SECTION III.

PHYSIOGRAPHY.

§ 1. General Description of Australia.

1. **Geographical Position.**—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 (a).

Tropical and Temperate Regions. Of the total area of Australia the lesser portion lies within the tropics. Assuming, as is usual, that the latitude of the Tropic of Capricorn is 23° 30′ S.,(b) the areas within the tropical and temperate zones are approximately as follows :—

AREAS OF TROPICAL AND TEMPERATE REGIONS

OF STATES AND TERRITORY 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 Commonwealth (0.386).   See hereafter Meteorology—page 54.

2. **Area of Australia compared with that of other Countries.**—That the area of Australia is greater than that of the United States of America, that it is four-fifths of that of Canada, that it is nearly one-fourth of the area of the whole of the British Empire, that it is more than three-fourths of the whole area of Europe, that it is more than 25 times as large as any one of the following, viz., the United Kingdom, Hungary, Italy, the Transvaal, and Ecuador, are facts which are not always adequately realised. It is this great size, taken together with the fact of the limited population, that gives to the problems of Australian development their unique character, and its clear comprehension is essential in any attempt to understand those problems.

The relative magnitudes may be appreciated by a reference to the following table, which shows how large Australia is compared with the countries referred to, or *vice versa.* Thus, to take line 1, we see that Europe is about 1$\frac{3}{10}$ times (1·29696) as large as Australia, or that Australia is about three-quarters (more accurately 0·77) of the area of Europe.

(a) 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." The limits, according to the 1903–4 edition of " A Statistical Account of Australia and New Zealand," p. 2, and, according to Volume XXV. of the Encyclopædia Britannica, tenth edition, p. 787, are respectively 113° 5′ E., 153° 16′ E., 10° 39′ S., and 39° 11½′ S., but these figures are obviously defective. A similar inaccuracy appears in the XI. edition of the Encyclopædia.

(b) Its correct value for 1920 is 23° 26′ 58.89″, and it decreases about 0.47″ per annum.

AREA OF AUSTRALIA IN COMPARISON WITH THAT OF OTHER COUNTRIES.

| Commonwealth of Australia | .. | .. | 2,974,581 square miles. |

Country.	Area.	Australian Commonwealth in comparison with—	In comparison with Australian C'wealth.
	Sq. miles.		
Continents—			
Europe	3,862,633	0.77	1.29854
Asia	16,705,070	0.18	5.61594
Africa	12,140,962	0.25	4.08157
North and Central America and West Indies..	8,549,010	0.35	2.87402
South America	7,355,087	0.40	2.47265
Australasia and Polynesia	3,450,364	0.86	1.15995
Total, exclusive of Arctic and Antarctic Conts.	52,063,120	0.06	17.50267
Europe—			
Russia (inclusive of Poland & Ciscaucasia) ..	1,997,309	1.49	0.67146
Austria-Hungary (inclusive of Bosnia & Herzegovina)	261,259	11.39	0.08783
Germany	208,780	14.25	0.07019
France	207,054	14.37	0.06961
Spain	194,783	15.27	0.06548
Sweden	173,035	17.19	0.05817
Finland	125,689	23.67	0.04225
Norway	125,001	23.80	0.04202
United Kingdom	121,633	24.46	0.04089
Italy	110,632	26.89	0.03719
Denmark (inclusive of Iceland)	55,291	53.80	0.01859
Rumania	53,489	55.61	0.01798
Bulgaria	47,750	62.29	0.01605
Greece	41,933	70.94	0.01410
Portugal	35,490	83.81	0.01193
Serbia	33,891	87.77	•0.01139
Switzerland	15,976	186.19	0.00537
Netherlands	12,582	236.42	0.00423
Albania	11,500	258.66	0.00387
Belgium	11,373	261.55	0.00382
Turkey	10,882	273.35	0.00366
Montenegro	5,880	505.88	0.00198
Luxemburg	999	2977.56	0.00034
Andorra	191	15573.72	0.00006
Malta	118	25208.31	0.00004
Liechtenstein	65	45762.78	0.00002
San Marino	38	78278.45	0.00001
Monaco	8	371822.63	..
Gibraltar	2	1487290.50	..
Total, Europe	3,862,633	0.77	1.29854
Asia—			
Russia (inclusive of Transcaucasia, Siberia, Steppes, Transcaspia, Turkestan and inland waters)	6,641,587	0.45	2.23278
China and Dependencies	3,913,560	0.76	1.31567
British India	1,093,074	2.72	0.36747
Independent Arabia	1,000,000	2.97	0.33618
Feudatory Indian States	709,555	4.19	0.23854
Persia	628,000	4.74	0.21112
Dutch East Indies	583,210	5.10	0.19606
Japan (and Dependencies).	261,276	11.38	0.08784
Turkey	247,271	12.03	0.08313

AREA OF AUSTRALIA IN COMPARISON WITH OTHER COUNTRIES—*continued*.

Country.	Area.	Australian Commonwealth in comparison with—	In comparison with Australian C'wealth.
ASIA—*continued*—	Sq. miles.		
Afghanistan	245,000	12.14	0.08236
Siam	195,000	15.25	0.06556
Mesopotamia	143,250	20.76	0.04816
Philippine Islands (inclsv. of Sulu Archipelago)	114,400	26.00	0.03846
Syria	106,740	27.87	0.03588
Laos	98,000	30.36	0.03295
Bokhara	83,000	35.84	0.02790
Omán	82,000	36.28	0.02757
British Borneo and Sarawak	73,106	40.69	0.02458
Nepál	54,000	55.08	0.01815
Annam	52,100	57.09	0.01752
Tonking	46,400	64.11	0.01560
Kurdistan	45,860	64.86	0.01542
Cambodia	45,000	66.10	0.01513
Federated Malay States	27,506	108.14	0.00925
Armenia	26,130	113.84	0.00878
Smyrna	25,801	115.29	0.00867
Ceylon	25,481	116.74	0.00857
Khiva	24,000	123.94	0.00807
Malay Protectorate (including Johore)	23,486	126.65	0.00790
Cochin China	21,988	135.28	0.00739
Bhután	20,000	148.73	0.00672
Palestine	13,724	216.74	0.00461
Aden and Dependencies	9,005	330.33	0.00303
Timor, &c. (Portuguese Indian Archipelago)	7,330	405.81	0.00246
Brunei	4,000	743.64	0.00134
Cyprus	3,584	829.96	0.00120
Andaman and Nicobar Islands	2,895	1027.49	0.00097
Kiauchau (Neutral Zone)	2,500	1189.83	0.00084
Goa, Damaõ, and Diu	1,638	1815.98	0.00055
Straits Settlements	1,600	1859.11	0.00054
Sokotra	1,382	2152.37	0.00046
Hong Kong and Dependencies	391	7607.62	0.00013
Wei-hai-wei	285	10437.13	0.00010
Bahrein Islands	250	11898.32	0.00008
Kiauchau (late German)	200	14872.91	0.00007
French India (Pondicherry, &c.)	196	15176.43	0.00007
Kwang Chau Wan	190	15655.67	0.00006
Maldive Islands	115	2586.59	0.00004
Macao, &c.	4	743645.25	..
Total, Asia	16,705,070	0.18	5.61594
Africa—			
French Sahara	1,544,000	1.93	0.51906
Sudan	1,014,400	2.93	0.34102
Belgian Congo	909,654	3.27	0.30581
French Equatorial Africa	672,000	4.43	0.22591
Senegambia and Niger	568,273	5.23	0.19104
Angola	517,000	5.75	0.17381
French Military District of the Niger	502,000	5.93	0.16876
Union of South Africa	473,096	6.29	0.15905
Rhodesia	440,000	6.76	0.14792
Portuguese East Africa	428,132	6.95	0.14393
Tripoli and Benghazi	406,000	7.33	0.13649
German East Africa	384,180	7.74	0.12915
Abyssinia	350,000	8.50	0.11766
Egypt	350,000	8.50	0.11766

AREA OF AUSTRALIA IN COMPARISON WITH OTHER COUNTRIES—*continued.*

Country.	Area.	Australian Commonwealth in comparison with—	In comparison with Australian C'wealth.
AFRICA—*continued*—	Sq. miles.		
Mauretania	344,967	8.62	0.11597
Nigeria and Protectorate ..	332,000	8.96	0.11161
German South-west Africa	322,200	9.23	0.10832
Bechuanaland Protectorate	275,000	10.82	0.09245
British East Africa Protectorate	246,822	12.05	0.08298
Morocco	231,500	12.85	0.07783
Madagascar	228,000	13.05	0.07665
Algeria (including Algerian Sahara)	222,180	13.39	0.07469
Kamerun (French)	158,130	18.81	0.05316
Italian Somaliland	139,430	21.33	0.04687
Ivory Coast	125,000	23.80	0.04202
Uganda Protectorate	110,300	26.97	0.03742
Rio de Oro, &c. ..	109,200	27.24	0.03671
French Guinea	93,000	31.98	0.03126
Gold Coast Protectorate (with Nth. Territories)	80,000	37.18	0.02689
Senegal	74,012	40.19	0.02488
British Somaliland	68,000	43.74	0.02286
Tunis ..	50,000	59.49	0.01681
French Somali Coast	46,000	64.66	0.01546
Eritrea ..	45,800	64.95	0.01540
Liberia ..	40,000	74.36	0.01345
Nyassaland Protectorate ..	39,573	75.17	0.01330
Dahomey	39,000	76.27	0.01311
Kameroon (British)	33,000	90.14	0.01109
Sierra Leone and Protectorate	31,000	95.95	0.01042
Portuguese Guinea	25,000	118.98	0.00840
Togoland (French)	21,200	140.31	0.00713
Togoland (British)	12,500	237.97	0.00420
Basutoland	11,716	253.89	0.00394
Spanish Guinea (Rio Muni, &c.)	9,470	314.11	0.00318
Swaziland	6,678	445.43	0.00225
Gambia and Protectorate ..	4,504	660.43	0.00151
Cape Verde Islands	1,480	2009.85	0.00050
Fernando Po, &c.	1,198	2482.96	0.00040
Zanzibar	1,020	2916.26	0.00034
Réunion	970	3066.58	0.00033
Mauritius and Dependencies	809	3676.86	0.00027
Comoro Islands ..	650	4576.25	0.00022
St. Thomas and Principe Islands	454	6551.90	0.00015
Seychelles	156	19067.83	0.00005
Mayotte, &c.	140	21247.01	0.00005
Spanish North and West Africa	87	34190.59	0.00003
St. Helena	47	63288.96	0.00002
Ascension	34	87487.68	0.00001
Total, Africa ..	12,140,962	0.25	4.08157
North and Central America and West Indies—			
Canada ..	3,729,665	0.80	1.25385
United States (exclusive of Alaska, &c.)	2,973,890	1.00	0.99977
Mexico ..	767,198	3.88	0.25792
Alaska ..	590,884	5.03	0.19864
Newfoundland and Labrador	162,734	18.28	0.05471
Nicaragua	49,200	60.46	0.01654
Guatemala	48,290	61.60	0.01623
*Greenland	46,740	63.64	0.01571
Honduras	44,275	67.18	0.01488

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

AREA OF AUSTRALIA IN COMPARISON WITH OTHER COUNTRIES—*continued.*

Country.	Area.	Australian Commonwealth in comparison with—	In comparison with Australian C'wealth.
N. & C. AMERICA & W. INDIES—*continued*—	Sq. miles.		
Cuba	44,164	67.35	0.01485
Costa Rica	23,000	129.33	0.00773
San Domingo	19,332	153.87	0.00650
Salvador	13,176	225.76	0.00443
Haiti	10,204	291.51	0.00343
British Honduras	8,592	346.20	0.00289
Bahamas	4,404	675.43	0.00148
Jamaica	4,207	707.05	0.00141
Porto Rico	3,606	824.90	0.00121
Trinidad and Tobago	1,974	1506.88	0.00066
Leeward Islands	715	4160.25	0.00024
Guadeloupe and Dependencies ..	722	4119.92	0.00024
Windward Islands	527	5644.37	0.00018
Curaçao and Dependencies ..	403	7381.09	0.00014
Martinique .. .. .: ..	385	7726.18	0.00013
Turks and Caicos Islands	224	13279.38	0.00008
Barbados	166	17919.16	0.00006
Virgin Islands of U.S.A., late Danish West Indies	132	22534.70	0.00004
St. Pierre and Miquelon	93	31984.74	0.00003
Cayman Islands	89	33422.25	0.00003
Bermudas	19	156556.89	..
Total, N. and C. America and W. Indies ..	8,549,010	0.35	2.87402
South America—			
Brazil	3,275,510	0.91	1.10117
Argentine Republic	1,153,119	2.58	0.38766
Peru	722,461	4.12	0.24288
Bolivia	514,155	5.79	0.17285
Colombia (exclusive of Panama)	440,846	6.75	0.14820
Venezuela	398,594	7.46	0.13400
Chile	289,829	10.26	0.09744
Paraguay	165,000	18.03	0.05547
Ecuador	116,000	25.64	0.03900
British Guiana	89,480	33.24	0.03008
Uruguay	72,153	41.23	0.02426
Dutch Guiana	46,060	64.58	0.01548
Panama	32,380	91.86	0.01089
French Guiana	32,000	92.96	0.01076
Falkland Islands	6,500	457.63	0.00219
South Georgia	1,000	2974.58	0.00034
Total, South America	7,355,087	0.40	2.47265
Australasia and Polynesia—			
Commonwealth of Australia	2,974,581	1.00	1.00000
Dutch New Guinea	151,789	19.60	0.05103
New Zealand and Dependencies ..	104,751	28.40	0.03522
Papua	90,540	32.85	0.03044
Kaiser Wilhelm Land	70,000	42.49	0.02353
Bismarck Archipelago	15,730	189.10	0.00529
British Solomon Islands	11,380	261.39	0.00383
New Caledonia and Dependencies	8,548	347.99	0.00287
Fiji	7,083	419.96	0.00238
Hawaii	6,449	461.25	0.00217
New Hebrides	5,100	583.25	0.00171

AREA OF AUSTRALIA IN COMPARISON WITH OTHER COUNTRIES—*continued*.

Country.	Area.	Australian Commonwealth in comparison with—	In comparison with Australian C'wealth.
	Sq. miles.		
AUSTRALASIA AND POLYNESIA—*continued*—			
French Establishments in Oceania	1,520	1956.96	0.00051
German Samoa	1,000	2974.58	0.00034
Caroline, Pelau and Marshall Islands ..	710	4189.55	0.00024
Tonga	385	7726.18	0.00013
Marianne Islands	250	11898.32	0.00008
Guam	225	13220.36	· 0.00008
Gilbert and Ellice Islands	208	14300.87	0.00007
Samoa (U.S.A. part)	102	29162.56	0.00003
Norfolk Island	13	228813.92	—
Total, Australasia and Polynesia ..	3,450,364	0.86	1.15995
British Empire, excluding Mandatory Territories	12,767,599	0·23	4·29223
Mandatory Territories	983.464	3.02	0.33062

It should be noted that in the above table the figures quoted for areas of the several countries of Europe refer to conditions prevailing prior to the outbreak of war, and modifications will in some instances be necessary after the final adjustment of boundaries has been effected.

3. **Relative Areas of Political Subdivisions.**—As already stated, Australia consists of six States and the Northern and Federal Territories. The areas of these, in relation to one another and to the total of Australia, are shewn in the following table :—

RELATIVE AREAS OF STATES, TERRITORIES, AND COMMONWEALTH.

State or Territory.	Area.	Ratio which the Area of each State and Territory bears to that of other States, Territories, and Commonwealth.							
		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N. Ter.	C'wlth.
	Sq. miles.								
New South Wales	309,432	1.000	3.521	0.461	0.814	0.317	11.804	0.591	0.104
Victoria ..	87,884	0.284	1.000	0.131	0.231	0.090	3.352	0.168	0.030
Queensland ..	670,500	2.167	7.629	1.000	1.764	0.687	25.577	1.280	0.225
South Australia	380,070	1.228	4.325	0.567	1.000	0.389	14.498	0.726	0.128
West. Australia	975,920	3.154	11.105	1.456	2.568	1.000	37.228	1.864	0.328
Tasmania ..	26,215	0.085	0.298	0.039	0.069	0.027	1.000	0.050	0.009
North. Territory	523,620	1.692	5.958	0.781	1.378	0.537	19.974	1.000	0.176
Federal Territory	940	0.003	0.011	0.001	0.002	0.001	0.036	0.002	0.000a
Commonwealth	2,974,581	9.613	33.847	4.436	7.826	3.048	113.469	5.681	1.000

a The correct decimal is 0.0003.

Thus, looking at the top line, New South Wales is seen to be over three-and-a-half times as large as Victoria (3.521) and less than one-half the size of Queensland (0.461) ; or again, looking at the bottom line, the Commonwealth is shewn to be more than nine-and-a-half times as large as New South Wales (9.613), and nearly thirty-four times as large as Victoria (33.847).

These relative magnitudes are shewn in the small diagram below. It may be added that Papua (or British New Guinea), with its area of 90,540 square miles, is 0.030 of the area of the Commonwealth. The comparatively small size of the Federal Territory prevents its being shewn in this diagram.
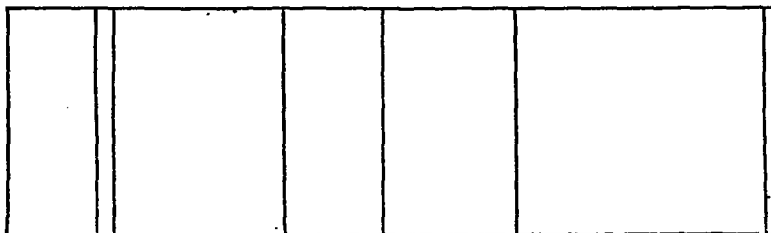
| % on total .. | N.S.W. 10 | V. 3 | Qld. 22 | S.A. 13 | N.T. 18 | W.A. 33 | Tas. 1 |

4. **Coastal Configuration.**—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).

(i) *Coast-line.* The lengths of coast-line, exclusive of minor indentations, both of each State and of the whole continent, are shewn in the following table:—

SQUARE MILES OF TERRITORY PER MILE OF COAST LINE.

STATES, TERRITORY, AND CONTINENT.

State.	Coast-line.	Area ÷ Coast-line.	State.	Coast-line.	Area ÷ 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 Territory.   (b) Area 2,948,366 square miles.

For the entire Commonwealth 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.

(ii) *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 Nuyt's 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 recognised 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. Thus No. 1 Year Book, pp. 60–68, contains an enumeration of Coastal features; No. 2, pp. 66–67, deals with Hydrology; No. 3, pp. 59–72, with Orography; No. 4, pp. 59–82, with the Lakes of Australia; No. 5, pp. 51–80, with the Islands of Australia; No. 6, pp. 55–66, with the Mineral Springs of Australia; No. 7, pp. 56–58, with the Salient Features in the Geological History of Australia, with special reference to changes of climate. A special article dealing with the plains and peneplains of Australia appeared in No. 12 Year Book, pp. 82–88. This practically completes the description of the ordinary physical features.

§ 2. The Fauna of Australia.

An authoritative article describing in some detail the principal features of the Fauna of Australia was given in Year Books No. 1 (see pp. 103 to 109) and No. 2 (see pp. 111 to 117), while a synoptical statement appeared in No. 3 (see pp. 73 to 76). Considerations of space, however, preclude the inclusion in this issue of more than a passing reference to the subject.

§ 3. The Flora of Australia.

In Year Books No. 1 (see pp. 109 to 114) and No. 2 (see pp. 117 to 122) a fairly complete though brief account was given of the Flora of Australia, and in Year Book No. 3 similar information in a greatly condensed form will be found on pp. 76 to 78. Space in this issue will not permit of more than a mere reference to preceding volumes.

A special article dealing with Australian fodder plants, contributed by J. H. Maiden, Esq., F.L.S., Government Botanist of New South Wales, and Director of the Botanic Gardens, Sydney, appeared in Official Year Book No. 6, pp. 1190-6. A special article on the grasses and saltbushes of Australia, contributed by E. Breakwell, B.A., B.Sc., Agrostologist at the Botanic Gardens, Sydney, appeared in Year Book No. 9, pp. 84–90. Year Book No. 10 contained two special articles; one dealing with Australian eucalyptus timbers, contributed by R. T. Baker, F.L.S., appeared on pp. 85 to 92, and one by H. G. Smith, F.C.S., dealing with the chemical products of Australian eucalypts, appeared on pp. 92–98.

§ 4. Seismology in Australia.

A brief statement regarding the position of seismology and seismological record in Australia appeared in Year Book No. 4, pp. 82 and 83.

§ 5. The Geology of Australia.

1. **General.**—Independent and authoritative sketches of the geology of each State were given in Year Books No. 1 (see pp. 73 to 103) and No. 2 (see pp. 78 to 111). Want of space has precluded the insertion of these sketches in the present issue of the Year Book, and it has not been considered possible to give anything like a sufficient account of the geology of Australia by presenting here a mere condensation of these sketches. Reference must, therefore, be made to either Year Book No. 1 or No. 2, *ut supra*.

2. **Geological Map of Australia.**—The map shewing the geographical distribution of the more important geological systems and formations, which appeared on page 51 of Year Book No. 12 and in preceding issues, has been discontinued pending the preparation of a new map embodying later information.

3. **The Plains and Peneplains of Australia.**—A special article dealing with this subject appears on pp. 82–88 of Year Book No. 12.

4. **The Building Stones of Australia.**—Independent and authoritative descriptions of the building stones of each State (with the exception of Queensland) will be found in Official Year Book No. 9, pp. 446–466.

A special article dealing with "The Building Stones of Queensland" will be found on pp. 89–95 of Year Book No. 12.

5. **Past Glacial Action in Australia.**—A special article on this subject will be found in Year Book No. 13, pp. 1133 *et seq.*

§ 6. Evidences of Past Volcanic Action in Australia.*

(A) Australia.

1. **Introduction.**—It will help to make clear the nature of the evidence of past volcanic action in Australia if we consider briefly the conditions under which such activity is developed on the earth at the present time, and the nature of present-day volcanic products.

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The geographical distribution of active volcanoes at present lies mainly along two lines, the one passing through the West Indies and the Mediterranean, the other girdling the Pacific, passing well to the east of the present coast-line of Australia, and stretching from the Kurile and Japanese Islands, through Java, New Guinea, New Hebrides, and New Zealand to the Antarctic at Mount Erebus. These lines lie near or along the margins of continents and ocean basins, and are regions of present crustal instability along which the forces of folding or faulting, with accompanying earthquakes, from time to time are renewed. Other lines of weakness are submarine, and at intervals along such lines volcanic islands such as Samoa and Hawaii have been built up. These lines may be pictured as lines along which the earth's crust is weak and fissured and the vertical rock pressure less than in adjoining areas. Such conditions are favourable for the rise of molten rock to the surface, along fissures, from the highly heated depths of the crust, and its passage to the surface may be facilitated by lateral crustal pressure or warping of adjoining areas, and by the expansion of highly heated gases present in the molten magmas as the result of diminished pressure above the fracture zones.

Among present-day types of volcanic activity are the wide lava floods poured out from fissures, as in the volcanic regions of Iceland and the centralized vents or volcanoes generally localized at intervals along fracture lines. Such a volcano commonly consists of a conical hill with a central crater and a vent or plug communicating with the interior. The crater may become enlarged by violent explosions or subsequent collapse, and may be broken across or breached by lava flows pouring over a low lip of the crater. Cones may consist entirely of lava, of scoria, of tuff, or of ash, or these may alternate and form a composite cone.

When the activity is effusive, lavas are poured out; when explosive, fragmental materials, such as scoria or tuff, accumulate round the vent. Dykes of volcanic rock frequently radiate from the necks of the volcanoes, and if these reach the surface may form parasitic cones. Volcanoes active on land may have their lavas and ashes interbedded with deposits of land or lake origin, while in submarine eruptions the products become intercalated between marine sediments, and may ultimately rise above the surface to form volcanic islands, so numerous in the Pacific Ocean.

The chemical composition of lavas may be highly siliceous, forming so-called acid lavas, such as rhyolite and obsidian; intermediate in character, giving rise to such rocks as trachytes and andesites; or basic, that is, with low silica percentage and rich in lime, magnesia and iron, in which case basalts and allied rocks are formed. Grouped in another way certain lavas may be described as calcic, in which lime and magnesia are present in greater quantities than potash and soda. Of this group, andesites and basalts are examples. Another group constitutes the alkalic rocks—rich in soda or potash—to which rhyolites, trachytes, and phonolites belong. A third group is recognised—the so-called spilite series—consisting of basic lavas, rich in albite felspar, usually submarine in origin, and associated with cherts.

Calcic and alkalic lavas, such as basalts and rhyolites or phonolites, may be poured out successively from the same or adjoining vents, indicating that some process of separation or differentiation has gone on in the reservoir of magma beneath the surface. While this is so, these three groups—the calcic, alkalic, and spilitic—are often associated with more or less distinct types of earth movement or earth structure, the calcic group with regions undergoing subsidence by folding or warping, though also associated with plateau movements, the alkalic closely associated with plateau movements of elevation or depression and often near fault lines, while the spilite or albite rich basic series appears to be formed normally as submarine flows at some distance from a shore line and at moderate depth.

Examples illustrating all the above phases, physical and chemical, of volcanic action are to be found among rocks of various geological ages in Australia, and we may now proceed to review in a summarized way the distribution of volcanic rocks in Australia, both geographically and geologically. It will be understood that our knowledge of the geology of the more remote parts of the continent is vague and uncertain, and that in the older rocks of the geological record it is sometimes difficult or impossible to recognise the existence of volcanic products on account of the great chemical and structural changes which they have undergone. Commencing with the oldest rocks, and working up the geological column, it will be convenient to record the principal volcanic rocks in each State and in Papua in turn.

2. **Pre-Cambrian Volcanic Rocks.**—(i) *Western Australia.* In the Pilbara gold-field, the Warrawoona beds consist of basic lavas and sills, in places altered to greenstone schists. At Kalgoorlie ancient sediments rest on a group of basic rocks forming the Boulder auriferous belt. Quartz dolerite is the most important rock. The igneous series is probably mainly intrusive. In the Norseman field, in the southern part of the State, bedded amygdaloidal lavas are associated with the pre-Cambrian sediments. On the South Coast, from west to east of Mount Barren, occur sills of amphibolized quartz-dolerite.

In the Kimberley division occurs the Nullagine series which, while apparently younger than the Warrawoona series, may be pre-Cambrian, and appears to be not younger than older Palæozoic. Associated with the sediments of this series submarine basalts, dolerites, amygdaloidal andesites and submarine ashes occur in great profusion on the Leopold Plateau.

In the Murchison gold-field, tuffs occur at Meekatharra and in the Yalgoo field at Mount Singleton. In the West Pilbara field, augite-andesites and quartz-felsites or rhyolites occur near the base of the series.

(ii) *Northern Territory.* In the Woggaman province submarine lavas are recorded, but, with this exception, the references are all to highly metamorphosed rocks which on indefinite evidence are referred to as altered tuffs. These are recorded from such localities as the Katherine River above the telegraph station, Arnhem Land, Marranboy tin-field, Yenberrie wolfram-field, Pine Creek, Mount Diamond, Brilliant, Woolngie, the Woggaman province, and the Tanami district.

3. **Cambrian Volcanic Rocks.**—(i) *New South Wales.* The uralitic dolerite (amphibolite) dykes of Broken Hill may be of Cambrian age.

(ii) *Victoria.* In several localities in western, central, and eastern Victoria, notably at Mount Stavely near Geelong, Heathcote, Mount William near Lancefield, Mount Major near Dookie, the Howqua River, and Waratah Bay, a big series of ancient basic lavas, agglomerates, and tuffs, with interbedded cherts and associated shales in places, underlie conformably the Lower Ordovician sediments, and appear to be exposed along axial lines trending roughly north and south. At the Dolodrook River, near Mount Wellington, basic submarine tuffs are interbedded with Upper Cambrian fossiliferous limestones, and constitute the Heathcotian series. The cherts and shales contain Upper Cambrian marine fossils. The volcanic rocks constitute submarine flows and ashes, and some of them are rich in primary or secondary albite, and therefore belong to the spilite series of rocks.

(iii) *South Australia.* Uralitic dolerite dykes at Blinman and Mount Remarkable are possibly of Cambrian age.

(iv) *Tasmania.* In the Dundas district, the central and western part of the Zeehan field, the Leven Gorge, Gunn's Plains, the North West Coast in Barkworth's Bay west of Goat Island, a mixed series of sediments and volcanic rocks occurs. They extend on an axial line parallel to the West Coast from Bass Strait to Birch's Inlet, in Macquarie Harbour. They are probably of Upper Cambrian age, and resemble the Heathcotian series of Victoria. They include slates, porphyroids (crushed quartz and felspar porphyries), breccias and submarine tuffs, and vesicular lavas resembling the spilite or amygdaloidal diabase of German authors.

(v) *Northern Territory.* In the Edith River district and other areas southward from it are extensive developments of basalt, dacite, volcanic agglomerates with boulders up to 4 feet in diameter, and tuffs several hundreds of feet in thickness. At Maude Creek, amygdaloidal basalt occurs. South of Rendezvous Hill, near Roper Bar, sandstones of apparently Cambrian age overlie natrolite basalts. South of Red Lily a similar basalt is interbedded with quartzites, but may be an intrusive sill. From Hodgson Downs to McArthur River basalt covers a great area of timberland country. On Nutwood Downs station, 5 miles from Tamumburini, acid tuffs are interbedded with the quartzite series. In the Pine Creek district, near Blackfellows Creek, and Swamp Billabong on Daly-Road, dolerites are apparently interbedded in the Lower Cambrian series, and similar rocks occur in the Victoria River and Willaroo districts.

4. **Ordovician.**—(i) *New South Wales.* In the Orange-Cadia district andesitic lavas and tuffs are associated with Ordovician sediments, while andesites also occur in the Forbes-Parkes district. There is also a great development of contemporaneous basic tuffs in the Upper Ordovician rocks of the Lyndhurst gold-field.

(ii) *Victoria.* At Mount Easton, near Wood's Point, loose-textured nodular beds, with included lapilli of andesite, appear to be submarine tuffs and are interbedded with Upper Ordovician sediments.

(iii) *Western Australia.* In the Townsend Range, in latitude 26° S., close to the South Australian border, and near the base of the series, are vesicular basalts and dolerite lavas apparently interbedded with sediments, and presumably of submarine origin. They may be of Ordovician age.

5. **Silurian.**—(i) *New South Wales.* At the Jenolan Caves, rhyolites, some of which are intrusive, and tuffs are interstratified with Silurian sediments. In the Orange, Yass, the Federal Territory of Canberra, and Cobar districts, rhyolites, some of which also are intrusive, and tuffs occur. In the Forbes-Parkes district andesitic lavas and tuffs, are associated with Silurian sediments.

(ii) *Victoria.* In the Thomson River district, near Walhalla, in an Upper Silurian limestone, flakes of biotite and chlorite, and bands of tuffaceous fragments suggest some submarine volcanic activity, but the fragments may be of detrital origin.

6. **Devonian.**—(i) *New South Wales.* (a) *Lower Devonian.* In the south-east of the State, at Taemas, 5,000 feet of acid lavas and tuffs occur, while the overlying Lower Devonian marine limestones are more or less tuffaceous throughout. At Tamworth, spilite lavas and interbedded tuffs occur.

(b) *Upper Devonian.* In the Yalwal district, and also near Eden, rhyolites and basalt flows are prominent.

(ii) *Victoria.* (a) *Lower Devonian.* In north-east and east Victoria the Snowy River porphyries consist of a volcanic series stretching from the Murray River southwards to Nowa Nowa, and from Cobberas, on the west, through the Mitta Mitta district to Corryong, in the north-east of the State. They consist of lavas and ashes from volcanic foci developed along meridional fractures close to a sinking shore line, and include porphyroids, trachytic-andesites, quartz-porphyrites, quartz-ceratophyres, and stratified ash beds. They pass upwards near Buchan into andesitic lavas and dykes or, in other places, into calcareous tuffs, which merge upwards into mid-Devonian marine limestones. The rocks of Noyang, in Dargo, may be of the same age, and include alkali rocks allied to quartz-ceratophyre. Rocks allied to the dacites, containing quartz and garnet, occur in the King Valley, and from Mount Timbertop and the Howqua River, towards Buller Creek, underlie Lower Carboniferous sediments, and may be of Lower Devonian age.

The main dacite series of central Victoria appears to have been the product of subaerial Lower Devonian volcanoes, and forms thick masses, in places 2,000 to 3,000 feet in thickness, of biotite or hypersthene dacites. Near Lilydale, toscanites form the base of the series. The Dandenong Ranges, Healesville to Warburton Ranges, the Marysville district, Mount Macedon, and the northern part of the Strathbogie Ranges are largely composed of lavas, with occasional tuffs of this rock series.

(b) *Upper Devonian or Lower Carboniferous.* The Upper Palæozoic sediments stretching from Ben Cruachan past Mount Wellington to the Snowy Bluff and northwards to the Howqua district, in Victoria, contain intercalated volcanic rocks. The rocks are mainly rhyolites and rhyolite tuffs. At Mount Wellington the lava is 2,000 feet in thickness. Thin lava flows of amygdaloidal basalt occur at Mount Wellington, and at the Snowy Bluff eight thin flows occur separated by beds of sandstone and shale.

In western Victoria, quartz porphyries, possibly intrusive, may be correlated with the Upper Palæozoic acid volcanic rocks of eastern Victoria. They occur between Hamilton and Cavendish, and near the latter place appear to underlie the Grampian sandstones. In the latter rock in places there occur dykes, sills, and possibly lavas of an acid character. The intrusive members may be as young as Upper Carboniferous.

7. **Carboniferous Volcanic Rocks.**—(i) *New South Wales.* Lower carboniferous volcanic rocks occur in the Barraba–Tamworth district, as andesitic tuff in the mudstones of the Burindi series, and as lavas and tuffs of rhyolite trachyte and andesite in the overlying Rocky River series. Further south, in the Hilldale-Dungog area, tuffs are interstratified with mudstones in the Burindi series. At Currabubula, 130 miles N.N.W. of Newcastle, fine-grained acid tuffs occur at the top of the Burindi series. During this volcanic period small flows of basalt and local eruptions of soda rhyolite occurred, while pyroxene andesite was intruded into the Burindi series. The recently described

Kuttung series of Middle and Upper carboniferous age, especially at Paterson, Clarence town, Seaham, and Eelah, includes large areas of soda rhyolites, toscanites, dacites, hornblende andesites, hornblende mica andesites, pyroxene andesites, and pitchstones. Near Pokolbin, potash rhyolites, soda rhyolites, trachytes, albite trachytes, and andesites occur. In northern New England, in the Drake gold-field near Bolivia and Tenterfield, rhyolites and tuffs are represented. Near the top of the Kuttung series, come important volcanic rocks with extensive outpourings of basalt, tuffs, and agglomerate, succeeded by sills and dykes of normal, albite, and teschenitic dolerites, hornblende and pyroxene andesites, and, lastly, by trachytoid quartz ceratophyres.

8. **Permo-Carboniferous Volcanic Rocks.**—(i) *New South Wales.* In the Lower Marine series in the Maitland district, extensive flows of natrolite basalt occur, while in the Drake gold-field in northern New England, andesitic lavas and tuffs are represented, which have been referred to this period.

At the close of the Upper Marine series, at Illawarra on the South coast, submarine lavas and tuffs 1,000 feet thick, and ranging from basic to intermediate in composition, are represented. They include alkali rocks such as orthoclase-basalts (latites), and continue on a reduced scale to the period of the Upper Coal Measures. During this latter period small basaltic flows were poured out in the coal measure swamps. At Murrurundi, on the north-west margin of the coal basin, basalts were poured out to a thickness of several hundred feet. At Newcastle, the Nobbys chert near the top of the Permo-Carboniferous series consists of silicified rhyolite tuff.

(ii) *Queensland.* In the Bowen River district the lower series includes basalts and melaphyres exposed over wide areas. In the Mackay district coarse volcanic agglomerates, basalt, dolerites, and felspar porphyry are represented.

In the Upper Bowen series, in the type area, plains of basalt and porphyrite occur. In the Mackenzie River and at Bowen, basalts and copper-bearing tuffs are interbedded in the Upper Marine sediments, while andesites, possibly of this age, occur on the Dawson River, and at Mount Morgan. At Gympie, amygdaloidal basalts, andesites, and volcanic ash are interbedded with sediments. Eight miles from Warwick, on the Darling Downs, is an extensive development of rhyolites, which may be of Upper Carboniferous age or may belong to the Lower Marine series of Permo-Carboniferous age. The latter sediments in this district are largely tuffaceous.

(iii) *Northern Territory.* In the Pine Creek, Victoria River, and Tanami districts, basalts and other volcanic rocks of doubtful age are, by some observers, referred to this period.

9. **Triassic Volcanic Rocks.**—(i) *New South Wales.* The Narrabeen series, of Lower Triassic age, consists partly of shales composed of redistributed tuffaceous material.

(ii) *Queensland.* At the base of the Ipswich sedimentary series, at and near Brisbane, occurs a coarse rhyolite tuff of Triassic age.

10. **Jurassic Volcanic Rocks.**—(i) *Victoria.* The extensive lacustrine sandstones and mudstones developed in western Victoria, the Otway Ranges, near Geelong, and in South Gippsland are composed largely of plagioclase, chlorite, and quartz, and may represent tuffaceous or redistributed tuffaceous material.

(ii) *Tasmania.* Probably at the close of the Jurassic, or during the Cretaceous period, gigantic intrusions, chiefly sills up to 500 feet thick of diabase, occurred in Tasmania, orming the precipitous tiers of that island. They are probably associated with plateau movements of subsidence and faulting.

11. **Kainozoic Volcanic Rocks.**—(i) *New South Wales.* The Kainozoic volcanic rocks of this State, as in Queensland and Victoria, have a threefold development. The oldest consist of an Older Basalt series consisting of cappings on the residuals of an old peneplain, as on the Blue Mountains tableland and the Bald Hills near Bathurst, and they also form deep leads near Kiandra. The middle series consists mainly of alkali rocks, and occurs principally in groups of extinct cones of limited area. The Canoblas mountains, near Orange, the Warrumbungle mountains, near Coonabarabran, and the Nandewar mountains, near Narrabri, are the best known. The sequence at Canoblas, which is generally similar to the other areas, consists from below upwards of comendites and quartz trachytes, alkaline phonolitic trachytes, and ande- sites.

In the Mittagong-Bowral district occur residual volcanic plugs of alkaline syenite allied to bostonite. The Gib Rock and Mount Jellore consist of similar conical masses of alkaline trachytes. Alkaline trachytes occur also near Dubbo and various places in the Northern Rivers district. In the Kiama district sills of nepheline syenite and tinguaite occur, and monchiquite dykes, which may be post-Tertiary in age.

In the Sydney-Blue Mountains area occur dykes radiating from east of Botany Bay. They include basalt, monchiquite, nephelinite, and basanite, and are probably of Middle to Upper Kainozoic age. Essexite or analcite-dolerite forms a sill (?) at Prospect, near Parramatta. Many volcanic necks occur in this region, some filled wholly or partly with basalt, while others are only explosive steam vents filled wholly or partly with non-igneous breccia from the wall rock. Occurrences at Hornsby and the Basin in the Nepean River are of this character. A volcanic neck at Dundas, near Parramatta, consists of basalt, agglomerate, and xenoliths of basic and ultrabasic plutonic rocks.

Tinguaites occur at Kosciusko, Berrigan, and Mount Stormy. Leucite-basalts are found at Cudgellico, Byrock, El Capitan, and Harden, and nepheline-basalt at Capertee and Mount Royal.

The Newer Basalt series, the plateau-basalts, occur as extensive sheets resting on the younger tableland or peneplain. Their greatest development is in New England, where they cover some hundreds of square miles near Inverell, Glen Innes, Armidale, Walcha, and other localities. On the central tableland they are met with in the Orange, Blayney, and Oberon districts, and on the southern tableland between Cooma and Bombala. They appear to have developed mainly from fissure eruptions, as no cones are found, and tuffs are rare.

(ii) *Victoria.* The threefold development of Kainozoic volcanic rocks is more clearly shewn than in any State except, perhaps, Queensland, and the association in some localities with marine or lacustrine sediments enables their relative age to be approximately determined. The lowest series consists of the Older Basalts. They are developed in and around Melbourne at Royal Park, Essendon, Broadmeadows, and Keilor, where they underlie Lower Kainozoic marine sediments. They are represented also near Geelong, at French Island, and Phillip Island. At Cape Schanck, a bore penetrated them for over 800 feet, while at Flinders another bore passed through over 1,200 feet of older basalts. They are widespread in South-east Gippsland, as at Buln Buln, Leongatha, Neerim, Mirboo, etc., while in North Gippsland they cap the plateau sometimes at elevations of over 5,000 feet, as at Mount Feathertop and Dargo High Plains.

The Middle Kainozoic series consists of alkali rocks. In the Western district of Victoria anorthoclase aegirine trachytes occur at Carapook, Coleraine, Mount Koroit, Koolomert, and the "Giant Rock" at Wotong Vale. Near Casterton two small lava flows of phonolite occur. In central Victoria, at Mount Macedon, the sequence from below upwards appears to be lavas of anorthoclase aegirine trachyte, volcanic plugs or mamelons of solvabergite forming the Camel's Hump, the Hanging Rock, and Brock's Monument, anorthoclase basalt lavas and flows of macedonite and woodendite, followed by olivine bearing trachytes and limburgite. Near Macalister's Rock, north of Mount Macedon, a tuff contains well-developed but minute nepheline crystals. Nepheline basalts also occur near Greendale. Volcanic hills of trachyte and trachy-phonolite, such as Blue Mountain, occur between Blackwood and Daylesford. The monchiquite dykes of Bendigo and Castlemaine, and similar dykes near Daylesford and Melbourne, may be genetically related to the alkali rocks. In north-eastern Victoria eight volcanic plugs or dykes of tinguaite and phonolite occur in the highlands south of Harrietville, while a nepheline phonolite volcano forms Gallows Hill near Tolmie, about 14 miles north-east of Mansfield. At Frenchman's Hill, just north of Omeo, a volcanic hill, with central core of solvabergite, has on its flanks lavas of anorthoclase trachyte and a more or less radial system of dykes, including pegmatites, quartz veins, bostonites, diabase, trachyte, and seven or eight dykes of nepheline phonolite. In Benambra, at Mount Leinster, a volcanic hill consists of solvabergite, anorthoclase trachyte, and dyke rocks allied to variolite.

The Upper Kainozoic to recent volcanic rocks in Victoria form very extensive plains, stretching from Mount Gambier in South Australia, through the Western district of Victoria to Melbourne, and in several places, as in the Loddon Valley, fill old valleys and run for long distances north of the present Main Divide. They cover over 6,000 square miles of surface, and are diversified by hundreds of small volcanic cones or puys in various stages of preservation or dissection, and probably the most recently active cone was the

compound one of Tower Hill, west of Warrnambool. Tuffs from Tower Hill overlie dune limestones containing still existing species of shells. Other well-preserved cones are Mount Noorat and Mount Franklin. Mount Bullenmerri, near Camperdown, consists of a caldera with crater enlarged probably by explosion, and now forming a lake. Breached cones occur as at Mount Leura, near Camperdown, and Mount Buninyong, near Ballarat. Broad depressions of the surface of the lava plains have formed extensive but shallow lakes, such as Lakes Colac and Colongulac. In places, the present streams have trenched deep and sometimes wide valleys through the lava plains. The Newer Basalt flows in and near Melbourne, as, for instance, at Clifton Hill, Burnley, and Footscray, have been extensively quarried for road metal and building stone. The rocks are mainly olivine basalts, but analcite has been recorded from a coarse olivine-augite dolerite or essexite occurring as boulders in the tuffs at the base of the volcanic series at Lake Bullenmerri. The eruptions probably proceeded mainly from fissures now concealed beneath the lava flows and connected with plateau movements of elevation and subsidence and faulting, which affected Victoria at intervals from Post-Pliocene to recent times. In some places the sequence is first tuffs, then lava flows, while the later volcanic cones consist mainly of scoria and tuffs. Well-preserved volcanic bombs are found on the flanks of many of the cones. Many of the tuffs are well bedded, and excellent sections are seen at places such as Tower Hill, Lake Bullenmerri, and Lake Burrumbeet. The flooding of such a large area of Victoria with basalt obliterated the old streams, and the sealing up of these old river valleys formed the deep leads which contained rich deposits of gold-bearing sands and gravels, as at Ballarat, Ararat, and the Loddon Valley.

(iii) *Queensland.* Volcanic rocks of three series and of different age are represented. The oldest consist of extensive basalt flows and basaltic tuffs and agglomerates in south-east Queensland between Ipswich and the New South Wales border, and were probably the products of fissure eruptions. Basalts of this series are widespread on the Darling Downs, as at Warwick and Toowoomba. The thickness of this series is usually less than 100 feet, but at Mount Lindsay it is over 1,500 feet. The middle member of the volcanic series consists of alkali rocks largely rhyolite and trachyte tuffs and agglomerates, rhyolite and pitchstone dykes, and extensive lavas of rhyolite and trachyte. Rhyolites especially occur in the southern part of south-east Queensland near the MacPherson Range, and trachytes in the south-west of the area along the line of the main range. Probably of the same age as this middle series are the volcanic plugs, flows, and associated tuffs of the Glasshouse Mountains, the Esk, the Yandina district, Mount Flinders, and Fassifern, Cainbable Creek, and Woodhill areas, in which, while andesites and dacites occur, as in the Glasshouse Mountains and the Esk district respectively, the main development consists of alkali rocks, such as trachytes, soda trachytes, and soda rhyolites. To this period may also be referred the volcanic rocks of Springsure, in Central Queensland, which also have a threefold development, an older basalt series of agglomerates and lavas, followed by an alkali series of noseau trachytes or trachy-phonolites, in which precious opal has been found, and succeeded in turn by a newer series of basalts. Somewhat similar alkali rocks occur at Mount Larcombe, south of Rockhampton and in the hills near Yeppoon, to the north-east of Rockhampton.

Possibly the leucite basalts of the Normanby Reefs, in the Cooktown district in North Queensland, may belong to the middle alkali series of other areas in the State.

The upper series of Kainozoic volcanic rocks in Queensland consists of basalts and andesites in successive and numerous flows in the south-east part of the State. At the Lamington plateau, the maximum development of 2,000 feet of basalt occurs, Agglomerates and tuffs are not found in the southern part of south-east Queensland, but occur on the main range and at Toowoomba. Basaltic rocks of uncertain age, possibly Upper Kainozoic, occur in various localities, such as the Anakie, Clermont, and Herberton districts.

(iv) *South Australia.* Small basaltic vents or puys of Upper Kainozoic to recent age occur in the south-east part of the State from Mount Schank, the best-preserved cone, to Mount Graham, a distance of 35 miles. Mount Gambier is the largest cone, and consists of ash, scoria, and lapilli. Small flows of basalt have issued from lateral fissures near the base of the cones. The crater is Brown's Lake; other lakes, such as Blue Lake and Leg of Mutton Lake, are not craters, but due to subsidence. On Kangaroo Island, lava possibly of somewhat greater age filled up a valley from Kingscote to Rettie's Bluff, 5 miles west of Kingscote.

(v) *Western Australia.* In the Kimberley district, basic lavas and ashes occur in the valleys of the Ord and the Bow rivers. On the Belen River, a dome or puy of basalt formed one of the foci from which lavas issued. In the southern part of the State, basalt flows occur near Bunbury, and other flows are located to the south, as at the Blackwood River and at Black Point on the South Coast, near Silver Mount. These may be of Middle or Upper Kainozoic age, and may belong to the same periods as those of South Australia and Victoria.

(vi) *Tasmania.* Basalt flows in many parts of the island overlie fluviatile and lacustrine deposits, and form deep leads. In the north-east, basalt flows occur near Branxholme and Derby. In the north-west of the island, a basalt sheet caps the coastal plateau, as at Wynyard and Burnie. The above may belong to the Older Kainozoic series. In many other districts Kainozoic basalts occur, but it is difficult to place them stratigraphically. To such belong the basalts of Sheffield, Conara, Barham Plains, and Bothwell. The extensive basalt sheets probably developed from fissure eruptions. Numerous alkali volcanic rocks in Tasmania may belong to the middle part of the Kainozoic period, as is the case in many areas on the mainland. Alkali basalts or trachy-dolerites with analcite and nepheline occur at Table Cape and the Nut at Circular Head. Small volcanic cones cut through the diabase at Shannon Tier, and consist of melilite nepheline basalt, and a similar rock occurs as a lava flow at Sandy Bay, near Hobart. The alkali rocks of Port Cygnet, Woodbridge, and Kettering cut the diabase, and are probably of Mid-Kainozoic age. They include tinguaites and solvabergite porphyries, and appear to consist of minor intrusions.

(B) Papua.

1. **Upper Kainozoic to recent Volcanic Rocks.** The volcanic rocks are known to comprise hornblende andesites and basalts. In the island of Misima (St. Aigan) are thin flows of trachyte. The Papuan lavas appear to belong to two volcanic zones in which the Aird Hills, a series of small volcanic cones about 200 miles north-west from Port Moresby, belong to the southern zone, and the other zone is parallel and adjacent to the northern coast of British Papua. The great extinct crater, Dayman, 9,500 feet high, belongs to this latter belt, as does Mount Victory, 6,000 feet high. The latter cone is interesting, as it is, so far as is known, the only active lava-producing cone in the Commonwealth, while the small island of Dobu (Goulvain) in the D'Entrecasteaux group is a volcanic cone from which steam is emitted.

(C) Summary.

The foregoing remarks bring to a close a rapid survey of past volcanic action in Australia. It has been noted that few of the geological periods in the history of the development of Australia have been entirely free from some kind of volcanic activity. Specially prominent periods of volcanic energy were the Cambrian in the Northern Territory and Victoria, and the Upper Palæozoic, including the Upper Silurian, Devonian, and Carboniferous periods in eastern Australia, especially in New South Wales and Victoria. The Mesozoic was mainly a period of repose in Australia, but at its close the big sills of diabase invaded Tasmania. From the lower Kainozoic to the present day, eastern Australia, including Queensland, New South Wales, Victoria, Tasmania and part of South Australia, has been at intervals the scene of immense volcanic activity. In Victoria and South Australia, the latest eruptions not only flooded wide areas with basaltic lavas, but in the later stages of explosive activity formed many hundreds of small and frequently well-preserved scoria and tuff cones or puys. Since then volcanic activity has become, for the time being, extinct on the mainland of the continent, and has shifted eastwards beyond the present continental borders, and now manifests itself at intervals along a line passing through Papua, the New Hebrides, and New Zealand.

NOTE.—Materials for this article have been taken from the publications of the Federal and State Geological Surveys, the Royal Societies of the various States, the Linnean Society of New South Wales, the Australasian Association for the Advancement of Science, the Federal and State handbooks for the British Association meeting in Australia in 1914, the Mining Handbook of West Australia, 1919, and from unpublished communications from Professor H. C. Richards of the University of Queensland, Mr. W. R. Browne of the University of Sydney, Dr. W. G. Woolnough, and the writer.

§ 7. 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 organisation 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, shewing pressure, temperature, wind, rain, cloud extent, and weather. Similar publications are also issued from the divisional offices in each of the State Capitals.

The Bulletins of Climatology are as follow :—No. 1.—A general discussion of the climate and meteorology of Australia, illustrated by one map and diagrams. No. 2.—A discussion of the rainfall over Australia during the ten years 1897–1906 compared with the normal, illustrated by one map. No. 3.—Notes and statistics of the remarkable flood rains over south-eastern Australia during the winter of 1909, illustrated by five maps and diagrams. No. 4.—A discussion of the monthly and seasonal rainfall over Australia, illustrated by one map and diagram. No. 5.—An investigation into the possibility of forecasting the approximate winter rainfall for Northern Victoria, illustrated by two diagrams. No. 6.—The physiography of the Federal Territory at Canberra, illustrated by a relief map and 21 plates. No. 7.—On the climate of the Yass-Canberra district, illustrated by one map. No. 8.—Physiography of Eastern Australia, with 28 text illustrations. No. 9.—The climate of Australia, with charts and diagrams, prepared for the Federal Handbook of Australia. No. 10.—Relation between cirrus directions as observed in Melbourne and the approach of the various storm systems affecting Victoria, illustrated by a number of charts. No. 11.—The climatic control of Australian production, with 43 illustrations. No. 12.—A graphical method of shewing the daily weather, and especially cloud types, with two graphs. No. 13.—Initial investigations in the upper air of Australia, with 35 illustrations. No. 14.—The control of settlement by humidity and temperature, with 21 charts and diagrams. No. 15.—Tropical Control of Australian Rainfall, illustrated by maps and diagrams.

Commencing with January, 1910, the "Australian Monthly Weather Report," containing statistical records from representative selected stations, with rain maps and diagrams, &c., is being published. Complete rainfall and other climatological data are published in annual volumes of meteorological statistics for each State separately.

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

3. General Description of Australia.—In the general description of Australia, page 39, it is pointed out that a considerable portion (0.530) of three divisions of the Australian Commonwealth 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 the Commonwealth 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 1.591). 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.

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* Prepared from data supplied by the Commonwealth Meteorologist, H. A. Hunt, Esquire, F.R. Met. Soc.

† In the article ".Australia " in the Encyclopædia Britannica, Vol. II., p. 946 (XI. edition), this area is given as 1,145,000 square miles.

‡ Given as 1,801,700 square miles in the work above quoted, where, however, the statistics are said " to refer only to the continental States of the Federation, not to Tasmania."

While on the coast the rainfall is often abundant and the atmosphere moist, in some portions of the interior the rainfall is very limited, and the atmosphere dry. The distribution of forest, as might be expected, and its climatic influence, is consequently very variable. In the interior there are on the one hand fine belts of trees, on the other there are large areas which are treeless, and where the air is hot and parched in summer. Again, on the coast, even as far south as latitude 35°, the vegetation is tropical in its luxuriance, and also somewhat so in character. Climatologically, therefore, Australia may be said to present a great variety of features. The various climatological characteristics will be referred to in detail.

4. **Meteorological Divisions.**—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., 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., from Wilcannia along the Darling River to its junction with the Murray ; (d) between divisions II. and V., from the junction of the Darling and Murray Rivers, along the latter to Encounter Bay ; (e) between divisions III. and IV., 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., 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) division V. includes Tasmania.

The population included within these boundaries at the Census of the 3rd April, 1911, was approximately as follows :—

Division	I.	II.	III.	IV.	V.
Population	·282,000	429,000	607,000	1,540,000	·1,597,000

In these divisions the order in which the capitals occur is as follows :—(i) Perth, (ii) Adelaide, (iii) Brisbane, (iv) Sydney, (v) Melbourne and Hobart; and for that reason the climatological and meteorological statistics will be set forth in the indicated order in this publication.

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.

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 ..	133	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.**—In respect of Australian temperatures generally it may be pointed out that the isotherm for 70° Fahrenheit extends in South America and South Africa as far south as latitude 33°, while in Australia it reaches only as far south as latitude 30°, thus shewing that, on the whole, Australia has a more temperate climate when compared latitude for latitude with other places in the Southern Hemisphere.

The comparison is even more favourable when the Northern Hemisphere is included therein, for in the United States the 70° isotherm extends in several of the western States as far north as latitude 41°. In Europe the same isotherm reaches almost to the southern shores of Spain, passing, 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 isothermal value 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 the Australian continent the temperatures are very equable. At Darwin, for example, the difference in the means for the hottest and coldest months is only 8.3°, and the extreme readings for the year, that is, the highest maximum in the hottest month and the lowest reading in the coldest month, shew a difference of under 50°.

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

The detailed temperature results for the several capitals of the States of Australia are shewn in the Climatological Tables hereinafter.

(i) *Hottest and Coldest Parts.* A comparison of the temperatures recorded at coast and inland stations shews 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° for days, and even weeks, continuously. The coldest part of the Commonwealth is the extreme south-east of New South Wales and extreme east of Victoria, namely, the region of the Australian Alps. Here the temperature seldom, if ever, reaches 100°, even in the hottest of seasons.

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

(ii) *Monthly Maximum and Minimum Temperatures.* The mean monthly maximum and minimum temperatures can be best shewn by means of graphs, which exhibit the nature of the fluctuation of each for the entire year. In the diagram (on page 65) for nine representative places in Australia, the upper heavy curves shew the mean maximum, the lower heavy curves the mean minimum temperatures based upon daily observations. On the same diagram the thin curves shew the relative humidities (see next paragraph).

6. **Relative Humidity.**—Next after temperature the degree of humidity may be regarded as of great importance as an element of climate; and the characteristic differences of relative humidity between the various capitals of Australia call for special remark. For six representative places the variations of humidity are shewn on the graph on page 65, which gives results based upon daily observations of the dry and wet bulb thermometers. Hitherto difficulties have been experienced in many parts of Australia in obtaining satisfactory observations for a continuous period of any length. For this reason it has been thought expedient to refer to the record of humidity at first order stations only, where the results are thoroughly reliable. Throughout, the degree of humidity given will be what is known as *relative humidity*, that is, the percentage of aqueous vapour actually existing to the total possible if the atmosphere were saturated.

The detailed humidity results for the several State capitals are given in the Climatological Tables hereinafter. From these, it is seen that, in respect of relative humidity, Sydney and Hobart have the first place, while Brisbane, Melbourne, Perth, and

Adelaide follow in the order stated, Adelaide being the driest. The graphs on page 65 shew the annual variations in humidity. It will be observed that the *relative* humidity is ordinarily but not invariably great when the temperature is low.

7. **Evaporation.**—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 records on pages 67 and 76 to 81, which shew that the yearly amount varies from about 32 inches at Hobart to 95 inches at Alice Springs in the centre of the Continent.

(i) *Monthly Evaporation Curves.* The curves shewing the mean monthly evaporation in various parts of the Commonwealth will disclose how characteristically different are the amounts for the several months in different localities. The evaporation for characteristic places is shewn on the diagram shewing also rainfalls (see page 66).

(ii) *Loss by Evaporation.* In the interior of Australia the possible evaporation is greater than the actual rainfall. Since, therefore, the loss by evaporation depends largely on the exposed area, tanks and dams so designed that the surface shall be a minimum are advantageous. Similarly, 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 of more than ordinary concern in the drier districts of Australia.

8. **Rainfall.**—As even a casual reference to climatological maps, indicating the distribution of rainfall and prevailing direction of wind, would clearly shew, 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 zone of the south-east trade and prevailing westerly winds. The southern limit of the south-east trade strikes the eastern shores at about 30° south latitude, and with very few exceptions, the heaviest rains of the Australian continent are precipitated along the Pacific slopes to the north of that latitude, the varying quantities being more or less regulated by the differences in elevation of the shores and of the chain of mountains, 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.

(i) *Factors determining Distribution and Intensity of Rainfall.*

(ii) *Time of Rainfall.*

In 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.

(iii) *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 148 and 166 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's Creek, 238.45 in 1901 and 80.47 inches in 1902, or a range of 157.98 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's Creek in the shorter period of 21 years has twice exceeded 200 inches, the total for 1910 being 201.28 inches.

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

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

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 shew that the annual average is from 10 to 12 inches.

(iv) *Quantities and Distribution of Rainfall generally.* The departure from the normal rainfall increases greatly and 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 shew. The general distribution is best seen from the map on page 72, shewing 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 shewn in the following table :—

DISTRIBUTION OF AVERAGE RAINFALL.

Average Annual Rainfall.	N.S.W. (a)	Victoria.	Queens-land.	South Australia.	Northern Territory	Western Australia.	Tasmania. (b)	Common-wealth. (b)
	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.
Under 10 inches	44,997	nil	91,012	317,600	138,190	513,653	nil	1,105,452
10—15 ,,	77,268	19,912	87,489	33,405	141,570	232,815	nil	592,459
15—20 ,,	57,639	12,626	112,738	14,190	62,920	89,922	937	350,972
20—30 ,,	77,202	29,317	213,779	13,827	93,470	95,404	7,559	530,558
30—40 ,,	30,700	14,029	69,880	984	40,690	40,750	4,588	201,621
Over 40 ,,	22,566	12,000	95,602	64	46,780	3,376	10,101	190,489
Total area ..	310,372	87,884	670,500	380,070	523,620	975,920	26,215	2,974,581

(*a*) Including Federal Capital Territory.   (*b*) Over an area of 3,030 square miles no records are available.

Referring first to the capital cities, the complete records of which are given on the following page, it is seen that Sydney with a normal rainfall of 48.34 inches occupies the chief place, Brisbane, Perth, Melbourne, Hobart and Adelaide following in that order, Adelaide with 21.03 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 shew how the rainfall is distributed throughout the year in various parts of the continent, the figures of representative towns have been selected. (See map on page 71.) Darwin, typical of the Northern Territory, shews that in that region nearly the whole of the rainfall occurs 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 in the former, and in November in 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. In general it may be said that 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 receiving generally from about 10 to 20 inches.

(v) *Curves of Rainfall and Evaporation.* The relative amounts of rainfall and evaporation at different times through the year are best seen by referring to the graphs for a number of characteristic places. (See page 66.) It will be recognised at once how large is the evaporation when water is fully exposed to the direct rays of the sun, and to wind.

(vi) *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.

RAINFALL AT THE AUSTRALIAN CAPITALS, 1840 TO 1920.

Year.	PERTH. Amount.	No. of Days.	10 Years' Means.	ADELAIDE. Amount.	No. of Days.	10 Years' Means.	BRISBANE. Amount.	No. of Days.	10 Years' Means.	SYDNEY. Amount.	No. of Days.	10 Years' Means.	MELBOURNE. Amount.	No. of Days.	10 Years' Means.	HOBART. Amount.	No. of Days.	10 Years' Means.
	in.		in.	in.		in.	in.		in.	in.		in.	in.		in.	in		in.
1840	..	..	..	24.23	99	..	29.32	..	..	58.52	150	..	22.57	..	..	..	..	..
1	..	..	..	17.96	93	..	49.31	..	..	76.31	142	..	30.18	..	..	13.95	74	..
2	..	..	..	20.32	122	..	28.81	..	..	48.32	138	..	31.16	..	..	23.60	88	..
3	..	..	..	17.19	104	..	51.67	..	..	62.78	168	..	21.54	..	..	13.43	87	..
4	..	..	..	16.88	136	..	63.20	..	..	70.66	156	..*	30.74	..	..	26.25	94	..
5	..	..	..	18.83	125	..	39.09	..	..	62.01	133	..	23.93	..	..	16.68	76	..
6	..	..	..	26.89	114	..	31.41	..	41.83	43.83	139	..	30.53	..	..	21.96	99	..
7	..	..	..	27.61	109	..	..	..	(7 yr.)	42.81	142	..	30.18	..	..	13.86	89	..
8	..	..	..	19.74	114	21.07	42.59	..	..	59.17	155	58.27	33.15	..	28.22	23.62	115	19.24
9	..	..	..	25.44	110	(9 yr.)	..	..	..	21.49	140	(9 yr.)	44.25	..	(9 yr)	33.52	103	(8 yr.)
1850	..	..	..	19.56	84	..	..	..	..	44.88	157	..	26.98	..	..	14.51	70	..
1	..	..	..	30.86	128	..	..	..	..	35.14	142	..	..	..	..	17.98	107	..
2	..	..	..	27.44	118	..	..	..	..	43.79	143	..	..	..	..	23.62	119	..
3	..	..	..	27.08	128	..	..	..	..	46.12	130	..	..	..	..	14.52	113	..
4	..	..	..	15.35	105	..	..	..	..	29.29	136	..	..	..	..	30.54	109	..
5	..	..	..	23.15	124	..	..	..	..	52.86	138	..	28.21	..	..	18.25	131	..
6	..	..	..	24.93	118	..	..	..	..	44.31	116	..	29.76	134	..	22.73	152	..
7	..	..	..	22.15	105	..	..	..	..	50.95	135	..	28.90	138	..	17.14	113	..
8	..	..	..	21.55	107	23.75	43.00	..	..	39.60	129	40.75	26.01	158	..	33.07	129	22.59
9	..	..	..	14.85	95	..	35.00	..	..	42.01	137	..	21.82	156	..	23.31	159	..
1860	..	..	..	19.67	119	..	54.63	144	..	82.76	180	..	25.38	133	..	21.05	142	..
1	..	..	..	24.04	147	..	69.45	155	..	59.36	157	..	29.16	159	..	28.19	167	..
2	..	..	..	21.85	119	..	28.27	98	..	23.99	108	..	22.08	139	..	21.72	148	..
3	..	..	..	23.68	145	..	68.83	146	..	47.08	152	..	36.42	165	..	40.67	163	..
4	..	..	..	19.75	121	..	47.00	114	..	69.12	185	..	27.40	144	..	28.11	142	..
5	..	..	..	15.51	108	..	24.11	52	..	36.15	140	..	15.94	119	..	23.07	146	..
6	..	..	..	20.11	116	..	51.18	142	..	36.91	156	..	22.41	107	..	23.55	127	..
7	..	..	..	19.05	112	..	61.04	112	..	59.56	140	..	25.79	133	..	22.27	139	..
8	..	..	..	19.99	113	19.85	35.98	110	47.55	42.98	161	49.99	18.27	120	24.47	18.08	112	25.00
9	..	..	..	14.74	117	..	54.39	114	..	48.00	150	..	24.58	129	..	23.87	131	..
1870	..	..	..	23.84	119	..	79.06	154	..	64.47	179	..	33.77	129	..	27.53	123	..
1	..	..	..	23.25	137	..	45.45	119	..	52.27	141	..	30.17	125	..	18.25	131	..
2	..	..	..	22.66	146	..	49.22	131	..	37.12	161	..	32.52	136	..	31.76	160	..
3	..	..	..	21.00	139	..	62.02	138	..	73.40	176	..	25.61	134	..	23.43	157	..
4	..	..	..	17.23	127	..	38.71	135	..	63.60	173	..	28.10	134	..	21.09	138	..
5	..	..	..	29.21	157	..	67.03	162	..	46.25	153	..	32.87	158	..	29.25	182	..
6	28.73	100	..	13.43	110	..	53.42	130	..	45.69	156	..	24.04	134	..	23.63	173	..
7	20.48	103	..	21.95	135	..	30.28	119	..	59.66	147	..	24.10	124	..	20.82	165	..
8	39.72	143	29.64	22.08	112	21.24	56.33	134	53.59	49.77	129	54.03	25.36	116	28.11	29.76	183	25.24
9	41.34	106	(3 yr.)	20.69	130	..	67.30	157	..	63.19	167	..	19.28	127	..	21.07	210	..
1880	31.79	116	..	22.48	142	..	49.12	134	..	29.51	142	..	28.48	147	..	..	..	..
1	24.78	101	..	18.02	135	..	29.39	117	..	40.99	163	..	24.08	134	..	..	..	..
2	35.68	109	..	15.70	134	..	42.62	121	..	44.28	112	..	22.40	131	..	30.69	..	..
3	39.65	122	..	26.76	161	..	32.22	114	..	46.92	157	..	23.71	130	..	21.05	161	..
4	31.96	92	..	18.74	138	..	43.49	136	..	44.04	159	..	25.85	128	..	21.55	171	..
5	33.44	110	..	15.89	133	..	26.85	112	..	39.91	145	..	26.94	123	..	28.29	176	..
6	28.90	89	..	14.42	141	..	53.66	152	..	39.43	152	..	21.00	128	..	21.39	189	..
7	37.52	105	..	25.70	164	..	81.54	242	..	60.16	190	..	32.39	153	..	24.21	174	..
8	27.83	117	33.29	14.55	131	19.30	33.08	143	45.93	23.01	132	42.94	19.42	123	24.66	23.71		(3 yr.)
9	39.96	123	..	30.87	143	..	49.36	155	..	57.16	186	..	27.14	125	..	30.80	180	..
1890	46.73	126	..	25.78	139	..	73.02	162	..	81.42	184	..	24.24	140	..	27.51	173	..
1	30.33	93	..	14.01	113	..	41.68	143	..	55.30	200	..	26.73	126	..	23.25	160	..
2	31.23	122	..	21.53	137	..	64.98	146	..	69.26	189	..	24.96	121	..	18.62	120	..
3	40.12	145	..	21.49	129	..	88.26	147	..	49.90	209	..	26.80	140	..	27.46	146	..
4	23.72	103	..	20.78	134	..	44.02	143	..	38.22	188	..	22.60	138	..	27.39	141	..
5	33.01	123	..	21.28	130	..	59.11	105	..	31.86	170	..	17.04	131	..	25.40	121	..
6	31.50	103	..	15.17	121	..	44.97	121	..	42.40	157	..	25.16	124	..	21.61	135	..
7	27.17	106	..	15.42	119	..	42.53	115	..	42.52	136	..	25.85	117	..	20.45	153	..
8	31.76	118	33.55	20.75	116	20.71	60.06	131	56.80	43.17	143	51.12	15.61	102	23.61	20.40	164	24.29
9	32.40	107	..	18.84	119	..	38.85	141	..	55.90	174	..	28.87	116	..	20.68	170	..
1900	36.61	124	..	21.68	133	..	34.41	110	..	66.54	170	..	28.09	139	..	19.14	135	..
1	36.75	122	..	18.01	124	..	38.48	110	..	40.10	149	..	27.45	113	..	25.11	149	..
2	27.06	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	..

RAINFALL AT THE AUSTRALIAN CAPITALS—continued.

Year	PERTH Amount	No. of Days	10 Years' Means	ADELAIDE Amount	No. of Days	10 Years' Means	BRISBANE Amount	No. of Days	10 Years' Means	SYDNEY Amount	No. of Days	10 Years' Means	MELBOURNE Amount	No. of Days	10 Years' Means	HOBART Amount	No. of Days	10 Years' Means
	in.		in.	in.		in.	in.		in.	in.		in.	in.		in.	in.		in.
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	..
Aver.	..	..	33.75	..	..	21.03	..	..	45.34	..	..	48.34	..	..	26.20	..	..	23.66
No.of Yrs.			(45)			(82)			(71)			(81)			(77)			(78)

NOTE.—The above average Rainfall figures for Brisbane, Sydney, and Melbourne differ slightly from the mean annual falls given in the Climatological Tables on pp. 76-81, which are for a less number of years.

9. Remarkable Falls of Rain.—The following are the more remarkable falls of rain in the States of New South Wales, Queensland, Western Australia, Victoria, and Tasmania, and in the Northern Territory, which have occurred within a period of twenty-four hours :—

HEAVY RAINFALLS, NEW SOUTH WALES, UP TO 1920, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Anthony ..	28 Mar., 1887	17.14	Madden's Creek ..	13 Jan., 1911	18.68
,, ..	15 Jan., 1890	13.13	Maitland W. ..	9 Mar., 1893	14.79
Araluen ..	15 Feb., 1898	13.36	Major's Creek ..	14 Feb., 1898	12.32
Bega ..	27 ,, 1919	17.88	Marrickville ..	9 Mar., 1913	10.40
Bellingen ..	4 Mar., ,,	13.16	Morpeth.. ..	9 ,, 1893	21.52
Berry ..	13 Jan., 1911	12.05	Mount Kembla ..	13 Jan., 1911	18.25
Billambil.. ..	14 Mar., 1894	12.94	Mt. Pleasant ..	24 Mar., 1914	10.30
Bomaderry ..	13 Jan., 1911	13.03	Murwillumbah ..	29 May, 1919	10.10
Broger's Creek ..	14 Feb., 1898	20.05	Nepean Tunnel ..	14 Feb., 1898	12.30
,, ,, ..	19 July, 1910	12.22	Nethercote ..	27 ,, 1919	14.39
,, ,, ..	13 Jan., 1911	20.83	Nowra	13 Jan., 1911	13.00
,, ,, ..	24 July, 1918	10.30	Numbugga ..	27 Feb., 1919	17.87
,, ,, ..	26 Feb., 1919	11.01	Orara Upper ..	4 Mar., 1919	14.00
*Broger's Creek ..	13 Dec,, 1920	10.50	Padstow Park ..	9 ,, 1913	10.64
Bulli Mountain ..	13 ,, 1898	17.14	Prospect ..	28 May, 1889	12.37
Burragate ..	27 ,, 1919	16.38	Raleigh Central ..	10 Nov., 1917	13.20
Camden Haven ..	22 Jan., 1895	12.23	Richmond ..	28 May, 1889	12.18
Candelo	27 Feb., 1919	18.58	Rosemount ..	23 Mar., 1914	12.62
Castle Hill ..	28 May, 1889	13.49	Rooty Hill ..	27 May, 1889	11.85
Colombo Lyttleton	5 Mar., 1893	12.17	Taree	28 Feb., 1892	12.24
Comboyne ..	18 May, 1914	10.68	Terara	26 ,, 1873	12.57
Condong ..	27 Mar., 1887	18.66	The Hill(Shell Harb.)	24 Mar., 1914	12.00
Cordeaux River ..	14 Feb., 1898	22.58	Tomago ..	9 ,, 1893	13.76
,, ,, ..	13 Jan., 1911	14.52	Tongarra Farm ..	14 Feb., 1898	15.12
Dapto West ..	14 Feb., 1898	12.05	Toothdale ..	27 ,, 1919	13.51
Dunheved ..	28 May, 1889	12.40	Towamba ..	5 Mar., 1893	20.00
Dunoon	9 Nov., 1917	10.02	Tweed River Heads	9 Nov., 1917	13.50
Eden	27 Feb., 1919	11.05	Sherwood ..	17 June, 1914	10.00
Holy Flat ..	12 Mar., 1887	12.00	Stockyard Mt. ..	24 Mar., ,,	10.72
,, ,, ..	28 Feb., 1892	12.24	South Head (near		
Jamberoo ..	23 Mar., 1914	10.22	Sydney) ..	29 Apr., 1841	20.12
,, ..	24 ,, ,,	11.28	,, ,, ..	16 Oct., 1844	20.41
Katoomba ..	7 Apr., 1913	10.50	Unanderra ..	24 Mar., 1914	11.68
Kembla Heights ..	13 Jan., 1911	17.46	Urunga	9 Nov., 1917	10.29
Kingswood ..	26 Feb., 1919	13.55	Verona	27 Feb., 1919	10.91
Leconfield ..	9 Mar., 1893	14.53	Wollongong ..	24 Mar., 1914	12.50

* From 9th to 13th Dec.=34.75.

HEAVY RAINFALLS, QUEENSLAND, UP TO 1920, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Adelaide Park ..	23 Jan., 1918	12.00	Collaroy ..	23 Jan., 1918	18.06
Allomba (Cairns) ..	30 ,, 1913	13.50	Cooktown ..	22 ,, 1903	12.49
Anglesey	26 Dec., 1909	18.20	,, ..	23 ,, 1914	13.98
,, ...	10 Feb., 1915	12.00	Cooran	1 Feb., 1893	13.62
Atherton (Cairns) ..	31 Jan., 1913	16.69	,, ...	26 Dec., 1908	14.08
Ayr	20 Sep., 1890	14.58	Cooroy	9 June, 1893	13.60
Babinda (Cairns) ..	31 Jan., 1913	12.79	,, ...	10 Jan., 1898	13.50
,, ,, ..·	1 Feb., ,,	20.51	Crohamhurst (Blackall Range)	2 Feb., 1893	35.71
,, ,, ..	24 Jan., 1916	22.30	,, ,, ..	9 June, ,,	13.31
,, ,, ..	25 ,, ,,	13.45	,, ,, ..	9 Jan., 1898	19.55
,, ,, ..	19 ,, 1918	13.53	,, ,, ..	6 Mar., ,,	16.01
,, ,, ..	21 Apr., 1920	16.05	,, ,, ..	26 Dec., 1909	13.85
Banyan (Cardwell)	31 ,, 1913	13.79	,, ,, ..	10 Feb., 1915	12.98
Barrine (Cairns) ..	31 ,, ,,	13.34	Crow's Nest ..	2 Aug., 1908	11.17
Batheaston ..	27 Dec., 1916	10.00	Croydon.. ..	29 Jan., ,,	15.00
Bloomsbury ..	14 Feb., 1893	17.40	Cryna (Beaudesert)	21 ,, 1887	14.00
,, ..	10 Jan., 1901	16.62	Dungeness ..	16 Mar., 1893	22.17
Blue Mountain ..	22 ,, 1918	13.00	,, ..	17 Apr., 1894	14.00
,, ,, ..	23 ,, ,,	13.00	Dunira	9 Jan., 1898	18.45
Bowen	13 Feb., 1893	14.65	,, ...	6 Mar., ,,	15.95
Boynedale ..	9 ,, 1915	11.20	Eddington (Clonc'ry)	23 Jan., 1891	10.33
Bracewell ..	9 ,, ,,	11.59	Emscote Farm ..	10 Feb., 1915	13.22
Brisbane ..	21 Jan., 1887	18.31	Emu Park ...	18 Jan., 1913	12.75
Bromby Park(Bowen)	14 Feb., 1893	13.28	Enoggera Railway	14 Mar., 1908	12.14
Brookfield ..	14 Mar., 1908	14.95	Ernest Junction ..	14 ,, ,,	13.00
Buderim Mountain	11 Jan., 1898	26.20	Fairymead Planta-tion (Bundaberg)	16 Jan., 1913	15.32
Bundaberg ..	16 ,, 1913	16.94	Finch Hatton ..	23 ,, 1918	11.06
Burketown , ..	15 ,, 1891	13.58	,, ,, ..	11 Mar., ,,	11.31
,, ..	12 Mar., 1903	14.52	Flat Top Island ..	22 Dec., 1909	12.96
Burnett Head (Bundaberg) ..	16 Jan., 1913	15.22	Floraville ..	6 Jan., 1897	10.79
Burpengary ..	10 Feb., 1915	11.11	,, ..	11 Mar., 1903	12.86
Bustard Head ..	17 Jan., 1913	14.93	Flying Fish Point..	7 Apr., 1912	16.06
Cairns	11 Feb., 1889	14.74	,, ,, ..	31 Jan., 1913	16.10
,, ...	21 Apr., ,,	12.40	Gatcombe Head (Gladstone) ..	18 ,, ,,	12.88
,, ...	5 ,, 1891	14.08	Gin Gin	16 ,, 1905	13.61
,, ...	11 Feb., 1911	15.17	,, ...	16 ,, 1913	12.27
,, ...	2 Apr., ,,	20.16	Gladstone ..	18 Feb., 1888	12.37
,, ...	31 Jan., 1913	13.94	,, - ..	31 Jan., 1893	14.62
,, ...	24 ,, 1916	12.28	,, ..	4 Feb., 1911	18.83
Calliope ..	9 Feb., 1915	12.09	,, ..	9 ,, 1915	10.10
Cape Grafton ..	5 Mar., 1896	13.37	Glen Boughton ..	5 Apr., 1894	18.50
Carbrook ..	11 Jan., 1918	14.03	,, ,,	31 Jan., 1913	14.92
,, ..	23 ,, ,,	22.66	,, ,,	24 ,, 1916	14.02
,, ..	24 ,, ,,	15.77	Glen Prairie ..	18 Apr., 1904	12.18
Cardwell ..	30 Dec., 1889	12.00	Gold Creek Reservoir	14 Mar., 1908	12.50
,, ..	23 Mar., 1890	12.00	Goldsbor'ugh (Cairns)	31 Jan., 1913	19.92
,, ..	18 ,, 1904	18.24	,, ,,	1 Feb., ,,	12.22
,, ..	3 Apr., 1911	12.84	Goodwood(Bund'b'g)	16 Jan., ,,	13.07
Carmilla ..	22 Jan., 1918	13.92	Goondi Mill(Innisfail)	6 Apr., 1894	15.69
,, ..	23 ,, ,,	15.92	,, ,,	18 ,, 1899	14.78
,, ..	24 ,, ,,	13.73	,, ,,	24 Jan., 1900	13.30
Clare	26 ,, 1896	15.30	,, ,,	29 Dec., 1903	17.83
Clermont ..	28 Dec., 1916	12.28	,, ,,	10 Feb., 1911	17.68
Coen ..	17 Feb., 1914	12.03	,, ,,	31 Mar., ,,	12.38
Collaroy ..	30 Jan., 1896	14.25			
,, ..	28 Dec., 1916	12.79			
,, ..	22 Jan., 1918	11.17			

HEAVY RAINFALLS, QUEENSLAND—continued.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Goondi Mill(Innisfail)	1 Apr., 1911	13.60	Innisfail (formerly Geraldton) ..	29 Dec., 1903	21.22
" "	6 " 1912	15.55	" " ..	11 Feb., 1911	14.48
Goondi	30 Jan., 1913	24.10	" " ..	1 Apr., "	12.35
Goorganga ..	23 " 1918	18.17	" " ..	2 " "	15.00
Granada (formerly Donaldson) ..	27 " 1891	11.29	" " ..	7 " 1912	20.50
" " ..	8 " 1911	13.50	" " ..	8 " "	12.15
" " ..	9 " "	14.30	" " ..	31 Jan., 1913	20.91
Halifax	5 Feb., 1899	15.37	Invicta (Kolan R.)	16 " "	14.58
"	6 Jan., 1901	15.68	Isis Junction ..	6 Mar., 1898	13.60
"	8 Apr., 1912	12.75	Kabra	23 Jan., 1901	10.28
"	22 " 1920	12.59	Kamerunga (Cairns)	20 " 1892	13.61
Hambledon Mill ..	13 Jan., 1909	13.80	" "	6 Apr., 1894	14.04
" " ..	2 " 1911	18.61	" "	5 " 1895	12.31
" " ..	10 Feb., "	13.97	" "	11 Feb., 1911	13.07
" " ..	30 Mar., "	13.04	" "	1 Apr., "	14.20
" " ..	31 " "	14.95	" "	2 " "	21.00
" " ..	1 Apr., "	19.62	" "	31 Jan., 1913	16.00
" " ..	30 Jan., 1913	17.32	Koumala ..	23 " 1918	22.31
" " ..	20 Apr. 1920	14.08	" ..	24 " "	20.65
Hampden ..	23 " 1918	17.30	Kulara (Cairns) ..	31 " 1913	12.69
" ..	24 " "	17.19	Kuranda (Cairns) ..	6 Mar., 1899	14.12
Harvey Creek ..	8 Mar., 1899	17.72	" " ..	20 Apr., 1903	14.16
" " ..	25 Jan., 1900	12.53	" " ..	14 Jan., 1909	12.37
" " ..	25 May, 1901	14.00	" " ..	11 Feb., 1911	16.30
" " ..	14 Mar., 1903	12.10	" " ..	17 Mar., "	15.10
" " ..	11 Jan., 1905	16.96	" " ..	31 " "	18.60
" " ..	28 " 1906	12.29	" " ..	1 Apr., "	24.30
" " ..	14 " 1909	14.40	" " ..	2 " "	28.80
" " ..	3 " 1911	27.75	" " ..	31 Jan., 1913	16.34
" " ..	11 Feb., "	12.88	Lake Nash ..	10 " 1895	10.25
" " ..	1 Apr., "	13.61	" ..	20 Mar., 1901	10.02
" " ..	2 " "	16.46	Landsborough ..	2 Feb., 1893	15.15
" " ..	31 Jan., 1913	24.72	" ..	9 June, "	12.80
" " ..	24 " 1916	13.17	" ..	26 Dec., 1909	14.00
Haughton Valley	26 " 1896	18.10	Low Island ..	10 Mar., 1904	15.07
Herberton ..	31 " 1913	14.00	" ..	31 " 1911	14.70
Hillcrest (Mooloolah)	26 Dec., 1909	13.35	" ..	1 Apr., "	15.30
Holmwood(Woodf'd)	2 Feb., 1893	16.19	Lucinda.. ..	17 Feb., 1906	13.35
" "	10 Jan., 1898	12.40	"	10 Mar., 1906	14.60
Homebush ..	3 Feb., "	12.04	"	22 Apr., 1920	14.92
Howard ..	15 Jan., 1905	19.55	Lyndon(via Brixton)	3 " 1917	17.00*
Huntley ..	27 Dec., 1916	18.94	Lytton	21 Jan., 1887	12.85
Ingham	18 Jan., 1894	12.60	Mackay	23 Dec., 1909	13.96
"	6 " 1901	13.59	"	21 Jan., 1918	24.70†
"	25 Dec., 1903	12.30	"	22 " "	17.25‡
"	11 Mar., 1918	12.68	"	23 " "	13.61
Inkerman ..	21 Sep., 1890	12.93	Sugar Experimental Farm, Mackay ..	23 Dec., 1909	12.00
" ..	24 Jan., 1918	12.70	" ..	21 Jan., 1918	16.80
Inneshowen (Johnstone River)	30 Dec., 1889	14.01	" ..	22 " "	17.20
Innisfail (formerly Geraldton) ..	11 Feb., "	17.13	" ..	23 " "	13.61
" " ..	31 Dec., "	12.45	Macnade Mill ..	18 " 1894	12.56
" " ..	6 Apr., 1894	16.02	" ..	17 Apr., "	14.26
" " ..	18 " 1899	13.20	" ..	5 Feb., 1899	15.20
" " ..	24 Jan., 1900	15.22	" ..	6 Jan., 1901	23.33
			" ..	7 Mar., 1914	12.44

* Mr. Jas. Laidlaw, of Lyndon, states that this fell in 4 hours.   † 37½ hours.   ‡ 22½ hours.

HEAVY RAINFALLS, QUEENSLAND—*continued.*

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Macnade Mill ..	4 Mar., 1915	22.00	Port Douglas ..	17 Mar., 1911	16.10
Maleny ..	26 Dec., 1909	14.76	,, ,, ..	1 Apr., ,,	31.53
Mapleton ..	14 Mar., 1908	14.29	Princhester ..	23 Jan., 1918	10.00
,, ..	26 Dec., 1909	15.72	Proserpine ..	23 ,, ,,	18.17
,, ..	10 Feb., 1915	12.75	Ravenswood ..	24 Mar., 1890	17.00
Marlborough ..	17 ,, 1888	14.24	Redcliffe ..	21 Jan., 1887	14.00
,, ..	22 Jan., 1918	13.70	,, ..	16 Feb., 1893	17.35
Milton	14 Mar., 1908	12.24	Reid River ..	2 ,, 1917	11.15
,, ...	9 Feb., 1915	10.15	Rosedale ..	6 Mar., 1898	12.60
Mirani	12 Jan., 1901	16.59	,, ..	16 Jan., 1913	18.90
,, ...	23 ,, 1918	13.50	Sandgate o ..	16 Feb., 1893	14.03
,, ...	24 ,, ,,	12.25	Sarina	23 Jan., 1918	22.60
Miriam Vale (B'berg)	17 ,, 1913	15.80	Somerset ..	28 ,, 1903	12.02
,, ,,	9 Feb., 1915	10.22	Spill Creek ..	21 ,, 1918	11.07
Mooloolah ..	13 Mar., 1892	21.53	Stanwell ..	22 ,, ,,	11.70
,, ..	2 Feb., 1893	19.11	,, ...	23 ,, ,,	11.05
,, ..	6 Mar., 1898	14.43	St. Helens (Mackay)	24 Feb., 1888	12.00
Mornington Island	18 Jan., 1919	14.85	St. Lawrence ..	17 ,, ,,	12.10
Mount Crosby ..	14 Mar., 1908	14.00	,, ..	30 Jan., 1896	15.00
Mount Cuthbert ..	8 Jan., 1911	18.00	Tewantin ..	30 Mar., 1904	12.30
Mount Molloy ..	31 Mar., ,,	20.00	The Caves ..	23 Jan., 1918	12.60
,, ..	1 Apr., ,,	20.00	The Hollow(Mackay)	23 Feb., 1888	15.12
,, ..	2 ,, ,,	20.00	Thornborough ..	20 Apr., 1903	18.07
Mount Mee ..	10 Feb., 1915	12.00	Townsville ..	24 Jan., 1892	19.20
Mourilyan ..	14 Jan., 1909	13.00	,, ..	28 Dec., 1903	15.00
,, ..	3 ,, 1911	12.70	Victoria Mill ..	6 Jan., 1901	16.67
,, ..	11 Feb., ,,	17.40	,, ..	21 Apr., 1920	12.40
,, ..	1 Apr., ,,	13.20	Walsh River ..	1 Apr., 1911	13.70
,, ..	7 ,, 1912	18.97	Warren State Farm	22 Jan., 1918	11.42
,, ..	31 Jan., 1913	15.05	Woodford ..	2 Feb., 1893	14.93
Mundoolun ..	21 ,, 1887	17.95	Woodlands (Yepp'n)	25 Mar., 1890	14.25
Musgrave ..	6 Apr., 1894	13.71	,, ,,	31 Jan., 1893	23.07
Nambour ..	9 Jan., 1898	21.00	,, ,,	9 Feb., 1896	13.97
,, ..	7 Mar., ,,	13.28	,, ,,	7 Jan., 1898	14.50
,, ..	27 Dec., 1909	16.80	Woody Island ..	16 ,, 1913	12.66
Nerang	15 June, 1892	12.35	Woombye ..	26 Dec., 1909	13.42
Netherdale . ..	22 Jan., 1918	19.50	Wootha	10 Feb., 1915	15.93
,, ..	11 Mar., ,,	12.25	Wycarbah ..	21 Jan., 1918	10.80
North Kolan (Bundaberg) ..	16 Jan., 1913	12.90	,, ..	22 ,, ,,	10.64
North Pine ..	16 Feb., 1893	14.97	Yandina ..	1 Feb., 1893	20.08
Nundah ..	14 Mar., 1908	12.00	,, ..	9 June, ,,	12.70
Oxenford ..	14 ,, ,,	15.65	,, ..	9 Jan., 1898	19.25
Palmwoods ..	4 Feb., 1893	12.30	,, ..	7 Mar., ,,	13.52
,, ..	10 Jan., 1898	15.85	,, ..	28 Dec., 1909	15.80
,, ..	7 Mar., ,,	13.02	Yarrabah ..	11 Feb., 1911	12.00
,, ..	25 Dec., 1909	17.75	,, ..	2 Apr., ,,	30.65
Peachester ..	26 ,, ,,	14.91	,, ..	24 Jan., 1916	27.20
Pialba(Marybor'gh)	16 Jan., 1913	17.22	,, ..	25 ,, ,,	18.60
Pittsworth ..	11 Mar., 1890	14.68	Yeppoon ..	31 ,, 1893	20.05
Plane Creek (Mackay)	26 Feb., 1913	27.73	,, ..	8 ,, 1898	18.05
Point Archer ..	23 Jan., 1914	13.47	,, ..	3 Feb., 1906	14.90
Port Douglas ..	5 Mar., 1887	13.00	,, ..	3 ,, 1911	14.92
,, ,, ..	10 ,, 1904	16.34	,, ..	18 Jan., 1913	13.00
,, ,, ..	11 Jan., 1905	14.68	,, ..	8 Oct., 1914	21.70

NOTE.—In Queensland falls of 12 or more inches within 20 miles of the coast or 10 or more inches inland are taken.

HEAVY RAINFALLS, WESTERN AUSTRALIA, UP TO 1920, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Ascot	8 Feb., 1912	8.85	Point Torment	17 Dec., 1906	11.86
„	9 „ „	5.85	Port George IV.	17 Jan., 1915	11.24
Balla Balla	21 Mar., 1899	14.40	Roebourne	3 Apr., 1898	11.44
Bamboo Creek	22 „ „	10.10	Roebuck Plains	5 Jan., 1917	14.01
Boodarie..	21 „ „	14.53	„ „	6 „ 1917	22.36
Broome	6 Jan., 1917	14.00	Tambray	6 Mar., 1900	10.00
„	7 „ „	6.20	„	3 „ 1903	10.47
Carlton	11 „ 1906	10.64	Thangoo	17-19 Feb.'96	24.18
Cossack	3 Apr., 1898	12.82	„	28 Dec., 1898	11.55
„	16 „ 1900	13.23	Whim Creek	2 Apr., 1898	7.08
Croydon	3 Mar., 1903	12.00	„ „	3 „ „	29.41
Derby	29 Dec., 1898	13.09	„ „	6 Mar., 1900	10.03
„	30 „ „	7.14	„ „	3 „ 1903	10.44
„	6 Jan., 1917	5.97	Woodbrook	2 Apr., 1898	3.80
„	7 „ „	16.47	„ „	3 „ 1898	8.78
Exmouth Gulf	2 Feb., 1918	12.50	Woodstock	21 Mar., 1912	13.00
Fortescue	3 May, 1890	23.36	Wyndham	27 Jan., 1890	11.60
Frazier Downs	3 Mar., 1916	12.25	„	4 Mar., 1919	12.50
Kerdiadary	7 Feb., 1901	12.00	„	11 Jan., 1903	9.98
Meda	2 Mar., 1916	10.55	„	12 „ „	6.64
Millstream	5 „ 1900	10.00	Yardil Creek	3 Feb., 1918	10.00
Obagama	28 Feb., 1910	12.00	Yeeda	2 Mar., 1916	10.70
„	24 Dec., 1920	13.02	„	6 Jan., 1917	10.20
Pilbara	2 Apr., 1898	14.04	„	7 „ „	11.75
Point Cloates	20 Jan., 1909	10.87			

HEAVY RAINFALLS, NORTHERN TERRITORY, UP TO 1920, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Bonrook	24 Dec., 1915	10.60	Cosmopolitan Gold Mine	24 Dec., 1915	10.60
Borroloola	14 Mar., 1899	14.00	Lake Nash	21 Mar., 1901	10.25
Brock's Creek	4 Jan., 1914	10.68	Pine Creek	8 Jan., 1897	10.35
„ „	24 Dec., 1915	14.33	Darwin	7 „ 1897	11.67
Burrundie	4 Jan., 1914	11.61			

HEAVY RAINFALLS, VICTORIA, UP TO 1920, 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 1920, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Gould's Country	8-10 Mar., '11	15.33	Mathinna	8-10 Mar.,'11	15.79
Lottah	8-10 „ „	18.10	The Springs	30-31 Jan.,'16	10.75

GRAPHS SHEWING ANNUAL FLUCTUATIONS OF MEAN. MAXIMUM AND MINIMUM TEMPERATURE AND HUMIDITY IN SEVERAL PARTS OF THE COMMONWEALTH OF AUSTRALIA.
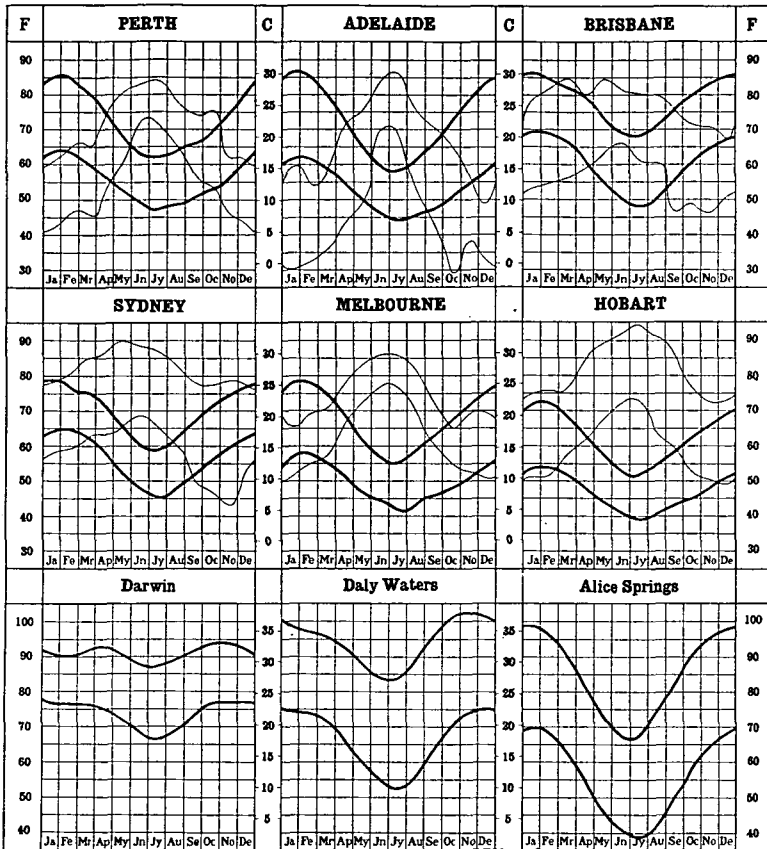
EXPLANATION OF THE GRAPHS OF TEMPERATURE AND HUMIDITY.—In the above graphs in which the heavy lines denote "temperature" and the thin lines "humidity," the fluctuations of mean temperature and mean humidity are shewn throughout the year. These curves are plotted from the data given in the Climatological Tables hereinafter. The temperatures are shewn in degrees Fahrenheit, the inner columns giving the corresponding values in Centigrade degrees. Humidities have not been obtained for Darwin, Daly Waters, and Alice Springs.

For the thin lines the degree numbers represent relative humidities, or the percentages of actual saturation (absolute saturation = 100).

The upper temperature line represents the mean of the maximum, and the lower line the mean of the minimum results ; thus the curves also shew the progression of the range between maximum and minimum temperatures throughout the year. The humidity curves shew the highest and lowest values of the mean monthly humidity at 9 a.m. recorded during a series of years.

INTERPRETATION OF THE GRAPHS.—The curves denote mean monthly values. Thus, taking for example, the temperature graphs for Perth, the mean readings of the maximum and minimum temperatures for a number of years on 1st January would give respectively about 83° Fahr. and 62° Fahr. Thus the mean range of temperature on that date is the difference, viz., 21°. Similarly, observations about 1st June would give respectively about 66° Fahr. and 51° Fahr., or a range of 15°.

In a similar manner it will be seen that the greatest mean humidity, say for March, is about 66° and the least mean humidity for the month 46° ; in other words, at Perth the degree of saturation of the atmosphere by aqueous vapour for the month of March ranges between 66% and 46%.

GRAPHS SHEWING ANNUAL FLUCTUATIONS OF MEAN RAINFALL AND MEAN EVAPORATION IN SEVERAL PARTS OF THE COMMONWEALTH OF AUSTRALIA.
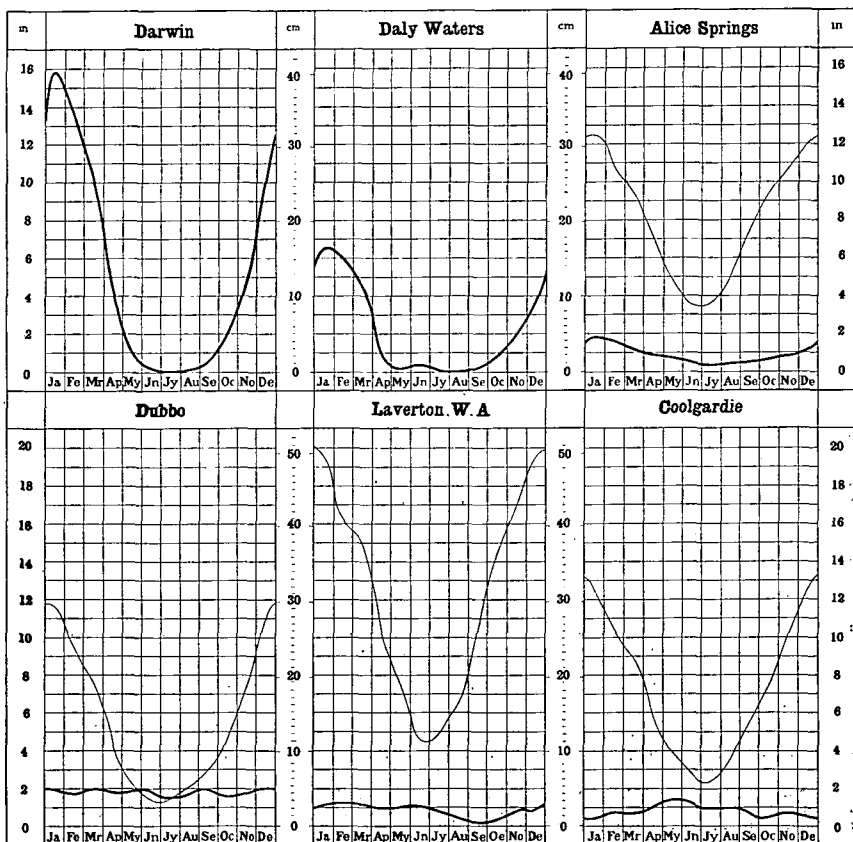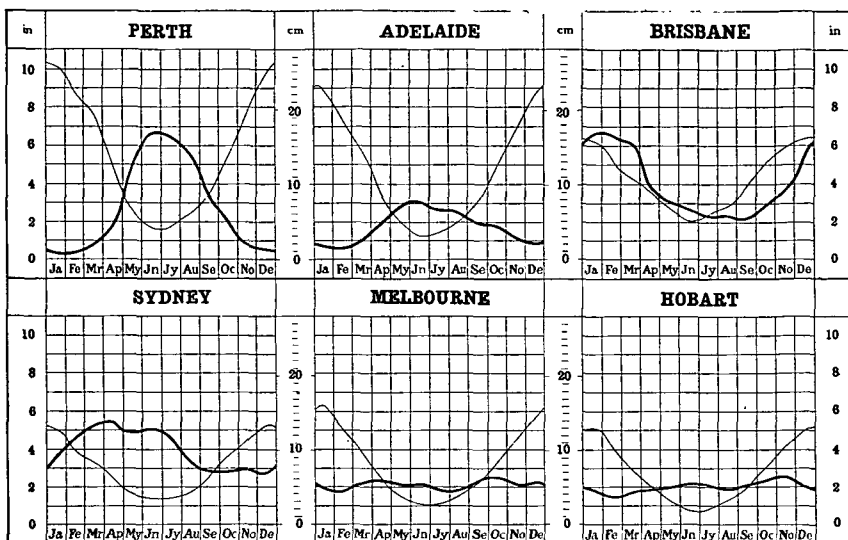
EXPLANATION OF THE GRAPHS OF RAINFALL AND EVAPORATION.—On the preceding graphs thick lines denote rainfall and thin lines evaporation, and shew the fluctuation of the mean rate of fall *per month* throughout the year. The results, plotted from the Climatological Tables hereinafter, are shewn in inches (see the outer columns), and the corresponding metric scale (centimetres) is shewn 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.

INTERPRETATION OF THE GRAPHS.—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, on the 1st January the rain falls on the average at the rate of about four-fifths of an inch per month, or, say, at the rate of about 9½ inches per year. In the middle of June it falls at the rate of nearly 3 inches per month, or, say, at the rate of about 36 inches per year. At Dubbo the evaporation is at the rate of nearly 11¼ inches per month about the middle of January, and only about 1½ inches at the middle of June.

TABLE SHEWING MEAN ANNUAL RAINFALL AND EVAPORATION IN INCHES AT THE
PLACES SHEWN ON PRECEDING PAGE, AND REPRESENTED BY THE GRAPHS.

—	Rainfall.	Evapora-tion.	—	Rainfall.	Evapora-tion.
Perth	33.75	65.90	Darwin	61.82	—
Adelaide	21.03	54.49	Daly Waters	26.13	—
Brisbane	45.52	51.52	Alice Springs	10.99	94.84
Sydney	48.12	38.00	Dubbo	22.04	66.37
Melbourne	25.60	38.81	Laverton, W.A.	10.02	140.98
Hobart	23.66	32.41	Coolgardie	10.07	87.72

GRAPHS SHEWING ANNUAL FLUCTUATIONS OF MEAN BAROMETRIC PRESSURE FOR
THE CAPITALS OF THE SEVERAL STATES OF THE COMMONWEALTH OF AUSTRALIA.
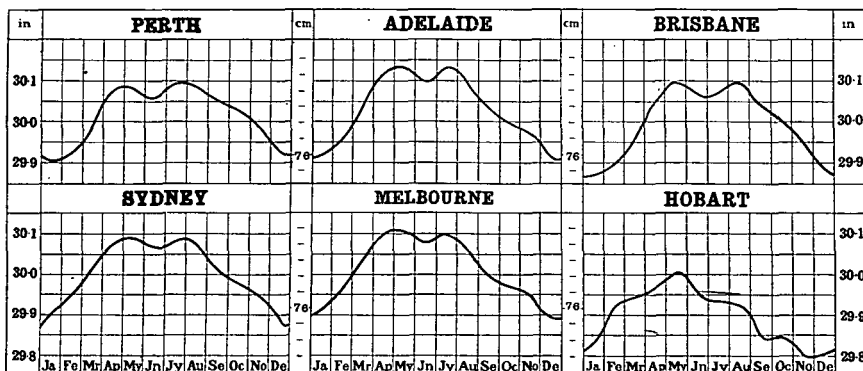
EXPLANATION OF THE GRAPHS OF BAROMETRIC PRESSURE.—On the above graphs the lines representing the yearly fluctuation of barometric pressure at the State capital cities are means for long periods, and are plotted from the Climatological Tables given hereinafter. The pressures are shewn in inches on about 2⅛ times the natural scale, and the corresponding pressures in centimetres are also shewn in the two inner columns, in which each division represents one millimetre.

INTERPRETATION OF THE BAROMETRIC GRAPHS.—Taking the Brisbane graph for purposes of illustration, it will be seen that the mean pressure on 1st January is about 29·87 inches, and there are maxima in the middle of May and August of about 30·09 inches.

Chart indicating the area affected and period of duration of the Longest Heat Waves when the Maximum Temperature for consecutive 24 hours reached or exceeded 90° Fah.

NOTE.—The figures on the lines indicate number of consecutive days.
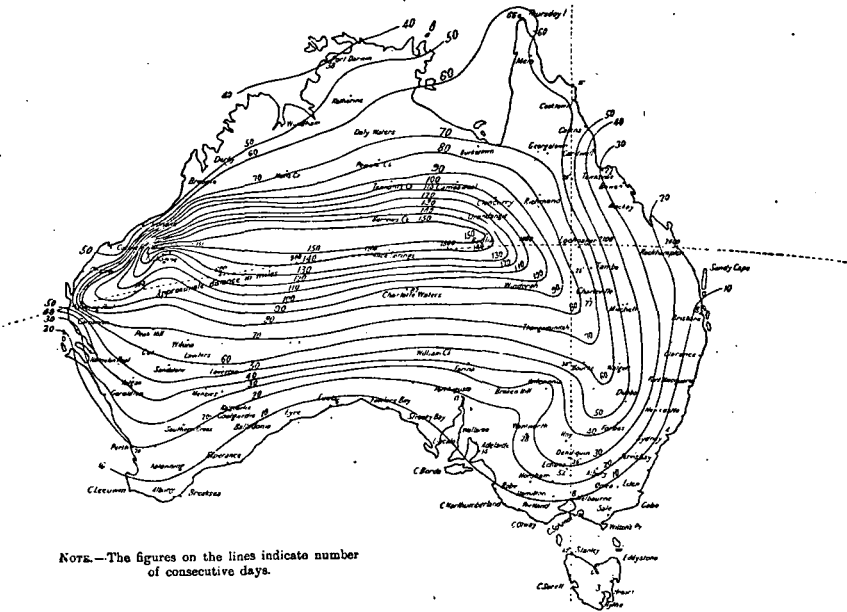
Diagram showing the greatest number of consecutive days on which the Temperature in the shade was over 100° and also over 90° at the places indicated.

METEOROLOGICAL MAP OF AUSTRALIA

WETTEST MONTHS OF YEAR

from data supplied by

H. A. HUNT, Esq.,

C'wealth Meteorologist.

January	
February	
March	
May	
June	
July	
October	

Copyright of outline map belongs to H. E. C. Robinson, 41 Phillip St., Sydney, N.S.W.

Printed by McCarron, Bird & Co., Melbourne.
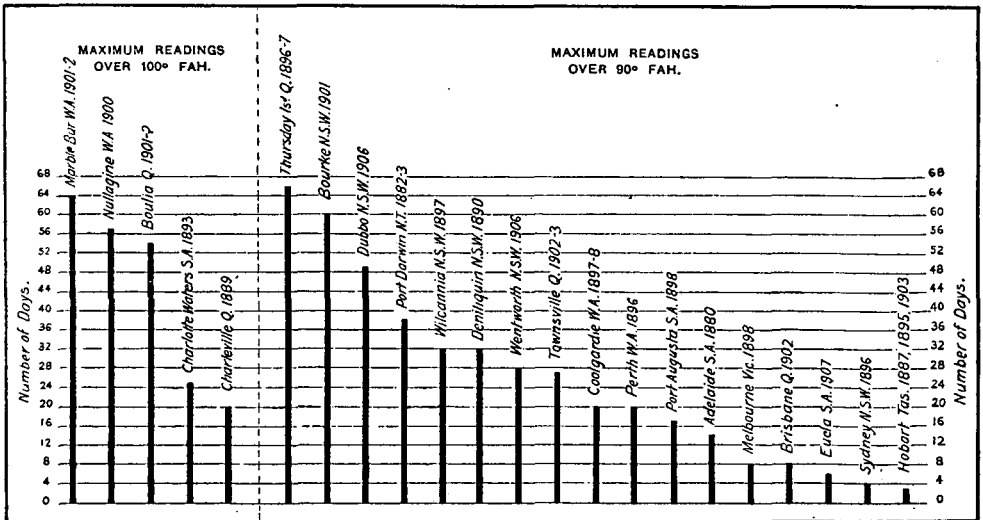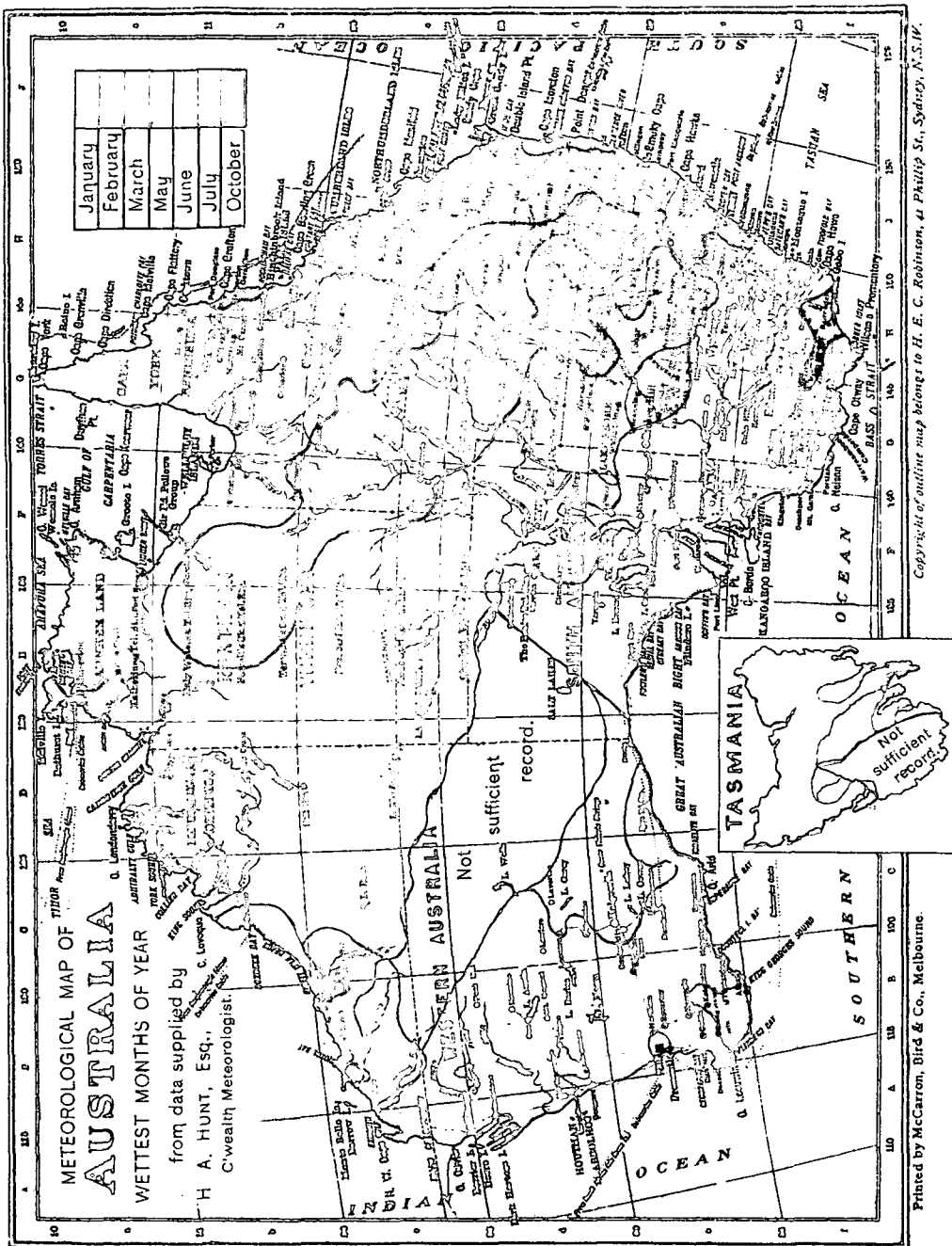
METEOROLOGICAL SUB-DIVISIONS.

WEST AUSTRALIA.	No.	No.	No.	No.
No.	11. Upper North.	22. Central Coast.	33. Central Tableland.	43. North Central.
1. East Kimberley.	12. North-East.	23. South-East Coast.	33a. Metropolitan.	44. Northern Country.
2. West Kimberley.	13. Lower North.	24. Darling Downs.	34. Cent. Westn. Slope.	45. Mallee.
3. North-West.	14. Central.	25. Maranoa.	35. Cent. Westn. Plain.	46. Wimmera.
4. Gascoyne.	15. Murray Valley.	26. South-West.	36. Riverina.	47. Western.
5 South-West.	16. South-East.		37. South-West Slope.	
6. Eucla.		NEW SOUTH WALES.	38. Southern Tableland	TASMANIA.
7. Eastern.	QUEENSLAND.	27. Western.	39. South Coast.	48. Northern.
	17. Peninsular.	28. North-West Plain.		49. W.Coast Mt. Region
SOUTH AUSTRALIA.	18. Gulf.	29. North-West Slope.	VICTORIA.	50. Central Plateau.
8. Northern Territory.	19. Far West.	30. Northern Tableland		51. Midland.
9. Far North and N.W.	20. Central.	31. North Coast.	40. Gippsland.	52. East Coast.
10. West.	21. Nth-East Coast.	32. Hunter & Manning.	41. North-East.	53. Derwent.
			42. Central.	54. South-Eastern.

GRAPHS SHEWING THE MEAN MONTHLY, AND MEAN ANNUAL TEMPERATURES OF THE
PRINCIPAL AUSTRALIAN CITIES FROM 1911 TO 1920.
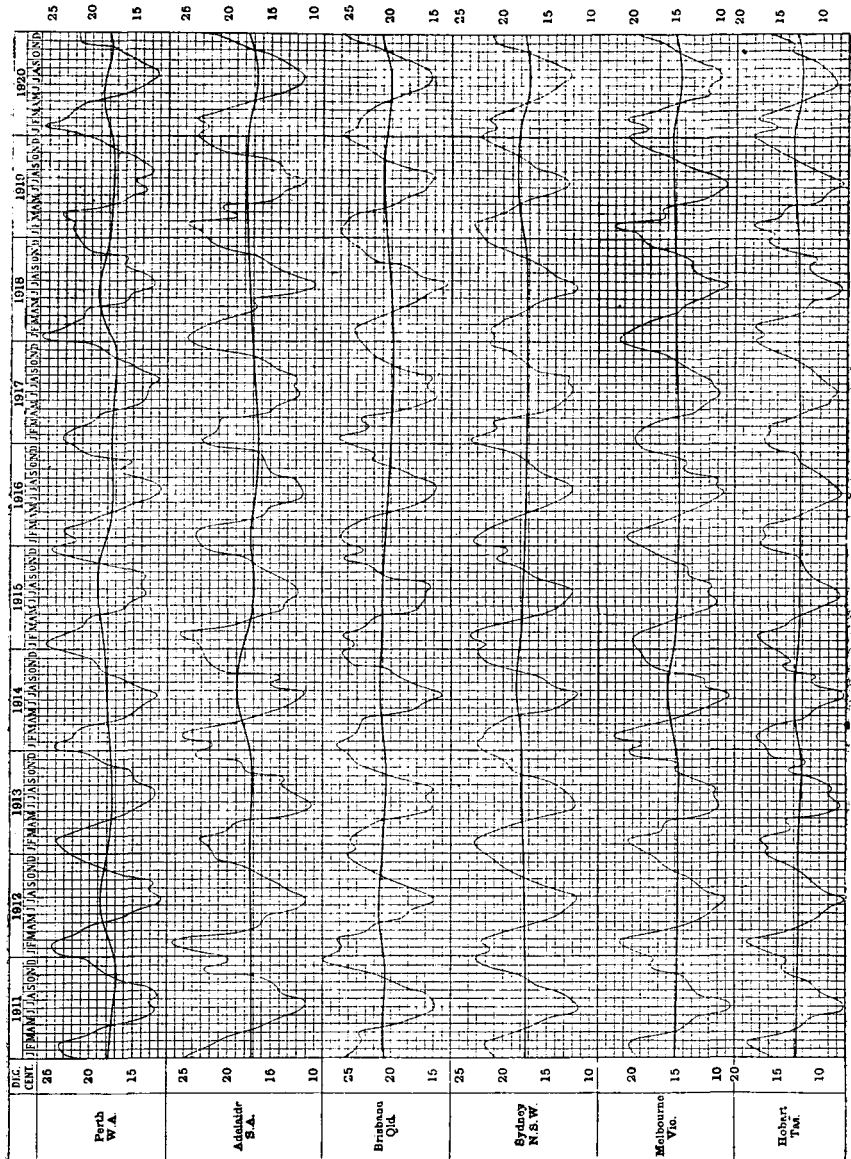
EXPLANATION OF GRAPHS.

The six light continuous curves shew the fluctuations of mean monthly temperatures of the Australian capitals from 1911 to 1920.

The six heavy curves similarly shew the fluctuations of the mean annual temperatures of the Australian capitals from 1911 to 1920.

The base of each small square denotes one month, and the vertical side 2° Centigrade or 3·6° Fahrenheit.

— 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

COMMONWEALTH METEOROLOGY

Revised Average Annual Rainfall Map,
Australia and Tasmania.

H. A. HUNT, Commonwealth Meteorologist.

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

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.

Reference

| 0 to 10 ins / 0 to 254 mm |
| 10 to 20 ins / 254 to 508 mm |
| 20 to 30 ins / 508 to 762 mm |
| 30 to 40 ins / 762 to 1016 mm |
| 40 to 60 ins / Over 1016 mm |
| Over 60 ins |

NOTE.
The isohyets are shown by continuous lines for complete, and dotted lines for incomplete data, and 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.

INDIAN OCEAN

SOUTH PACIFIC OCEAN

Gulf of Carpentaria

WESTERN AUSTRALIA

SOUTH AUSTRALIA

QUEENSLAND

NEW SOUTH WALES

Great Australian Bight

TASMAN SEA

Bass Strait

Tropic of Capricorn

10. **Snowfall.**—Light snow has been known to fall even as far north,. occasionally, 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 as far north as Toowoomba in Queensland. During the winter snow covers the ground to a great extent on the Australian Alps for several months, where also the temperature falls below zero Fahrenheit during the night, and in the ravines around Kosciusko and similar localities the snow never entirely disappears.

The antarctic " V "-shaped disturbances are always associated with our most pronounced and extensive snowfalls. The depressions on such occasions are very steep in the vertical area, and the apexes are unusually sharp-pointed and protrude into very low latitudes, sometimes even to the tropics.

11. **Hail.**—Hail falls throughout Australia 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. Rarely does a summer pass without some station experiencing a fall of stones exceeding in size an ordinary hen-egg, and many riddled sheets of light-gauge galvanised iron bear evidence of the weight and penetrating power of the stones.

Hail storms occur most frequently in Australia 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 shewn on page 67.

13. **Wind.**—Notes on the distinctive wind currents in Australia were given in preceding Year Books (see No. 6, page 83) and are here omitted to save space.

14. **Cyclones and Storms.**—The "elements" in Australia are ordinarily peaceful, and although severe 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 Straits, 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, that is, in that part of them which has a north-westerly to a south-westerly circulation.

Occasionally the north-east coast of Queensland is 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 of south-westerly direction. 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,

causing 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 coast-line, or cross the continent to the Great Australian Bight. When they take the latter course their track is marked by torrential rains, as much as 29.41 inches, for example, being recorded in 24 hours at Whim Creek from one such occurrence. Falls of 10 inches and over have frequently been recorded in the northern interior of Western Australia from similar storms.

Some further notes on severe cyclones and on " Southerly Bursters," a characteristic feature of the eastern part of Australia, will be found in previous issues of the Year Book (see No. 6, pp. 84, 85, 86).

15. **Influences affecting Australian Climate.**—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 therein, however, have 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 shews a rise of two-tenths of a degree during the last twenty years, a change probably brought about by the great growth of residential and manufacturing buildings within the city and in the surrounding suburbs during that period. Again, low-lying lands on the north coast of New South Wales, that 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.

(i) *Influences 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 equalising 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. 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. Thus, 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 inland rivers. Thus, the River Murray, which has never been known to run dry, derives its steadiness of flow mainly through the causes above indicated.

(ii) *Direct Influences 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 contend the opposite.

Sufficient evidence exists, however, to establish that, even if the rainfall has not increased, the beneficial effect of forest lands in tempering the effects of the climate is more than sufficient to disclose the importance of their protection and extension.

It is the rapid rate of evaporation, induced by both hot and cold winds, which injures crops and makes life uncomfortable on the plains. Whether the forest aids in increasing precipitation there may be doubt, but nobody can say that it does not check the 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 our treeless interior. 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 Year Book No. 6, pp. 86 and 95).

16. **Comparison of Rainfalls and Temperatures.**—For the purpose of comparison the following lists of rainfalls and temperatures are given for various important cities throughout the world, for the site of the Federal capital, and for the capitals of the Australian States.

COMPARISONS OF RAINFALLS AND TEMPERATURES
OF CITIES OF THE WORLD WITH THOSE OF AUSTRALIA.

Place.	Height above M.S.L.	Annual Rainfall.			Temperature.					
		Average.	Highest.	Lowest.	*Mean Summer.	†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	43.31	63.72	26.32	66.1	52.5	91.0	31.9	67.2	51.8
Athens ..	351	15.48	33.32	4.55	79.2	49.1	106.5	19.6	81.1	47.5
Bergen ..	146	89.10	102.80	73.50	56.8	34.5	88.5	4.8	57.9	33.6
Berlin ..	115	22.95	30.04	14.25	64.7	32.2	98.6	−13.0	66.0	30.0
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	100.2	53.3	84.8	74.2
Breslau ..	482	22.00	28.01	16.45	63.9	30.0	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 ..	72	36.82	80.73	21.53	73.2	51·5	103.1	25.9	74.2	50.5
Calcutta ..	21	61.98	89.32	39.38	84.9	67.1	108.2	44.2	85.4	65.5
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	33.54	45.86	24.52	69.2	25.4	103.0	−23.0	72.3	24.0
Christchurch ..	25	25.45	35.30	13.54	61.1	43.4	95.7	21.3	61.6	42.4
Christiania ..	82	22.52	31.73	16.26	61.0	24.4	95.0	−21.1	62.6	23.9
Colombo..	40	83.83	139.70	51.60	81.5	79.9	95.8	65.0	22.6	79.1
Constantinople ..	245	28.75	42.74	14.78	74.0	43.5	103.6	13.0	75.7	42.0
Copenhagen ..	46	22.33	28.78	13.94	60.7	32.1	90.5	−13.0	62.2	31.4
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	37.06	53.90	22.15	57.3	43.1	94.0	23.0	57.9	42.0
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 ..	159	24.12	35.54	16.38	61.3	39.3	100.0	4.0	62.7	38.6
Hong Kong ..	110	84.10	119.72	45.83	81.3	60.3	97.0	32.0	81.8	58.1
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 ..	18	24.04	38.20	18.23	61.2	39.3	100.0	9.4	62.8	38.7
Madras ..	22	49.06	88.41	18.45	86.7	76.0	113.0	57.5	87.6	75.3
Madrid ..	2,149	16.23	27.48	9.13	73.0	41.2	107.1	10.5	75.7	39.7
Marseilles ..	246	21.88	43.04	12.28	70.3	45.3	100.4	11.5	72.1	43.3
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	42.47	59.68	28.78	72.1	31.7	100.0	− 6.0	74.5	30.3
Ottawa ..	294	33.40	44.44	26.36	67.2	14.1	98.5	−33.0	69.7	12.0
Paris ..	165	21.92	29.56	16.44	63.5	37.1	101.1	−14.1	65.8	36.1
Pekin ..	143	24.40	36.00	18.00	77.7	26·6	114.0	− 5.0	79.2	23.6
Quebec ..	296	40.46	47.57	32.12	63.5	12.4	95.5	−34.3	66.3	10.1
Rome ..	166	32.57	57.89	12.72	74.3	46.0	107.6	17.2	76.1	44.6
San Francisco ..	155	22.83	38.82	9.31	59.0	51.0	101.0	29.0	61.0	50.0
Shanghai ..	14	44.13	62.52	27.91	77.4	39.4	102.9	10.2	79.7	37.4
Singapore ..	8	91.99	158.68	32.71	81.2	78.6	94.2	63.4	81.5	78.3
Stockholm ..	146	18.31	25.46	11.78	59.7	27.0	91·8	−22.0	62.1	25.7
Petrograd ..	16	21.30	29.52	13.75	61.1	17.4	97.0	−38.2	63.7	15.2
Tokio ..	70	59.17	77.10	45.72	73.9	38.9	97.9	15.4	77.7	37.1
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	33.63	9.39	63.9	11.0	95.7	−21.8	69.4	6.1
Washington ..	75	43.80	61.33	18.79	74.7	34.5	104.0	−15.0	76.8	32.9
Wellington (N.Z.) ..	110	49.70	67.68	30.02	61.7	48.4	88.0	30.0	62.4	47.5
Zürich ..	1,542	45.15	78.27	29.02	63.3	31.3	94.1	−0.8	65.1	29.5

FEDERAL CAPITAL SITE.

Canberra (Dist.) Queanbeyan	{ 2,000 to 2,900 }	22.38	41.29	10.45	*68.5	†44.1	102.6	18.0	69.0	43.1

THE STATE CAPITALS.

Perth ..	197	33.75	46.73	20.21	72.9	55.9	107.9	34.2	74.0	55.1
Adelaide..	140	21.03	30.87	11.39	73.1	53.0	116.3	32.0	74.1	51.6
Brisbane ..	137	45.52	88.26	16.17	76.6	59.7	108.9	36.1	77.1	58.4
Sydney ..	133	48.19	82.76	21.49	71.0	54.0	108.5	35.9	71.7	52.5
Melbourne ..	115	25.60	44.25	15.61	66.6	50.0	111.2	27.0	67.4	48.6
Hobart ..	177	23.66	43.39	13.43	61.7	46.7	105.2	27.0	62.4	45.4

* Mean of the three hottest months.   † Mean of the three coldest months.

17. Climatological Tables.—The means, averages, extremes, totals, &c., for a number of climatological elements have been determined from long series of observations at the Australian capitals up to and including the year 1920.   These are given in the following tables:—

CLIMATOLOGICAL DATA FOR PERTH, W.A.

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. 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	36	23	23	23	23	22	23	24	24
January	29.906	797 27/98	0.69	11,309	S S E	10.43	1.8	2.7	14.1
February	29.926	650 6/08	0.63	9,891	S S E	8.59	1.3	2.8	11.4
March	29.989	651 6/13	0.54	10,018	S S E	7.57	1.4	3.3	11.5
April	30.074	955 25/00	0.42	8,503	S E	4.74	1.3	4.2	7.7
May	30.084	768 5/12	0.35	8,063	E N E	2.76	1.8	5.2	5.3
June	30.058	861 27/10	0.38	8,061	N	1.74	2.1	5.9	3.1
July	30.092	949 11/99	0.39	8,409	N	1.68	2.5	5.4	5.0
August	30.082	966 15/03	0.43	8,924	W	2.36	1.6	5.4	4.6
September	30.060	864 11/05	0.47	9,107	S W	3.31	1.4	4.9	5.6
October	30.032	809 6/16	0.53	9,911	S S W	5.22	1.1	4.9	5.8
November	29.988	777 18/97	0.60	10,219	S	7.67	1.4	3.8	7.9
December	29.929	672 31/98	0.65	10,945	S	9.83	1.5	2.9	12.2
Year ⎰ Totals	—	—	—	113,360	—	65.90	19.2	—	94.2
Year ⎱ Averages	30.018	—	0.51	—	S	—	—	4.4	—
Year Extremes	—	966 15/8/03	—	—	—	—	—	—	—

TEMPERATURE.

Month.	Mean Max.	Mean Min.	Mean.	Extreme Shade Highest.	Extreme Shade Lowest.	Greatest Range.	Extreme Highest in Sun.	Extreme Lowest on Grass.	Mean Hours of Sunshine.
No. of yrs. over which observation extends	24	24	24	24	24	24	23	22	23
January	84.6	63.4	74.0	107.0 16/97 & 9/18	50.6 25/01	56.4	177.3 22/14	42.4 25/02	321.5
February	84.6	63.2	73.9	107.3 12/15	47.7 1/02	59.6	169.0 4/99	39.8 1/13	274.1
March	81.1	60.7	70.9	106.1 6/14	45.8 8/03	60.3	167.0 19/18	36.7 8/03	267.9
April	75.9	57.0	66.4	99.7 9/10	39.3 20/14	60.4	157.0 8/16	31.0 20/14	218.4
May	68.6	52.4	60.5	90.4 2/07	34.3 11/14	56.1	139.2 5/20	25.3 11/14	179.7
June	63.8	49.5	56.6	81.7 2/14	36.3 29/14	45.4	135.5 9/14	29.0 20/16	143.5
July	62.6	47.6	55.1	74.1 17/19	34.2 7/16	39.9	133.2 13/15	25.1 30/20	169.3
August	63.7	48.1	55.9	81.0 12/14	35.3 31/08	45.7	143.2 22/13	27.9 10/11	185.9
September	66.1	50.3	58.2	90.9 30/18	38.9 17/13	52.0	153.6 29/16	29.2 21/16	203.8
October	69.3	52.7	61.0	93.4 17/06	40.9 4/17	52.5	154.0 29/14	30.5 4/17	236.0
November	75.5	56.6	66.0	104.6 24/13	42.0 1/04	62.6	166.8 21/14	35.5 6/10 & 14/12	289.8
December	80.6	60.5	70.6	107.9 20/04	48.0 2/10	59.9	168.7 25/15	39.1 2/10	326.5
Year ⎰ Averages	73.0	55.2	64.1	—	—	—	—	—	2816.4*
Year ⎱ Extremes	—	—	—	107.9 20/12/04	34.2 7/7/16	73.7	177.3 22/1/14	25.1 30/7/20	—

* Total for Year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Rel. Hum. Mean 9 a.m.	Rel. Hum. Highest Mean.	Rel. Hum. Lowest Mean.	Rainfall Mean Monthly.	Rainfall Mean No. of Days Rain.	Rainfall Greatest Monthly.	Rainfall Least Monthly.	Rainfall Greatest in One Day.	Dew Mean Amount of Dew.	Dew Mean No. Days Dew.
No. of yrs. over which observation extends	24	24	24	45	45	45	45	45	—	24
January	52	61	42	0.34	3	2.17 1879	nil *	1.74 28/79	—	2.6
February	54	65	46	0.45	2	2.30 ·1883	nil *	1.63 26/15	—	3.0
March	57	66	46	0.74	4	4.50 1896	nil *	1.53 17/76	—	5.7
April	64	72	53	1.60	7	4.97 1882	nil 1920	2.62 30/04	—	8.9
May	72	81	61	4.75	14	12.13 1879	0.98 1903	2.80 20/79	—	12.2
June	78	83	72	6.87	17	12.11 1890	2.16 1877	3.90 10/20	—	11.7
July	78	84	72	6.50	17	10.90 1902	2.42 1876	3.00 4/91	—	13.4
August	74	79	67	5.73	18	10.33 1882	0.46 1902	2.79 7/03	—	11.1
September	68	75	55	3.31	14	7.72 1903	0.62 1914	1.73 23/07	—	9.2
October	62	75	54	2.12	12	7.87 1890	0.49 1892	1.38 15/10	—	5.4
November	55	63	46	0.77	6	2.12 1880	nil 1891	1.11 30/03	—	4.0
December	52	62	44	0.57	4	3.05 1888	nil 1886	1.72 1/88	—	3.0
Year ⎰ Totals	—	—	—	33.75	118	—	—	—	—	90.2
Year ⎱ Averages	62	—	—	—	—	—	—	—	—	—
Year Extremes	—	84	42	—	—	12.13 5/79	nil †	3.90 10/6/20	—	—

* Various years. † January, February, March, November, and December, various years.

CLIMATOLOGICAL DATA FOR ADELAIDE, S.A.

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. Min. 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	64	43		43	43	43	51	49	53	39
January	29.917	758	19/99	0.34	7,909	S	8.99	2.3	3.4	8.5
February	29.952	691	22/96	0.30	6,791	S	7.33	1.9	3.4	7.3
March	30.037	628	9/12	0.25	6,743	S	5.79	2.2	3.9	6.9
April	30.121	773	10/96	0.22	6,150	S x W	3.41	1.7	5.0	4.0
May	30.126	760	9/80	0.21	6,221	N x E	2.02	1.7	5.7	1.9
June	30.094	750	12/78	0.25	6,661	N	1.24	2.1	6.2	1.5
July	30.130	674	25/82	0.25	6,781	N	1.30	1.7	5.8	1.8
August	30.096	773	31/97	0.28	7,203	N N W	1.87	2.2	5.6	2.5
September.. ..	30.040	720	2/87	0.31	7,348	W	2.84	2.4	5.2	3.3
October	29.999	768	28/98	0.34	7,923	S W x W	4.76	3.4	4.9	4.1
November	29.975	677	2/04	0.33	7,570	S S W	6.50	3.7	4.6	5.2
December	29.919	675	12/91	0.34	7,935	S S W	8.44	2.7	3.7	7.5
Year { Totals ..	—	—		—	—	—	54.49	28.0	—	54.5
Averages ..	30.034	—		0.28	7,103	S W x S	—	—	4.8	—
Extremes ..	--	773*		—	—	—	—	—	—	—

*10/4/96 and 31/8/97.

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	64	64	64	64	64	64	43	60	39
January	86.5	61.6	74.0	116.3 26/58	45.1 21/84	71.2	180.0 18/82	36.5 14/79	310.5
February	86.1	62.1	74.1	113.6 12/99	45.5 23/18	68.1	170.5 10/00	36.7 ‡	264.2
March	80.7	58.9	69.8	108.0 12/61	44.8 –/57	63.2	174.0 17/83	33.8 27/80	237.6
April	73.2	54.5	63.9	98.0 10/66	39.6 15/59	58.4	155.0 1/83	30.2 16/17	178.0
May	65.5	50.1	57.8	88.3 5/66	36.9 *	51.4	148.2 12/79	25.9 10/91	148.9
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	120.6
July	58.8	44.5	51.6	74.0 11/06	32.0 24/08	42.0	134.5 26/90	23.3 25/11	138.3
August	62.0	45.9	54.0	85.0 31/11	32.3 17/59	52.7	140.0 31/92	23.5 7/88	162.9
September.. ..	66.3	47.8	57.0	90.7 23/82	32.7 4/58	58.0	160.5 23/82	26.2 15/08	183.7
October	72.5	51.4	61.9	102.8 30/19	36.0 –/57	66.8	158.8 19/82	27.8 2/18	228.1
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	261.5
December	83.5	59.0	71.2	114.2 14/76	43.0 †	71.2	175.7 7/99	32.5 4/84	304.7
Year { Averages ..	72.8	53.2	63.0	—	—	—	—	—	2,539.0§
Extremes ..	—	—	—	116.3 26/1/58	32.0 24/7/08	84.3	180.0 18/1/82	22.9 12/6/13	—

*26/1895 and 24/1904.   †16/1861 and 4/1906.   ‡24/78 and 23/18.   §Total for year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Rel. Hum. (%)			Rainfall (inches).					Dew (inches).	
	Mean 9 a.m.	Highest Mean.	Lowest Mean.	Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Mean Amount of Dew.	Mean No. days Dew.
No. of yrs. over which observation extends	53	53	53	82	82	82	82	82	—	49
January	38	59	30	0.70	4	4.00 1850	nil *	2.30 2/89	—	4.2
February	41	56	31	0.65	4	2.89 1919	nil †	2.24 14/13	—	5.8
March	47	58	36	1.05	6	4.60 1878	nil ‡	3.50 5/78	—	11.1
April	56	72	44	1.80	9	6.78 1853	0.06 1910	3.15 5/60	—	14.1
May	68	76	49	2.71	14	7.75 1875	0.20 1891	2.75 1/53	—	15.9
June	77	84	69	3.13	15	8.58 1916	0.42 1886	2.11 1/20	—	15.6
July	76	87	68	2.64	17	5.38 1865	0.37 1899	1.75 10/65	—	17.1
August	69	77	54	2.52	16	6.24 1852	0.35 1914	2.23 19/51	—	16.4
September.. ..	61	72	44	1.97	14	4.64 1840	0.45 1896	1.42 ‖	—	15.6
October	51	67	29	1.73	11	3.83 1870	0.17 1914	2.24 16/08	—	12.7
November	43	57	34	1.16	8	3.55 1851	0.04 1885	1.88 28/58	—	7.1
December	38	50	33	0.97	5	3.98 1861	nil 1904	2.42 23/13	—	4.8
Year { Totals ..	—	—	—	21.03	123	—	—	—	—	140.4
Averages ..	53	—	—	—	—	—	—	—	—	—
Extremes ..	—	87	29	—	—	8.58 6/16	nil §	3.50 5/3/78	—	—

*1848, 1849, 1878, and 1906.   †1848, 1860, &c.   ‡1859, &c.   ‖25/93 and 12/17.
§January, February, March, and December, various years.

SECTION III.—PHYSIOGRAPHY.

CLIMATOLOGICAL DATA FOR 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.	Mean Hourly Pressure. (lbs.)	Total Miles.	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	34	10	10	10	34	12	34	29	12
January	29.874	315 24/14	0.09	4,185	E	6.533	5.4	5.8	3.1
February	29.900	340 10/15	0.12	4,440	S E	5.224	5.1	5.7	2.1
March	29.955	305 29/16	0.09	4.038	S E & S	4.738	4.4	5.3	4.7
April	30.050	252 13/19	0.07	3,591	S	3.691	3.3	4.6	8.0
May	30.091	245 29/19	0.07	3,606	S	2.775	3.0	4.4	8.1
June	30.065	307 23/16	0.07	3.420	S	2.102	2.1	4.1	8.7
July	30.073	279 19/17	0.07	3,485	S	2.309	· 2.5	3.7	11.8
August	30.094	250 22/17	0.08	3,822	S	2.830	3.4	3.6	11.6
September.. ..	30.033	239 25/17	0.07	3,572	S	3.696	5.7	3.5	12.1
October	29.999	325 25/18	0.09	4,134	N E & N	5.110	6.9	4.1	7.8
November	29.952	265 27/14	0.10	4,254	N E & N	5.882	8.2	4.8	5.8
December	29.884	295 21/13	0.11	4,537	N E & E	6.628	8.3	5.1	3.5
Year { Totals ..	—	—	—	—	S to E	51.518	58.3	—	87.3
Year { Averages ...	29.998	—	0.09	3,932	and N E	—	—	4.6	—
Year { Extremes ..	—	340 10/2/15	—	—	—	—	—	—	—

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	34	34	34	34	34	34	34	34	12
January	85.4	68.8	77.1	108.9 14/02	58.8 4/93	50.1	166.4 10/17	49.9 4/93	218.2
February	84.5	68.2	76.4	101.9 11/04	58.7 *	43.2	165.2 6/10	49.3 9/89	202.1
March	82.3	66.3	74.8	99.4 5/19	52.4 29/13	47.0	160.0 1/87	45.4 29/13	202.2
April	79.1	61.6	70.4	95.2 †	48.6 17/00	46.6	153.8 11/16	37.0 17/00	204.2
May	73.4	55.3	64.4	88.8 18/97	41.3 24/99	47.5	147.0 1/10	29.8 8/97	188.2
June	69.4	50.8	60.1	88.9 19/18	36.3 29/08	52.6	136.0 3/18	25.4 23/88	163.0
July	68.4	48.3	58.4	83.4 28/98	36.1 ‡	47.3	146.1 20/15	23.9 11/90	191.3
August	71.2	49.8	60.5	87.5 28/07	37.4 6/87	50.1	141.9 20/17	27.1 9/99	218.7
September.. ..	75.8	54.8	65.3	95.2 16/12	40.7 1/96	54.5	155.5 26/03	30.4 1/89	230.7
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	244.6
November	83.0	64.1	73.6	106.1 18/13	48.5 2/05	57.6	162.3 7/89	38.8 1/05	237.8
December	85.3	67.5	76.4	105.9 26/93	56.4 13/12	49.5	160.4 7/14	49.1 3/94	244.7
Year { Averages ..	78.1	59.6	68.9	—	—	—	—	—	2545.7§
Year { Extremes ..	—	—	—	108.9 14/1/02	36.1 ‡	72.8	166.4 10/1/17	23.9 11/7/90	—

* 10 and 11/04.   † 9/96 and 5/03.   ‡ 12/94 and 2/96.   § Total for year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Rel. Hum. (%). Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall (inches). Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest In One Day.	Dew (inches) Mean Amount of Dew.	Mean No. Days Dew
No. of yrs. over which observation extends	34	34	34	69	61	69	69	—	—	34
January	67	79	53	6.50	14	27.72 1895	0.32 1919	18.31 21/87	—	4.6
February	70	82	55	6.41	14	40.39 1893	0.58 1849	8.36 16/93	—	5.0
March	72	85	56	5.86	15	34.04 1870	nil 1849	11.18 14/08	—	8.2
April	73	79	60	3.58	12	15.28 1867	0.04 1897	4.47 13/16	—	11.1
May	74	85	64	2.93	· 10	13.85 1876	nil 1846	5.62 9/79	—	11.9
June	73	82	67	2.57	8	14.03 1873	nil 1847	6.01 9/93	—	9.9
July	74	81	61	2.22	8	8.46 1889	nil 1841	3.54 †	—	11.3
August	70	80	61	2.19	8	14.67 1879	nil *	4.89 12/87	—	9.0
September.. ..	65	76	47	2.08	8	5.43 1886	0.10 1907	2.46 2/94	—	8.9
October	61	72	49	2.64	9	9.99 1882	0.14 1900	1.95 20/89	—	6.9
November	60	72	46	3.67	10	12.40 1917	nil 1842	4.46 16/86	—	3.9
December	63	67	52	4.87	12	13.99 1910	0.35 1865	6.60 28/71	—	3.3
Year { Totals ..	—	—	—	45.52	128	—	—	—	—	94.0
Year { Averages ..	69	—	—	—	—	—	—	—	—	—
Year { Extremes ..	—	85	46	—	—	40.39 2/1893	nil ‡	18.31 21/1/87	—	—

* 1862, 1869, 1880.   † 15/76, 16/89.   ‡ March, May, June, July, August, and November, various years.

CLIMATOLOGICAL DATA FOR SYDNEY, N.S.W.

LAT. 33° 52′ S., LONG. 151° 12′ E.   HEIGHT ABOVE M.S.L. 133 FT.

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

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 24 hourly 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	62	54	54	54	54	41	61	59	57
January	29.901	721 1/71	0.36	8,138	N E	5.239	4.7	5.8	2.0
February	29.947	871 12/69	0.30	6,985	N E	4.085	4.3	6.0	1.4
March	30.015	943 20/70	0.24	6,764	N E	3.506	4.2	5.6	2.0
April	30.076	803 6/82	0.19	6,116	N E	2.502	4.0	5.0	2.7
May	30.084	758 6/98	0.24	6,340	W	1.729	3.3	4.8	3.4
June	30.059	712 7/00	0.30	6,956	W	1.406	2.2	4.8	3.5
July	30.064	930 17/79	0.30	7,085	W	1.495	2.4	4.4	4.5
August	30.075	756 22/72	0.24	6,838	W	1.831	3.2	4.1	4.6
September	30.014	964 6/74	0.30	7,111	W	2.625	4.1	4.3	4.2
October	29.972	926 4/72	0.30	7,729	N E	3.764	4.9	5.0	2.5
November	29.931	720 13/68	0.30	7,600	N E	4.524	5.5	5.6	1.7
December	29.885	938 3/84	0.36	8,038	N E	5.298	5.7	5.6	2.0
Year { Totals	—	—	—	—	—	38.004	48.5	—	34.5
Averages	30.002	—	0.29	7,142	N E	—	—	5.1	—
Extremes	—	964 6/9/74	—	—	—	—	—	—	—

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	62	62	62	62	62	62	62	62	10
January	78.4	64.9	71.7	108.5 13/96	51.2 14/65	57.3	164.3 26/16	44.2 18/97	195.9
February	77.4	64.9	71.2	101.0 19/66	49.3 28/63	51.7	162.1 16/98	43.4 25/91	173.2
March	75.5	62.9	69.3	102.6 3/69	48.8 14/86	53.8	150.3 4/89	39.9 17/13	187.6
April	71.1	58.0	64.6	89.0 4/09	44.6 27/64	44.4	144.1 10/77	33.3 24/09	143.8
May	65.2	52.1	58.6	86.0 1/19	40.2 22/59	45.8	129.7 1/96	29.3 25/17	131.4
June	60.7	48.2	54.5	75.5 13/19	38.0 5/20	37.5	123.0 14/78	28.1 24/11	111.4
July	59.2	45.8	52.5	74.9 17/71	35.9 12/90	39.0	124.7 19/77	24.0 4/93	124.9
August	62.4	47.6	55.0	82.0 31/84	36.8 3/72	45.2	149.0 30/78	26.1 4/09	170.8
September	66.7	51.4	59.1	92.3 27/19	40.8 18/64	51.5	142.2 12/78	30.1 17/05	179.6
October	71.2	55.8	63.5	99.7 19/98	43.3 2/99	56.4	151.9 *	32.7 9/05	195.7
November	74.4	59.6	67.1	102.7 21/78	45.8 1/05	56.9	158.5 28/99	36.0 6/06	185.2
December	77.3	62.9	70.1	107.5 21/04	49.3 2/59	58.2	171.5 4/88	41.5 6/09	196.7
Year { Averages	70.0	56.2	63.1	—	—	72.6	171.5	24.0	1996.2†
Extremes	—	—	—	108.5 13/1/96	35.9 12/7/90	—	171.5 4/12/88	24.0 4/7/93	—

* 30 and 31/14.   † Total for year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Rel. Hum. (%). Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall (inches). Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Dew (inches). Mean Amount of Dew.	Mean No. Days Dew.
No. of yrs. over which observation extends	62	62	62	62	62	62	62	62	61	61
January	69	78	58	3.62	14.1	15.26 1911	0.42 1888	7.08 13/11	0.002	1.2
February	72	81	59	4.51	14.1	18.56 1873	0.34 1902	8.90 25/73	0.004	2.0
March	74	85	63	5.06	14.9	18.70 1870	0.42 1876	6.52 9/13	0.008	3.3
April	77	87	63	5.38	13.5	24.49 1861	0.06 1868	7.52 29/60	0.016	5.5
May	76	90	66	5.13	15.0	23.03 1919	0.18 1860	8.36 28/89	0.022	6.2
June	78	89	68	4.96	12.6	16.30 1885	0.19 1902	5.17 16/84	0.018	5.3
July	77	88	65	4.84	12.5	13.21 1900	0.12 1862	5.72 28/08	0.016	5.3
August	73	84	56	3.06	11.4	14.89 1899	0.04 1885	5.33 2/60	0.014	4.9
September	69	79	49	2.90	12.0	14.05 1879	0.08 1882	5.69 10/79	0.008	3.4
October	67	77	47	2.95	12.6	11.14 1916	0.21 1867	6.37 13/02	0.007	3.0
November	66	79	42	2.88	12.5	9.88 1865	0.07 1915	4.23 19/00	0.004	2.1
December	67	77	52	2.83	13.0	15.82 1920	0.23 1913	4.75 13/10	0.003	1.4
Year { Totals	—	—	—	48.12	158.2	—	—	—	0.122	43.6
Averages	72	—	—	—	—	—	—	—	—	—
Extremes	—	90	42	—	—	24.49 April/61	0.04 Aug./85	8.90 25/2/73	—	—

CLIMATOLOGICAL DATA FOR 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., 3 & 9 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	63	49	49	49	49	48	13	63	13
January	29.914	583 10/97	0.29	7,345	S W, S E	6.41	1.8	5.0	7.8
February	29.962	566 8/68	0.28	6,441	S W, S E	5.04	2.0	5.0	7.1
March	30.032	677 9/81	0.22	6,398	S W, S E	3.94	1.7	5.5	4.9
April	30.104	597 7/68	0.19	5,719	S W, N W	2.35	0.9	5.9	4.2
May	30.106	693 12/65	0.19	5,958	N W, N E	1.47	0.5	6.5	3.1
June	30.073	761 13/76	0.24	6,461	N W, N E	1.10	1.0	6.7	2.0
July	30.095	755 8/74	0.23	6,482	N W, N E	1.06	0.7	6.3	3.5
August	30.064	637 14/75	0.26	6,882	N W, N E	1.48	0.9	6.3	2.7
September.. ..	29.998	617 11/72	0.29	7,108	N W, S W	2.30	1.8	6.1	3.5
October	29.968	899 5/66	0.29	7,377	S W, N W	3.34	1.9	6.0	4.3
November	29.951	734 13/66	0.29	7,083	S W, S E	4.55	2.2	5.9	3.5
December	29.898	655 1/75	0.30	7,503	S W, S E	5.77	2.0	5.5	4.6
Year { Totals ..	—	—	—	—	—	38.81	17.4	—	51.2
Averages ..	30.014	—	0.26	6,730	S W, N W	—	—	5.9	—
Extremes ..	—	899 5/10/66	—	—	—	—	—	—	—

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	65	65	65	65	65	65	61	61	39
January	78.1	56.7	67.4	111.2 14/62	42.0 28/85	69.2	178.5 14/62	30.2 28/85	245.8
February	77.9	57.0	67.5	109.5 7/01	40.3 9/65	69.2	167.5 15/70	30.9 6/91	208.9
March	74.3	54.6	64.5	105.5 2/93	37.1 17/84	68.4	164.5 1/68	28.9 *	172.8
April	68.3	50.7	59.5	94.0 6/65	34.8 24/88	59.2	152.0 8/61	25.0 23/97	136.3
May	61.4	46.7	54.0	83.7 7/05	29.9 29/16	53.8	142.6 2/59	21.1 26/16	110.6
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	85.3
July	55.5	41.7	48.6	68.4 24/78	27.0 21/69	41.4	125.8 27/80	20.5 12/03	102.9
August	58.8	43.4	51.1	77.0 20/85	28.3 11/63	48.7	137.4 29/69	21.3 14/02	125.3
September.. ..	62.6	45.6	54.1	85.0 19/19	31.1 16/08	53.9	142.1 20/67	22.8 8/18	145.7
October	67.0	48.2	57.6	98.4 24/14	32.1 3/71	66.3	154.3 28/68	24.8 22/18	176.9
November	71.4	51.2	61.3	105.7 27/94	36.5 2/96	69.2	159.6 29/65	24.6 2/96	208.3
December	75.4	54.2	64.8	110.7 15/76	40.0 4/70	70.7	170.3 20/69	33.2 1/04	232.7
Year { Averages ..	67.3	49.5	58.4	—	—	—	—	—	1951.5†
Extremes ..	—	—	—	111.2 14/1/62	27.0 21/7/69	84.2	178.5 14/1/62	20.4 17/6/95	—

* 17/1884 and 20/1897.   † Total for year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Rel. Hum. (%)			Rainfall (Inches).					Dew (inches).	
	Mean 9 a.m.	Highest Mean.	Lowest Mean.	Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Mean Amount of Dew.	Mean No. Days Dew.
No. of yrs. over which observation extends	13	13	13	65	65	65	65	65	—	13
January	58	65	50	1.84	7	5.68 1904	0.04 1878	2.97 9/97	—	2.5
February	61	69	53	1.70	7	6.24 1904	0.03 1870	3.37 18/19	—	3.2
March	64	71	57	2.25	9	7.50 1911	0.18 1859	3.55 5/19	—	7.5
April	71	78	66	2.26	11	6.71 1901	0.33 1908	2.28 22/01	—	8.5
May	78	84	73	2.18	13	4.31 1862	0.45 1901	1.85 7/91	—	7.8
June	32	87	77	2.10	14	4.51 1859	0.73 1877	1.74 21/04	—	7.9
July	32	86	76	1.83	14	7.02 1891	0.57 1902	2.71 12/91	—	10.2
August	76	82	70	1.83	14	3.59 1909	0.48 1903	1.87 17/81	—	7.9
September.. ..	69	76	60	2.45	14	7.93 1916	0.52 1907	2.62 12/80	—	6.5
October	62	67	56	2.61	13	7.61 1869	0.29 1914	3.00 17/69	—	6.6
November	59	69	52	2.34	11	6.71 1916	0.25 1895	2.57 16/76	—	1.8
December	56	69	51	2.37	9	7.18 1863	0.11 1904	2.62 28/07	—	1.6
Year { Totals ..	—	—	—	25.76	136	—	—	—	—	72.0
Averages ..	68	—	—	—	—	—	—	—	—	—
Extremes ..	—	87	50	—	—	7.93 9/16	0.03 2/70	3.55 5/3/19	—	—

CLIMATOLOGICAL DATA FOR 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.				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	36	10	10	10	16	10	13	58	14
January	29.832	500 30/16	0.19	5,958	N W & S E	5.401	0.6	5.9	3.1
February	29.922	393 19/13	0.13	4,433	S E & N	3.910	1.2	5.9	2.7
March	29.939	406 8/15	0.12	4,800	N & S E	2.980	1.2	5.9	2.0
April	29.959	432 7/17	0.13	4,719	N W & S E	2.016	0.8	6.0	1.7
May	29.989	411 3/16	0.12	4,741	N & N W	1.355	0.6	6.0	2.0
June	29.939	569 27/20	0.13	4,764	N & N W	0.853	0.7	6.0	1.6
July	29.932	396 17/11	0.12	4,588	N & N W	0.871	0.5	5.7	2.6
August	29.928	459 30/11	0.13	4,842	N & N W	1.208	0.7	5.9	2.1
September	29.846	516 26/15	0.18	5,613	N & N W	1.988	0.9	6.1	1.9
October	29.840	461 8/12	0.18	5,814	N W & S E	3.168	0.8	6.3	1.7
November	29.802	508 18/15	0.19	5,781	N W & S E	3.951	0.9	6.3	1.7
December	29.808	486 30/20	0.18	5,770	N W & S E	4.713	1.4	6.2	1.3
Year ⎰ Totals	—	—	—	61,823	—	32.414	10.3	—	24.4
⎱ Averages	29.895	—	0.16	—	N	—	—	6.0	—
Extremes	—	569 27/6/20	—	—	—	—	—	—	—

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	50	50	50	74	74	74	33	53	26
January	71.4	53.0	62.2	105.0 1/00	40.3 *	64.7	160.0 †	30.6 19/97	207.4
February	71.5	53.3	62.4	104.4 12/99	39.0 20/87	65.4	165.0 24/98	28.3 –/87	174.8
March	68.0	50.8	59.4	98.8 5/46	36.0 31/05	62.8	150.0 3/05	27.5 30/02	166.9
April	62.7	47.6	55.2	90.0 2/56	30.0 25/56	60.0	142.0 18/93	25.0 –/86	136.4
May	57.3	43.6	50.4	77.5 1/41	29.2 20/02	48.3	128.0 ‡	20.0 19/02	128.9
June	52.7	41.0	46.8	75.0 7/74	28.0 22/79	47.0	122.0 12/94	21.0 6/87	99.5
July	51.8	39.1	45.4	72.0 22/77	27.0 18/66	45.0	118.7 19/96	18.7 16/86	122.7
August	55.0	41.0	48.0	77.0 3/76	30.0 10/73	47.0	129.0 –/87	20.1 7/09	139.2
September	58.7	43.1	50.9	80.0 9/72	30.0 12/41	50.0	138.0 23/93	22.7 –/86	141.5
October	62.8	45.4	54.1	92.0 24/14	32.0 12/89	60.0	156.0 9/93	23.8 §	166.5
November	66.2	48.2	57.2	98.0 20/88	35.2 5/13	62.8	154.0 19/92	26.0 1/08	192.9
December	69.5	51.2	60.4	105.2 30/97	38.0 13/06	67.2	161.0 24/20	27.2 –/86	192.1
Year ⎰ Averages	62.3	46.4	54.4	—	—	—	—	—	1,868.8‖
⎱ Extremes	—	—	—	105.2 30/12/97	27.0 18/7/66	78.2	165.0 24/2/98	18.7 16/7/86	

* 3/72 and 2/06. † 5/86 and 13/05. ‡ –/88 and –/92. § 1/86 and.–/99. ‖ Total for year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Rel. Hum. (%)			Rainfall (inches).					Dew (inches)	
	Mean 9 a.m.	Highest Mean.	Lowest Mean.	Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Mean Amount of Dew.	Mean No. days Dew.
No. of yrs. over which observation extends	40	40	40	78	77	78	78	54	—	11
January	64	75	51	1.78	9	5.91 1893	0.03 1841	2.96 30/16	—	1.0
February	65	76	51	1.44	8	9.15 1854	0.07 1847	4.50* 25/54	—	2.3
March	70	76	59	1.70	10	7.60 1854	0.02 1843	2.79 5/19	—	4.4
April	74	85	60	1.88	11	6.50 1909	0.07 1904	5.02 20/09	—	10.3
May	79	90	68	1.87	13	6.37 1905	0.10 1843	3.22 14/58	—	13.0
June	83	94	73	2.20	14	8.15 1889	0.22 1852	4.11 14/89	—	6.9
July	81	97	74	2.12	14	5.98 1849	0.30 1850	2.00 27/78	—	7.9
August	78	92	64	1.83	14	10.16 1858	0.23 1854	4.35 12/58	—	7.7
September	71	87	60	2.13	14	7.14 1844	0.39 1847	3.50 29/44	—	4.5
October	67	75	51	2.23	15	6.67 1906	0.26 1850	2.58 4/06	—	3.1
November	64	73	51	2.51	14	8.92 1849	0.16 1868	3.97 6/49	—	1.4
December	62	73	49	1.97	11	9.00 1875	0.11 1842	2.48 13/16	—	1.0
Year ⎱ Totals	—	—	—	23.66	147	—	—	—	—	63.5
⎰ Averages	71	—	—	—	—	—	—	—	—	—
⎱ Extremes	—	97	49	—	—	10.16 8/1858	0.02 3/1843	5.02 20/4/09	—	—

* 4.18, 26/54 also.