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 correct value for 1926 is 23° 26′ 56.08″), the areas within the tropical and temperate zones are approximately as follows :—

AUSTRALIA—AREAS OF TROPICAL AND TEMPERATE REGIONS.

(STATES AND TERRITORY PARTIALLY WITHIN TROPICS.)

Areas.	Queensland.	Western Australia.	Northern Territory.	Total.
	Sq. Miles.	Sq. Miles.	Sq. Miles.	Sq. Miles.
Within Tropical Zone	359,000	364,000	426,320	1,149,320
Within Temperate Zone	311,500	611,920	97,300	1,020,720
Ratio of Tropical part to whole State ..	0.535	0.373	0.814	0.530
Ratio of Temperate part to whole State ..	0.465	0.627	0.186	0.470

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

2. **Area of Australia compared with Areas of other Countries.**—It is not always realized that the area of Australia is nearly as great as that of the United States of America, that it is four-fifths of that of Canada, that it is over one-fifth of the area of the whole of the British Empire, that it is more than three-fourths of the whole area of Europe, and that it is about 25 times as large as Great Britain and Ireland or Italy. 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 other countries are given in the following table :—

AREA OF AUSTRALIA AND OF OTHER COUNTRIES.

Country.	Area.
	Sq. miles.
Continental Divisions—	
Europe	3,874,100
Asia	15,971,338
Africa	12,041,502
North and Central America and West Indies ..	8,598,378
South America	7,134,460
Australasia and Polynesia	3,463,128
Total, exclusive of Arctic and Antarctic Conts.	51,682,906
Europe—	
Russia	1,680,730
France..	212,659
Spain	194,800
Germany	182,001
Sweden	173,105
Poland	149,915
Finland	132,642
Norway	124,964
Rumania	122,282
Italy and annexed Provinces	119,624
Serb, Croat, and Slovene State	96,134
Great Britain and Northern Ireland	94,633
Lithuania	59,633
Czecho-Slovakia ..	54,207
Greece	49,912
Bulgaria	39,814
Iceland	39,709
Hungary	35,911
Portugal	35,490
Azerbaijan	33,970
Austria	32,369
Irish Free State ..	27,000
Georgia	25,760
Latvia	25,000
Spitzbergen, Bear and adjacent islands ..	25,000
Estonia	18,354
Albania	17,374
Denmark	17,144
Switzerland	15,940
Netherlands	13,208
Belgium	11,755
Turkey	10,882
Luxemburg	999
Danzig	754
Andorra	191
Malta	122
Liechtenstein	65
San Marino	38
Monaco	8
Gibraltar	2
Total, Europe ..	3,874,100

Country.	Area.
Asia—	Sq. miles.
Russia	5,460,390
China and Dependencies ..	4,279,170
British India and Administered Territories ..	1,094,300
Arabia	1,000,000
Feudatory Indian States	711,032
Persia	628,000
Dutch East Indies ..	572,950
Turkey	483,656
Japan (and Dependencies)	260,707
Afghanistan	245,000
Siam	200,148
Iraq (Mesopotamia) ..	143,250
Philippine Islands ..	115,026
Laos	82,604
Oman	82,000
Bokhara	79,000
British Borneo, Brunei, and Sarawak	77,106
Cambodia	67,550
Syria	60,000
Nepál	54,000
Tonking	40,530
Annam	39,758
Federated Malay States ..	27,506
Cochin China	26,476
Ceylon	25,332
Khiva	24,000
Malay Protectorate (inc. Johore)	22,486
Bhután	20,000
Armenia	15,240
Aden and Dependencies ..	9,000
Palestine	9,000
Timor, etc. (Portuguese Indian Archipelago) ..	7,330
Cyprus	3,584
Goa, Damao, and Diu ..	1,638
Straits Settlements ..	1,600
Kwantung	538
Hong Kong and Dependencies	391
Wei-hai-wei	285
Bahrein Islands ..	250
French India (Pondicherry, etc.)	196
Kwang Chau Wan ..	190
Maldive Islands ..	115
Macao, etc.	4
Total, Asia	15,971,338
Africa—	
French Sahara	1,500,000
Anglo-Egyptian Sudan ..	1,014,400
French Equatorial Africa	982,049
Belgian Congo	909,654

AREA OF AUSTRALIA AND OF OTHER COUNTRIES—*continued.*

Country.	Area.	Country.	Area.
AFRICA—*continued.*	Sq. miles.	AFRICA—*continued.*	Sq. miles.
French Sudan	648,480	Comoro Islands, Mayotte, etc.	790
Tripolitania and Cyrenaica	580,000	St. Thomas and Principe Islands	360
Angola	484,800	Seychelles	156
South African Union ..	472,347	St. Helena	47
Rhodesia	440,000	Ascension	34
Portuguese East Africa ..	428,132		
Territory of the Niger ..	404,914	Total, Africa	12,641,502
Egypt	383,000		
Tanganyika Territory ..	365,000		
Abyssinia	350,000	**North and Central America and West Indies—**	
Mauritania	347,400	Canada	3,729,665
Nigeria and Protectorate	335,700	United States	3,026,789
South-west Africa ..	322,768	Mexico	767,198
Bechuanaland Protectorate	275,000	Alaska	590,884
Madagascar	228,707	Newfoundland and Labrador	162,734
Morocco	223,800	Nicaragua	51,660
Algeria (inc. Algerian Sahara)	222,180	(*a*)Greenland	46,740
Kenya Colony and Protectorate	209,248	Honduras	44,275
Cameroon (French) ..	166,489	Cuba	44,164
Upper Volta	154,400	Guatemala	42,353
Italian Somaliland ..	154,000	Costa Rica	23,000
Ivory Coast	121,976	Santo Domingo ..	19,332
Uganda Protectorate ..	110,300	Salvador	13,176
Rio de Oro and Adrar ..	109,200	Haiti	10,204
French Guinea	92,640	British Honduras ..	8,598
Gold Coast Protectorate (with Nth. Territories)	80,000	Jamaica, inc. Turks, Caicos and Cayman Is. ..	4,674
Senegal	74,112	Bahamas	4,404
British Somaliland ..	68,000	Porto Rico	3,435
Tunis	48,300	Trinidad and Tobago ..	1,976
Eritrea	45,754	Leeward Islands ..	715
Liberia	43,000	Guadeloupe and Dependencies	688
Dahomey	42,460	Windward Islands ..	516
Nyasaland Protectorate ..	37,890	Curaçao and Dependencies	403
Cameroon (British) ..	31,000	Martinique	385
Sierra Leone and Protectorate	31,000	Barbados	166
Togoland (French) ..	22,000	Virgin Islands of U.S.A. ..	132
Portuguese Guinea ..	13,940	St. Pierre and Miquelon ..	93
Togoland (British) ..	12,600	Bermudas	19
Basutoland	11,716		
Spanish Guinea (Rio Muni, etc.)	10,036	Total, N. and C. America and W. Indies ..	8,598,378
Spanish Morocco ..	7,700		
Swaziland	6,678	**South America—**	
French Somali Coast ..	5,790	Brazil	3,285,318
Gambia and Protectorate	4,134	Argentine Republic ..	1,153,119
Cape Verde Islands ..	1,480	Peru	532,047
Sokotra	1,382	Bolivia	514,155
Zanzibar	1,020	Colombia (exc. of Panama)	440,846
Réunion	970		
Ifni	965		
Mauritius and Dependencies	809		
Fernando Po, etc. ..	795		

(*a*) Danish colony only. Total area has been estimated as between 827,000 and 850,000 square miles.

AREA OF AUSTRALIA AND OF OTHER COUNTRIES—*continued.*

Country.	Area.	Country.	Area.
SOUTH AMERICA—*continued.*	Sq. miles.	AUSTRALASIA AND POLYNESIA —*continued.*	Sq. miles.
Venezuela	393,874	British Solomon Islands ..	11,000
Chile	290,084	New Caledonia and Dependencies	8,548
Ecuador	174,155	Fiji	7,083
British Guiana	89,480	Hawaii	6,449
Uruguay	72,153	New Hebrides	5,700
Paraguay	61,647	French Establishments in Oceania	1,520
Dutch Guiana	54,291	Territory of Western Samoa	1,250
Panama	32,380	Gilbert and Ellice Islands	1,011
French Guiana	34,740	Marianne, Caroline, and Marshall Islands ..	960
Falkland Islands and South Georgia ..	5,618	Tonga	385
Panama Canal Zone ..	553	Guam	210
Total, South America ..	7,134,460	Samoa (U.S.A. part) ..	62
		Norfolk Island	13
Australasia and Polynesia—		Nauru Island	10
Commonwealth of Australia	2,974,581	Total, Australasia and Polynesia	3,463,128
Dutch New Guinea ..	160,692		
New Zealand and Dependencies	103,862		
Papua	90,540		
Territory of New Guinea	89,252	**British Empire**	13,366,208

The figures quoted in the table have, in most cases, been extracted from the Statesman's Year Book for 1926.

3. **Areas of Political Subdivisions.**—As already stated, Australia consists of six States and the Northern and Federal 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	309,432	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
Federal Capital Territory ..	940	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 Year Book No. 1, an enumeration of the features of the coast-line of Australia was given (see pp. 60 to 68).

(ii) *Coast-line.* The lengths of coast-line, exclusive of 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	South Australia	1,540	247
Victoria.. ..	680	129	Western Australia	4,350	224
Queensland ..	3,000	223	Continent (*b*) ..	11,310	261
Northern Territory	1,040	503	Tasmania ..	900	29

(*a*) Including Federal 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 recent figures, England and Wales have only one-third of this, viz., 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 each of the earlier issues of this Year Book fairly complete information has been given concerning some special geographical element. The nature of this information and its position in the various Year Books can be readily ascertained on reference to the special index following the index to maps and graphs at the end of this work.

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

7. **Changing of German Place Names in Australia.**—A list of German place and district names in Australia which were changed during the Great War appeared in Year Book No. 19, pages 50 and 51. Limitations of space, however, preclude its repetition in this issue.

§ 2. Climate and Meteorology of Australia.*

1. **Introductory.**—In preceding Year Books some account was given of the history of Australian meteorology, including reference to the development of magnetic observations and the equipment for the determination of various climatological records. (See Year Book No. 3, pp. 79, 80.) In 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 of 1907. Space will not permit of the inclusion of this matter in the present issue.

2. **Meteorological Publications.**—The following publications are issued daily from the Central Meteorological Bureau, viz. :—(i) Weather charts. (ii) Rainfall maps. (iii) Bulletins, Victorian and Interstate, showing pressure, temperature, wind, rain, cloud extent, and weather. Similar publications are also issued from the divisional offices in each of the State Capitals.

* Prepared from data supplied by the Commonwealth Meteorologist, H. A. Hunt, Esquire.

Commencing with January, 1910, the "Australian Monthly Weather Report," containing statistical records from representative selected stations, with rain maps and diagrams, etc., was published, but was suspended in September, 1913. Complete rainfall and other climatological data are published in volumes of meteorological statistics for each State separately.

The first text book of Australian meteorology, "Climate and Weather of Australia," was published in 1913.

In addition, fifteen Bulletins of Climatology have been published, particulars of which are given in preceding issues of the Official Year Book (see No. 12, page 54).

The following publications have since been issued :—

The Australian Meteorological Observer's Handbook.

Bulletin No. 16. Australian Hurricanes and Related Storms, with appendix on Hurricanes in the South Pacific.

Bulletin No. 17. Some periods of Australian Weather; observations of Visibility at various Australian stations during the years 1923 and 1924.

Atmospheric Pollution; observations with the Owens' dust counter during the years 1923 and 1924.

Map showing the principal River Basins of Australia.

Map of Normal Meteorological Conditions in Australia affecting Aviation (set of four sheets) unmounted.

Map of Normal Meteorological Conditions in Australia affecting Aviation (set of four maps) mounted.

Map of Potential Cotton-growing Areas of Australia, determined by Climatic Factors.

3. **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 the States of Queensland and 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, 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 altitudes of the surface of Australia 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 it 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 where 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.

4. **Meteorological Divisions.**—(i) *General.* The Commonwealth Meteorologist has divided Australia, for climatological and meteorological purposes, into five divisions. The boundaries between these may be thus defined :—(*a*) Between divisions I. and II., the boundary between South and Western Australia, viz., the 129th meridian of east longitude; (*b*) between divisions II. and III., a line starting at the Gulf of Carpentaria, along the Norman River to Normanton, thence a straight line to Wilcannia on the Darling River, New South Wales; (*c*) between divisions II. and IV., a line from Wilcannia along the Darling River to its junction with the Murray; (*d*) between divisions II. and V., a line from the junction of the Darling and Murray Rivers, along the latter to Encounter Bay; (*e*) between divisions III. and IV., a line starting at Wilcannia, along the Darling, Barwon, and Dumaresq Rivers to the Great Dividing Range, and along that range and along the watershed between the Clarence and Richmond Rivers to Evans Head on the east coast of Australia; (*f*) between divisions IV. and V., a line from the junction of the Darling and Murray Rivers along the latter to its junction with the Murrumbidgee, along the Murrumbidgee to the Tumut River, and along the Tumut River to Tumut, thence a straight line to Cape Howe; (*g*) Tasmania is included in division V.

The population included within these boundaries at the Census of the 4th April, 1921, was approximately as follows :—

Division	I.	II.	III.	IV.	V.
Population	332,000	500,000	824,000	1,915,000	1,866,000

In these divisions, the order in which the capitals occur is as follows :—(*a*) Perth, (*b*) Adelaide, (*c*) Brisbane, (*d*) Sydney, (*e*) Melbourne, and (*f*) Hobart; and the climatological and meteorological statistics relating to the capital cities are dealt with herein in accordance with that order.

(ii) *Special Climatological Stations.* The latitudes, longitudes, and altitudes of special stations, the climatological features of which are graphically represented hereinafter are as follows :—

SPECIAL CLIMATOLOGICAL STATIONS—AUSTRALIA.

Locality.	Height above Sea Level.	Latitude. S.		Longitude. E.		Locality.	Height above Sea Level.	Latitude. S.		Longitude. E.	
	Feet.	deg.	min.	deg.	min.		Feet.	deg.	min.	deg.	min.
Perth ..	197	31	57	115	50	Darwin ..	97	12	28	130	51
Adelaide ..	140	34	56	138	35	Daly Waters	691	16	16	133	23
Brisbane ..	137	27	28	153	2	Alice Springs	1,926	23	38	133	37
Sydney ..	138	33	52	151	12	Dubbo ..	870	32	18	148	35
Melbourne ..	115	37	49	144	58	Laverton, W.A.	1,530	28	40	122	23
Hobart ..	177	42	53	147	20	Coolgardie ..	1,389	30	57	121	10

5. **Temperatures.**—(i) *Comparisons with other Countries.* In respect of Australian temperatures generally, it may be pointed out that the isotherm for 70° Fahrenheit extends in South America and South Africa so far south as latitude 33°, while in Australia it reaches only so 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 the 70° isotherm extends in several of the western States so far north as latitude 41°. In Europe, the same isotherm reaches almost to the southern shores of Spain, passing, however, afterwards 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°.

The extreme range of shade temperatures in summer and winter in a very large part of Australia amounts to probably only 81°. In Siberia, in Asia, the similar range is no less than 171°, and in North America 153°, or approximately double the Australian range.

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 months is only 8.4°, and the extreme readings for the year, or the highest maximum in the hottest month and the lowest reading in the coldest month, show a difference of under 50°.

Coming southward, the extreme range of temperature increases gradually on the coast, and in a more pronounced manner inland.

(ii) *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 with increasing distance from the coast.

In the interior of Australia, and during exceptionally dry summers, the temperature occasionally reaches or exceeds 120° in the shade, and during the dry winters the major portion of the country to the south of the tropics is subject to ground frosts. An exact knowledge of temperature disposition cannot be determined until the interior becomes more settled, but from data procurable it would appear that the hottest area of the continent is situated in the northern part of Western Australia about the Marble Bar and Nullagine goldfields, where the maximum shade temperature during the summer sometimes exceeds 100° continuously for days and weeks. The coldest part of Australia is the extreme south-east of New South Wales and extreme east of Victoria—the region of the Australian Alps. Here the temperature seldom, if ever, reaches 100° even in the hottest of seasons.

Tasmania as a whole enjoys a most moderate and equable range of temperature throughout the year, although occasionally hot winds may cross the Straits and cause the temperature to rise to 100° in the low-lying parts.

(iii) *Monthly Maximum and Minimum Temperatures.* The normal monthly maximum and minimum temperatures can be best shown by means of graphs, which exhibit the nature of the fluctuation of each for all available years. In the diagram herein for nine representative places in Australia, the upper heavy curves show the mean maximum, and the lower heavy curves the mean minimum temperatures based upon daily observations, while the other curves show the humidities.

6. **Humidity.**—After temperature, humidity is the most important element of climate, as regards its effect on human comfort, rainfall supply, and in connexion with engineering problems generally.

In this publication the *absolute humidity* has been graphically represented in the form of inches of vapour pressure (i.e. that portion of the barometric pressure due to vapour). It is this total quantity of moisture in the air which affects personal comfort, plays an important part in varying the density of the atmosphere, and in heating and refrigerating processes. The more commonly quoted value, called the *relative humidity,* refers to the ratio which the actual moisture contents of the air bear to the total amount possible if saturation existed at the given temperature, and is usually quoted as a percentage. The relative humidity is an important factor in all drying operations, but is much less important than the absolute humidity as affecting animal life.

The mean monthly vapour pressure has also been added to the tables of climatological data for the capital cities included herein.

The normal monthly values of vapour pressure, it should be noted, combine to make the annual curve for this element which 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 vapour pressure is Darwin, Daly Waters, Brisbane, Sydney, Perth, Adelaide, Melbourne, Hobart and Alice Springs, while the relative humidity diminishes in the order, Sydney, Hobart, Darwin, Brisbane, Melbourne, Perth, Adelaide, Daly Waters and Alice Springs.

7. **Evaporation.**—(i) *General.* The rate and quantity of evaporation in any territory is influenced by the prevailing temperature, and by atmospheric humidity, pressure, and movement. In Australia, the question is of perhaps 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 tabular records herein, which show that the yearly amount varies from about 32 inches at Hobart to 94 inches at Alice Springs in the centre of the Continent. Over the *inland* districts of the Continent it has been calculated that evaporation equals the rainfall where the annual totals are about 36 inches, the variations above and below this quantity being inverse.

(ii) *Monthly Evaporation Curves.* The curves showing the mean monthly evaporation in various parts of Australia disclose how characteristically different are the amounts for the several months in different localities. The evaporation for representative places is shown on the diagram herein.

(iii) *Loss by Evaporation.* In the interior of Australia the possible evaporation is greater than the actual rainfall. 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 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.

8. **Rainfall.**—(i) *General.* As even a casual reference to climatological maps indicating the distribution of rainfall and prevailing direction of wind would clearly show, 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 the physiographical features generally.

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

* In Australia, artificial storage ponds or reservoirs are called "tanks."

being more or less regulated by the differences in elevation of the shores and of the chain of mountains upon which the rain-laden winds blow from the New South Wales northern border to Thursday Island. 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 very reliable, although generally light to moderate, rains enjoyed by the south-western portion of Western Australia, by the south-eastern agricultural areas of South Australia, by a great part of Victoria, and by the whole of Tasmania.

(ii) *Factors determining Distribution and Intensity of Rainfall.* (iii) *Time of Rainfall.* In Official Year Book No. 6 (see pp. 72 to 74) some notes were given of the various factors governing the distribution, intensity, and period of Australian rainfall.

(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 three stations situated on, or adjacent to, the Johnstone and Russell Rivers have an average annual rainfall of between 144 and 165 inches. The maximum and minimum falls there are :— 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 record at this station covers a period of 34 years.

Harvey Creek, in the shorter period of 26 years has three times exceeded 200 inches, the total for 1921 being 254.77 inches, and at the South Johnstone Sugar Experiment Station, where a gauge has recently been established, 202.52 inches were recorded in 1921.

In Tasmania the wettest part is in the West Coast region, the mean annual rainfall at Lake Margaret being 145.34, with a maximum of 175.12 in 1924.

The driest known part of the continent is in the Lake Eyre district in South Australia (the only part of the continent below sea level), where the annual average is only 5 inches, and where the fall rarely exceeds 10 inches for the twelve months.

The inland districts of Western Australia were at one time regarded as the driest part of Australia, but authentic observations in recent years over the settled districts in the east of that State show that the annual average is from 10 to 12 inches.

(v) *Quantities and Distribution of Rainfall.* The departure from the normal rainfall increases progressively from the southern to the northern shores of the continent, and similarly also at all parts of the continent subject to capricious monsoonal rains, as the comparisons hereunder will show. The general distribution is best seen from the rainfall map herein, which shows the areas subject to average annual rainfalls lying between certain limits. The areas enjoying varying quantities of rainfall determined from the latest available information are shown in the following table :—

AVERAGE ANNUAL RAINFALL DISTRIBUTION.

Average Annual Rainfall.	N.S.W. (a)	Victoria.	Queensland.	South Australia	Northern Territory	Western Australia.	Tasmania. (b)	Total. (b)
	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.
Under 10 inches	48,749	nil	80,496	310,660	140,500	486,952	nil	1,067,357
10—15 ,,	78,454	19,270	81,549	36.460	132,780	255,092	nil	603,605
15—20 ,,	55,762	13,492	111,833	19,940	63,026	94,101	304	358,458
20—25 ,,	45,140	14,170	143,610	8,620	49,157	44,340	3,844	308,881
25—30 ,,	30,539	15,579	99,895	3,258	41,608	31,990	3,016	225,885
30—40 ,,	33,557	14,450	61,963	1,036	37,642	59,520	5,027	213,195
Over 40 ,,	18,171	10,923	91,154	96	58,907	3,925	11,247	194,423
Total area ..	310,372	87,884	670,500	380,070	523,620	975,920	23,438	2,971,804

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

Referring first to the capital cities, the complete records of which are given in the next table, it will be seen that Sydney, with a normal rainfall of 47.46 inches, occupies the chief place ; Brisbane, Perth, Melbourne, Hobart and Adelaide following in that order, Adelaide with 21.22 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 (19.48 inches).

In order to show how the rainfall is distributed throughout the year in various parts of the continent, the figures of representative towns have been selected. (See map.) The figures for Darwin, typical of the Northern Territory, 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 Perth, as representing the south-western part of the continent, are the reverse, for while the summer months are dry, the winter ones are very wet. In Melbourne and Hobart the rain is fairly well distributed throughout the twelve months, with a maximum in October for the former, and in November for the latter. The records at Alice Springs and Daly Waters indicate that in the central parts of Australia the wettest months are in the summer and autumn. In Queensland, as in the Northern Territory, the heaviest rains fall in the summer months, but good averages are also maintained during the other seasons.

On the coast of New South Wales, the first six months of the year are the wettest, with a maximum 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 or more inches, the remaining two-thirds averaging from 5 to 20 inches.

(vi) *Curves of Rainfall and Evaporation.* The relative amounts of rainfall and evaporation at different times through the year are clearly indicated in the graphs herein. Inspection thereof will show how large is the evaporation when water is fully exposed to the direct rays of the sun and to wind.

(vii) *Tables of Rainfall.* The table of rainfall for a 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. As pointed out in 4 *ante*, the capitals are dealt with in the order in which they occur in the adopted meteorological divisions.

RAINFALL—AUSTRALIAN CAPITAL CITIES, 1901 TO 1926.

Year.	Perth.			Adelaide.			Brisbane.			Sydney.			Melbourne.			Hobart.		
	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.
	in.		in.	in.		in.	in.		in.	in.		in.	in.		in.	in.		in.
1901	36.75	122	..	18.01	124	..	33.48	110	..	40.10	149	..	27.15	113	..	25.11	149	
2	27.96	93	..	16.02	123	..	16.17	87	..	43.07	180	..	23.08	102	..	21.85	150	..
3	35.69	140	..	25.47	134	..	49.27	136	..	38.62	173	..	28.43	130	..	25.86	139	..
4	34.35	125	..	20 31	117	..	33.23	124	..	45.93	158	..	29.72	128	..	22.41	139	..
5	34.61	116	..	22.28	131	..	36.76	108	..	35.03	145	..	25.64	129	..	32.09	168	..
6	32.37	121	..	26.51	127	..	42.85	125	..	31.89	160	..	22.29	114	..	23.31	155	..
7	40.12	132	..	17.78	125	..	31.46	119	..	31.32	132	..	22.26	102	..	25.92	166	..
8	30.52	106	34.05	24.56	125	21.15	44.01	125	36.55	45.65	167	43.41	17.72	130	25.36	16.50	148	23.29
9	39.11	107	..	27.69	138	..	34.06	111	..	32.45	177	..	25.86	171	..	27.29	170	..
1910	37.02	135	..	24.62	116	..	49.00	133	..	46.91	160	..	24.61	167	..	25.22	205	..
11	23.38	108	..	15.99	127	..	35.21	128	..	50.24	155	..	36.61	168	..	26.78	193	..
12	27.85	123	..	19.57	116	..	41.30	114	..	47.51	172	..	20.37	157	..	23.14	181	..
13	38.28	141	..	18.16	102	..	40.81	115	..	57.70	141	..	21.17	157	..	19 36	165	..
14	20.21	128	..	11.39	91	..	33.99	141	..	56.42	149	..	18.57	129	..	15.42	154	..
15	43.61	164	..	19.38	117	..	25.66	93	..	34.83	117	..	20.95	167	..	20.91	196	..
16	35.16	128	..	28.16	142	..	52.80	136	..	44.91	161	..	38.04	170	..	43.39	203	..
17	45.64	146	..	28.90	153	..	40.92	127	..	52.40	151	..	30.57	171	..	30.62	214	..
18	39.58	138	34.98	17.41	107	21.13	24.95	121	37.87	42.99	149	46.64	27.13	160	26.39	26.04	179	25.82
19	30.66	120	..	17.21	108	..	19.36	96	..	58.71	152	..	24.89	141	..	22.48	153	..
20	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	..	22.40	171	..
26	49.22	167	..	22.20	116	..	30.82	111	..	37.07	127	..	20.81	149	..	25.79	187	..
Aver.	34.32	120	..	21.22	123	..	45.08	128	..	47.50	153	..	26.13	138	..	23.84	150	..
No. of Yrs.	51	51	..	88	88	..	77	67	..	87	87	..	83	71	..	84	84	..

NOTE.—The above average rainfall figures for Brisbane, Sydney, and Melbourne differ slightly from the mean annual falls given in the Climatological Tables, which are for a less number of years. Annual totals from 1860 to 1900 inclusive will be found in Official Year Book No. 15, page 53.

9. **Remarkable Falls of Rain.**—The following are the more remarkable falls of rain in the various States and in the Northern Territory, which have occurred within a period of twenty-four hours. In New South Wales and Queensland falls of less than 15 inches in the twenty-four hours are not included. Reference, however, to them may be found in preceding Official Year Books (see No. 14, pp. 60–63) :—

HEAVY RAINFALLS—NEW SOUTH WALES, UP TO 1926, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Anthony	28 Mar., 1887	17.14	Kembla Heights ..	13 Jan., 1911	17.46
Araluen	27 May, 1925	15.83	Madden's Creek ..	13 Jan., 1911	18.68
Bega	27 Feb., 1919	17.88	Morpeth ..	9 Mar., 1893	21.52
Broger's Creek ..	14 ,, 1898	20.05	Mount Kembla ..	13 Jan., 1911	18.25
,, ,, ..	13 Jan., 1911	20.83	Numbugga .	27 Feb., 1919	17.87
Bulli Mountain ..	13 Dec., 1898	17.14	Tongara Farm ..	14 ,, 1898	15.12
Burragate ..	27 ,, 1919	16.38	Towamba ..	5 Mar., 1893	20.00
Candelo	27 Feb., ,,	18.58	South Head (near Sydney) ..	29 Apr., 1841	20.12
Condong ..	27 Mar., 1887	18.66	,, ,, ..	16 Oct., 1844	20.41
Cordeaux River ..	14 Feb., 1898	22.58			
Dapto	11 May, 1925	15.00			

HEAVY RAINFALLS—QUEENSLAND, UP TO 1926, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Anglesey ..	26 Dec., 1909	18.20	Flying Fish Point	31 Jan., 1913	16.10
Atherton (Cairns) ..	31 Jan., 1913	16.69	Gladstone ..	4 Feb., 1911	18.83
Babinda (Cairns) ..	1 Feb., ,,	20.51	Glen Boughton ..	5 Apr., 1894	18.50
,, ,, ..	24 Jan., 1916	22.30	Goldsborough (Cairns) ..	31 Jan., 1913	19.92
,, ,, ..	21 Apr., 1920	16.05	Goondi Mill (Innisfail) ..	6 Apr., 1894	15.69
Babinda	25 Mar., 1921	15.76	,, ,, ..	29 Dec., 1903	17.83
Banyan	1 Mar., 1925	16.43	,, ,, ..	10 Feb., 1911	17.68
Bloomsbury ..	14 Feb., 1893	17.40	,, ,, ..	6 Apr., 1912	15.55
,, ..	10 Jan., 1901	16.62	Goondi	30 Jan., 1913	24.10
Brisbane ..	21 ,, 1887	18.31	Goorganga ..	23 ,, 1918	18.17
Buderim Mountain	11 ,, 1898	26.20	Halifax	5 Feb., 1899	15.37
Bundaberg ..	16 ,, 1913	16.94	,, ...	6 Jan., 1901	15.68
Burnett Head (Bundaberg) ..	16 ,, 1913	15.22	Hambledon Mill ..	2 ,, 1911	18.61
Cairns	11 Feb., 1911	15.17	,, ,, ..	1 Apr., ,,	19.62
,, ...	2 Apr., ,,	20.16	,, ,, ..	30 Jan., 1913	17.32
Carbrook ..	23 Jan., 1918	22.66	Hampden ..	23 Apr., 1918	17.30
,, ..	24 Jan., 1918	15.77	,, ..	24 ,, ,,	17.19
Cardwell ..	18 Mar., 1904	18.24	Harvey Creek ..	8 Mar., 1899	17.72
,, ...	11 Mar., 1918	16.65	,, ,, ..	11 Jan., 1905	16.96
Carmilla	23 Jan., 1918	15.92	,, ,, ..	3 ,, 1911	27.75
Clare	26 ,, 1896	15.30	,, ,, ..	2 Apr., ,,	16.46
Collaroy	23 ,, 1918	18.06	,, ,, ..	31 Jan., 1913	21.72
Crohamhurst (Blackall Range)	2 Feb., 1893	35.71	,, ,, ..	25 Mar., 1921	15.80
,, ,,	9 Jan., 1898	19.55	,, ,, ..	12 Mar., 1924	16.50
,, ,,	6 Mar., ,,	16.01	,, ,, ..	13 Mar., ,,	15.78
Croydon	29 Jan., 1908	15.00	Haughton Valley ..	26 Jan., 1896	18.10
Dungeness ..	16 Mar., 1893	22.17	Holmwood (Woodford)	2 Feb., 1893	16.19
Dunira	9 Jan., 1898	18.45	Howard ..	15 Jan., 1905	19.55
,, ...	6 Mar., ,,	15.95	Huntley ..	27 Dec., 1916	18.94
Dunwich	8 May, 1925	15.46	Innisfail (formerly Geraldton) ..	11 Feb., 1889	17.13
Fairymead Plantation (Bundaberg)	16 Jan., 1913	15.32	,, ,, ..	6 Apr., 1894	16.02
Flying Fish Point ..	7 Apr., 1912	16.06			

HEAVY RAINFALLS—QUEENSLAND—*continued.*

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Innisfail (formerly Geraldton) ..	24 Jan., 1900	15.22	Mourilyan ..	7 Apr., 1912	18.97
,, ,, ..	29 Dec., 1903	21.22	,, ..	31 Jan., 1913	15.05
,, ,, ..	2 Apr., 1911	15.00	Mundoolun ..	21 ,, 1887	17.95
,, ,, ..	7 ,, 1912	20.50	Nambour ..	9 ,, 1898	21.00
,, ,, ..	31 Jan., 1913	20.91	,, ..	27 Dec., 1909	16.80
Kamerunga (Cairns)	2 Apr., 1911	21.00	Netherdale ..	22 Jan., 1918	19.50
,, ,,	31 Jan., 1913	16.00	Oxenford ..	14 Mar., 1908	15.65
Koumala ..	23 ,, 1918	22.31	Palmwoods ..	10 Jan., 1898	15.85
,, ..	24 ,, ,,	20.65	,, ..	25 Dec., 1909	17.75
Kuranda (Cairns) ..	11 Feb., 1911	16.30	Pialba (Marybor'gh)	16 Jan., 1913	17.22
,, ,, ..	17 Mar., ,,	15.10	Plane Creek (Mackay) ..	26 Feb., ,,	27.73
,, ,, ..	31 ,, ,,	18.60	Port Douglas ..	10 Mar., 1904	16.34
,, ,, ..	1 Apr., ,,	24.30	,, ,, ..	17 ,, 1911	16.10
,, ,, ..	2 ,, ,,	28.80	,, ,, ..	1 Apr., ,,	31.53
,, ,, ..	31 Jan., 1913	16.34	Proserpine ..	23 Jan., 1918	18.17
Landsborough ..	2 Feb., 1893	15.15	Ravenswood ..	24 Mar., 1890	17.00
Low Island ..	10 Mar., 1904	15.07	Redcliffe ..	16 Feb., 1893	17.35
,, ..	1 Apr., 1911	15.30	Rosedale ..	16 Jan., 1913	18.90
Lyndon (*via* Brixton)	3 ,, 1917	17.00*a*	Sarina	23 ,, 1918	22.60
Mackay	21 Jan., 1918	24.70*b*	St. Lawrence ..	30 ,, 1896	15.00
,, ...	22 ,, ,,	17.25*c*	The Hollow (Mackay)	23 Feb., 1888	15.12
Sugar Experimental Farm, Mackay ..	21 ,, ,,	16.80	Thornborough ..	20 Apr., 1903	18.07
,, ..	22 ,, ,,	17.20	Townsville ..	24 Jan., 1892	19.20
Macnade Mill ..	5 Feb., 1899	15.20	,, ..	28 Dec., 1903	15.00
,, ..	6 Jan., 1901	23.33	Victoria Mill ..	6 Jan., 1901	16.67
,, ..	4 Mar., 1915	22.00	Woodlands (Yepp'n)	31 ,, 1893	23.07
Mapleton ..	26 Dec., 1909	15.72	Wootha ..	10 Feb., 1915	15.93
Mirani	12 Jan., 1901	16.59	Yandina ..	1 ,, 1893	20.08
Miriam Vale (B'berg)	17 ,, 1913	15.80	,, ..	9 Jan., 1898	19.25
Mooloolah ..	13 Mar., 1892	21.53	,, ..	28 Dec., 1909	15.80
,, ..	2 Feb., 1893	19.11	Yarrabah ..	2 Apr., 1911	30.65
Mount Cuthbert ..	8 Jan., 1911	18.00	,, ..	24 Jan., 1916	27.20
Mount Molloy ..	31 Mar., ,,	20.00	,, ..	25 ,, ,,	18.60
,, ..	1 Apr., ,,	20.00	Yeppoon ..	31 ,, 1893	20.05
,, ..	2 ,, ,,	20.00	,, ..	8 ,, 1898	18.05
Mourilyan ..	11 Feb., 1911	17.40	,, ..	8 Oct., 1914	21.70

HEAVY RAINFALLS—WESTERN AUSTRALIA, UP TO 1926, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Alice Downs ..	15 Mar., 1922	10.58	Exmouth Gulf ..	2 Feb., 1918	12.50
Balla Balla ..	21 ,, 1899	14.40	Fortescue ..	3 May, 1890	23.36
Bamboo Creek ..	22 ,, ,,	10.10	Frazier Downs ..	3 Mar., 1916	11.25
Boodarie ..	3 Jan., 1896	10.03	Gnaraloo ..	20 ,, 1923	11.00
,, ..	21 ,, ,,	14.53	Kerdiadary ..	7 Feb., 1901	12.00
Booloogooroo ..	17 ,, 1923	10.96	Meda	2 Mar., 1916	10.55
Broome	6 Jan., 1917	14.00	Millstream ..	5 ,, 1900	10.00
Carlton	11 ,, 1903	10.64	Minilya ..	15 Jan., 1923	11.50
Cossack	3 Apr., 1898	12.82	Obagama ..	28 Feb., 1910	12.00
,, ...	16 ,, 1900	13.23	,, ..	24 Dec., 1920	13.02
Croydon	3 Mar., 1903	12.00	Pilbara	2 Apr., 1898	14.04
Derby	29 Dec., 1898	13.09	Point Cloates ..	20 Jan., 1909	10.87
,, ...	7 Jan., 1917	16.47	Point Torment ..	17 Dec., 1906	11.86

a Mr. Jas. Laidlaw, of Lyndon, states that this fell in 4 hours. *b* 37½ hours. *c* 22½ hours.

HEAVY RAINFALLS, WESTERN AUSTRALIA—*continued.*

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Port George IV. ..	17 Jan., 1915	11.24	Whim Creek ..	21 Mar., 1899	18.17
Roebourne ..	3 Apr., 1898	11.44	,, ,, ..	6 ,, 1900	10.03
,, ..	6 Mar., 1900	10.32	,, ,, ..	3 ,, 1903	10.44
Roebuck Plains ..	5 Jan., 1917	14.01	Winderrie ..	17 Jan., 1923	14.23
,, ,, ..	6 ,, ,,	22.36	Woodstock ..	21 ,, 1912	13.00
Springvale ..	14 Mar., 1922	12.25	Wyndham ..	27 Jan., 1890	11.60
Tambray ..	6 ,, 1900	11.00	,, ..	4 Mar., 1919	12.50
,, ..	3 ,, 1903	10.47	Yardie Creek ..	3 Feb., 1918	10.00
Thangoo	17-19 Feb. '96	24.18	Yeeda	2 Mar., 1916	10.70
,, ...	28 Dec., 1898	11.15	,, ...	6 Jan., 1917	10.20
Whim Creek ..	3 Apr., 1898	29.41	,, ...	7 ,, ,,	11.75

HEAVY RAINFALLS—NORTHERN TERRITORY, UP TO 1926, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Bathurst Island Mission ..	7 Apr., 1925	11.85	Cosmopolitan Gold Mine	24 Dec., 1915	10.60
Bonrook	24 Dec., 1915	10.60	Darwin	7 Dec., 1915	11.67
Borroloola ..	14 Mar., 1899	14.00	Groote Eylandt ..	30-31 Mar., '23	12.00*a*
Brock's Creek ..	4 Jan., 1914	10.68	Lake Nash ..	21 Mar., 1901	10.25
,, ,, ..	24 Dec., 1915	14.33	Pine Creek ..	8 Jan., 1897	10.35
Burrundie ..	4 Jan., 1914	11.61			

(*a*) Approximate only, as gauge was washed away.

HEAVY RAINFALLS—SOUTH AUSTRALIA, UP TO 1926, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Wilmington ..	28 Feb., 1921	3.97	Wilmington ..	1 Mar., 1921	7.12

HEAVY RAINFALLS—VICTORIA, UP TO 1926, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Balook	26 Sept.,1917	5.32	Mt. Buffalo ..	6 June, 1917	8.53
,, ...	27 ,, ,,	7.23	,, ..	7 ,, ,,	6.56
,, ...	28 ,, ,,	2.08			

HEAVY RAINFALLS—TASMANIA, UP TO 1926, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Cullenswood ..	5 June, 1923	10.50	Mathinna ..	8-10 Mar., '11	15.79
Gould's Country ..	8-10 Mar., '11	15.33	The Springs ..	30-31 Jan., '16	10.75
Lottah	8-10 ,, ,,	18.10	Triabunna ..	5 June, 1923	10.20

10. **Snowfall.**—Light snow has been known to fall occasionally so 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 the State of New South Wales, and has extended at times along the whole of the Great Dividing Range, from its southern extremity in Victoria so 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 Kosciusko and similar localities the snow never entirely disappears.

The antarctic " V "-shaped disturbances are always associated with the most pronounced and extensive snowfalls. The barometric gradients are very steep where the " trough line " extends northward, and the apexes are unusually sharp-pointed, and protrude into very low latitudes, sometimes even to the tropics.

11. **Hail.**—Hail falls most frequently along the southern shores of the continent in the winter, and over south-eastern Australia during the summer months. The size of the hailstones generally increases with distance from the coast, a fact which lends strong support to the theory that hail is brought about by ascending currents. 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 hailstorms occur most frequently when the barometric readings indicate a flat and unstable condition of pressure. They are almost invariably associated with tornadoes or tornadic tendencies, and on the east coast the clouds from which the stones fall are generally of a remarkable sepia-coloured tint.

12. **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 in the interior of the continent, ranged as high as 30.77 inches (at Kalgoorlie on the 28th July, 1901) and have fallen as low as 27.55 inches. This lowest record was registered at Mackay during a tropical hurricane on the 21st January, 1918. An almost equally abnormal reading of 27.88 inches was recorded at Innisfail during a similar storm on the 10th March, 1918. The mean annual fluctuations of barometric pressure for the capitals of Australia are shown on the graph herein.

13. **Wind.**—Notes on the distinctive wind currents in Australia were given in preceding Year Books (see No. 6, page 83), but, owing to limitations of space, have not been included herein.

14. **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 cyclonic storms, evolved from the V-shaped 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 cyclones 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 S.W. and finally towards the S.E. Only a small percentage, however, reach Australia, the majority recurving in their path to the east of New Caledonia.

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 apparently originate in the ocean in the vicinity of Cambridge Gulf, 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, and cause great havoc amongst the pearl-fishers. 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 coastline, 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, will be found in previous issues of the Official Year Book (see No. 6, pp. 84, 85, 86).

A special article dealing with "Australian Hurricanes and Related Storms" appeared in Official Year Book No. 16, pp. 80–84.

15. 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, the mean temperature of Sydney shows a rise of two-tenths of a degree during the last twenty years, a change probably brought about by the great increase of residential and manufacturing buildings within the city and in the surrounding suburbs. Again, 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 high lands now flows unchecked and untempered down the sides of the hills to the valleys and lower lands.

(ii) *Influence of Forests 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 alternate 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, 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.

In previous issues some notes on observations made in other countries were added (see Official Year Book No. 6, pp. 86 and 95).

16. Rainfall and Temperatures, Various Cities.—The following table shows rainfall and temperature for various important cities throughout the world, for the site of the Federal capital, and for the capitals of the Australian States.

RAINFALL AND TEMPERATURE—VARIOUS CITIES.

Place.	Height above M.S.L.	Annual Rainfall.			Temperature.					
		Average.	Highest.	Lowest.	(a) Mean Summer.	(b) Mean Winter.	Highest on Record.	Lowest on Record.	Average Hottest Month.	Average Coldest Month.
	Ft.	Ins.	Ins.	Ins.	Fahr.	Fahr.	Fahr.	Fahr.	Fahr.	Fahr.
Amsterdam ..	6	27.29	40.59	17.60	63.2	36.8	90.0	4.1	64.4	35.4
Auckland ..	125	43.88	74.15	26.32	66.2	52.5	91.0	31.9	67.1	51.8
Athens	351	15.48	33.33	4.56	79.2	49.1	109.4	19.6	81.0	47.4
Bergen	72	77.09	111.58	44.49	56.8	34.2	88.5	4.8	57.9	33.6
Berlin	161	22.72	30.04	14.25	64.8	33.0	98.6	−13.0	66.0	31.8
Berne	1,877	36.30	58.23	24.69	62.2	30.1	91.4	− 3.6	64.4	28.0
Bombay ..	37	71.15	114.89	33.41	83.5	75.1	100.0	55.9	84.8	74.2
Breslau ..	482	22.52	32.56	16.50	64.1	33.5	100.0	−23.4	65.5	29.3
Brussels ..	328	28.35	41.18	17.73	62.6	36.0	95.5	− 4.4	63.7	34.5
Budapest ..	500	25.20	35.28	16.79	68.6	30.2	98.6	− 5.1	70.4	28.2
Buenos Ayres ..	82	38.78	79.72	20.04	72.7	50.9	103.1	22.3	73.8	50.0
Calcutta ..	21	61.82	98.48	38.43	85.6	68.0	108.2	44.2	86.0	66.4
Capetown ..	40	25.50	36.72	17.71	68.1	54.7	102.0	34.0	68.8	53.9
Caracas ..	3,420	30.03	47.36	23.70	68.3	65.3	87.8	48.2	69.2	63.7
Chicago ..	823	33.28	45.86	24.52	70.0	26.1	103.0	−23.0	72.4	23.7
Christchurch ..	25	25.16	35.30	13.54	61.3	43.3	95.7	21.3	61.6	42.4
Christiania (Oslo)..	75	23.23	32.21	16.26	61.0	24.5	95.0	−21.1	62.6	23.9
Colombo ..	40	83.83	139.70	51.60	81.5	79.9	95.8	65.0	82.6	79.1
Constantinople ..	245	28.75	42.74	14.78	74.0	43.5	103.6	13.0	75.7	42.0
Copenhagen ..	10	20.79	25.83	15.47	60.4	33.3	85.5	− 3.3	61.9	32.4
Dresden ..	115	26.80	34.49	17.72	62.9	32.4	93.4	−15.3	64.4	31.6
Dublin	47	27.66	35.56	16.60	59.4	42.0	87.2	13.3	60.5	41.7
Dunedin ..	300	36.96	54.51	22.15	56.3	42.6	94.0	23.0	57.0	41.5
Durban ..	260	40.79	71.27	27.24	75.6	64.4	110.6	41.1	76.7	63.8
Edinburgh ..	441	25.21	32.05	16.44	55.8	38.8	87.7	5.0	57.2	38.3
Geneva	1,328	33.48	46.89	21.14	64.4	33.7	..	..	66.2	32.2
Genoa	157	51.29	108.22	28.21	73.8	46.8	94.5	16.7	75.4	45.5
Glasgow ..	184	38.49	56.18	29.05	52.7	41.0	84.9	6.6	58.0	38.4
Greenwich ..	149	23.50	35.54	16.38	62.0	39.5	100.0	6.9	63.5	38.5
Hong Kong ..	109	84.28	119.72	45.84	86.2	64.8	97.0	32.0	86.7	62.9
Johannesburg ..	5,750	31.63	50.00	21.66	65.4	54.4	94.0	23.3	68.2	48.9
Leipzig	384	24.69	31.37	17.10	63.1	31.5	97.3	−14.8	64.8	30.6
Lisbon	312	29.18	52.79	17.32	69.6	51.3	94.1	32.5	70.2	49.3
London (Kew) ..	18	23.80	38.20	16.64	61.2	39.8	94.0	9.4	62.7	38.9
Madras	22	49.85	88.41	18.45	89.0	76.8	113.0	57.5	89.9	76.1
Madrid ..	2,149	16.23	27.48	9.13	73.0	41.2	107.1	10.5	75.7	39.7
Marseilles ..	246	22.24	43.03	12.28	70.5	45.3	100.4	11.7	72.3	44.6
Moscow ..	526	18.94	29.28	12.07	63.4	14.7	99.5	−44.5	66.1	11.9
Naples	489	34.00	56.58	21.75	73.6	48.0	99.1	23.9	75.4	46.8
New York ..	314	44.63	58.68	33.17	71.4	31.8	102.0	−13.0	73.5	30.2
Ottawa	236	33.40	53.79	25.63	67.2	14.1	98.0	−33.0	69.7	12.0
Paris	164	22.64	29.57	16.46	63.5	37.2	101.1	−14.1	64.9	36.1
Pekin	143	24.40	36.00	18.00	77.7	26.6	114.0	− 5.0	79.2	23.6
Petrograd ..	16	21.30	29.52	13.75	61.1	17.4	97.0	−38.2	63.7	15.2
Quebec	296	40.50	53.79	32.12	63.5	12.4	96.0	−34.0	66.3	10.1
Rome	166	32.57	57.89	12.72	74.3	46.0	104.2	17.2	76.1	44.6
San Francisco ..	155	22.27	38.82	9.00	58.8	50.5	101.0	29.0	59.3	49.5
Shanghai ..	21	45.00	62.52	27.92	78.0	41.1	102.9	10.2	80.4	37.8
Singapore ..	8	91.99	158.68	32.71	81.2	78.6	94.2	63.4	81.5	78.3
Stockholm ..	144	19.09	28.27	11.81	59.5	27.3	96.8	−25.6	61.9	26.4
Tokio	65	61.45	86.37	45.72	74.8	39.2	97.9	17.2	77.7	37.5
Trieste	85	42.94	63.14	26.57	73.9	41.3	99.5	14.0	76.3	39.9
Vienna	663	24.50	33.90	16.50	65.7	30.4	97.7	− 8.0	67.1	28.0
Vladivostock ..	55	19.54	33.60	9.39	63.9	11.0	95.7	−21.8	69.4	6.1
Washington ..	112	43.50	61.33	30.85	74.7	34.5	106.0	−15.0	76.8	32.9
Wellington (N.Z.)	10	48.65	67.68	27.83	61.8	48.6	88.0	28.6	62.5	47.7
Zürich	1,542	45.15	78.27	29.02	63.3	31.3	94.1	− 0.8	65.1	29.5

FEDERAL CAPITAL SITE.

					(a)	(b)				
Canberra (Dist.) Queanbeyan	2,000 to 2,900	22.67	41.29	10.45	67.7	44.2	102.6	14.0	68.4	42.7

STATE CAPITALS.

					(a)	(b)				
Perth	197	34.32	49.22	20.21	72.8	56.0	108.4	34.2	74.0	55.2
Adelaide ..	140	21.22	30.87	11.39	73.0	53.0	116.3	32.0	74.2	51.8
Brisbane ..	137	45.08	88.26	16.17	76.7	59.7	108.9	36.1	77.2	58.4
Sydney	138	47.50	82.76	21.49	71.0	54.1	108.5	35.9	71.6	52.7
Melbourne ..	115	25.58	44.25	15.61	66.6	50.0	111.2	27.0	67.6	48.7
Hobart	177	23.84	43.39	13.43	61.6	46.8	105.2	27.0	62.3	45.6

(a) Mean of the three hottest months. (b) Mean of the three coldest months.

17. Climatological Tables.—The means, averages, extremes, totals, etc., for a number of climatological elements have been determined from long series of observations at the Australian capitals up to and including the year 1926. These are given in the following tables :—

CLIMATOLOGICAL DATA—PERTH, WESTERN AUSTRALIA.

LAT. 31° 57′ S., LONG. 115° 50′ E. HEIGHT ABOVE M.S.L. 197 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.					Mean Amount of Evaporation (inches).	No. of Days Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m. & 9 p.m.	No. of Clear Days.
		Greatest Number of Miles in One Day.		Mean Hourly Pressure. (lbs.)	Total Miles.	Prevailing Direction.				
No. of yrs. over which observation extends	42	29		28	29	29	28	28	29	29
January	29.908	797	27/98	0.68	11,181	S S E	10.39	1.6	2.8	13.9
February	29.923	650	6/08	0.62	9,763	S S E	8.55	1.4	2.9	11.7
March	29.987	651	6/13	0.53	9,911	S S E	7.60	1.4	3.2	12.0
April	30.074	955	25/00	0.40	8,351	S E	4.72	1.5	4.2	7.9
May	30.072	768	5/12	0.36	8,147	E N E	2.73	2.3	5.3	5.1
June	30.059	861	27/10	0.36	7,863	N	1.75	2.5	5.9	3.3
July	30.090	1015	20/26	0.39	8,593	N	1.75	2.3	5.4	5.1
August	30.089	966	15/03	0.42	8,758	W	2.37	1.6	5.2	5.3
September ..	30.061	864	11/05	0.46	8,921	S W	3.32	1.4	4.9	5.8
October	30.029	809	6/16	0.53	9,906	S S W	5.22	1.2	4.8	5.8
November.. ..	29.990	777	18/97	0.60	10,054	S	7.63	1.2	3.8	8.3
December ..	29.927	776	6/22	0.65	10,899	S	9.80	1.4	3.1	12.1
Year Totals ..	—	—		—	—	—	65.83	20.0	—	96.3
Year Averages ..	30.017	—		0.50	9,362	S	—	—	4.3	—
Year Extremes ..	—	1015	20/7/26	—	—	—	—	—	—	—

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (Fahr.).			Extreme Shade Temperature (Fahr.).				Extreme Range.	Extreme Temperature (Fahr.).				Mean Hours of Sunshine.
	Mean Max.	Mean Min.	Mean	Highest.		Lowest.			Highest in Sun.		Lowest on Grass.		
No. of yrs. over which observation extends	30	30	—	30		30		—	28		28		29
January	84.5	63.2	73.8	108.4	28/21	48.6	20/25	59.8	177.3	22/14	39.5	20/25	319.5
February	84.8	63.4	74.1	107.4	4/23	47.7	1/02	59.7	169.0	4/99	39.8	1/13	266.6
March	81.4	61.1	71.2	106.4	14/22	45.8	8/03	60.6	167.0	19/18	36.7	8/03	268.0
April	76.1	57.2	66.6	99.7	9/10	39.3	20/14	60.4	157.0	8/16	31.0	20/14	219.0
May	68.7	52.6	60.6	90.4	2/07	34.3	11/14	56.1	146.0	4/25	25.3	11/14	175.8
June	64.1	49.6	56.8	81.7	2/14	35.0	30/20	46.7	135.5	9/14	26.5	30/20	144.7
July	62.8	48.1	55.4	76.4	21/21	34.2	7/16	42.2	133.2	13/15	25.1	30/20	167.3
August	63.8	48.1	55.9	81.0	12/14	35.3	31/08	45.7	145.1	29/21	27.9	10/11	187.3
September ..	66.2	50.1	58.1	90.9	30/18	38.9	17/13	52.0	153.6	29/16	29.2	21/16	203.9
October	68.8	52.7	60.7	95.3	30/22	40.5	5/24	54.8	154.0	29/14	30.5	4/17	235.8
November.. ..	75.4	56.8	66.1	104.6	24/13	42.0	1/04	62.6	167.0	30/25	35.4	6/10	285.1
December ..	80.8	60.6	70.6	107.9	20/04	48.0	2/10	59.9	168.7	25/15	39.0	(c)	322.6
Year Averages ..	73.1	55.3	64.2	—		—		—	—		—		2782.8
Year Extremes ..	—	—	—	108.4	28/1/21	34.2	7/7/16	74.2	177.3	22/1/14	25.1	30/7/20	—

HUMIDITY, RAINFALL, AND DEW.

Month.	Vapour Pressure (inches).	Rel. Hum. (%)			Rainfall (inches).								Dew.
	Mean 9 a.m.	Mean 9 a.m.	Highest Mean.	Lowest Mean.	Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.		Least Monthly.		Greatest in One Day.		Mean No. Days Dew.
No. of yrs. over which observation extends	29	29	29	29	51	51	51		51		51		29
January	0.431	52	61	42	0.34	3	2.17	1879	0.00	(a)	1.74	28/79	2.3
February	0.451	54	65	46	0.45	3	2.98	1915	0.00	(a)	1.63	26/15	3.2
March	0.432	57	66	46	0.79	4	4.50	1896	0.00	(a)	2.06	26/23	5.5
April	0.397	63	72	51	1.65	7	5.85	1926	0.00	1920	2.62	30/04	9.1
May	0.370	73	81	61	4.97	14	12.13	1879	0.98	1903	2.80	20/79	12.4
June	0.336	78	83	68	6.92	17	12.80	1923	2.16	1877	3.90	10/20	12.6
July	0.315	77	84	69	6.57	17	12.28	1926	2.42	1876	3.00	4/91	13.6
August	0.318	74	79	63	5.63	18	10.33	1882	0.46	1902	2.79	7/03	11.7
September ..	0.342	68	76	58	3.41	15	7.84	1923	0.34	1916	1.73	23/09	9.7
October	0.355	62	75	54	2.21	12	7.87	1890	0.49	1892	1.38	15/10	5.3
November.. ..	0.376	56	63	46	0.81	6	2.78	1916	0.00	1891	1.11	30/03	3.7
December ..	0.413	45	62	44	0.57	4	3.05	1888	0.00	1896	1.72	1/88	2.8
Year Totals ..	—	—	—	—	34.32	120	—		—		—		91.9
Year Averages ..	0.371	63	—	—	—	—	—		—		—		—
Year Extremes ..	—	—	84	42	—	—	12.80	1923	Nil	(b)	3.90	10/6/20	—

(a) Various years. (b) Jan., Feb., March, April, Nov., Dec., various years. (c) 3/1910 and 12/1920.

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. Greatest Number of Miles in One Day.	Wind. Mean Hourly Pressure. (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction. 9 a.m.	Wind. Prevailing Direction. 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m. & 9 p.m.	No. of Clear Days.
No. of yrs. over which observation extends	70	49	49	49	49		57	55	59	45
January	29.916	758 19/99	0.34	7,885	S x W	S W	8.96	2.3	3.5	8.3
February	29.951	691 22/96	0.29	6,676	S E x E	S W x S	7.32	2.0	3.5	7.1
March	30.038	628 9/12	0.24	6,650	S E x E	S W	5.83	2.1	3.9	7.2
April	30.120	773 10/96	0.22	6,094	E x N	W S W	3.45	1.6	5.0	4.2
May	30.120	760 9/80	0.21	6,255	N E x N	W x N	2.01	1.7	5.8	2.0
June	30.096	750 12/78	0.25	6,526	N N E	N W x W	1.23	2.0	6.1	1.7
July	30.127	674 25/82	0.24	6,723	N N E	N W x W	1.29	1.6	5.8	1.8
August	30.099	773 31/97	0.28	7,134	N x E	W N W	1.87	2.2	5.6	2.6
September ..	30.039	720 2/87	0.31	7.284	N	W	2.84	2.5	5.2	3.2
October	29.994	768 28/98	0.34	7,881	N N W	W S W	4.76	3.4	5.0	4.0
November	29.976	677 2/04	0.33	7,527	W x S	S W x W	6.56	3.5	4.6	5.4
December ..	29.919	675 12/91	0.34	7.888	S W x W	S W	8.39	2.6	3.8	7.3
Year { Totals ..	—	—	—	—	—		54.51	27.5	—	54.8
Year { Averages ..	30.033	—	0.28	7,044	N E x N	W S W	—	—	4.8	—
Year { Extremes ..	—	773 (a)	—	—	—		—	—	—	—

(a) 10/4/96 and 31/8/97.

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (Fahr.). Mean Max.	Mean Temperature (Fahr.). Mean Min.	Mean Temperature (Fahr.). Mean	Extreme Shade Temperature (Fahr.). Highest.	Extreme Shade Temperature (Fahr.). Lowest.	Extreme Range.	Extreme Temperature (Fahr.). Highest in Sun.	Extreme Temperature (Fahr.). Lowest on Grass.	Mean Hours of Sunshine.
No. of yrs. over which observation extends	70	70	70	70	70	70	49	66	45
January	86.2	61.5	73.8	116.3 26/58	45.1 21/84	71.2	180.0 18/82	36.5 14/79	310.3
February	86.2	62.1	74.1	113.6 12/99	45.5 23/18	68.1	170.5 10/00	35.8 23/26	262.5
March	80.8	58.8	69.8	108.0 12/61	44.8 –/57	63.2	174.0 17/83	33.8 27/80	240.9
April	73.3	54.6	64.0	98.0 10/66	39.6 15/59	58.4	155.0 1/83	30.2 16/17	178.6
May	65.6	50.2	57.9	89.5 4/21	36.9 (a)	52.6	148.2 12/79	25.9 10/91	147.6
June	60.3	46.7	53.5	76.0 23/65	32.5 27/76	43.5	138.8 18/79	22.9 12/13	122.3
July	58.9	44.6	51.8	74.0 11/06	32.0 24/08	42.0	134.5 26/90	23.3 25/11	137.9
August	62.0	45.9	53.9	85.0 31/11	32.3 17/59	52.7	140.0 31/92	23.5 7/88	164.0
September ..	66.2	47.9	57.1	90.7 23/82	32.7 4/58	58.0	160.5 23/82	26.2 15/08	182.9
October	72.4	51.4	61.9	102.9 21/22	36.0 –/57	66.9	162.0 30/21	27.8 2/18	227.9
November	78.6	55.3	67.0	113.5 21/65	40.8 2/09	72.7	166.9 20/78	31.5 2/09	263.3
December ..	83.3	58.9	71.1	114.2 14/76	43.0 (b)	71.2	175.7 7/99	32.5 4/84	302.2
Year { Averages ..	72.8	53.2	63.0	—	—	—	—	—	2540.4c
Year { Extremes ..	—	—	—	116.3 26/1/58	32.0 24/7/08	84.3	180.0 18/1/82	22.9 12/6/1913	—

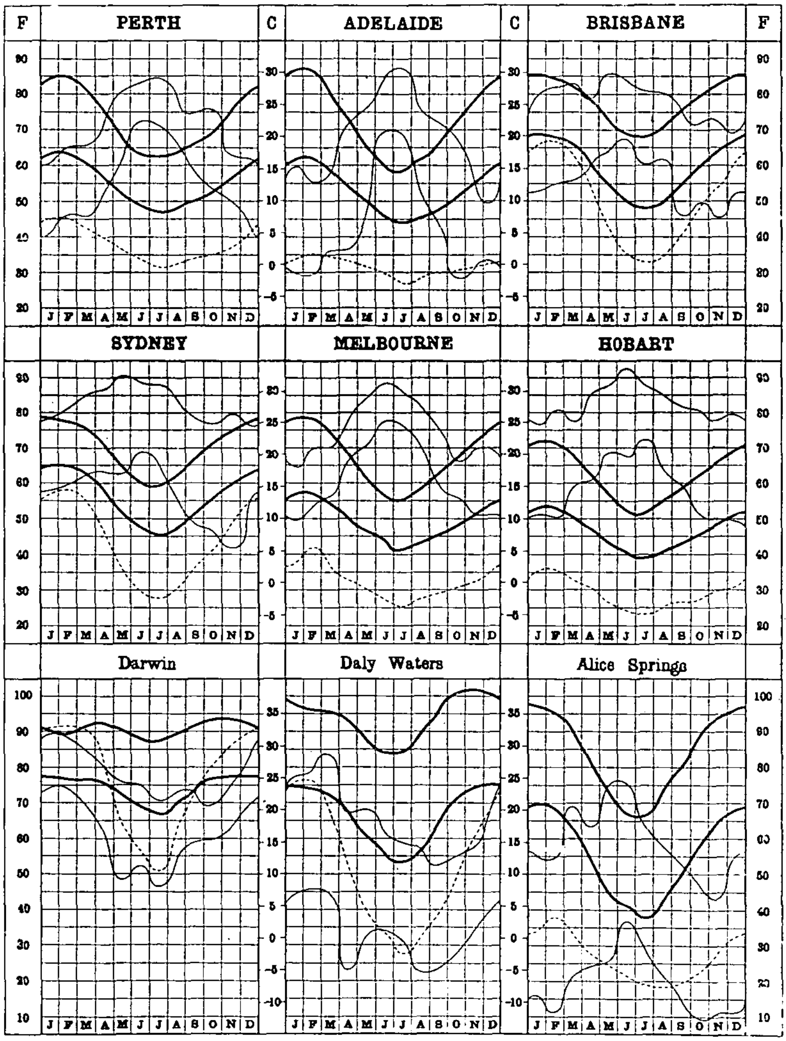
(a) 26/1895 and 24/1904. (b) 16/1861 and 4/1906. (c) Total for year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Vapour Pressure (inches) Mean 9 a.m.	Rel. Hum. (%) Mean 9 a.m.	Rel. Hum. (%) Highest Mean.	Rel. Hum. (%) Lowest Mean.	Rainfall (inches). Mean Monthly.	Rainfall (inches). Mean No. of Days Rain.	Rainfall (inches). Greatest Monthly.	Rainfall (inches). Least Monthly.	Rainfall (inches). Greatest in One Day.	Dew. Mean No. Days Dew.
No. of yrs. over which observation extends	59	59	59	59	88	88	88	88	88	55
January	0.343	39	59	30	0.72	4	4.00 1850	Nil (a)	2.30 2/89	4.0
February	0.356	40	56	30	0.72	4	6.09 1925	Nil (b)	5.57 7/25	5.8
March	0.348	47	58	36	1.03	6	4.60 1878	Nil (c)	3.50 5/78	11.0
April	0.336	56	72	37	1.75	9	6.78 1853	0.03 1923	3.15 5/60	13.9
May	0.320	68	76	49	2.78	14	7.75 1875	0.20 1891	2.75 1/53	15.7
June	0.300	77	84	69	3.12	16	8.58 1916	0.42 1886	2.11 1/20	15.9
July	0.276	76	87	68	2.64	16	5.38 1865	0.37 1899	1.75 10/65	17.1
August	0.286	69	77	54	2.51	16	6.24 1852	0.35 1914	2.23 19/51	16.5
September ..	0.297	61	72	44	2.06	14	5.83 1923	0.45 1896	1.59 20/23	15.6
October	0.301	51	67	29	1.74	11	3.83 1870	0.17 1914	2.24 16/08	12.9
November	0.310	43	57	31	1.15	7	3.55 1851	0.04 1885	1.88 28/58	7.0
December ..	0.323	39	50	33	1.00	6	3.98 1861	Nil 1904	2.42 23/13	4.8
Year { Totals ..	—	—	—	—	21.22	123	—	—	—	140.1
Year { Averages ..	0.311	53	—	—	—	—	—	—	—	—
Year { Extremes ..	—	—	87	29	—	—	8.58 6/16	Nil (d)	5.57 7/2/25	—

(a) 1848, etc. (b) 1848, etc. (c) 1859, etc. (d) January, February, March, December, various years.

ANNUAL FLUCTUATIONS OF NORMAL MAXIMUM AND MINIMUM TEMPERATURE AND HUMIDITY.



EXPLANATION.—The upper and lower heavy lines in each graph represent the maximum and minimum temperatures respectively. The Fahrenheit temperature scales are shown on the outer edge of the sheet under " F " and the centigrade scales in the two inner columns under " C."

The broken line shows the normal absolute humidity in the form of 9 a.m. vapour pressures for which the figures in the outer " F " columns represent hundredths of an inch of barometric pressure.

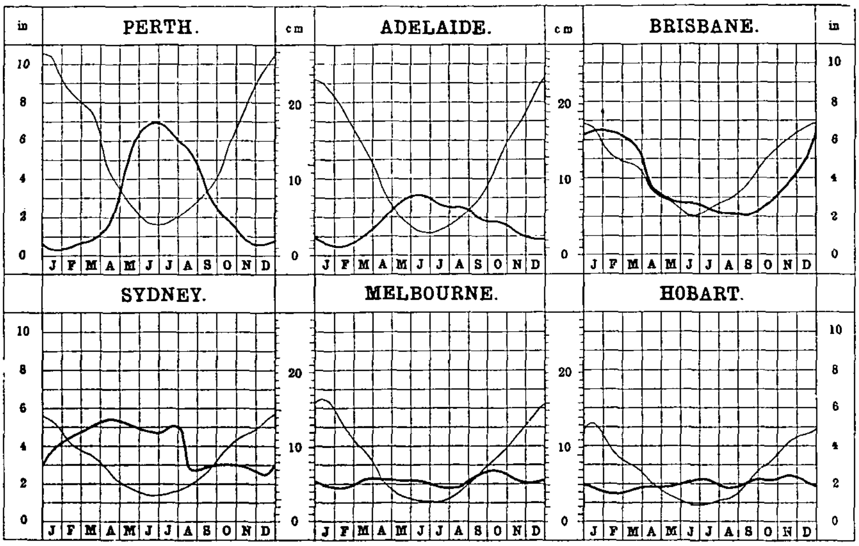
The upper and lower fine lines join the greatest and the least monthly means of relative humidity respectively, the figures under the outer columns " F " indicating percentage values.

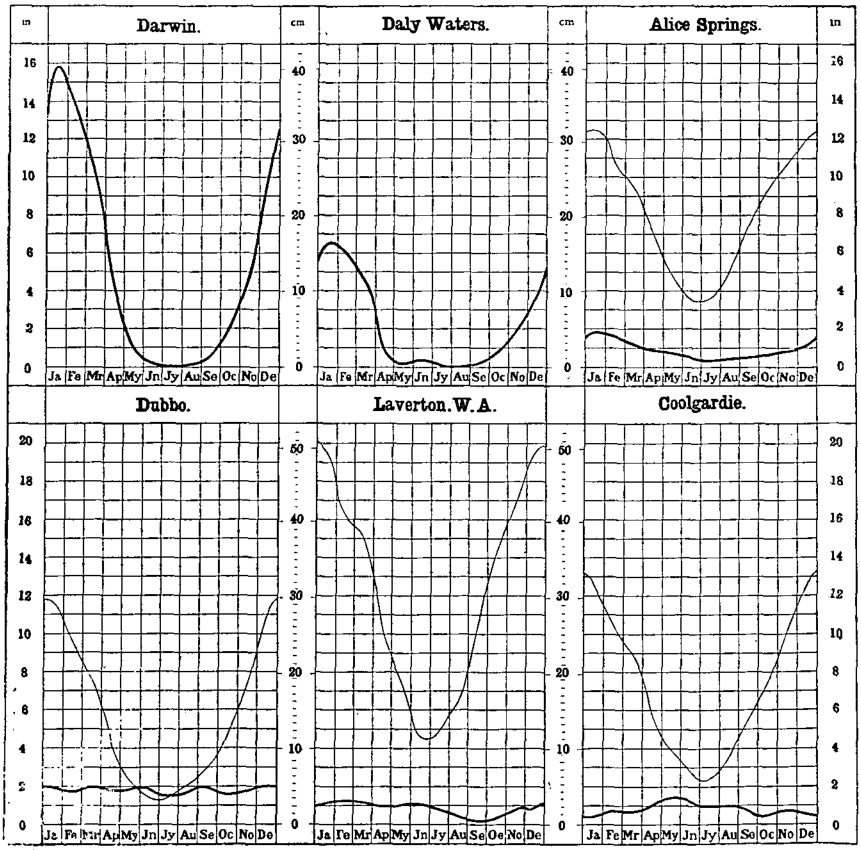
The curves for temperature and vapour pressure joining the mean monthly values serve to show the annual fluctuation of these elements, but the relative humidity graphs joining the extreme values for each month do not indicate any normal annual variation.

Comparison of the maximum and minimum temperature curves affords a measure of the mean diurnal range of temperature. At Perth in the middle of January, for instance, there is normally a range of 21° from 63° F. to 84° F., but in June it is only 15° from 48° F. to 63° F.

The relative humidity curves illustrate the extreme range of the mean monthly humidity over a number of years.

MEAN MONTHLY RAINFALL AND EVAPORATION.





EXPLANATION.—On the preceding graphs thick lines denote rainfall, and thin lines evaporation, and show the fluctuation of the mean rate of fall *per month* throughout the year. The results, plotted from the Climatological Tables herein are shown in inches (see the outer columns), and the corresponding metric scale (centimetres) is shown in the two inner columns. The evaporation is not given for Darwin and Daly Waters.

At Perth, Adelaide, Brisbane, Melbourne, Hobart, Alice Springs, and Coolgardie the results have been obtained from jacketed tanks sunk in the ground. At Sydney and Dubbo sunken tanks without water jackets are used, whilst at Laverton (W.A.) the records are taken from a small portable jacketed evaporation dish of 8 inches in diameter.

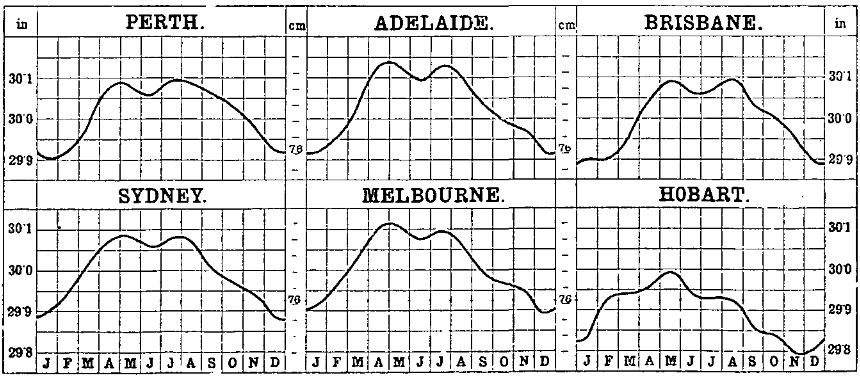
The distance for any date from the zero line to the curve represents the average number of inches, reckoned as per month, of rainfall at that date. Thus, taking the curves for Adelaide in the middle of January the rain falls on the average at the rate of about three-fourths of an inch per month, or, say, at the rate of about 9 inches per year. In the middle of June it falls at the rate of a little over 3 inches per month, or, say, at the rate of about 37 inches per year. At Dubbo, the evaporation is at the rate of nearly 11¾ inches per month about the middle of January, and only about 1¼ inches at the middle of June.

The mean annual rainfall and evaporation at the places indicated are given in the appended table

MEAN ANNUAL RAINFALL AND EVAPORATION.

Place.	Rainfall.	Evaporation.	Place.	Rainfall.	Evaporation.
	In.	In.		In.	In.
Perth ..	34.32	65.83	Darwin ..	61.67	—
Adelaide ..	21.22	53.91	Daly Waters ..	26.63	—
Brisbane ..	45.07	55.00	Alice Springs ..	11.10	94.24
Sydney ..	47.46	38.67	Dubbo ..	22.11	66.37
Melbourne ..	25.58	38.92	Laverton, W.A.	9.67	142.17
Hobart ..	23.84	31.76	Coolgardie ..	10.06	84.41

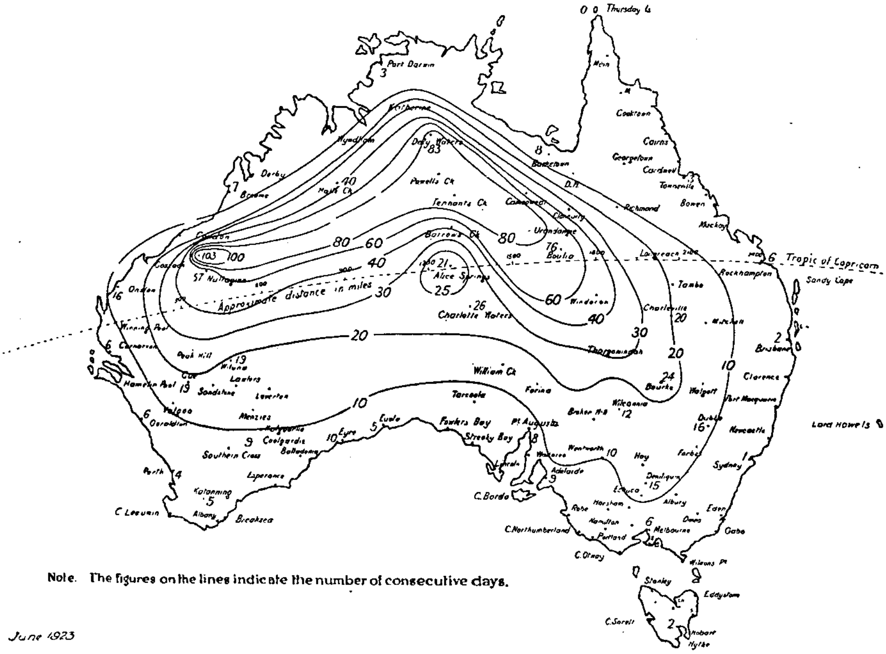
MEAN BAROMETRIC PRESSURE.—CAPITAL CITIES.



EXPLANATION.—The lines representing the yearly fluctuations of barometric pressure at the State capital cities are means for long periods, and are plotted from the Climatological Tables herein. The pressures are shown in inches on about 2½ times the natural scale, and the corresponding pressures in centimetres are also shown in the two inner columns, in which each division represents one millimetre.

INTERPRETATION.—Taking the Brisbane graph for purposes of illustration, it will be seen that the mean pressure in the middle of January is about 29.87 inches, and there are maxima in the middle of May and August of about 30.09 inches.

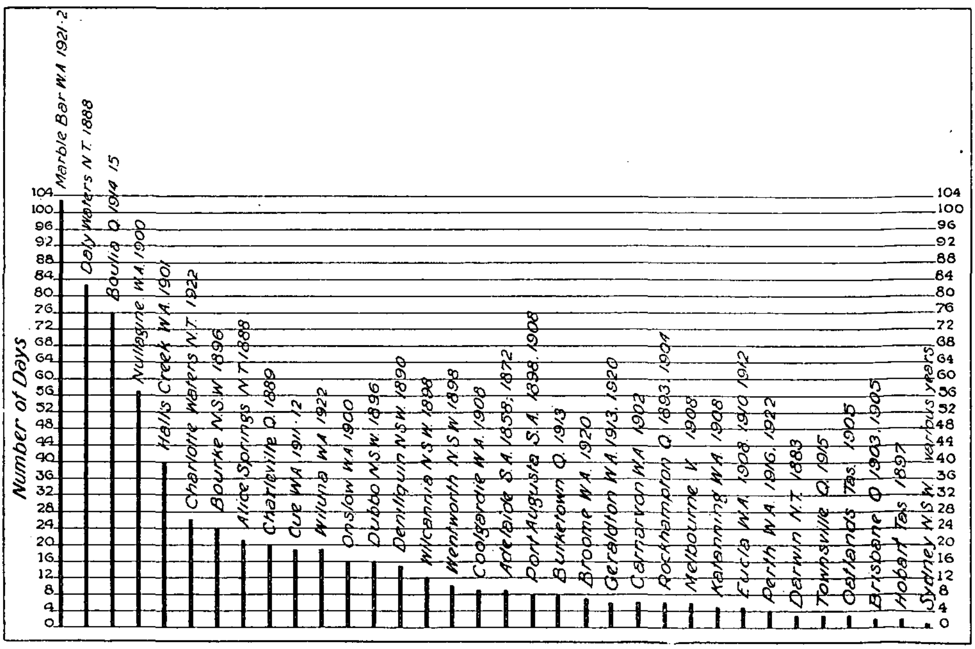
Area affected and period of duration of the Longest Heat Waves when the Maximum Temperature for consecutive 24 hours reached or exceeded 100° Fah.

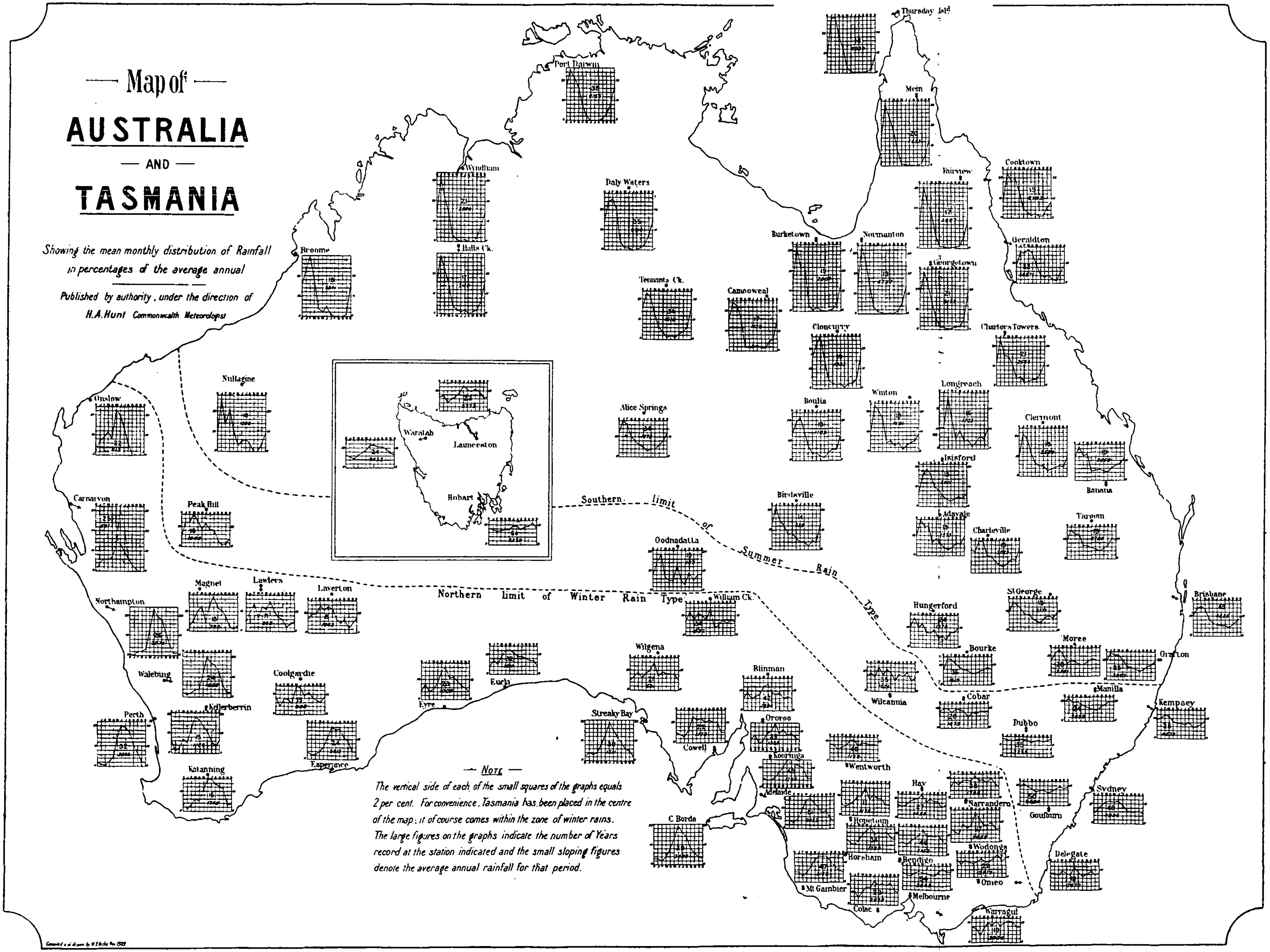


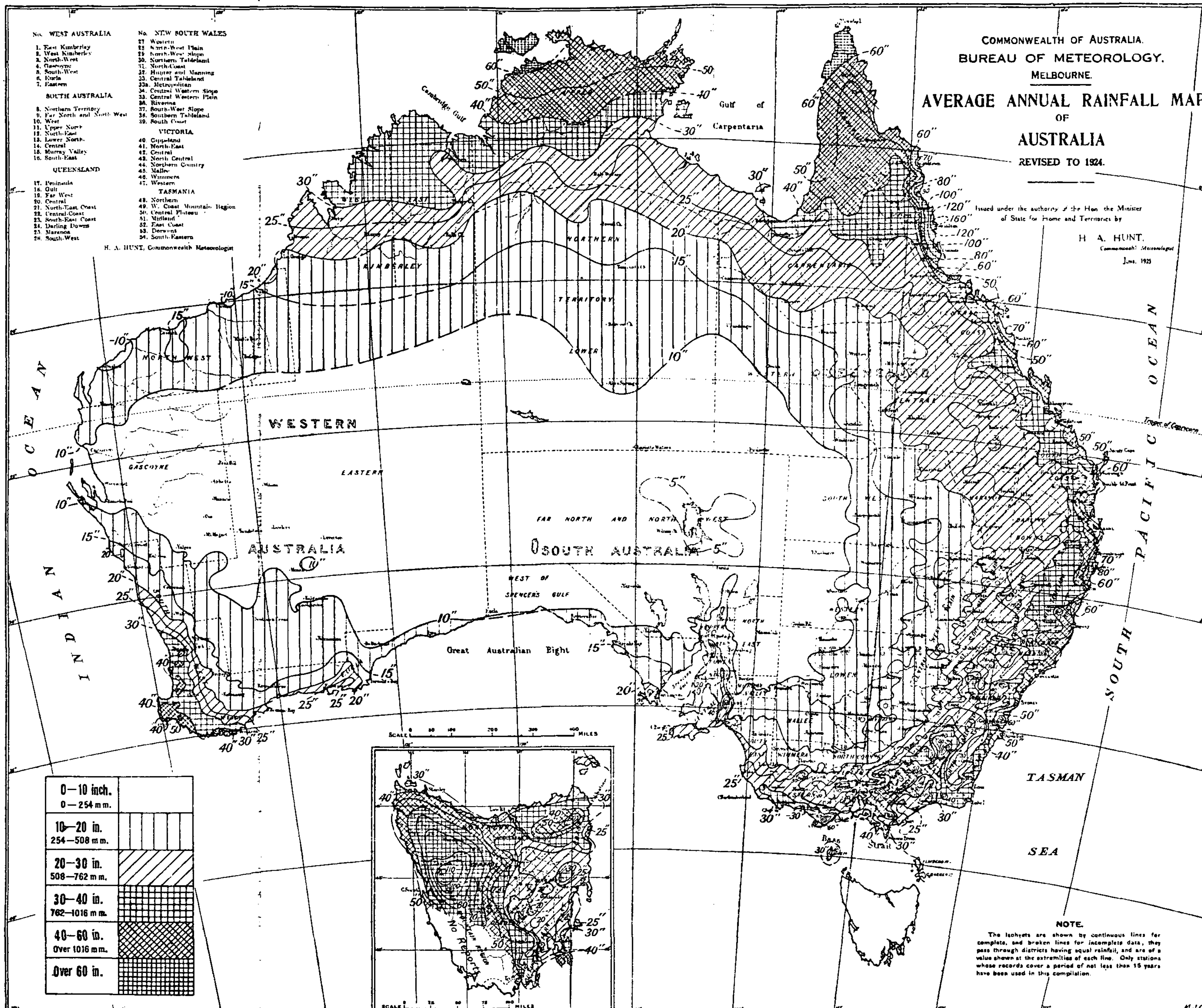
Note. The figures on the lines indicate the number of consecutive days.

June 1923

Greatest number of consecutive days on which the Shade Temperature was over 100° Fah. at the places indicated.




Map of
AUSTRALIA
AND
TASMANIA
Showing the mean monthly distribution of Rainfall in percentages of the average annual
Published by authority, under the direction of H.A. Hunt Commonwealth Meteorologist
Note
The vertical side of each of the small squares of the graphs equals 2 per cent. For convenience, Tasmania has been placed in the centre of the map; it of course comes within the zone of winter rains.
The large figures on the graphs indicate the number of Years record at the station indicated and the small sloping figures denote the average annual rainfall for that period.
Southern limit of Summer Rain Type
Northern limit of Winter Rain Type
Thursday Isld
Port Darwin
Mein
Wyndham
Cooktown
Fairview
Daly Waters
Halls Ck.
Broome
Burketown
Normanton
Geraldton
Georgetown
Tennants Ck.
Camooweal
Cloncurry
Charters Towers
Nullagine
Onslow
Waratah
Launceston
Hobart
Alice Springs
Boulia
Winton
Longreach
Clermont
Isisford
Banana
Carnarvon
Peak Hill
Birdsville
Adavale
Charleville
Taroom
Oodnadatta
Magnet
Lawlers
Laverton
Northampton
William Ck.
Hungerford
St George
Brisbane
Moree
Bourke
Grafton
Wilgena
Blinman
Walebing
Coolgardie
Eucla
Eyre
Wilcannia
Manilla
Cobar
Kellerberrin
Perth
Streaky Bay
Ororoo
Dubbo
Kempsey
Cowell
Kooringa
Wentworth
Esperance
Katanning
Adelaide
Hay
Narrandera
Goulburn
Sydney
C Borda
Hopetoun
Horsham
Bendigo
Wodonga
Omeo
Delegate
Mt Gambier
Colac
Melbourne
Warragul



No. WEST AUSTRALIA
1. East Kimberley
2. West Kimberley
3. North-West
4. Gascoyne
5. South-West
6. Eucla
7. Eastern
SOUTH AUSTRALIA
8. Northern Territory
9. Far North and North West
10. West
11. Upper North
12. North-East
13. Lower North
14. Central
15. Murray Valley
16. South-East
QUEENSLAND
17. Peninsula
18. Gulf
19. Far West
20. Central
21. North-East Coast
22. Central-Coast
23. South-East Coast
24. Darling Downs
25. Maranoa
26. South-West
No. NEW SOUTH WALES
27 Western
28 North-West Plain
29 North-West Slope
30. Northern Tableland
31. North-Coast
32. Hunter and Manning
33. Central Tableland
33a. Metropolitan
34. Central Western Slope
35. Central Western Plain
36. Riverina
37. South-West Slope
38. Southern Tableland
39. South Coast
VICTORIA
40. Gippsland
41. North-East
42. Central
43. North Central
44. Northern Country
45. Mallee
46. Wimmera
47. Western
TASMANIA
48. Northern
49. W. Coast Mountain Region
50. Central Plateau
51. Midland
52. East Coast
53. Derwent
54. South-Eastern
H. A. HUNT, Commonwealth Meteorologist
COMMONWEALTH OF AUSTRALIA.
BUREAU OF METEOROLOGY.
MELBOURNE.
AVERAGE ANNUAL RAINFALL MAP
OF
AUSTRALIA
REVISED TO 1924.
Issued under the authority of the Hon. the Minister of State for Home and Territories by
H. A. HUNT.
Commonwealth Meteorologist
June, 1925
Gulf of Carpentaria
INDIAN OCEAN
SOUTH PACIFIC OCEAN
TASMAN SEA
Great Australian Bight
WESTERN AUSTRALIA
SOUTH AUSTRALIA
0—10 inch. 0—254 mm.
10—20 in. 254—508 mm.
20—30 in. 508—762 mm.
30—40 in. 762—1016 mm.
40—60 in. Over 1016 mm.
Over 60 in.
NOTE.
The Isohyets are shown by continuous lines for complete, and broken lines for incomplete data, they pass through districts having equal rainfall, and are of a value shown at the extremities of each line. Only stations whose records cover a period of not less than 15 years have been used in this compilation.

CLIMATOLOGICAL DATA—BRISBANE, QUEENSLAND.

LAT. 27° 28′ S., LONG. 153° 2′ E. HEIGHT ABOVE M.S.L. 137 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. Greatest Number of Miles in One Day.	Wind. Mean Hourly Pressure, (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction. 9 a.m. 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m. & 9 p.m.	No. of Clear Days.
No. of yrs. over which observation extends	40	13	..	16	40	18	40	35	18
January	29.868	361 1/22	..	4,351	E	6.429	6.4	5.7	3.4
February	29.903	347 5/22	..	4,080	S E	5.316	5.5	5.7	2.1
March	29.959	348 10/25	..	3,968	S E	4.936	4.5	5.2	5.3
April	30.049	400 3/25	..	3,693	S & S E	3.945	3.3	4.5	7.9
May	30.081	363 7/16	..	3,381	S	2.902	3.3	4.4	8.8
June	30.067	400 12/24	..	3,569	S W	2.232	2.4	4.1	9.1
July	30.072	359 2/23	..	3,631	S W	2.535	2.6	3.7	12.1
August	30.096	331 6/23	..	3,650	S W	3.144	3.8	3.5	11.8
September ..	30.040	322 14/23	..	3,486	N E & S	4.054	5.9	3.5	12.5
October	30.002	325 25/18	..	4,066	N E	5.500	6.7	4.0	9.0
November ..	29.959	274 18/23	..	4,232	N E	6.106	8.7	4.9	6.6
December ..	29.889	467 15/26	..	4,453	N E	6.807	9.2	5.3	3.6
Year { Totals ..	—	—	—	—	—	53.906	62.3	—	92.2
Year { Averages ..	29.999	—	..	3,884	S & E	—	—	4.5	—
Year { Extremes ..	—	467 15/12/26	—	—	—	—	—	—	—

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (Fahr.). Mean Max.	Mean Temperature (Fahr.). Mean Min.	Mean Temperature (Fahr.). Mean.	Extreme Shade Temperature (Fahr.). Highest.	Extreme Shade Temperature (Fahr.). Lowest.	Extreme Range.	Extreme Temperature (Fahr.). Highest in Sun.	Extreme Temperature (Fahr.). Lowest on Grass.	Mean Hours of Sunshine.
No. of yrs. over which observation extends	40	40	40	40	40	40	40	40	18
January	85.5	68.9	76.9	108.9 14/02	58.8 4/93	50.1	166.4 10/17	49.9 4/93	221.3
February	84.6	63.6	76.5	105.7 21/25	58.7 (a)	47.0	165.2 6/10	49.3 9/89	207.7
March	82.4	66.3	74.3	99.4 5/19	52.4 29/13	47.0	161.7 4/25	45.4 29/13	207.2
April	76.6	61.6	70.2	95.2 (b)	44.4 25/25	50.8	153.8 11/16	36.7 24/25	207.3
May	73.6	55.4	64.5	90.3 21/23	41.3 24/99	49.0	147.0 1/10	29.8 8/97	196.7
June	69.4	51.0	60.2	88.9 19/18	36.3 29/08	52.6	136.0 3/18	25.4 23/88	174.4
July	68.4	48.5	55.9	83.4 28/98	36.1 (c)	47.3	146.1 20/15	23.9 11/90	202.5
August	70.9	49.9	60.5	87.5 28/07	37.4 6/87	50.1	141.9 20/17	27.1 9/99	228.4
September ..	75.7	54.8	65.2	95.2 16/12	40.7 1/96	54.5	155.5 26/03	30.4 1/89	235.6
October	79.8	59.9	69.9	101.4 18/93	43.3 3/99	58.1	157.4 31/18	34.9 8/89	255.0
November ..	82.8	64.2	73.5	106.1 18/13	48.5 2/05	57.6	162.3 7/89	38.8 1/05	245.1
December ..	85.4	67.5	76.3	105.9 26/93	56.4 13/12	49.5	161.7 27/26	49.1 3/94	241.1
Year { Averages ..	77.9	59.7	68.7	—	—	—	—	—	2639.0
Year { Extremes ..	—	—	—	108.9 14/1/02	36.1 (d)	72.8	166.4 10/1/17	23.9 11/7/90	—

(a) 10 and 11/04. (b) 9/96 and 5/03. (c) 12/94 and 2/96. (d) 12/7/94 and 2/7/96.

HUMIDITY, RAINFALL, AND DEW.

Month.	Vapour Pressure (inches). Mean 9 a.m.	Rel. Hum. (%) Mean 9 a.m.	Rel. Hum. (%) Highest Mean.	Rel. Hum. (%) Lowest Mean.	Rainfall (inches). Mean Monthly.	Rainfall (inches). Mean No. of Days Rain.	Rainfall (inches). Greatest Monthly.	Rainfall (inches). Least Monthly.	Rainfall (inches). Greatest in One Day.	Dew. Mean No. Days Dew.
No. of yrs. over which observation extends	40	40	40	40	75	67	75	75	75	40
January	0.637	65	79	53	6.29	14	27.72 1895	0.32 1919	18.31 21/87	7.2
February	0.646	69	82	55	6.19	13	40.39 1893	0.58 1849	8.36 16/93	7.3
March	0.615	72	85	56	5.75	15	34.04 1870	nil 1849	11.18 14/08	10.4
April	0.525	72	80	60	3.56	12	15.28 1867	0.04 1897	4.47 13/16	12.8
May	0.428	74	85	63	2.85	10	13.85 1876	nil 1846	5.62 9/79	13.9
June	0.361	74	84	67	2.77	8	14.03 1873	nil 1847	6.01 9/93	12.0
July	0.330	73	81	61	2.30	8	8.46 1889	nil 1841	3.54 16/89	13.4
August	0.352	70	80	60	2.10	7	14.67 1879	nil (a)	4.89 12/87	11.6
September ..	0.415	65	76	47	2.05	8	5.43 1886	0.10 1907	2.46 2/94	11.4
October	0.476	60	72	48	2.52	9	9.99 1882	0.14 1900	1.95 20/89	10.2
November ..	0.552	60	72	45	3.73	10	12.41 1917	nil 1842	4.46 16/86	6.6
December ..	0.603	62	69	52	4.96	12	13.99 1910	0.35 1865	6.60 28/71	6.2
Year { Totals ..	—	—	—	—	45.07	126	—	—	—	123.0
Year { Averages ..	0.495	68	—	—	—	—	—	—	—	—
Year { Extremes ..	—	—	85	45	—	—	40.39 2/93	nil (b)	18.31 21/1/87	—

(a) 1862, 1869, 1880. (b) March, May, June, July, August and November, 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. Greatest Number of Miles in One Day.	Wind. Mean Hourly Pressure. (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction.	Mean Amount of Evaporation (inches).	No. of Days Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m. & 9 p.m.	No. of Clear Days.
No. of yrs. over which observation extends	68	60	60	60	60	47	67	65	63
January	29.897	721 1/71	0.35	8,023	N E	5.291	4.8	5.8	2.5
February	29.943	871 12/69	0.31	6,878	N E	4.180	4.3	5.9	1.9
March	30.013	943 20/70	0.24	6,682	N E	3.580	4.1	5.5	2.4
April	30.074	803 6/82	0.21	6,045	N E	2.568	3 8	5.0	3.4
May	30.078	758 6/98	0.21	6,265	W	1.785	3.2	4.9	3.8
June	30.059	712 7/00	0.27	6,776	W	1.422	2.2	4.8	4.3
July	30.073	930 17/79	0.27	6,986	W	1.516	2.3	4.4	5.2
August	30.070	756 22/72	0.25	6,752	W	1.889	3.1	4.0	5.5
September ..	30.007	964 6/74	0.29	6,995	W	2.663	4.0	4.3	4.7
October	29.966	926 4/72	0.31	7,645	N E	3.859	4.8	4.9	3.3
November.. ..	29.939	720 13/68	0.32	7,477	N E	4.582	5.4	5.5	2.3
December ..	29.882	938 3/84	0.34	7,896	N E	5.337	5.7	5.6	2.5
Year Totals ..	—	—	—	—	—	38.672	47.7	—	41.8
Year Averages ..	30.000	—	0.28	7,036	N E	—	—	5.1	—
Year Extremes ..	—	964 6/9/74	—	—	—	—	—	—	—

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (Fahr.). Mean Max.	Mean Temperature (Fahr.). Mean Min.	Mean Temperature (Fahr.). Mean	Extreme Shade Temperature (Fahr.). Highest.	Extreme Shade Temperature (Fahr.). Lowest.	Extreme Range.	Extreme Temperature (Fahr.). Highest in Sun.	Extreme Temperature (Fahr.). Lowest on Grass.	Mean Hours of Sunshine.
No. of yrs. over which observation extends	68	68	68	68	68	68	65	68	16
January	78.4	64.8	71.6	108.5 13/96	51.2 14/65	57.3	164.3	43.7	208.7
February	77.7	65.0	71.3	107.8 8/26	49.3 28/63	58.5	161.2	43.4	187.9
March	75.7	62.9	69.3	102.6 3/69	48.8 14/86	53.8	158.3	39.9	189.5
April	71.3	58.1	64.7	91.0 20/22	44.6 27/64	46.4	144.1	33.3	156.5
May	65.4	52.2	58.8	86.0 1/19	40.2 22/59	45.8	129.7	29.3	140.4
June	61.0	48.3	54.7	79.8 2/23	38.0 5/20	41.8	125.5	28.1	130.0
July	59.5	45.9	52.7	78.3 22/26	35.9 12/90	42.4	124.7	24.0	147.0
August	62.6	47.5	55.0	82.0 31/84	36.8 3/72	45.2	149.0	26.1	187.2
September ..	67.0	51.4	59.2	92.3 27/19	40.8 18/64	51.5	142.2	30.1	195.5
October	71.3	55.8	63.6	99.7 19/98	42.3 3/18	57.4	151.9	32.7	214.5
November.. ..	74.5	59.6	67.1	102.7 21/78	45.8 1/05	56.9	158.5	36.0	206.0
December ..	77.2	62.9	70.1	107.5 31/04	48.4 3/24	59.1	164.5	41.4	205.1
Year Averages ..	70.1	56.2	63.2	—	—	—	—	—	2168.3
Year Extremes ..	—	—	—	108.5 13/1/96	35.9 12/7/90	72.6	164.5	24.0	—

HUMIDITY, RAINFALL, AND DEW

Month.	Vapour Pressure (inches.) Mean 9 a.m.	Rel. Hum. (%) Mean 9 a.m.	Rel. Hum. (%) Highest Mean.	Rel. Hum. (%) Lowest Mean.	Rainfall (inches). Mean Monthly.	Rainfall (inches). Mean No. of Days Rain.	Rainfall (inches). Greatest Monthly.	Rainfall (inches). Least Monthly.	Rainfall (inches). Greatest in One Day.	Dew. Mean No. Days Dew.
No. of yrs. over which observation extends	68	68	68	68	68	68	68	68	68	68
January	0.546	67	78	58	3.67	14	15.26 1911	0.42 1888	7.08 13/11	1.2
February	0.560	71	81	59	4.25	14	18.56 1873	0.34 1902	8.90 25/73	2.0
March	0.527	73	85	62	4.99	15	18.70 1870	0.42 1876	6.52 9/13	3.3
April	0.444	76	87	63	5.33	13	24.49 1861	0.06 1868	7.52 29/60	5.5
May	0.358	78	90	63	5.23	15	23.03 1919	0.18 1860	8.36 28/89	6.2
June	0.299	77	89	68	4.75	13	16.30 1885	0.19 1904	5.17 16/84	5.3
July	0.275	76	88	65	4.86	12	13.21 1900	0.12 1862	5.72 28/08	5.3
August	0.290	72	84	56	3.01	11	14.89 1899	0.04 1885	5.33 2/60	4.9
September ..	0.331	66	79	49	2.85	12	14.05 1879	0.08 1882	5.69 10/79	3.4
October	0.383	63	77	46	2.84	12	11.14 1916	0.21 1867	6.37 13/02	3.0
November.. ..	0.444	63	79	42	2.81	12	9.89 1865	0.07 1915	4.23 19/00	2.1
December ..	0.503	64	77	52	2.87	13	15.82 1920	0.23 1913	4.75 13/10	1.4
Year Totals ..	—	—	—	—	47.46	156	—	—	—	43.6
Year Averages ..	0.400	69	—	—	—	—	—	—	—	—
Year Extremes ..	—	—	90	42	—	—	24.49 4/1861	0.04 8/1885	8.90 25/2/73	—

CLIMATOLOGICAL DATA—MELBOURNE, VICTORIA.

LAT. 37° 49′ S., LONG. 144° 58′ E. HEIGHT ABOVE M.S.L., 115 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. Greatest Number of Miles in One Day.	Wind. Mean Hourly Pressure. (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction. 9 a.m.	Wind. Prevailing Direction. 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m. & 9 p.m.	No. of Clear Days.
No. of yrs. over which observation extends.	69	53	53	53	53		54	19	69	19
January	29.911	583 10/97	0.27	7,198	S W	S E	6.415	2.0	5.1	7.5
February	29.960	566 8/68	0.25	6,236	S W	S E	5.057	2.6	5.0	6.9
March	30.034	677 9/81	0.20	6,208	S W	S E	3.984	1.6	5.5	5.2
April	30.103	597 7/68	0.19	5,625	S W	N W	2.384	0.8	5.8	4.6
May	30.100	693 12/65	0.19	5,763	N W	N E	1.464	0.6	6.5	3.1
June	30.075	761 13/76	0.22	6,217	N W	N E	1.088	0.7	6.7	2.3
July	30.091	755 8/74	0.21	6,253	N W	N E	1.055	0.5	6.3	3.2
August	30.066	637 14/75	0.24	6,681	N W	N E	1.472	1.1	6.3	3.0
September ..	29.997	617 11/72	0.26	6,856	N W	S W	2.302	1.5	6.1	3.6
October	29.961	899 5/66	0.27	7,172	S W	N W	3.359	2.2	6.0	3.8
November.. ..	29.950	734 13/66	0.27	6,894	S W	S E	4.561	2.4	5.9	3.7
December.. ..	29.898	655 1/75	0.27	7,231	S W	S E	5.781	1.8	5.5	4.3
Year Totals ..	—	—	—	—	—		38.922	17.8	—	51.2
Year Averages ..	30.012	—	0.24	6,528	S W	N W	—	—	5.9	—
Year Extremes ..	—	899 5/10/66	—	—	—		—	—	—	—

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature (Fahr.). Mean Max.	Mean Temperature (Fahr.). Mean Min.	Mean Temperature (Fahr.). Mean	Extreme Shade Temperature (Fahr.). Highest.	Extreme Shade Temperature (Fahr.). Lowest.	Extreme Range.	Extreme Temperature (Fahr.). Highest in Sun.	Extreme Temperature (Fahr.). Lowest on Grass.	Mean Hours of Sunshine.
No. of yrs. over which observation extends	71	71	71	71	71	71	67	67	45
January	78.0	56.7	67.4	111.2 14/62	42.0 28/85	69.2	178.5 14/62	30.2 28/85	265.9
February	78.0	57.1	67.6	109.5 7/01	40.2 24/24	69.3	167.5 15/70	30.9 6/91	243.2
March	74.4	54.6	64.5	105.5 2/93	37.1 17/84	68.4	164.5 1/68	28.9 (b)	207.3
April	68.3	50.7	59.5	94.0 (a)	34.8 24/88	59.2	152.0 8/61	25.0 23/97	163.2
May	61.4	46.7	54.1	83.7 7/05	29.9 29/16	53.8	142.6 2/59	21.1 26/16	130.4
June	56.8	44.1	50.4	72.2 1/07	28.0 11/66	44.2	129.0 11/61	20.4 17/95	111.0
July	55.6	41.8	48.7	69.3 22/26	27.0 21/69	42.3	125.8 27/80	20.5 12/03	107.1
August	58.7	43.4	51.0	77.0 20/85	28.3 11/63	48.7	137.4 29/69	21.3 14/02	155.6
September ..	62.6	45.7	54.1	85.0 19/19	31.1 16/08	53.9	142.1 20/67	22.8 8/18	171.6
October	67.1	48.3	57.7	98.4 24/14	32.1 3/71	66.2	154.3 28/68	24.8 22/18	206.4
November.. ..	71.3	51.2	61.3	105.7 27/94	36.5 2/96	69.2	159.6 29/65	24.6 2/96	242.3
December.. ..	75.3	54.3	64.8	110.7 15/76	40.0 4/70	70.7	170.3 20/69	33.3 1/04	255.0
Year Averages ..	67.3	49.5	58.4	—	—	—	—	—	c2259.0
Year Extremes ..	—	—	—	111.2 14.1.62	27.0 21/7/69	84.2	178.5 14/1/62	20.4 17/6/95	—

(a) 6/1865 and 17/1922. (b) 17/1884 and 20/1897. (c) Total for year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Vapour Pressure (inches) Mean 9 a.m.	Rel. Hum. (%) Mean 9 a.m.	Rel. Hum. (%) Highest Mean.	Rel. Hum. (%) Lowest Mean.	Rainfall (inches). Mean Monthly.	Rainfall (inches). Mean No. of Days Rain.	Rainfall (inches). Greatest Monthly.	Rainfall (inches). Least Monthly.	Rainfall (inches). Greatest in One Day.	Dew. Mean No. Days Dew.
No. of yrs. over which observation extends	19	19	19	19	71	71	71	71	68	19
January	0.383	55	65	50	1.91	8	5.68 1904	0.04 1878	2.97 9/97	2.7
February	0.413	58	69	48	1.72	7	6.24 1904	0.03 1870	3.37 18/19	2.9
March	0.372	62	71	57	2.19	10	7.50 1911	0.18 1859	3.55 5/19	7.1
April	0.332	67	78	66	2.19	11	6.71 1901	Nil 1923	2.28 22/01	8.4
May	0.303	77	86	71	2.17	13	4.31 1862	0.45 1901	1.85 7/91	9.0
June	0.274	79	89	77	2.07	14	4.51 1859	0.73 1877	1.74 21/04	8.7
July	0.264	81	86	76	1.85	14	7.02 1891	0.57 1902	2.71 12/91	9.3
August	0.280	75	82	70	1.87	14	4.04 1924	0.48 1903	1.94 26/24	8.5
September ..	0.293	71	76	60	2.45	14	7.93 1916	0.52 1907	2.62 12/80	6.0
October	0.301	62	67	53	2.63	13	7.61 1869	0.29 1914	3.00 17/69	6.0
November.. ..	0.332	57	69	52	2.24	11	6.71 1916	0.25 1895	2.57 16/76	1.9
December.. ..	0.360	56	69	51	2.29	9	7.18 1863	0.11 1904	2.62 28/07	1.9
Year Totals ..	—	—	—	—	25.58	138	—	—	—	72.4
Year Averages ..	0.326	67	—	—	—	—	—	—	—	—
Year Extremes ..	—	—	89	48	—	—	7.93 9/1916	Nil 4/1923	3.55 5/3/19	—

CLIMATOLOGICAL DATA—HOBART, TASMANIA.

LAT. 42° 53′ S., LONG. 147° 20′ E. HEIGHT ABOVE M.S.L., 177 FT.

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

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 9 a.m. and 3 p.m. readings.	Wind. Greatest Number of Miles in One Day.		Wind. Mean Hourly Pressure (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction. 9 a.m.	Wind. Prevailing Direction. 3 p.m.	Mean Amount of Evaporation (inches).	No. of Days Lightning.	Mean Amount of Clouds, 9 a.m., 3 p.m. & 9 p.m.	No. of Clear Days.
No. of yrs. over which observation extends	42	16		16	16	21		16	19	64	20
January	29.830	500	30/16	0.19	5,945	N N W	S E	4.911	0.9	6.0	2.6
February	29.918	393	19/13	0.14	4,692	N N W	S E	3.753	1.3	6.0	2.4
March	29.942	431	14/26	0.13	4,921	N N W	S E	3.045	1.3	5.9	2.4
April	29.964	533	27/26	0.14	4,892	N N W	N W	2.025	0.8	6.1	1.8
May	29.985	411	3/16	0.12	4,696	N N W	N N W	1.355	0.5	6.1	2.2
June	29.948	569	27/20	0.13	4,652	N N W	N N W	0.895	0.7	6.1	2.0
July	29.931	425	16/21	0.12	4,754	N N W	N N W	0.892	0.6	5.8	2.4
August	29.927	612	19/26	0.13	4,999	N N W	N N W	1.255	0.6	6.0	2.1
September	29.847	516	26/15	0.18	5,534	N N W	N W	1.960	0.8	6.1	1.6
October	29.825	461	8/12	0.19	5,945	N N W	S E	3.087	0.8	6.3	1.4
November	29.802	508	18/15	0.20	5,900	N N W	S E	4.041	0.9	6.4	1.6
December	29.808	486	30/20	0.18	5,762	N N W	S E	4.539	1.1	6.3	1.1
Year — Totals	—	—		—	—	—		31.758	10.3	—	23.6
Year — Averages	29.894	—		0.15	5,224	N N W	S E & N N W	—	—	6.0	—
Year — Extremes	—	612	19/8/26	—	—	—		—	—	—	—

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 Hours of Sunshine.
No. of yrs. over which observation extends	56	56	56	80		80		80	39		59		32
January	71.2	52.9	62.0	105.0	1/00	40.3	(a)	64.7	160.0	(b)	30.6	19/97	211.6
February	71.3	53.3	62.3	104.4	12/99	39.0	20/87	65.4	165.0	24/98	28.3	–/87	178.4
March	68.0	50.8	59.4	98.8	5/46	35.2	31/26	63.6	150.0	3/05	27.5	30/02	175.4
April	62.7	47.6	55.2	90.0	2/56	30.0	25/56	60.0	142.0	18/93	25.0	–/86	141.2
May	57.3	43.7	50.5	77.8	5/21	29.2	20/02	48.6	128.0	(c)	20.0	19/02	132.0
June	52.8	41.1	47.0	75.0	7/74	28.0	22/79	47.0	122.0	12/94	21.0	6/87	103.3
July	52.0	39.3	45.6	72.0	22/77	27.0	18/66	45.0	121.0	12/93	18.7	16/86	124.6
August	55.0	41.0	48.0	81.0	21/72	30.0	10/73	47.0	129.0	–/87	20.1	7/09	144.5
September	58.8	43.2	51.0	80.0	9/72	30.0	12/41	50.0	138.0	23/93	18.3	16/26	146.2
October	62.7	45.5	54.1	92.0	24/14	32.0	12/89	60.0	156.0	9/93	23.8	20/14	169.9
November	66.1	48.2	57.2	98.0	20/88	35.2	5/13	62.8	154.0	19/92	26.0	(d)	201.2
December	69.3	51.2	60.2	105.2	30/97	38.0	13/06	67.2	157.0	30/18	27.2	–/86	198.7
Year — Averages	62.3	46.5	54.4	—		—		—	—		—		1927.0e
Year — Extremes	—	—	—	105.2	30/12/97	27.0	18/7/66		165.0	24/2/98	18.3	16/9/26	—

(a) 3/72, 2/06, and 27/13. (b) 5/86 and 13/05. (c) –/88 and –/93. (d) 1/86 and –/99. (e) Total for Year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Vapour Pressure (inches) Mean 9 a.m.	Rel. Hum. (%) Mean 9 a.m.	Rel. Hum. (%) Highest Mean.	Rel. Hum. (%) Lowest Mean.	Rainfall (inches). Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.		Least Monthly.		Greatest in One Day.		Dew. Mean No. Days Dew.
No. of yrs. over which observation extends	40	40	40	40	84	83	84		84		60		17
January	0.332	59	72	47	1.84	10	5.91	1893	0.03	1841	2.96	30/16	0.7
February	0.358	63	77	53	1.46	9	9.15	1854	0.07	1847	4.50	25/54a	1.8
March	0.328	67	77	58	1.70	10	7.60	1854	0.02	1843	2.79	5/19	4.8
April	0.303	72	84	58	1.87	11	6.50	1909	0.07	1904	5.02	20/09	10.2
May	0.269	77	89	65	1.98	13	6.37	1905	0.10	1843	3.22	14/58	13.1
June	0.245	81	91	68	2.24	14	8.15	1889	0.22	1852	4.11	14/89	8.8
July	0.234	81	94	72	2.18	14	6.02	1922	0.30	1850	2.51	18/22	8.5
August	0.237	77	92	64	1.84	14	10.16	1858	0.23	1854	4.35	12/58	8.5
September	0.251	68	85	60	2.08	15	7.14	1844	0.39	1847	3.50	29/44	4.7
October	0.272	64	73	51	2.28	15	6.67	1906	0.26	1850	2.58	4/06	2.9
November	0.295	59	72	50	2.48	14	8.92	1849	0.16	1868	3.97	6/49	1.2
December	0.313	57	67	45	1.98	11	9.00	1875	0.11	1842	2.48	13/16	0.8
Year — Totals	—	—	—	—	23.84	150	—		—		—		66.0
Year — Averages	0.281	67	—	—	—	—	—		—		—		—
Year — Extremes	—	—	94	45	—	—	10.16	8/1858	0.02	3/1843	5.02	20/4/09	—

(a) 4.18 on 26/54 also.

THE TOPOGRAPHY OF AUSTRALIA.

[*By Professor Griffith Taylor, University of Sydney.*]

§ 1. The Continent.

1. **General.**—Australia is the smallest of the continents, and is situated to the south-east of that great block of land which comprises Europe, Asia and Africa. The two main belts of late topographic change traverse the Old World. One runs across Europe and Asia and constitutes the Himalaya Belt. The other surrounds the Pacific, and has resulted in the high mountains and the numberless festoon islands fringing Asia and Australia in the Western Pacific. These two belts meet in the complex region of the East Indies, and have produced the varied topography of New Guinea. But neither of them traverses Australia, which in consequence is one of the regions with least topographic variety in the world.

2. **The Great Australian Peneplain.**—The characteristic feature of Australian topography is one of which most Australians know very little. It is the extremely large level area constituting most of Western Australia, Northern Territory and western South Australia. This is on the whole poorly supplied with rainfall, and in consequence has only a meagre population. But it comprises more than half of the continent and forms a single unit which is best described as "The Great Australian Peneplain." It consists essentially of a rather low plateau about 1,200 feet above sea-level, built up of many diverse geological formations. Probably in Pliocene times (some two or three million years ago) it lay at sea level. It was in fact the level surface of an ancient continent which rain and rivers had eroded nearly to sea-level during perhaps a hundred million years.

Although Australia did not suffer buckling and folding as did much of Europe, Asia and America, yet (like Africa) it was subjected to broad uplifts which raised a large portion of the continent *en masse*. This *epeirogenic* movement produced the present-day peneplain of western and central Australia. In the eastern portion of the continent, more localized uplifts took place, so that real *folds* occurred in places and many *faults* (largely in a north-south direction) developed. Blocks of the earth's crust were isolated and elevated to varying degrees, and most of our mountains in eastern Australia are due to the uplift of these blocks or *horsts*.

Between the western peneplain and the eastern cordillera is a region of somewhat lower land, which has sunk below sea-level at Lake Eyre. This can be divided into two portions—the Artesian Basin in the north and the Murray Basin in the south. They are probably due to the same broad movements which affected the rest of the continent.

If we consider the chief geological features of Australia, we find that the western peneplain consists for the most part of very ancient rocks which appear to have resisted folding through a very large portion of geological history. It forms, in fact, one of those particularly stable portions of the earth's crust known as *coigns* or *shields*. On the other hand, the lower Murray Basin probably contains the largest deposits of Tertiary Age in the continent, and would thus appear to be a trough (or series of troughs) folded against the resistant western coign. The eastern cordillera with its deeply dissected surface exhibited in the profound gorges of the Blue (Mountain) Plateau and elsewhere has clearly been uplifted within comparatively recent geological time. If we pass further to the east, we find in the alternating deeps and ridges of the Tasman Sea the same phenomena repeated on a grander scale until we reach the profound depths of the Tonga Deep to the north of New Zealand. Here some authorities would place the "engine" or "centre of disturbance," whose uneasy movements have determined to a considerable extent the topography of Australia.

At any rate it explains why the topography on the whole becomes less and less striking as we move from east to west of Australia. There are, of course, local exceptions, but speaking generally we can say that the eastern coastlands exhibit marked juvenile topography, while the rest of Australia is more or less senile throughout. Only on the margins of the great peneplain, where rivers are busily cutting down the scarps, is there a zone of youthful rivers, and this feature is well marked near Perth and along the north coast of the continent.

§ 2. Western Australia.

1. **General.**—This State occupies nearly one-third of the whole continent of Australia, and forms the major portion of the great peneplain mentioned previously. As pointed out in §1 it was probably uplifted to a height of about 1,200 feet somewhere near the end of Pliocene times. In consequence, the erosion by rivers has been carried on rather extensively in the marginal portions where the rainfall is fairly heavy. In places this peneplain is bounded by fault scarps, and the so-called Darling Range, behind Perth, is of this type. The deep valleys of the Helena River and adjoining rivers near Perth are thus of late origin, while the broad shallow valleys of their headwaters still show the topography of pre-uplift times. Yet in this State as elsewhere the results of recent oscillations of the land are often to be observed. Thus along the coast south of Broome the writer has noted numerous examples of *raised* beaches, while at Port Hedland, some 300 miles further south, is a *drowned* river valley somewhat resembling Port Jackson in plan.

We may consider the detailed topography in six main regions. These are (1) Kimberley, (2) Desert, (3) North-west, (4) Swanland, (5) Salt Lake Region, (6) Nullarbor.

2. **The Kimberley Region.**—This region differs from most of the State in that it has a rainfall exceeding 20 inches. It is, however, part of the general peneplain—consisting of many different formations which have been eroded in varying degrees. The highest point is Mount Hann (2,800 feet). With the greater rainfall, the older moderately flat surface is now broken into ridges and valleys. Some of the harder rocks stand out as steep walls, running roughly from N.W. to S.E. These in part constitute the King Leopold, Napier and Geikie Ranges, and the rivers in places zig-zag through these " walls " in deep antecedent gorges. It has been suggested that the rivers originally flowed to the south-west like Sturt Creek, but have been captured by west-flowing coastal streams. The main stream is the Fitzroy River, which is about 350 miles long, and carries enormous volumes of water to the sea after the summer rains. It drains broad grassy plains, and, occasionally, as in 1914, these are covered by floods over 20 miles wide. In the dry months it ceases to run, but long waterholes are common along its course.

The coast is marked by a number of deep narrow gulfs (rias) which are due to the relatively late drowning of large river valleys by the sea. A tidal rise of 25 feet is common on this coast.

3. **The Desert Region.**—This division comprises the large block of uninhabited country which lies east of a line joining the De Grey River to Laverton. It extends far into South Australia and the Northern Territory. Its topography is fairly well known from the accounts of Talbot, Clarke, Carnegie, Clapp and others. The general level is about 1,500 feet, and there are no marked topographic variations beyond shallow salt-lakes and insignificant ranges. The latter are often little more than " breakaways," which the local geologists consider are probably the relics of the ancient valley walls eroded in a former wet epoch.

The salient features are the sand-ridges, which Carnegie describes as from 30 to 50 feet high, and running very regularly nearly east and west. Much of the region, however, consists of a great undulating desert of gravel, formed largely of pebbles of ferruginous sandstone. Carnegie travelled from Laverton to Hall's Creek, i.e., through the centre of this region. Talbot describes the country along Canning's stock route somewhat to the north-west, starting from Wiluna. Water was obtainable from wells dug some 50 feet deep, or native rock-holes, which were found at intervals of 20 miles or so. " In windy weather the air is full of sand, but the sand ridges do not seem to be shifting perceptibly." They usually carry a fairly strong growth of desert gum and " buck " spinifex, and sometimes some grass. Talbot is emphatic that south of Sturt's Creek the country is never likely to be occupied by pastoralists.

A later traverse by Talbot and Clarke from Wiluna E.N.E. to the border reveals the same type of country. For 300 miles desert country consisting of sand ridges or sand plains was encountered. Occasionally "breakaways" 150 feet high were seen. To the east of the Townsend Range (long. 127° E.) broken granite ranges occurred with a belt of better country amid the desert. They saw, however, little or no probability of pastoral occupation here.

To the north-west the desert reaches the Indian Ocean at the 90-mile Beach. Here the writer found that the bare sand ridges commenced about 25 miles north of Wollal, and great streaks of red dust lay for miles over the ocean, where the constant trade wind had carried them. (This is exactly parallel to the conditions off the Sahara desert near Cape Blanco.) The eastern portion of this region will be considered in the sections dealing with the Northern Territory and South Australia.

4. **The North-west Division.**—This extends from the De Grey River to the Murchison River, and has been compared to the Punj-ab in that it also consists (with the intervening Fortescue, Ashburton and Gascoyne) of five great river basins. The country is a peneplain rising from the coast to a height of 4,000 feet at Mount Bruce. It is crossed by fault and fold scarps and merges into the sand ridge desert on the east. This region contains one of the few large areas over 3,000 feet in Australia. It is named the Hamersley-Ophthalmia Plateau, and appears to be bounded by a marked fault scarp along the north, below which flows the Fortescue River. All the inland portion of the division consists of undulating (late mature) topography with large areas of plains, crossed by low ridges. Spinifex (*Triodia*) is the common vegetation in the Upper Ashburton and Fortescue basins, but to the south mulga is all prevailing.

The river valleys are of the nature of "wadis," in that it is only rarely that they contain water on the surface. Thus the Shaw River had not run for nine years (in 1924), but its gravels gave a plentiful supply which was carried by train 40 miles to Port Hedland. However, at Millstream (on the Lower Fortescue) a rocky floor determines a perennial flow which is visible for several miles, until the water vanishes again in the gravels.

5. **Swanland.**—To the temperate south-west portion of Western Australia, with a rainfall suitable for agriculture and close settlement, the name Swanland has been applied. It is a portion of the Great Peneplain which has long been actively attacked by many rivers and streams, hence the topography is somewhat different from that of the rest of the State. The western littoral is separated off by the Darling Fault Scarp, and has dropped relatively to the inland portion. This scarp extends approximately for 200 miles from Moora southwards. The littoral has been dissected into wide shallow valleys, in which old-looking rivers meander. It consists of clays and sands largely of fluviatile origin, which are deepest near Perth, and also of sand dunes. The littoral has later subsided, especially near Perth, and so drowned the Swan Estuary. A small upraised block appears to account for the elevated region near Cape Leeuwin. The Stirling Range is 50 miles long, and consists of quartzites which have perhaps been thrust up as an earth block to a height of 3,000 feet. This movement seems to have occurred fairly lately, since small lakes and elevated valleys still show the disturbances which disrupted the ancient drainage. King George Sound at Albany is, of course, a fine example of a drowned coastal valley.

6. **The Salt Lake Division.**—This area lies between Swanland and the Desert Division. It has a rainfall of 8 or 10 inches, and is characterized by a great number of playas or shallow salt lakes. These are nearly all linear in shape, sometimes 50 miles long and about 5 miles wide. They occupy slight hollows in the great peneplain, and many theories have been put forward as to their origin. There is little doubt that they originated as river valleys in the wetter epochs of Tertiary times. The lakes north of Kalgoorlie (Raeside, Darlot, Salt, and Cary) appear to be dismembered portions of a river which once flowed to the south-east to Goddard's Creek, and so to the Bight. Gregory believes that these rivers were unable to keep their channels clear from encroaching sand-dunes during Post-Miocene desiccation. As Jutson shows, however,

desert erosion has since affected these lakes, so that they often exhibit flat rocky floors bounded by almost vertical cliffs. Abrupt rocky islands stand out above the " billiard-table " floors.

The water in the lakes soon evaporates, but underground water can be obtained without trouble in most parts. In the south this is often salt, but in the north it is fresh, and the land, therefore, is extensively occupied by pastoralists.

7. **The Nullarbor Division.**—This Division occupies the south-east corner of the State. It consists of a vast plateau built up of fairly late limestones. These are Cretaceous in the north, like those of the Queensland artesian basin, and are overlaid by Tertiary (Miocene) deposits in the south. The latter form the cliffs of the Bight, which are about 200 feet high. Thence, the plateau rises gradually to the north to a height of 1,000 feet. The limestone is cavernous and is often 800 feet thick. The rains sink at once into the limestone, and it is this lack of surface water which has prevented settlement on the Nullarbor Plains.

§ 3. The Northern Territory.

1. **General.**—To a very large extent the Northern Territory forms part of the great peneplain, which as we have seen was partly uplifted in Middle or Late Tertiary times. Jensen believes that this upward movement has continued to the present day, and is indicated by raised beaches around most of the coastline.

So also the canyons of the Katherine and MacArthur Rivers show the rejuvenation of these rivers by the late uplift.

2. **Inland Features.**—Inland the peneplain has not yet been trenched by the rivers in any general fashion. The northern part of the Territory seems to lie at an elevation between 500 and 900 feet, though considerable portions of Arnhem Land (which is not yet fully explored) may be higher. The Barkly " Tableland " appears to be well defined only on its northern edge where it drops somewhat rapidly towards the coast. It may be about 1,100 feet high, and much of its drainage flows into vast shallow basins, which become lakes in very wet seasons. Thus, Lake DeBurgh (near Brunette Downs) may expand to a length of about 100 miles, though generally disintegrated into a series of swampy areas at the lower ends of Playford, Creswell, and other Creeks. Lake Woods (near Newcastle Waters) is another such lake, (probably due to a slight warp in the crust), which at present has almost vanished.

3. **Coastal Rivers.**—The coastal rivers carry great bodies of water during the summer rains. Boats drawing 3 feet can penetrate 100 miles up the Victoria River, while the Adelaide and Roper will carry much larger craft about the same distance. In dry seasons these rivers become largely estuarine, but springs at their heads give rise to considerable bodies of fresh water even in the winter " dry " season.

4. **The Southern Area.**—The southern portion of the Territory differs considerably from the northern. It is both higher and drier than the latter. South of Powell's Creek and the Barkly Tableland there is a great expanse of little known country, though the route along the overland telegraph is often traversed. To the west, is the north-east extension of the western desert (between Tanami and Barrow Creek); to the east is the smaller but equally unpopulated area to which the name Arunta Desert has been assigned.

These unattractive regions are more or less vegetated by mulga shrubs and by clumps of spinifex. They exhibit characteristic features of arid erosion, such as large areas of sand-dunes (usually fixed by vegetation), which run from north-west to south-east or thereabouts. There are also stretches of stony plains, and occasionally sandy valleys and bare clay-pans.

5. **The Macdonnell Ranges.**—The Macdonnell Ranges differ a good deal in topography from the remainder of the Territory. Keith Ward has described the vicinity of Alice Springs in some detail.

> "The (Mesozoic) sea retreated from continental Australia, and throughout the tertiary period to the present day, the interior of Australia has been subject to continuous sub-aerial denudation. The Mesozoic rocks on elevation above sea level formed a broad plateau region. . . . . and at the present time the remnants of this plateau slope gently towards the Lake Eyre depression, whither the drainage trends. . . . . The peneplanation of the Macdonnell Ranges was followed by an uplift which rejuvenated the streams. They cut down steep-sided gaps through the ridges of hard quartzite which were gradually etched out in strong relief. Sometimes these gaps (as at Temple Bar) are determined by the position of fault fractures."

The Finke River is the chief watercourse from the Macdonnell Ranges. It flows to the south-east, but rises north of the chief range in the Burt Plain at a height of 2,400 feet. It then cuts through the edges of the upturned Paleozoic strata as described above. Normally the channel is occupied by long stretches of white sand devoid of surface water, separated at rare intervals by short lengths of channel where water may be flowing gently over a rocky bed. In heavy floods the Finke reaches Lake Eyre.

§ 4. South Australia.

1. **General.**—This State has a rather diversified topography, which can best be considered in some half dozen separate regions. In the north-west is the south-eastern extension of the Great Peneplain. It is dominated by the residuals forming the Musgrave Ranges. To the south-west is the greater part of the Nullarbor Plains, which, as we have seen, extend into Western Australia. The eastern portion of the State has been much less stable, and the major topographic features are due to the very late buckling which has produced the Flinders Range, and also led to the chain of lakes surrounding this range.

2. **The Southern Area.**—The southern part of the State is marked by the development of three peninsulas and three gulfs, which constitute a type of coastline not found in any other part of Australia. The series runs as follows:—Eyre's Peninsula (buttressed by the Gawler Ranges), Spencer's Gulf, Yorke Peninsula, St. Vincent Gulf, Fleurieu Peninsula (ending in Cape Jervis, but, structurally prolonged into Kangaroo Island), and the Murray Outlet Gulf. The latter has largely been silted by the immense deposits of alluvial brought down by the Murray.

3. **The North West.**—R. L. Jack has given us a valuable discussion of the topography in the north-west of the State. The fairly level-bedded cretaceous rocks of the eastern portion have been subjected to induration of the surface by the action of the sun and infrequent rains on the siliceous rocks. The hard capping thus formed tends to break down in the form of table-top hills, and ultimately the hard fragments constitute the "gibbers" of the stony plains. Wind-blown dunes are common near the Alberga River, but after the paleozoic rocks to the west are reached, the elevation of the peneplain gradually increases (to the north-westward) from 1,000 to 2,000 feet.

The Musgrave Ranges are divided into separate hills by wide valleys which are about 2,200 feet above the sea. Still higher rise the rougher hills of granite and gneiss, of which Mount Woodroffe (about 5,000 feet) is the highest. The Everard Ranges, to the south, consist of low rounded hills rising into domes above the peneplain, which is here about 1,700 feet above sea level.

4. **Evolution of South Australian Topography.**—In various papers Howchin has discussed the evolution of the topography of South Australia. He shows from the geological evidence that the Mount Lofty Ranges did not exist until Pliocene times, when a great continental uplift occurred. The main divide in South Australia was probably much farther north than it is to-day, and the coast extended much farther south. Great north-south valleys developed, possibly leading the drainage of the Macdonnells and Musgraves to the south by way of what later became the large gulfs already noted.

Relics of this stage of erosion are found throughout the Ranges in the form of flat-topped hills now about 1,500 feet high, from which rise residuals such as Mount Lofty (2,334 feet). This plateau-like area later broke into crustal blocks in the south, while apparently a vast downward buckle occurred in the northern portion of the area. As a result we find a series of ranges running north and south, flanked by *graben* (or fault-valleys) now largely occupied by the sea.

If we examine the chain of lakes which extends from the head of Spencer's Gulf right round to Lake Frome, it is seen that very little depression would extend the gulf right round nearly to Broken Hill. From the head of the Gulf, a chain of swamps and lagoons rising only about 100 feet in 40 miles, leads to the vast salty expanse of Lake Torrens. This is 150 miles long, and is separated from the Lake Eyre depression by a ridge only 175 feet above sea level. Lake Eyre is 39 feet below sea level, and flanked by ancient lake-terraces which have been briefly examined by Halligan. Between Lake Eyre and Lake Gregory there are stony rises only about 100 feet high. Thence there are sand-hills about 25 feet high, separating the last lake from Lake Blanche, which at times connects with Lake Callabonna by floods in the Strzelecki Creek. A channel joins Lake Frome to Lake Callabonna, and the two latter are practically at the same level. There seems little doubt that this horseshoe series of lakes has developed in a semi-circular depression which accompanied the upward folding and faulting producing the Flinders Range. The latter rises sharply to 3,470 feet in Mount Benbonyathe right above Lake Frome; while St. Mary's Peak (also in this northern portion of the horst blocks) overlooks Lake Torrens from a height of 3,900 feet.

No better proof of the recency of these uplifts of the order of 2,000 feet could be desired than that available at Orroroo. Here we have relics of a vast river system, probably rivalling the Murray, which once drained the south-west and reached the sea near the head of St. Vincent's Gulf. The Pasmore and Siccus Rivers are filled with hundreds of feet of alluvial. At Orroroo near the summit of the ranges to-day a bore penetrated 591 feet of river sands and gravel without reaching bedrock. It is clear that these gravel deposits have been buckled up to form the divide only recently, for they must rapidly disappear under the attacks of normal erosion.

The Mount Lofty Ranges are bounded by fault scarps, which appear as a series of "steps" on both flanks of the uplands. Howchin shows that there is a remarkable series of such fragmentary blocks in the Adelaide district. Thus, the Upper Sturt flows on a surface about 1,900 feet above the sea. Belair, nearer the coast, is on a broken portion of the same peneplain, now about 1,000 feet above the sea; Burnside is on a fragment some 500 feet high. Under Adelaide are sunken areas at 220 feet and 2,000 feet (?) below sea level.

The lower Murray River has very little fall (only 57 feet) while flowing through South Australia. It seems likely that its original path has been much changed by the late Tertiary uplift. The sharp angle at Morgan is suggestive in this connexion. The river flows through a wide senile valley to Overland Corner (half way from Renmark to Morgan), and then passes between well marked cliffs, showing that fairly recent uplift of the order of several hundred feet has affected the ancient valley.

5. **Mount Gambier.**—In the extreme south-east of the State are the low volcanic cones (600 to 700 feet) of Mount Gambier. A number of small lakes, usually due to subsidence, are associated with the cones. It seems probable that their water supply is derived from permeable beds extending well into Victoria.

§ 5. Queensland.

1. **General.**—The State can be divided broadly into two regions, the Western Lowlands, largely consisting of the plains covering the Artesian water-bearing beds, and the Eastern Cordillera, which extends in a belt some 200 miles wide along the coast. There are, however, several subdivisions.

2. Selwyn Upland.—To the west of Cloncurry is a belt of uplands, including the Selwyn Range, which consists of ancient rocks forming the boundary of the Mesozoic Artesian Series. These rocks are on the whole siliceous and mineral bearing, and contain such well-known fields as Mount Isa and Duchess. They form part of the main Divide, but consist in places of meridional ridges running more or less across the Divide. Towards Camooweal occur interesting *dolines* (or deep hollows) in the porous massive limestones. The Gulf rivers rise in perennial streams flowing from similar limestones.

3. Great Artesian Basin.—This well-defined geological feature extends into four States, but more than half of the total area is in Queensland. The water-bearing layer is at varying depths; outcropping on the east along the Divide, and sinking to 7,000 feet below the surface, near Blackall on the Barcoo River. There is another localized depression over 3,500 feet deep near Mungindi. (These deeply seated waters flow out to the surface along the western edge of the basin, in the form of hundreds of mound springs, especially between Lake Frome and Oodnadatta).

The surface of this region is a vast plain almost wholly below 1,000 feet. Indeed, except along the eastern margin, nearly all of it is below 500 feet, but near Kynuna an east-west belt forms a low ridge (above 500 feet) right across the northern part of the basin. Other lower ridges separate from each other the broad alluvial-filled valleys of the Diamantina, Thomson, and Paroo. These rivers flow only after heavy rains, but in flood time they are many miles wide.

4. The (So-called) Dividing Range.—In connexion with the Queensland Highlands, which form part of the Eastern Cordillera, it may be well to discuss the so-called "Great Dividing Range," which is so prominent a feature on most maps. This belt of highlands undoubtedly constitutes the divide between the coastal drainage and that flowing westward to Lake Eyre or the Murray mouth. But, if we examine it at all closely, it is seen to be in no sense a range, but is for the most part a series of disconnected elements of very diverse origin.

In Queensland, it is only an important feature where formed of basalt flows of comparatively late date. Between these it is often a mere warp-ridge but a few hundred feet above the general level.

In the north of New South Wales the Divide is more definite for 100 miles, for here it runs along the great New England granite massif. But the Liverpool Ranges—a quite late geological formation—deviate it to the west. Here the Divide deteriorates to a mere water parting (at Cassilis) between the Goulburn and Talbragar Rivers, where crustal folding, combined with the cutting action of the Goulburn, has driven the Divide far to the west. The "range" is not 2,000 feet high hereabouts.

The Divide returns along the southern rim of the Goulburn Valley towards the coast, and is then carried southwards by a series of indefinite ranges, consisting here of basalt flows, there of recent folds; and again, as at Cooma, with hardly any apparent elevation at all. Hereabouts we notice that Lake George is perched right on the Divide, while Merigan Creek flows right through the so-called Divide. Near Cooma it enters on an extraordinary zig-zag path, which points to recent interruptions in the drainage. These zig-zags around the heads of the Snowy and Tambo Rivers are almost certainly the results of important river captures. Finally, in Victoria, the great area of Pliocene basalt in the west of the State has certainly flooded pre-existing lowlands and valleys, and converted portions of them into the modern Divide.

5. The Eastern Cordillera.—Lying parallel to the modern Divide, and in the north considerably to the east of it, is another belt of highlands almost coincident with the coastline. These coast ranges are formed of an almost continuous series of granite masses, which reach from Tasmania to Cape York. South of Queensland the modern basalt-capped Divide and the granite masses are mingled to a greater degree. This broad "complex" of highlands of varying origin forms a fairly well marked belt to which the name Eastern Cordillera is here applied.

6. **The Queensland Highlands.**—In the far north of this belt is one of the most interesting elevated regions in Australia. The Atherton Plateau is almost the only tropical plateau worthy of the name. No other large areas over 2,000 feet exist in our tropical areas except right on the Tropic itself at a comparatively high latitude. Furthermore, the Atherton Plateau is well-watered, fertile, and rich in minerals, and it bulks largely, therefore, in discussions of tropical settlement. Its area (over 2,000 feet) is, however, only about 15,000 square miles out of a total of 1,149,320 square miles in tropical Australia. The plateau rises gradually to the east, the summit being Mount Bartle Frere (5,438 feet), the highest point in Queensland. This mountain rises almost straight up from a narrow coastal plain. It stands right in the path of the constant trade winds, and its flanks are drenched with rains, amounting to 165 inches at Harvey Creek. This factor, combined with the recency of the uplift, has led to very rapid headward erosion by such coastal streams as the Barron, Johnstone, Mulgrave, &c. The headwaters of the Mitchell, which rises right on the east coast, have accordingly been captured by the Barron River. Fine waterfalls are common, and the scenery stands out among Australian examples.

The coast has been subjected to many oscillations in recent times. A series of coastal plains of very recent origin points to an upward "joggle." The great gorges and waterfalls also show evidence of some hundreds of feet uplift many thousand years ago. But the dominant feature is subsidence. The coral reefs of the Great Barrier probably form only a veneer of a few hundred feet on a subsided coastal margin. The festoon islands so common along the coast also clearly indicate dominant subsidence.

The Clarke Range near Mackay has only a restricted area over 2,000 feet. Some of the basalt tablelands along the Great Divide (e.g., Buckland Tableland) rise to about this same level. A number of small lakes just north of the Tropic, e.g., Buchanan, Galilee, Dunn, and Mueller, seem to be relics of ancient rivers running across the present Divide. Perhaps the present Burdekin formerly drained westward into the Thomson River, via these depressions. Lake Galilee is about 20 miles long, and there is only a divide of 200 feet separating it from Belyando River.

The Darling Downs area is also largely composed of basalt. Small portions rise above 2,000 feet. The coastal rivers are shifting the divide to the west, and steep slopes flank the east of these uplands. A series of late tertiary volcanic cones constitutes the Glass House Mountains. Somewhat similar cones are found in the Peak Range farther north. Much field work remains to be done in Queensland before the topography can be adequately described, as very little investigation has been attempted away from the coastlands.

§ 6. New South Wales.

1. **General.**—Owing to the work of David, Andrews, Sussmilch, and others, the topography of this State is fairly well known. The major divisions resemble those of Queensland. There is a low western region—not, however, in general covering artesian water as in Queensland—and a mountainous eastern division extending almost to the coastline. Several subdivisions may usefully be employed.

A. WESTERN DIVISION (LOWLAND).

Northern Artesian Basin.
Broken Hill Buckle.
Cobar Buckle.
Riverina or Murray Basin.

B. EASTERN DIVISION (HIGHLAND).

New England.
Blue Plateau.
Kosciusko and the Monaro.

Associated with the latter division are small coastal plains; such as those near the Clarence, Hunter, and Hawkesbury Rivers.

2. **Western Division.**—(i) *Lowlands.* With regard to the lowland portions of the west, there is not much difference in the topography of the northern (Artesian) region and the southern (Riverina) region. Both exhibit senile valleys choked with alluvial, and so level that they merge into plains with indistinguishable divides. Thus the Paroo

River in time of flood is stated to spread to a width of some 20 miles. Probably much of the alluvial is a legacy of larger rivers of the Pleistocene period. Some uplift has affected the main streams in places. Thus, at Walgett, the Darling (or Barwon) flows in a trench 30 feet below the alluvial plains. The same condition obtains at Wilcannia. The soil consists largely of black *chernozem* near the rivers, with much humus and unoxidized fragments of basic rocks. Older alluvial tends to be reddish and less "sticky" owing partly to oxidization.

The southern boundary of the Artesian Division is not marked by any notable surface feature. It runs from Bourke to Dubbo near the Bogan River. On the east, the land rises rapidly to the outlying spurs of the New England Plateau. The Artesian water is found at much shallower depths than in Queensland—on an average about 1,800 feet down. (The deepest, Boronga Bore, near Mungindi, penetrates to a depth of 4,338 feet).

(ii) *Central District.* The central portion of New South Wales exhibits three low earth waves, which probably originated in pressure from the New Zealand area exerted on the mobile crust thrusting it against the Great Australian Shield. We have already considered the Flinders Range—the most western of these buckles. To the east lie the Broken Hill Uplands, the Cobar Peneplain, and the Blue Plateau. These bear marks of recency and probably date from the Pleistocene or "Kosciusko" period.

(iii) *The Broken Hill Upland.* The Broken Hill Upland (rather inaccurately named the Barrier Ranges) consists of a horst some 100 miles long and 30 miles wide. It rises some 500 feet above the alluvial plains, which in turn are 500 feet above the sea. The upland is crossed by low ridges, which represent the edges of upturned resistant strata. Well-marked fault-scarps cut by deep gorges appear along the western edge. Large delta-fans of an earlier wetter cycle run far out on the alluvial deposits of the Frome Plain.

(iv) *The Darling River.* The Darling River flows from the Northern (Artesian) Division to the Southern (Riverina) Division of the lowlands. No marked rejuvenation of the river seems to have ensued due to the buckling here, for at Wilcannia the Darling is only entrenched about 30 feet in its alluvials.

(v) *The Cobar Peneplain.* The Cobar Peneplain is an area some 200 miles wide of early Paleozoic rocks rising about 600 feet above the sea, and so only a little higher than the surrounding deep alluvial plains. It represents fairly closely the pre-uplift topography of most of Eastern Australia in middle tertiary times. The level area around Wyalong to the south is of somewhat the same topography.

(vi) *The Riverina or Murray Basin.* The Riverina Region extends from about Narrandera westwards to the border of South Australia. It is characterized by extremely level conditions, so that the rivers have the habit of delta-streams and distributaries are common. In local floods the water at times flows *upstream.* Billabongs and anabranches cross from river to river. Willandra Billabong in periods of flood connects the Lachlan near Hillston with the Murray at Euston. So also Yanco Creek joins the Murrumbidgee with the Murray by an alternative channel, to the south of the main drainage of the region (via Hay). Local uplift has caused the Murray to be slightly rejuvenated in its Echuca section, but very little work has been done on the topography of the Murray.

3. **Eastern Division.**—(i) *The New England Plateau.* New England is the most extensive plateau in Australia, though not the highest. If covers an area about 200 miles long by 40 miles wide—all over 3,000 feet high. Three bosses between Armidale and Tenterfield (Ben Lomond, Capoompeta, and Chandler's Peak) rise to 5,000 feet, while an important high spur, called Snowy Mountain, runs to the east, and the "Barrington Tops" to the south are about the same height. Andrews writes of New England, "The conception which harmonizes most with the facts of observation appears to be that the main New England Plateau surface was developed by erosive activities near sea level, and that it has since been raised unevenly, so as to form a warped and faulted surface." There are three of these plateau levels. The Guyra Peneplain is

at about 4,300 feet elevation, the Mole Peneplain is at 4,000, the Sandon and Stannifer Peneplain at about 3,200 feet. The coastal rivers have cut back into this uplifted region and have formed canyons (as at the head of the Macleay) some 3,000 feet deep.

Three volcanic groups are associated with New England. The Nandewar group of trachyte cones rises to a height of 4,000 feet between Armidale and Narrabri. A similar group to the south of Narrabri is called the Warrumbungles. Its highest point is about 3,000 feet. Linking these to the main plateau is the basalt-capped highland called the Liverpool Range.

A very marked topographic feature lies just to the south of this group of highlands. It is the *Cassilis Gate*, and is a broad gap, well below 2,000 feet. It is the most striking break in the highlands from the latitude of Brisbane to that of Melbourne. Curiously enough, no railway so far takes advantage of this topographic advantage for a route to the west. The depression is due partly to tectonic and partly to erosional factors.

(ii) *The Blue Plateau.* The next massif to the south is the *Blue Plateau.* (The term " Blue Mountains " is a misnomer). It consists of a boldly warped portion of the crust, which has been elevated three or four thousand feet. The main flexure is along the western bank of the lower Nepean River, and here the surface rises sharply about 1,000 feet. But several other parallel folds further west bring the ancient peneplain surface to a height of over 4,000 feet at Mount Bindo (near Jenolan).

Marked faults have accompanied the folding. Near Kurrajong, a fault scarp of about 500 feet is a marked feature, and similar faults are probably common to the southward. The uplift dates back many thousand years, and marked rejuvenation and reversal of the streams is the result. It seems likely that the pre-uplift drainage here was to the north-west or north, as suggested in 1911 by the writer. Such courses are still dominant in the Wianamatta " Stillstand " (or region of negligible uplift) which lies between Sydney and the Blue Plateau. Field work being carried out at present seems to support the view that the Wollondilly and Cox Rivers originally joined the Macquarie streams to the north-west. The remarkably broad and deep gorges cut in the plateau, with their unique bottle-necks, where they pass through the " hinge " of the earth fold, are due to the presence of a hard horizontal sandstone capping softer coal measures. They have been described elsewhere.

(iii) *The Lake George Gate.* An area of marked faulting separates the Blue Plateau from the next massif to the south. To this area of relatively low faulted topography the name of *Lake George Gate* has been given. Here the former tributaries of the Yass River and other streams have been ponded back by meridional faults to form lakes like Lake George (20 miles long) and Lake Bathurst. Fine " antecedent " gorges such as the Molonglo (east of Canberra) and the Murrumbidgee (as it flows west through the horst) at Burrinjuck show the relative recency of the Kosciusko uplift.

(iv) *Kosciusko and The Monaro.* The south-east corner of New South Wales contains the highest mountains in Australia. *Kosciusko* rises to 7,328 feet, but it is merely the summit of a crustal block or horst with a general level of five or six thousand feet. The topography of the Kosciusko Plateau has been worked out in some detail. Glacial relics of the Pleistocene ice age, such as moraines and cirques, only occur within about 10 miles of the summit, at elevations over 5,500 feet. Sussmilch has shown that the courses of the Murrumbidgee and Snowy Rivers near Kosciusko have been largely determined by the presence of *graben* bounded by meridional faults.

It seems probable that a " lineament " (or line of crustal weakness) extends from Canberra southwards, perhaps to Bass Strait. The late Mr. Dannevig charted a deep submarine canyon or drowned river valley near Cape Everard, which was perhaps the southern end of this lineament. Evidences of capture are common along the courses of the Upper Murrumbidgee and of the Snowy River in this district. This lineament traverses the Monaro Plateau, which probably constitutes another crustal block parallel to the Kosciusko horst, but at a level of about 2,500 feet. It is bounded on the east by a marked scarp, by which travellers descend rapidly to the coast. The linear and parallel character of the coast from Cape Howe north to Bateman's Bay indicates that faulting has played a part here. A similar coastline from the Shoalhaven northward nearly to Sydney is also probably largely determined by faulting. The term "Illawarra Range" for this faulted feature is, therefore, a misnomer and should be replaced by "Illawarra Scarp."

§ 7. Victoria.

1. **General.**—The topography of Victoria may be considered in three major divisions. The *Eastern Highlands* are structurally associated with those of south-east New South Wales. The *Northern Plains* are merely portion of the Murray Basin which we have already considered. In the south-east of the State is a fairly level low area which has been termed the *Great Valley* of Victoria.

2. **The Eastern Highlands.**—The marked change in the direction of the main axis of the cordillera near Kosciusko is of much interest. Yet the Victorian highlands, like those in the south-east of New South Wales, appear also to be built up of meridional horsts arranged parallel to each other right across Victoria. The highest "blocks" are to the east, and Mounts Bogong (6,508) and Hotham (6,100) are not much lower than Kosciusko itself. The chief gap hereabouts is the Omeo "Gate," which separates the Victorian portion of the Kosciusko massif (with the Cobboras (6,000) and Mount Gibbo) from the Bogong Plateau. The Mitta and Tambo valleys here apparently form a "lineament" across the highlands. Lake Omeo is on this line of weakness, and the Tambo headwaters appear largely to have been captured by the Upper Mitta.

3. **The Dargo High Plains.**—The Dargo High Plains are at about 4,500 feet elevation, and lie to the south of Mount Bogong. Mount Buffalo (5,645 feet) extends to the north, raising fairly abruptly above the Murray Plains. The edges of this elevated peneplain have been deeply notched by the rivers to north and south. The Goulburn has cut a deep wide valley and has had a varied history involving several captures. Eastward the highlands are somewhat lower, but Mounts Howitt and Wellington are over 5,000 feet. Further east again the divide becomes more ridge-like and rapidly drops from Mount Torbreck (4,995 feet) to the Kilmore "Gate," where it is only about 1,000 feet above sea-level.

The elevated portion of the State to the west of this Gate also consists of a peneplain in general sloping from Mount Macedon (3,324) to the south-west. The level is about 2,000 feet at Ballarat, 1,000 at Ararat and 600 at Hamilton. Fault scarps, similar in origin and direction to those described near Kosciusko, define the Pyrenees (3,240) and Grampians (3,827). These latter seem to be horsts above the general level of the elevated peneplain.

4. **The Great Victorian Valley.**—The whole of the Western Plains south of the divide (in the west) has been flooded by basalt lavas. This region between Ballarat and the Otway Ranges (of Jurassic strata some 1,900 feet high) is part of the Great Victorian Valley. It is about 500 feet above sea-level. Small volcanic cones are common throughout, such as Mount Elephant (1,294 feet), Mount Noorat, and Tower Hill. Lakes are scattered over this basalt plain, occupying depressions in the fairly lately formed surface. Port Phillip would appear to be a sunken portion of the Great Valley, which, structurally, extends to the east as the Gippsland Plains. Here the Strzelecki Ranges are of the same type and age as the Otway Ranges. On Wilson's Promontory are isolated granite hills reaching 2,434 feet.

5. **The North West Plains.**—The north-west of the State consists of a vast plain mostly below 500 feet and covered with alluvial deposited by the 'tributaries' of the Murray. These latter in general end blindly in a maze of sand-hills, for the rainfall is only about 12 inches a year. The Murray has a large enough supply to flow continuously (except in dry years like 1914 or 1923), but the Wimmera, Yarriambiack, and Avoca Rivers have too little catchment. Numerous swampy lakes, like Hindmarsh and Tyrrell, have developed where the tributaries end.

§ 8. Tasmania.

1. **General.**—This State, like the adjacent region on the mainland, consists essentially of lower Paleozoic sediments buttressed by granite. But over a large portion of the centre and east a basin in the Paleozoic rocks has been filled with coal measures (and allied deposits), and these again have been overwhelmed with basic eruptive rocks.

2. **The Central Plateau.**—The dominant feature is the central plateau, which falls from a general level of 3,500 feet in the north-west towards the south-east, being drained by the Derwent system. This plateau seems to be a horst, the lowlands to the north and east having having been relatively depressed by step faulting, which has left bold scarps (locally called tiers).

Along the western edge the plateau rises to considerable heights in Cradle Mountain (5,069), Eldon (4,789) and Frenchman's Cap; while the southern wall of the Derwent basin is crowned by Mount Field West (4,725) and Mount Wellington (4,166). The northern rim is also high (Ironstone 4,736), but the east of the plateau is much lower and connects at Oatlands (1,350) with the east coast highlands.

3. **North-east and South-west Massifs.**—Two somewhat isolated massifs lie in the north-east and south-west respectively. The highest point in the State is Legge's Peak (5,160) on the rectangular plateau of Ben Lomond. This is bounded on the west by the lowland drained by the Tamar and its tributaries. In the south-west of the Island, the Huon River flows parallel to the Gordon, Tamar and Derwent. These river-directions probably indicate the prevalence of lineaments across the plateaux forming Tasmania. The Wilmot and Arthur highlands in the south-west are probably outlying portions of the same uplifted peneplain. Their summits are about 3,500 feet above the sea.

4. **Evidences of Late Elevation.**—The deep gorges of the western rivers (e.g., King, Franklin and Denison), the large lakes on the central plateau (e.g., Great Lake, Arthur and Sorell), and the truncated east coast (as at St. Mary's where the South Esk *rises* on the coastal rim) are all features pointing to the comparatively late development of the present topography of Tasmania. Moraines and other relics of the glacial age have been described as occurring on Cradle Mountain, Mount Field, Mount Anne and other peaks.

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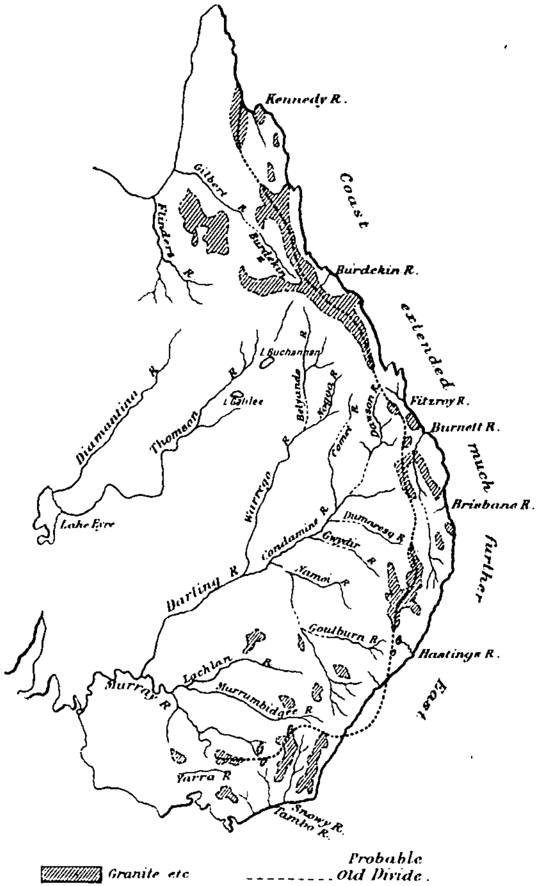


FIG. 1.—The Granite Areas of Eastern Australia which before the great uplift probably formed the divide. The probable arrangement of early Tertiary drainage is indicated.

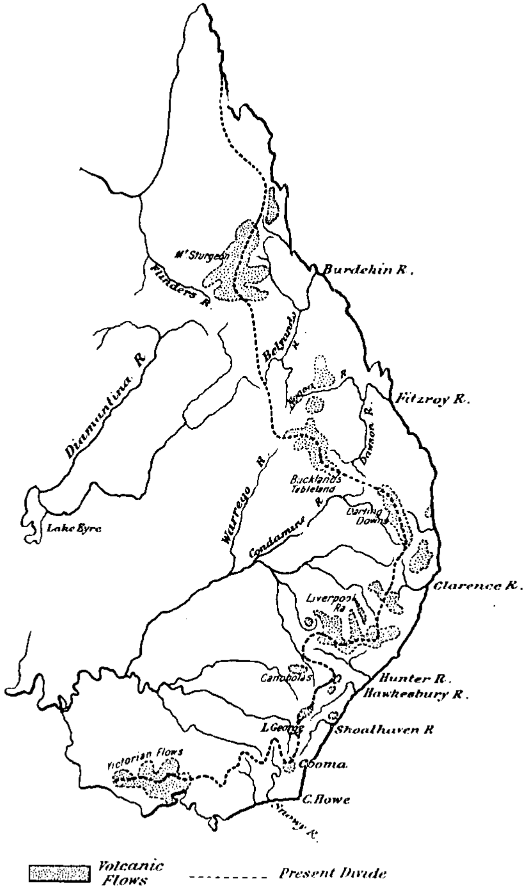


FIG. 2.—The later Volcanics of Australia, chiefly late Tertiary basalts, showing their association with the present divide.

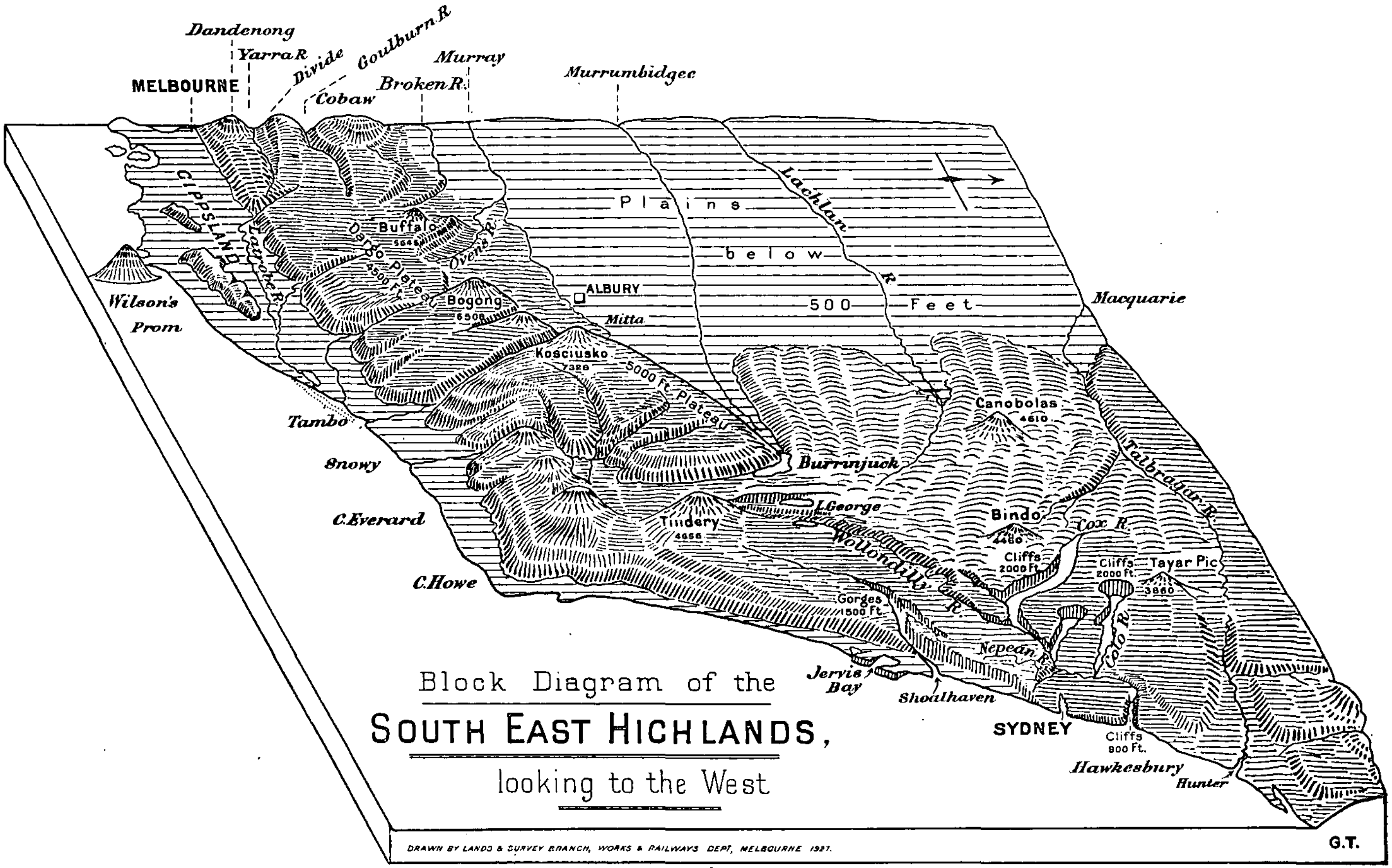
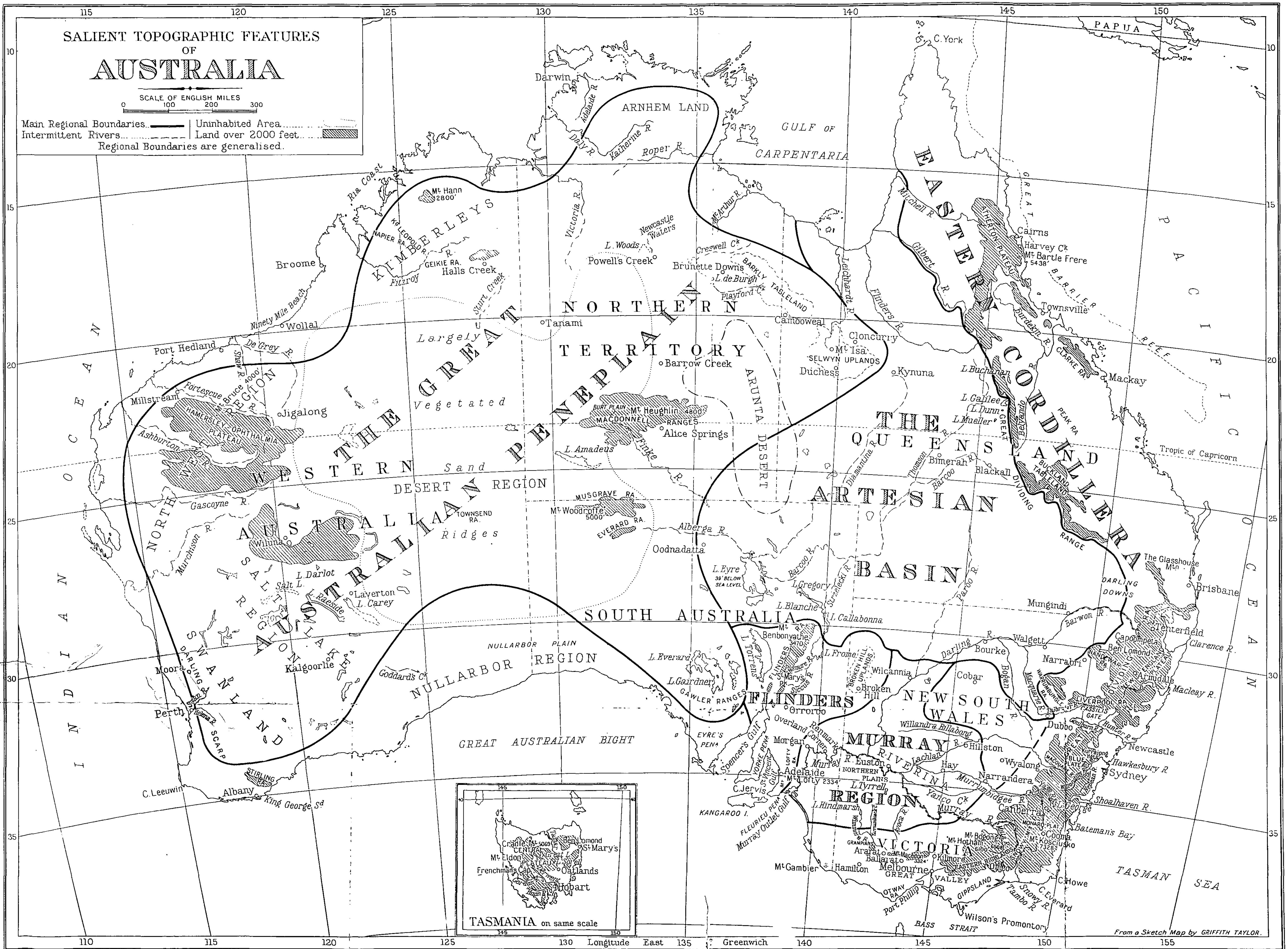

Dandenong
Yarra R
Divide
Goulburn R
Murray
MELBOURNE
Broken R.
Cobaw
Murrumbidgee
GIPPSLAND
Latrobe R.
Plains
below
500
Feet
Lachlan R.
Buffalo
5645
Dargo Plateau
4500 Ft.
Ovens R.
Bogong
6508
ALBURY
Mitta
Wilson's
Prom
Macquarie
Kosciusko
7328
5000 Ft. Plateau
Canobolas
4610
Tambo
Burrinjuck
Snowy
Talbragar R.
L.George
Bindo
4460
Cox R.
C.Everard
Tindery
4656
Wollondilly R.
Cliffs
2000 Ft.
Cliffs
2000 ft.
Tayar Pic
3860
C.Howe
Gorges
1500 Ft.
Colo R.
Nepean R.
Jervis
Bay
Shoalhaven
SYDNEY
Cliffs
900 Ft.
Hawkesbury
Hunter
Block Diagram of the
SOUTH EAST HIGHLANDS,
looking to the West
DRAWN BY LANDS & SURVEY BRANCH, WORKS & RAILWAYS DEPT, MELBOURNE 1927.
G.T.

FIG. 3.



Drawn by Lands & Survey Branch, Works & Railways Dept, Melbourne. 1927.