1.75 3/47	0.8
October	0.270	59	72	46	2.30	10	6.59 1934	0.34 1940	2.51 25/34	0.2
November	0.304	54	67	38	1.97	8	4.32 1946	0.28 1936	1.78 7/27	0.1
December	0.340	51	70	37	2.02	8	8.80 1947	0.16 1938	2.29 28/29	0.0
Year Totals ..	—	—	—	—	22.91	98	—	—	—	17.9
Year Averages	0.275	66	—	—	—	—	—	—	—	—
Year Extremes ..	—	—	90	37	—	—	8.80 12/47	0.01 2/33,3/40	3.88 3/5/48	—

CLIMATOLOGICAL DATA : PERTH, WESTERN AUSTRALIA.

LAT. 31° 57′ S., LONG. 115° 51′ E. HEIGHT ABOVE M.S.L. 210 FT.

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

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 9 a.m. and 3 p.m. readings.	Wind. (Height of Anemometer 71 feet.) Average Miles per Hour.	Highest Mean Speed in One Day. (m.p.h.)	Highest Gust Speed (miles per hour).	Prevailing Direction 9 a.m.	Prevailing Direction 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days of Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m., 9 p.m.(a)	No. of Clear Days.
No. of years of observations.	30(b)	30(b)	50	36	30(b)	30(b)	30(b)	30(b)	30(b)	30(b)
January ..	29.897	13.8	33.2 27/98	49	E	SSW	10.37	2	2.9	14
February ..	29.922	13.5	27.1 6/08	50	ENE	SSW	8.63	2	3.1	13
March ..	29.976	12.8	27.1 6/13	66	E	SSW	7.52	2	3.5	12
April	30.071	10.7	39.8 25/00	61	ENE	SSW	4.62	2	4.2	9
May	30.062	10.6	34.4 29/32	73	NE	WSW	2.80	3	5.4	6
June	30.068	10.6	38.1 17/27	80	N	NW	1.82	2	5.9	5
July	30.082	11.2	42.3 20/26	73	NNE	W	1.76	2	5.6	5
August ..	30.084	11.8	40.3 15/03	77	N	WNW	2.37	2	5.6	6
September ..	30.073	11.8	36.0 11/05	75	ENE	SSW	3.44	1	4.9	8
October ..	30.033	12.6	33.7 6/16	61	SE	SW	5.38	1	4.8	8
November ..	29.989	13.4	32.4 18/97	63	E	SW	7.65	2	3.9	9
December ..	20.023	13.9	32.3 6/22	64	E	SSW	9.69	2	3.2	13
Year Totals ..	—	—	—	—	—	—	66.05	23	—	108
Year Averages	30.015	12.2	—	—	E	SSW	—	—	4.4	—
Year Extremes	—	—	42.3 20/7/26	80	—	—	—	—	—	—

(a) Scale 0–10. (b) Standard 30 years' normal (1911–1940).

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (°Fahr.). Mean Max.	Mean Min.	Mean	Extreme Shade Temperature (°Fahr.). Highest.	Lowest.	Extreme Range.	Extreme Temperature (°Fahr.). Highest in Sun.	Lowest on Grass.	Mean Daily Hours of Sunshine.
No. of years over which observation extends.	30(a)	30(a)	30(a)	52	52	52	50	50	30(a)
January	84.6	63.3	73.9	110.2 12/34	48.6 20/25	61.6	177.3 22/14	39.5 20/25	10.4
February	85.1	63.5	74.3	112.2 8/33	47.7 1/02	64.5	173.7 4/34	39.8 1/13	9.8
March	81.3	61.5	71.4	106.4 14/22	45.8 8/03	60.6	167.0 19/18	36.7 8/03	8.8
April	76.3	57.4	66.8	99.7 9/10	39.3 20/14	60.4	157.0 8/16	31.0 20/14	7.5
May	69.0	52.8	60.9	90.4 2/07	34.3 11/14	56.1	146.0 4/25	25.3 11/14	5.7
June	64.4	49.8	57.1	81.7 2/14	35.0 30/20	46.7	135.5 9/14	26.3 11/37	4.8
July	62.8	48.0	55.4	76.4 21/21	34.2 7/16	42.2	133.2 13/15	25.1 30/20	5.4
August	63.8	48.4	56.1	82.0 21/40	35.3 31/08	46.7	145.1 29/21	26.7 24/35	6.0
September	66.8	50.4	58.6	90.9 30/18	38.5 15/47	52.4	153.6 29/16	29.2 21/16	7.2
October	69.7	52.6	61.1	95.3 30/22	40.0 16/31	55.3	157.5 31/36	29.8 16/31	8.1
November	76.7	57.3	67.0	104.6 24/13	42.0 1/04	62.6	167.0 30/25	35.5 (b)	9.6
December	81.2	60.0	71.0	107.9 20/04	48.0 2/10	59.9	168.8 11/27	39.0 12/20	10.4
Year Averages ..	73.5	55.5	64.5	—	—	—	—	—	7.8
Year Extremes ..	—	—	—	112.2 8/2/33	34.2 7/7/16	78.0	177.3 22/1/14	25.1 30/7/20	—

(a) Standard 30 years' normal (1911–1940). (b) 6/10 and 14/12.

HUMIDITY, RAINFALL AND FOG.

Month.	Vapour Pressure (inches) Mean 9 a.m.	Rel. Hum. (%) at 9 a.m. Mean.	Highest Mean.	Lowest Mean.	Rainfall (inches). Mean Monthly.	Mean No. of Days of Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Fog. Mean No. of Days of Fog.
No. of years over which observation extends.	30(a)	30(a)	52	52	30(a)	30(a)	73	73	73	30(a)
January	0.438	51	61	41	0.33	3	2.17 1879	Nil (b)	1.74 27/79	0
February	0.434	51	65	43	0.50	3	2.98 1915	Nil (b)	1.63 26/15	0
March	0.432	57	66	46	0.90	5	5.71 1934	Nil (b)	3.03 9/34	0
April	0.397	61	73	51	1.75	8	5.85 1926	Nil 1920	2.62 30/04	1
May	0.365	70	81	61	5.14	15	12.13 1879	0.98 1903	3.00 17/42	2
June	0.337	75	83	68	7.55	17	18.75 1945	2.16 1877	3.90 10/20	2
July	0.322	76	84	69	7.08	19	12.28 1926	2.42 1876	3.00 4/81	2
August	0.316	71	81	62	5.78	19	12.53 1945	0.46 1902	2.91 14/45	1
September	0.341	66	75	58	3.37	15	7.84 1923	0.34 1916	1.82 4/31	0
October	0.345	60	75	52	2.30	12	7.87 1890	0.15 1946	1.73 3/33	0
November	0.374	52	63	41	0.75	7	2.78 1916	Nil 1891	1.40 15/48	0
December	0.409	51	63	44	0.54	5	3.05 1888	Nil (c)	1.72 1/88	0
Year Totals ..	—	—	—	—	35.99	128	—	—	—	8
Year Averages ..	0.370	62	—	—	—	—	—	—	—	—
Year Extremes ..	—	—	84	41	—	—	18.75 6/1945	Nil Various months	3.90 10/6/20	—

(a) Standard 30 years' normal (1911–1940). (b) Various years. (c) 1886 and 1924.

CLIMATOLOGICAL DATA : ADELAIDE, SOUTH AUSTRALIA.

LAT. 34° 56′ S., LONG. 138° 35′ E. HEIGHT ABOVE M.S.L. 140 FT.

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

Month.	Bar. corrected to 32° F, Mn. Sea Level and Standard Gravity from 9 a.m. and 3 p.m. readings.	Wind. (Height of Anemometer 75 feet.) Average Miles per Hour.	Highest Mean Speed in One Day. (m.p.h.)	Highest Gust Speed (miles per hour).	Prevailing Direction. 9 a.m.	Prevailing Direction. 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days of Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m., 9 p.m.(a)	No. of Clear Days.
No. of years of observations.	30(b)	30(b)	71	32	30(b)	30(b)	30(b)	30(b)	30(b)	30(b)
January ..	29.917	9.9	31.6 19/99	72	SW	SW	9.27	2.3	3.6	12.9
February ..	29.953	8.8	28.8 22/96	64	NE	SW	7.56	2.0	3.7	11.2
March ..	30.037	8.3	26.2 9/12	63	S	SW	6.39	1.8	4.0	10.6
April	30.119	8.0	32.2 10/96	81	NE	SW	3.78	1.5	5.2	7.2
May	30.131	8.1	31.7 9/80	63	NE	NW	2.27	1.3	5.8	4.9
June	30.119	8.3	31.3 12/78	67	NE	N	1.37	1.3	6.1	4.1
July	30.111	8.5	28.1 25/82	60	NE	NW	1.34	1.5	6.0	4.3
August ..	30.084	9.2	32.2 31/97	57	NE	SW	1.99	2.0	5.5	5.6
September ..	30.050	9.2	30.0 2/87	69	NNE	SW	3.05	2.0	5.3	5.8
October ..	30.007	9.8	32.0 28/98	69	NNE	SW	5.03	2.8	5.3	5.7
November ..	29.990	9.9	32.2 7/48	79	SW	SW	6.89	3.3	4.9	7.2
December ..	29.922	9.9	28.1 12/91	75	SW	SW	8.74	2.2	4.2	9.5
Year Totals ..	—	—	—	—	—	—	57.68	24.0	—	89.0
Year Averages	30.037	9.0	—	—	NE	SW	—	—	5.0	—
Year Extremes	—	—	32.2 (c)	81	—	—	—	—	—	—

(a) Scale 0–10. (b) Standard 30 years' normal (1911–1940). (c) 10/4/1896, 31/8/1897 and 7/11/1948.

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (°Fahr.) Mean Max.	Mean Min.	Mean	Extreme Shade Temperature (°Fahr.). Highest.	Lowest.	Extreme Range.	Extreme Temperature (°Fahr.). Highest in Sun.	Lowest on Grass.	Mean Daily Hours of Sunshine.
No. of years over which observation extends.	30(a)	30(a)	30(a)	92	92	92	54(b)	88	30(a)
January	84.8	61.0	72.9	117.7 12/39	45.1 21/84	72.6	180.0 18/82	36.5 14/79	10.0
February	85.7	61.8	73.7	113.6 12/99	45.5 23/18	68.1	170.5 10/00	35.8 23/26	9.3
March	81.3	59.1	70.2	110.5 9/34	43.9 21/33	66.6	174.0 17/83	32.1 21/33	7.9
April	73.0	54.4	63.7	98.6 5/38	39.6 15/59	59.0	155.0 1/83	30.2 16/17	6.0
May	66.8	50.8	58.8	89.5 4/21	36.9 (c)	52.6	148.2 12/79	25.6 19/28	4.8
June	61.0	46.6	53.8	76.0 23/65	32.5 (d)	43.5	138.8 18/79	21.0 24/44	4.2
July	59.9	45.4	52.7	74.0 11/06	32.0 24/08	42.0	134.5 26/90	22.1 30/29	4.3
August	62.3	46.2	54.3	85.0 31/11	32.3 17/59	52.7	140.0 31/92	22.8 11/29	5.4
September	66.8	48.3	57.5	91.3 29/44	32.7 4/58	58.6	160.5 23/82	25.0 25/27	6.3
October	72.5	51.7	62.1	102.9 21/22	36.0 —/57	66.9	162.0 30/21	27.8 (e)	7.3
November	78.1	55.4	66.7	113.5 21/65	40/8 2/09	72.7	166.9 20/78	31.5 2/09	8.6
December	82.6	58.9	70.7	114.6 29/31	43.0 (f)	71.6	175.7 7/99	32.5 4/84	9.5
Year Averages ..	72.9	53.3	63.1	—	—	—	—	—	7.0
Year Extremes ..	—	—	—	117.7 12/1/39	32.0 24/7/08	85.7	180.0 18/1/82	21.0 24/6/44	—

(a) Standard 30 years' normal (1911–1940). (b) Records incomplete, 1931–34. Discontinued, 1934. (c) 26/1895. (d) 27/1876 and 24/1944. (e) 4/1931 and 2/1918. (f) 16/1861 and 4/1906.

HUMIDITY, RAINFALL AND FOG.

Month.	Vapour Pressure (inches) Mean 9 a.m.	Rel. Hum. (%) 9 a.m. Mean.	Highest Mean.	Lowest Mean.	Rainfall (inches). Mean Monthly.	Mean No. of Days of Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Fog. Mean No. of Days of Fog.
No. of years over which observation extends.	30(a)	30(a)	81	81	30(a)	30(a)	110	110	110	30(a)
January	0.327	39	59	29	0.76	5	4.00 1850	Nil (b)	2.30 2/89	0.0
February	0.352	41	56	30	1.10	5	6.09 1925	Nil (b)	5.57 7/25	0.0
March	0.332	44	58	29	0.87	5	4.60 1878	Nil (b)	3.50 5/78	0.0
April	0.329	55	72	37	1.45	10	6.78 1853	Nil 1945	3.15 5/60	0.0
May	0.313	64	76	49	2.49	13	7.75 1875	0.10 1934	2.75 1/53	0.6
June	0.294	75	84	67	2.93	15	8.58 1916	0.42 1886	2.11 1/20	1.1
July	0.282	75	87	66	2.49	16	5.38 1865	0.37 1899	1.75 10/65	1.4
August	0.282	68	78	54	2.58	16	6.24 1852	0.33 1944	2.23 19/51	0.4
September	0.289	59	72	44	2.39	13	5.83 1923	0.45 1896	1.59 20/23	0.2
October	0.287	48	67	29	1.54	10	4.38 1948	0.17 1914	2.24 16/08	0.0
November	0.292	41	57	31	1.22	8	4.10 1934	0.04 1885	2.08 7/34	0.0
December	0.322	40	50	31	1.27	6	3.98 1861	Nil 1904	2.42 23/13	0.0
Year Totals ..	—	—	—	—	21.09	122	—	—	—	3.7
Year Averages ..	0.304	52	—	—	—	—	—	—	—	—
Year Extremes ..	—	—	87	29	—	—	8.58 6/1916	Nil (c)	5.57 7/2/25	—

(a) Standard 30 years' normal (1911–1940). (b) Various years. (c) December to April, various years.

CLIMATOLOGICAL DATA : BRISBANE, QUEENSLAND.

LAT. 27° 28′ S., LONG. 153° 2′ E. HEIGHT ABOVE M.S.L. 134 FT.

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

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 9 a.m. and 3 p.m. readings.	Wind. (Height of Anemometer 105 feet.) Average Miles per Hour.	Highest Mean Speed in One Day. (m.p.h.)	Highest Gust Speed (miles per hour).	Prevailing Direction. 9 a.m.	Prevailing Direction. 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days of Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m., 9 p.m.(a)	No. of Clear Days.
No. of years of observations.	30(b)	30(b)	34	34	30(b)	30(b)	30(b)	30(b)	30(b)	30(b)
January ..	29.865	6.8	19.7 23/47	51	SE	NE	6.74	9.8	5.7	3.5
February ..	29.912	7.0	21.0 5/31	67	SE	NE	5.49	6.5	5.6	2.4
March ..	29.975	6.5	20.3 1/29	50	S	E	5.05	5.9	5.1	5.4
April ..	30.035	5.9	16.7 3/25	57	S	E	4.05	5.0	4.3	7.8
May	30.083	5.8	17.9 17/26	48	SW	SE	3.09	4.1	4.3	8.3
June	30.091	5.7	19.0 14/28	58	SW	W & SW	2.45	2.9	4.4	9.2
July	30.090	5.6	15.0 2/23	52	SW	W & SW	2.69	2.8	3.8	12.4
August ..	30.105	5.8	14.8 4/35	56	SW	NE	3.51	3.8	3.1	13.1
September ..	30.067	5.9	16.1 1/48	57	SW	NE	4.51	5.8	3.3	13.0
October ..	30.019	6.3	15.7 1/41	62	S	NE	5.81	7.1	4.2	8.5
November ..	29.958	6.7	15.5 10/28	59	SE & N	NE	6.32	9.5	4.9	5.9
December ..	29.890	7.0	19.5 15/26	79	SE	NE	7.02	10.6	5.3	3.8
Year Totals ..	—	—	—	—	—	—	56.73	73.8	—	93.3
Year Averages	30.007	6.3	—	—	SW	NE	—	—	4.5	—
Year Extremes	—	—	21.0 5/2/31	79	—	—	—	—	—	—

(a) Scale 0–10. (b) Standard 30 years' normal (1911–1940).

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (°Fahr.). Mean Max.	Mean Min.	Mean	Extreme Shade Temperature (°Fahr.). Highest.	Lowest.	Extreme Range.	Extreme Temperature (°Fahr.). Highest in Sun.	Lowest on Grass.	Mean Daily Hours of Sunshine.
No. of years over which observation extends.	30(a)	30(a)	30(a)	62	62	62	50(b)	62	30(a)
January	85.5	69.1	77.3	109.8 26/40	58.8 4/93	51.0	169.0 2/37	49.9 4/93	7.6
February	84.6	68.7	76.6	105.7 21/25	58.5 23/31	47.2	165.2 6/10	49.1 22/31	7.4
March	82.3	66.2	74.3	99.4 5/19	52.4 29/13	47.0	162.5 6/39	45.4 29/13	7.0
April	79.1	61.5	70.3	95.2 (c)	44.4 25/25	50.8	153.8 11/16	36.7 24/25	7.1
May	73.7	55.6	64.7	90.3 21/23	41.3 24/99	49.0	147.0 1/10	29.8 8/97	6.6
June	69.4	51.5	60.5	88.9 19/18	36.3 29/08	52.6	136.0 3/18	25.4 23/88	6.3
July	68.6	49.4	59.0	84.3 23/46	36.1 (d)	48.2	146.1 20/15	23.9 11/90	6.8
August	71.1	50.0	60.6	91.0 14/46	37.4 6/87	53.6	141.9 20/17	27.1 9/99	7.9
September ..	75.5	54.8	65.1	100.9 22/43	40.7 1/96	60.2	155.5 26/03	30.4 1/89	8.2
October	79.2	60.3	69.8	101.4 18/93	43.3 3/99	58.1	157.4 31/18	34.9 8/89	8.4
November	82.3	64.6	73.4	106.1 18/13	48.5 2/05	57.6	162.3 7/89	38.8 1/05	8.2
December	84.5	67.5	76.0	105.9 26/93	56.4 13/12	49.5	165.9 28/42	49.1 3/94	8.2
Year Averages ..	78.0	59.9	69.0	—	—	—	—	—	7.5
Year Extremes ..	—	—	—	109.8 26/1/40	36.1 (d)	73.7	169.0 2/1/37	23.9 11/7/90	—

(a) Standard 30 years' normal (1911–1940). (b) From 1887 to March, 1947, excluding 1927 to 1936.
(c) 9/1896 and 5/1903. (d) 12/7/1894 and 2/7/1896.

HUMIDITY, RAINFALL AND FOG.

Month.	Vapour Pressure (inches). Mean 9 a.m.	Rel. Hum. (%) at 9 a.m. Mean.	Highest Mean.	Lowest Mean.	Rainfall (inches). Mean Monthly.	Mean No. of Days of Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Fog. Mean No. of Days of Fog.
No. of years over which observation extends.	30(a)	30(a)	62	62	30(a)	30(a)	97	97(b)	97	30(a)
January	0.636	66	79	53	5.72	12	27.72 1895	0.32 1919	18.31 21/87	0.6
February	0.644	69	82	55	5.47	12	40.39 1893	0.58 1849	10.61 6/31	0.9
March	0.606	72	85	56	4.97	14	34.04 1870	Nil 1849	11.18 14/08	1.6
April	0.512	71	80	56	3.68	11	15.28 1867	0.04 1944	5.46 5/33	4.0
May	0.420	71	85	59	2.35	9	13.85 1876	Nil 1846	5.62 9/79	5.4
June	0.357	73	84	54	2.75	8	14.03 1873	Nil 1847	6.41 15/48	4.5
July	0.331	71	81	53	1.88	8	8.46 1889	Nil 1841	3.54 (c)	4.9
August	0.338	67	80	55	1.07	7	14.67 1879	Nil (d)	4.89 12/87	5.9
September ..	0.396	62	76	47	1.69	7	5.43 1886	0.10 1907	2.46 2/94	2.8
October	0.459	59	72	48	2.27	8	9.99 1882	0.14 1900	3.75 3/27	1.6
November	0.533	61	72	45	4.00	10	12.40 1917	Nil 1842	4.46 16/86	0.7
December	0.589	62	70	51	4.24	11	17.36 1942	0.35 1865	6.60 28/71	0.4
Year Totals ..	—	—	—	—	40.09	117	—	—	—	33.3
Year Averages ..	0.485	67	—	—	—	—	—	—	—	—
Year Extremes ..	—	—	85	45	—	—	40.39 2/1893	Nil (e)	18.31 21/1/87	—

(a) Standard 30 years' normal (1911–1940). (b) Records incomplete for various years between 1846 and 1859. (c) 15/1876 and 16/1889. (d) 1862, 1869, 1880. (e) Various months in various years.

CLIMATOLOGICAL DATA : SYDNEY, NEW SOUTH WALES.

LAT. 33° 52′ S., LONG. 151° 12′ E. HEIGHT ABOVE M.S.L. 138 FT.

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

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 9 a.m. and 3 p.m. readings.	Wind. (Height of Anemometer 58 feet.) Average Miles per Hour.	Highest Mean Speed in One Day. (m.p.h.)	Highest Gust Speed (miles per hour).	Prevailing Direction. 9 a.m.	Prevailing Direction. 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days of Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m., 9 p.m.(a)	No. of Clear Days.
No. of years of observations.	30(b)	26(c)	35 (d)	29(e)	26(c)	26(c)	26(c)	20(f)	30(b)	30(b)
January ..	29.875	8.9	24.9 2/22	63	S	ENE	5.71	5.9	5.7	4.8
February ..	29.942	8.1	20.1 14/18	61	NE	ENE	4.68	4.1	5.5	5.4
March ..	30.009	7.5	20.7 10/44	58	W	ENE	4.05	3.5	5.3	5.8
April	30.063	7.0	23.4 19/27	72	W	NE	2.91	2.9	5.0	7.0
May	30.098	6.8	19.6 2/26	63	W	S	2.17	1.8	4.9	7.4
June	30.078	7.1	24.5 17/14	67	W	W	1.61	1.7	4.8	8.3
July ..	30.070	7.2	26.6 6/31	68	W	W	1.69	1.5	4.5	10.1
August ..	30.060	7.4	24.0 3/21	68	W	NE	2.30	2.6	3.9	11.1
September ..	30.018	8.0	22.3 19/17	70	W	NE	3.00	3.1	4.2	10.0
October ..	29.976	8.2	21.1 18/44	95	W	ENE	4.17	4.5	4.9	7.4
November ..	29.935	8.5	22.6 14/30	71	W & E	ENE	4.97	5.0	5.5	5.7
December ..	29.881	8.9	24.9 10/20	75	S	ENE	5.64	6.3	5.8	4.8
Year Totals ..	—	—	—	—	—	—	42.90	42.9	—	87.8
Year Averages	30.000	7.8	—	—	W	NE	—	—	5.0	—
Year Extremes	—	—	26.6 6/7/31	95	—	—	—	—	—	—

(a) Scale 0–10. (b) Standard 30 years' normal (1911–1940). (c) 1915–1940. (d) 1914–1948. (e) 1917–1948. (f) 1921–1940.

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (°Fahr.). Mean Max.	Mean Min.	Mean	Extreme Shade Temperature (°Fahr.). Highest.	Lowest.	Extreme Range.	Extreme Temperature (°Fahr.). Highest in Sun.	Lowest on Grass.	Mean Daily Hours of Sunshine.
No. of years over which observation extends.	30(a)	30(a)	30(a)	90	90	90	84	90	20(b)
January	78.6	65.1	71.8	113.6 14/39	51.2 14/65	62.4	164.3 26/15	43.7 6/25	7.4
February	78.7	65.5	72.1	107.8 8/26	49.3 28/63	58.5	168.3 14/39	42.8 22/33	7.3
March	76.6	62.9	69.8	102.6 3/69	48.8 14/86	53.8	158.3 10/26	39.9 17/13	6.5
April	72.0	57.7	64.9	91.4 1/36	44.6 27/64	46.8	144.1 10/77	33.3 24/09	6.0
May	67.0	52.4	59.7	86.0 1/19	40.2 22/59	45.8	129.7 1/96	29.3 25/17	5.7
June	62.8	48.1	55.5	80.4 11/31	35.7 22/32	44.7	125.5 2/23	28.0 22/32	5.4
July	61.8	46.4	54.1	78.3 22/26	33.9 12/90	42.4	124.7 19/77	24.0 4/93	6.1
August	64.3	47.6	56.0	82.8 12/46	36.8 3/72	46.0	149.0 30/78	26.1 4/09	7.0
September	68.3	51.4	59.9	92.3 27/19	40.4 15/59	51.9	142.2 12/78	30.1 17/05	7.3
October	71.7	55.9	63.8	99.4 4/42	42.2 6/27	57.2	152.2 20/33	32.7 9/05	7.5
November	74.5	59.8	67.1	104.5 6/46	45.8 1/05	61.3	158.5 28/99	36.0 6/06	7.7
December	76.9	63.2	70.1	107.5 31/04	48.4 3/24	59.1	164.5 27/89	41.4 3.24	7.3
Year Averages ..	71.1	56.3	63.7	—	—	—	—	—	6.8
Year Extremes ..	—	—	—	113.6 14/1/39	35.7 22/6/32	77.9	168.3 14/2/39	24.0 4/7/93	—

(a) Standard 30 years' normal (1911–1940). (b) 1921–1940 (different exposure prior to 1921).

HUMIDITY, RAINFALL AND FOG.

Month.	Vapour Pressure (inches) Mean 9 a.m.	Rel. Hum. (%) at 9 a.m. Mean.	Highest Mean.	Lowest Mean.	Rainfall (Inches). Mean Monthly.	Mean No. of Days of Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Fog. Mean No. of Days of Fog.
No. of years over which observation extends.	30(a)	30(a)	73	73	30(a)	30(a)	90	90	90	20(b)
January	0.537	65	78	58	3.86	13	15.26 1911	0.25 1932	7.08 13/11	0.5
February	0.560	68	81	60	3.15	12	18.56 1873	0.12 1939	8.90 25/73	0.9
March	0.527	71	85	62	4.44	13	20.52 1942	0.42 1876	11.05 28/42	2.1
April	0.441	73	87	63	5.65	14	24.49 1861	0.06 1868	7.52 29/60	2.9
May	0.362	75	90	63	4.98	12	23.03 1919	0.18 1860	8.36 28/89	4.5
June	0.303	76	89	65	3.68	11	16.30 1885	0.19 1904	5.17 16/84	4.4
July	0.282	74	88	63	4.89	12	13.21 1900	0.10 1946	7.80 7/31	3.3
August	0.288	68	84	54	2.41	10	14.89 1899	0.04 1885	5.33 2/60	2.9
September	0.325	62	79	49	2.77	11	14.05 1879	0.08 1882	5.69 10/79	0.9
October	0.378	60	77	46	2.80	11	11.13 1916	0.21 1867	6.37 13/02	0.7
November	0.433	60	79	42	2.54	11	9.88 1865	0.07 1915	4.23 19/00	0.7
December	0.501	63	77	51	3.63	13	15.82 1920	0.23 1913	4.75 13/10	0.3
Year Totals ..	—	—	—	—	44.80	143	—	—	—	24.1
Year Averages ..	0.393	68	—	—	—	—	—	—	—	—
Year Extremes ..	—	—	90	42	—	—	24.49 4/1861	0.04 8/1885	11.05 28/3/42	—

(a) Standard 30 years' normal (1911–1940). (b) 1921–1940.

CLIMATOLOGICAL DATA : MELBOURNE, VICTORIA.

LAT. 37° 49′ S., LONG. 144° 58′ E. HEIGHT ABOVE M.S.L. 114 FT.

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

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 9 a.m. and 3 p.m. readings.	Wind. (Height of Anemometer 93 feet.) Average Miles per Hour.	Highest Mean Speed in One Day. (m.p.h.)	Highest Gust Speed (miles per hour).	Prevailing Direction. 9 a.m.	Prevailing Direction. 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days of Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m., 9 p.m.(a)	No. of Clear Days.
No. of years of observations.	30(b)	9(c)	36	25	30	30	30(b)	30(b)	30(b)	30(b)
January ..	29.097	8.8	21.1 27/41	66	S & SW	S	6.55	1.8	4.9	6.8
February ..	29.950	8.3	19.0 13/47	66	N & S	S	5.10	2.3	4.8	6.4
March ..	30.025	7.9	16.5 (d)	66	N	S	4.26	1.8	5.3	5.5
April	30.092	7.3	19.9 16/43	67	N	S	2.53	1.2	5.9	4.6
May	30.113	7.5	20.0 4/44	72	N	N	1.57	0.5	6.1	3.4
June	30.097	7.7	22.8 16/47	60	N	N	1.18	0.4	6.5	2.7
July	30.079	8.9	20.9 9/44	68	N	N	1.16	0.3	6.3	2.9
August ..	30.048	8.4	21.3 20/42	64	N	N	1.54	0.9	6.0	3.1
September ..	30.001	8.6	18.3 6/48	69	N & W	N & S	2.41	1.3	5.9	3.3
October ..	29.968	8.3	16.4 22/48	69	N	S	3.54	1.8	6.1	3.8
November ..	29.951	8.4	17.5 8/48	65	S & SW	S	4.62	2.3	6.0	3.6
December ..	29.896	8.6	18.9 1/34	61	S & SW	S	5.85	1.9	5.6	4.5
Year Totals ..	—	—	—	—	—	—	40.31	16.5	—	50.6
Year Averages	30.010	8.2	—	—	N	S	—	—	5.8	—
Year Extremes	—	—	22.8 16/6/47	72	—	—	—	—	—	—

(a) Scale 0–10. (b) Standard 30 years' normal (1911–1940). (c) Early records not comparable.
(d) 22/31 and 3/41.

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (°Fahr.). Mean Max.	Mean Min.	Mean	Extreme Shade Temperature (°Fahr.). Highest.	Lowest.	Extreme Range.	Extreme Temperature (°Fahr.). Highest in Sun.	Lowest on Grass.	Mean Daily Hours of Sunshine.
No. of years over which observation extends.	30(a)	30(a)	30(a)	93	93	93	86(b)	89	25(c)
January	77.7	56.9	67.3	114.1 13/39	42.0 28/85	72.1	178.5 14/62	30.2 28/85	7.6
February	78.6	58.0	68.3	109.5 7/01	40.2 24/24	69.3	167.5 15/70	30.9 6/91	7.4
March	74.9	55.2	65.1	107.0 11/40	37.1 17/84	69.9	164.5 1/68	28.9 (d)	6.7
April	67.9	50.8	59.3	94.8 5/38	34.8 24/88	60.0	152.0 8/61	25.0 23/97	5.0
May	62.0	46.9	54.5	83.7 7/05	29.9 29/16	53.8	142.6 2/59	21.1 26/16	4.1
June	56.8	43.8	50.3	72.2 1/07	28.0 11/66	44.2	129.0 11/61	19.9 30/29	3.5
July	56.2	42.6	49.4	69.3 22/26	27.0 21/69	42.3	125.8 27/80	20.5 12/03	3.8
August	58.7	43.7	51.2	77.0 20/85	28.3 11/63	48.7	137.4 29/69	21.3 14/02	4.6
September	63.3	46.0	54.7	88.6 28/28	31.0 3/40	57.6	142.1 20/67	22.8 8/18	5.5
October	67.9	48.7	58.3	98.4 24/14	32.1 3/71	66.3	154.3 28/68	24.8 22/18	5.8
November	71.3	51.8	61.5	105.7 27/94	36.5 2/96	69.2	159.6 29/65	24.6 2/96	6.3
December	75.4	55.3	65.3	110.7 15/76	40.0 4/70	70.7	170.3 20/69	33.2 1/04	7.0
Year Averages ..	67.6	50.0	58.8	—	—	—	—	—	5.6
Year Extremes ..	—	—	—	114.1 13/1/39	27.0 21/7/60	87.1	178.5 14/1/62	19.9 30/6/29	—

(a) Standard 30 years' normal (1911–1940). (b) Records discontinued, 1946. (c) 1916–1940.
(d) 17/1884 and 20/1897.

HUMIDITY, RAINFALL AND FOG.

Month.	Vapour Pressure (inches). Mean 9 a.m.	Rel. Hum. (%) at 9 a.m. Mean.	Highest Mean.	Lowest Mean.	Rainfall (inches). Mean Monthly.	Mean No. of Days of Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Fog. Mean No. of Days of Fog.
No. of years over which observation extends.	30(a)	30(a)	41	41	30(a)	30(a)	93	93	93	30(a)
January	0.382	58	65	50	1.88	9	6.66 1941	0.01 1932	2.97 9/97	0.1
February	0.417	62	69	48	2.00	8	7.72 1939	0.03 1870	3.44 26/46	0.3
March	0.385	64	73	50	2.22	9	7.50 1911	0.14 1934	3.55 5/19	1.1
April	0.351	72	82	66	2.30	13	6.71 1901	Nil 1923	2.28 22/01	2.3
May	0.311	79	86	70	1.94	14	5.60 1942	0.14 1934	1.85 7/91	6.8
June	0.276	83	92	75	2.06	16	4.51 1859	0.73 1877	1.74 21/04	6.5
July	0.264	82	86	75	1.93	17	7.02 1891	0.57 1902	2.71 12/91	6.5
August	0.271	76	82	70	2.02	17	4.35 1939	0.48 1903	1.94 26/24	3.7
September	0.288	68	76	60	2.20	15	7.93 1916	0.52 1907	2.62 12/80	1.3
October	0.307	62	67	52	2.63	14	7.61 1869	0.29 1914	3.00 17/69	0.3
November	0.336	60	69	52	2.33	13	6.71 1916	0.25 1895	2.57 16/76	0.3
December	0.373	59	69	48	2.38	11	7.18 1863	0.11 1904	3.20 1/34	0.2
Year Totals ..	—	—	—	—	25.89	156	—	—	—	29.4
Year Averages ..	0.323	69	—	—	—	—	—	—	—	—
Year Extremes ..	—	—	92	48	—	—	7.93 9/1916	Nil 4/1923	3.55 5/3/19	—

(a) Standard 30 years' normal (1911–1940).

CLIMATOLOGICAL DATA : HOBART, TASMANIA.

LAT. 42° 53′ S., LONG. 147° 30′ E. HEIGHT ABOVE M.S.L. 177 FT.

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

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 9 a.m. and 3 p.m. readings.	Wind. (Height of Anemometer 40 feet.) Average Miles per Hour.	Highest Mean Speed in One Day. (m.p.h.)	Highest Gust Speed (miles per hour).	Prevailing Direction. 9 a.m.	Prevailing Direction. 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days of Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m.(a).	No. of Clear Days.
No. of years of observations.	30(b)	30(b)	58	58	30(b)	30(b)	30(b)	30(b)	30(b)	30(b)
January ..	29.819	8.0	20.8 30/16	76	NNW	SSE	4.84	0.9	6.4	1.9
February ..	29.913	7.2	25.2 4/27	63	NNW	SSE	3.71	1.0	6.2	2.3
March ..	29.961	6.8	21.4 13/38	68	NW	SSE	3.10	1.2	6.1	2.4
April	29.997	6.7	22.2 27/26	74	NW	W	1.98	0.7	6.5	1.7
May	30.009	6.3	20.2 20/36	70	NNW	NW	1.37	0.4	6.1	2.4
June	29.986	6.2	23.7 27/20	71	NW	NW	0.91	0.4	6.2	2.4
July	29.958	6.5	20.8 19/35	78	NNW	NNW	0.94	0.3	6.1	2.0
August ..	29.906	6.8	25.5 19/26	87	NNW	NW	1.28	0.4	6.1	2.1
September ..	29.860	7.9	21.5 26/15	84	NNW	NW	1.97	0.7	6.3	1.5
October ..	29.833	8.2	19.2 8/12	74	NNW	SW	3.05	0.6	6.6	1.0
November ..	29.831	7.9	21.2 18/15	73	NNW	S	3.77	0.7	6.4	1.3
December ..	29.816	7.6	23.4 1/34	62	NNW	SSE	4.37	0.5	6.8	1.1
Year Totals ..	—	—	—	—	—	—	31.29	7.8	—	22.1
Year Averages	29.907	7.2	—	—	NNW	W	—	—	6.3	—
Year Extremes	—	—	25.5 19/8/26	87	—	—	—	—	—	—

(a) Scale 0–10. (b) Standard 30 years' normal (1911–1940).

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (°Fahr.) Mean Max.	Mean Min.	Mean	Extreme Shade Temperature (°Fahr.). Highest.	Lowest.	Extreme Range.	Extreme Temperature (°Fahr.). Highest in Sun.	Lowest on Grass.	Mean Daily Hours of Sunshine.
No. of years over which observation extends.	30(a)	30(a)	30(a)	65(b)	65(b)	65(b)	57(c)	65(b)	28
January	69.8	52.4	61.0	105.0 1/00	40.1 (d)	64.9	160.0 (e)	30.6 19/97	7.7
February	70.6	53.7	62.2	104.4 12/99	39.0 20/87	65.4	165.0 24/98	28.3 —/87	7.0
March	67.5	51.3	59.4	99.1 13/40	35.2 31/26	63.9	150.9 26/44	27.5 30/02	6.3
April	62.2	48.0	55.1	87.1 1/41	33.3 24/88	53.8	142.0 18/93	25.0 —/86	4.9
May	57.8	44.6	51.2	77.8 5/21	29.2 20/02	48.6	128.0 (f)	20.0 19/02	4.5
June	52.8	41.2	47.0	69.2 1/07	29.2 28/44	40.0	122.0 12/94	21.0 6/87	3.9
July	52.7	40.6	46.6	66.1 14/34	27.7 11/95	38.4	121.0 12/93	18.7 16/86	4.3
August	55.4	41.7	48.7	71.6 28/14	30.5 (g)	41.1	129.0 —/87	20.1 7/09	5.1
September ..	59.0	43.7	51.4	81.7 23/26	31.0 16/97	50.7	138.0 23/93	18.3 16/26	5.9
October	62.5	46.1	54.3	92.0 24/14	32.0 12/89	60.0	156.0 9/93	23.8 (h)	6.2
November	65.0	48.2	56.6	98.3 26/37	35.0 16/41	63.3	154.0 19/92	26.0 1/08	7.2
December	67.9	51.3	59.6	105.2 30/97	38.0 3/06	67.2	161.5 10/39	27.2 —/86	7.3
Year Averages ..	61.9	46.9	54.4	—	—	—	—	—	5.8
Year Extremes ..	—	—	—	105.2 30/12/97	27.7 11/7/95	77.5	165.0 24/2/98	18.3 16/9/26	—

(a) Standard 30 years' normal (1911–1940). (b) Records 1855–1882 not comparable. (c) Period 1934–1938 not comparable; records discontinued, 1946. (d) 9/37 and 11/37. (e) 5/86 and 13/05. (f) —/89 and —/93. (g) 4/97 and 7/09. (h) 1/86 and —/99.

HUMIDITY, RAINFALL AND FOG.

Month	Vapour Pressure (inches) Mean 9 a.m.	Rel. Hum. (%) at 9 a.m. Mean.	Highest Mean.	Lowest Mean.	Rainfall (inches). Mean Monthly.	Mean No. of Days of Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Fog. Mean No. of Days of Fog.
No. of years over which observation extends.	30(a)	29	62	62	30(a)	30(a)	65(b)	65(b)	65(b)	27
January	0.309	57	72	46	1.82	13	5.91 1893	0.17 1915	2.96 30/16	0.0
February	0.342	62	77	48	1.68	10	4.96 1935	0.11 1914	2.18 5/38	0.0
March	0.323	65	77	52	2.13	13	10.05 1946	0.29 1943	3.47 17/46	0.3
April	0.290	69	84	58	2.31	14	8.50 1935	0.07 1904	5.02 20/09	0.2
May	0.263	74	89	65	1.71	14	6.37 1905	0.14 1913	1.75 2/93	0.8
June	0.233	78	91	68	2.25	16	8.15 1889	0.28 1886	4.11 13/89	0.7
July	0.227	78	94	72	2.14	17	6.02 1922	0.51 1902	2.51 18/22	1.0
August	0.232	72	92	61	1.82	18	6.32 1946	0.30 1892	2.28 14/90	0.4
September ..	0.240	64	85	58	1.90	17	4.47 1928	0.40 1891	1.57 24/85	0.0
October	0.258	60	73	51	2.52	18	7.60 1947	0.39 1914	2.58 4/06	0.0
November	0.274	57	72	50	2.23	16	7.39 1885	0.33 1921	3.70 30/85	0.0
December	0.306	58	67	45	2.52	14	7.72 1916	0.17 1931	3.33 5/41	0.0
Year Totals ..	—	—	—	—	25.03	180	—	—	—	3.4
Year Averages ..	0.271	65	—	—	—	—	—	—	—	—
Year Extremes ..	—	—	94	45	—	—	10.05 3/1946	0.07 4/1904	5.02 20/4/09	—

(a) Standard 30 years' normal (1911–1940). (b) Records prior to 1883 not comparable.

§ 3. Standard Times in Australia.

Prior to 1895 the official time adopted in the several colonies was for most purposes the mean solar time of the capital city of each.

In November, 1892, an intercolonial conference of surveyors was held in Melbourne to consider, among other things, the advantages of introducing the system of standard time. In this system it was proposed to make the initial meridian that of Greenwich and to change local standard time by whole hours according to the longitude east or west of that of Greenwich. Thus for every difference of 15° in longitude a change of one hour would be required. The minutes and seconds would then be identical everywhere.

To give effect to this proposal it was suggested that Australia should be divided into three zones, the standard times for which should be respectively the mean solar times of the meridians of 120°, 135° and 150° E. longitude, thus giving standard times 8, 9 and 10 hours respectively ahead of Greenwich time. It was proposed that the 120° zone should comprise Western Australia, that the 135° zone should comprise South Australia and the Northern Territory, and that the 150° zone should comprise Queensland, New South Wales, Victoria and Tasmania.

The matter was also considered by several intercolonial postal conferences, and eventually in 1894 and 1895 legislation was enacted by each of the colonies in accord with the recommendations of the Surveyors' Conference of 1892.

In 1898 the South Australian legislature amended its earlier provision, and adopted the mean solar time of the meridian 142° 30′ E. longitude as the standard time for that colony, thus reducing the difference between the standard time of Adelaide and that of the capitals of the eastern colonies from an hour to half-an-hour. Particulars concerning these enactments are as follows :—

STANDARD TIMES IN AUSTRALIA.

State.	Date when Act came into Operation.	Meridian Selected.	Time Ahead of Greenwich.
			Hours.
New South Wales ..	1st February, 1895 ..	150° E.	10
Victoria	1st February, 1895 ..	150° E.	10
Queensland	1st January, 1895 ..	150° E.	10
South Australia ..	1st February, 1895 ..	135° E.	9
South Australia ..	1st May, 1899	142° 30′ E.	9½
Western Australia ..	1st December, 1895 ..	120° E.	8
Tasmania	1st September, 1895 ..	150° E.	10

The standard time in the Australian Capital Territory is the same as in New South Wales, and in the Northern Territory the same as in South Australia.

Consequent upon the opening of the Trans-Australian Railway an arrangement was made by which the change of time between South Australia and Western Australia (namely, 1½ hours) is divided into two changes of 45 minutes each. Going east from Kalgoorlie the first change is made at Rawlinna, 235.18 miles out, where the time is put forward by 45 minutes. The second change of the same amount is made at Tarcoola, 794.05 miles out. Thenceforward South Australian standard time is kept. The Commonwealth Observatory at Mount Stromlo, Canberra, and the State Observatories at Sydney, Adelaide, and Perth derive time by astronomical observations.

Time signals are originated by these Observatories and by the Postmaster-General's Research Laboratory, Melbourne. The latter participates with the Commonwealth Observatory in the Commonwealth Time Service.