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.[1]

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.,[2] 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 55.

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 nearly 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 (1·29828) as large as Australia, or that Australia is about three-quarters (more accurately 0·77) of the area of Europe.

1. 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.

2. Its correct value for 1919 is 23° 26′ 59.36″, and it decreases about 0″.47 per annum.

SIZE 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	3,861,856	0.77	1.29828
Asia	16,838,571	0.18	5.66082
Africa	12,373,563	0.24	4.15977
North and Central America and West Indies..	8,547,640	0.35	2.87356
South America	7,370,141	0.40	2.47771
Australasia and Polynesia	3,462,029	0.86	1.16387
Total, exclusive of Arctic and Antarctic Conts.	52,453,800	0.06	17.63401
Europe—			
Russia (inclusive of Poland, Ciscaucasia & Finland)	2,122,998	1.40	0.71371
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	194,778	15.27	0.06548
Sweden	173,035	17.19	0.05817
Norway	124,643	23.86	0.04190
United Kingdom	121,633	24.46	0.04089
Italy	110,632	26.89	0.03719
Denmark (inclusive of Iceland)	55,338	53.75	0.01860
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
Belgium	11,373	261.55	0.00382
Albania	11,317	262.84	0.00380
Turkey	10,882	273.35	0.00366
Montenegro	5,603	530.89	0.00188
Luxemburg	998	2980.54	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	3,861,856	0.77	1.29828
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
Turkey	699,342	4.25	0.23511
Persia	628,000	4.74	0.21112
Dutch East Indies	583,210	5.10	0.19606
Japan (and Dependencies)..	261,069	11.39	0.08777

SIZE 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	3,861,856	0.77	1.29828
Asia	16,838,571	0.18	5.66082
Africa	12,373,563	0.24	4.15977
North and Central America and West Indies..	8,547,640	0.35	2.87356
South America	7,370,141	0.40	2.47771
Australasia and Polynesia	3,462,029	0.86	1.16387
Total, exclusive of Arctic and Antarctic Conts.	52,453,800	0.06	17.63401
Europe—			
Russia (inclusive of Poland, Ciscaucasia & Finland)	2,122,998	1.40	0.71371
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	194,778	15.27	0.06548
Sweden	173,035	17.19	0.05817
Norway	124,643	23.86	0.04190
United Kingdom	121,633	24.46	0.04089
Italy	110,632	26.89	0.03719
Denmark (inclusive of Iceland)	55,338	53.75	0.01860
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
Belgium	11,373	261.55	0.00382
Albania	11,317	262.84	0.00380
Turkey	10,882	273.35	0.00366
Montenegro	5,603	530.89	0.00188
Luxemburg	998	2980.54	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	3,861,856	0.77	1.29828
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
Turkey	699,342	4.25	0.23511
Persia	628,000	4.74	0.21112
Dutch East Indies	583,210	5.10	0.19606
Japan (and Dependencies)..	261,069	11.39	0.08777

SIZE 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
Philippine Islands (inclsv. of Sulu Archipelago)	114,400	26.00	0.03846
Laos	111,940	26.57	0.03763
Bokhara	83,000	35.84	0.02790
Omán	82,000	36.28	0.02757
British Borneo and Sarawak	73,106	40.69	0.02458
Cambodia	67,724	43.92	0.02277
Annam	61,718	48.20	0.02075
Nepál	54,000	55.08	0.01815
Tonking	46,223	64.35	0.01554
Federated Malay States	27,506	108.14	0.00925
Ceylon	25,332	117.42	0.00852
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
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
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
Kwang Chau Wan	386	7706.17	0.00013
Wei-hai-wei	285	10437.13	0.00010
Bahrein Islands	250	11898.32	0.00008
Kiauchau (German)	200	14872.91	0.00007
French India (Pondicherry, &c)	196	15176.43	0.00007
Macao, &c.	4	743645.25	..
Total, Asia	16,838,571	0.18	5.66082
Africa—			
French Sahara	1,544,000	1.93	0.51906
Sudan	1,014,400	2.93	0.34102
French Equatorial Africa	1,003,600	2.96	0.33739
Belgian Congo	909,654	3.27	0.30581
French Military District of the Niger	534,124	5.57	0.17956
Angola	517,000	5.75	0.17381
Union of South Africa	473,075	6.29	0.15904
Rhodesia	440,000	6.76	0.14792
Portuguese East Africa	426,712	6.97	0.14345
Tripoli and Benghazi	406,000	7.33	0.13649
Abyssinia	400,000	7.44	0.13447
German East Africa	384,000	7.75	0.12909
Egypt	350,000	8.50	0.11766
Mauretania	344,967	8.62	0.11597
Algeria (including Algerian Sahara)	343,500	8.66	0.11548
Nigeria and Protectorate	336,000	8.85	0.11296
German South-west Africa	322,200	9.23	0.10832
Senegambia and Niger	302,136	9.85	0.10157
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	226,016	13.16	0.07598
Kamerun	191,130	15.56	0.06425

SIZE 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.		
Italian Somaliland	139,430	21.33	0.04687
Ivory Coast	125,538	23.69	0.04220
Uganda Protectorate	109,119	27.26	0.03668
French Guinea	92,249	32.25	0.03101
Gold Coast Protectorate (with Nth. Territories)	80,000	37.18	0.02689
Senegal	74,012	40.19	0.02488
Rio de Oro, &c.	73,000	40.75	0.02454
British Somaliland	68,000	43.74	0.02286
Tunis	50,000	59.49	0.01681
French Somali Coast	46,320	64.22	0.01557
Eritrea	45,800	64.95	0.01540
Liberia	40,000	74.36	0.01345
Nyassaland Protectorate	39,573	75.17	0.01330
Dahomey	37,527	79.27	0.01262
Togoland	33,700	88.27	0.01133
Sierra Leone and Protectorate	31,000	95.95	0.01042
Portuguese Guinea	25,000	118.98	0.00840
Spanish Guinea (Rio Muni, &c.)	12,000	247.88	0.00403
Basutoland	11,716	253.89	0.00394
Swaziland	6,536	455.11	0.00220
Gambia and Protectorate	4,504	660.43	0.00151
Cape Verde Islands	1,480	2009.85	0.00050
Zanzibar	1,020	2916.26	0.00034
Réunion	965	3082.47	0.00032
Fernando Po, &c.	814	3654.28	0.00027
Mauritius and Dependencies	809	3676.86	0.00027
Comoro Islands	694	4286.14	0.00023
St. Thomas and Principe Islands	454	6551.94	0.00015
Seychelles	156	19067.83	0.00005
Mayotte, &c.	143	20801.27	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	12,373,563	0.24	4.15977
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
Cuba	44,215	67.28	0.01486
Costa Rica	23,000	129.33	0.00773
San Domingo	18,045	164.84	0.00607
Salvador	13,176	225.76	0.00443
Haiti	10,204	291.51	0.00343
British Honduras	8,598	345.96	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	1,868	1592.39	0.00063
Leeward Islands	715	4160.25	0.00024
Guadeloupe and Dependencies	688	4323.52	0.00023
Windward Islands	527	5644.37	0.00018

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

SIZE 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.		
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	33422.26	0.00003
Bermudas	19	156556.89	..
Total, N. and C. America and W. Indies	8,547,640	0.35	2.87356
South America—			
Brazil	3,290,564	0.90	1.10623
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	7,370,141	0.40	2.47771
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	20,000	148.73	0.00672
British Solomon Islands	14,573	204.12	0.00490
New Caledonia and Dependencies	8,548	347.99	0.00287
Fiji	7,083	419.96	0.00238
Hawaii	6,449	461.25	0.00217
German Solomon Islands, &c.	5,160	576.47	0.00173
New Hebrides	5,100	583.25	0.00171
French Establishments in Oceania	1,520	1956.96	0.00051
German Samoa	1,000	2974.58	0.00034
Tonga	390	7627.13	0.00013
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	10	297458.10	..
Total, Australasia and Polynesia	3,462,029	0.86	1.16387
British Empire	12,784,755	0·23	4·29800

It should be noted that in the table above the figures quoted for areas refer to conditions prevailing prior to the outbreak of war.

3. **Relative Size 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 :—

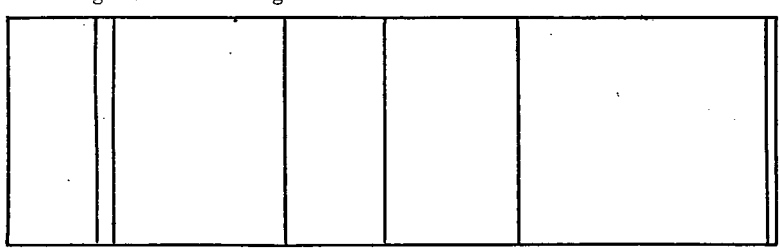
RELATIVE SIZE OF STATES, TERRITORIES, AND COMMONWEALTH.

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	0.000[1]
Commonwealth	2,974,581	9.613	33.847	4.436	7.826	3.048	113.469	5.681	1.000

1. The correct decimal is 0.0003.

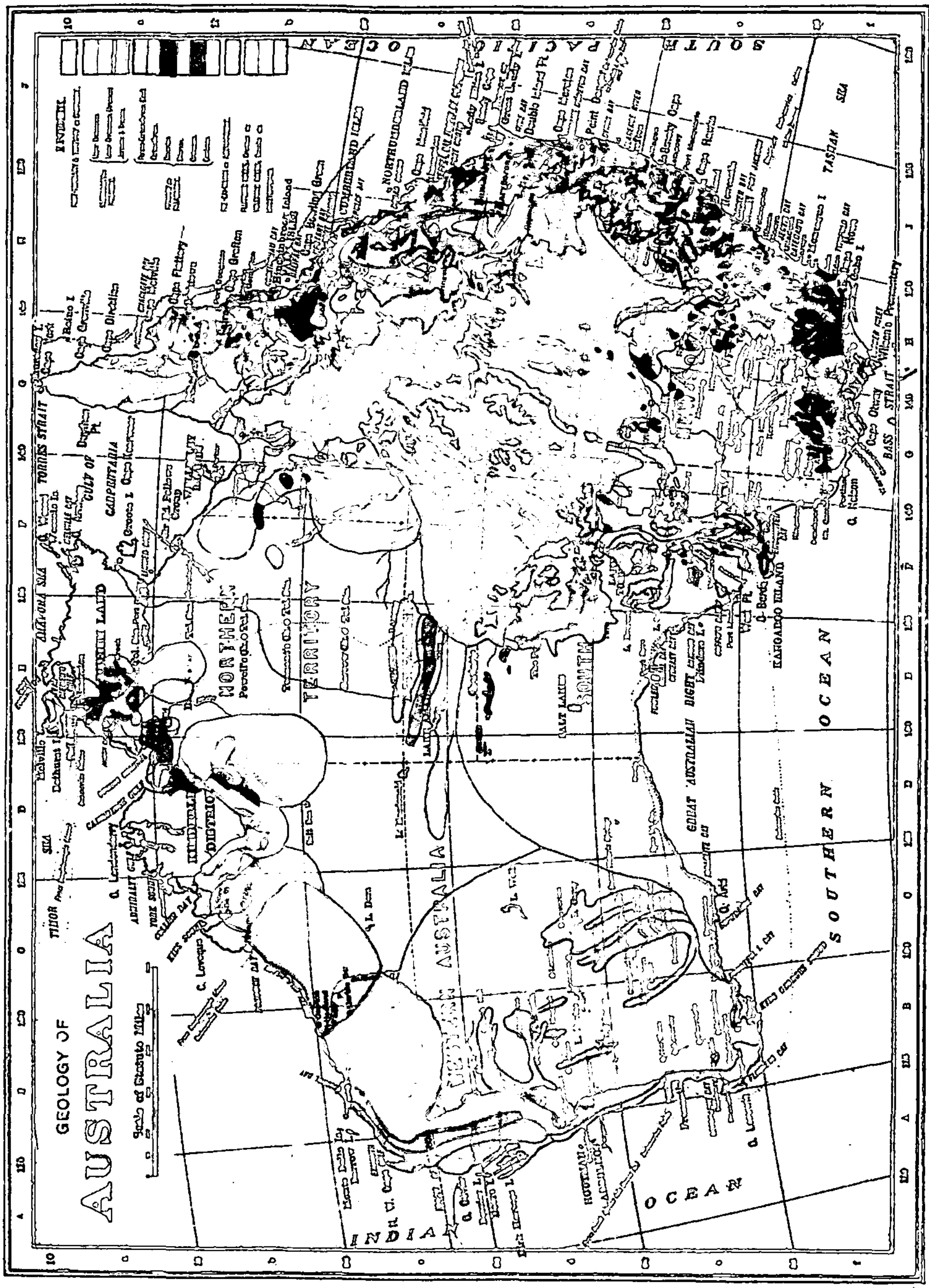
Thus, looking at the top line, New South Wales is seen to be over three-and-a-half times as large as Victoria (3.521) and less than one-half the size of Queensland (0.461); or again, looking at the bottom line, the Commonwealth is shewn to be more than nine-and-a-half times as large as New South Wales (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.	V.	Qld.	S.A.	N.T.	W.A.	Tas.
	10	3	22	13	18	33	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 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[1]	700	443	South Australia	1,540	247
Victoria ..	680	129	Western Australia	4,350	224
Queensland ..	3,000	223	Continent[2] ..	11,310	261
Northern Territory	1,040	503	Tasmania ..	900	29

1. Including Federal Territory. 2. 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 figurés, 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 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 ; and 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 will be found in § 8 of this section. This practically completes the description of the ordinary physical features An orographical or vertical relief map of Australia will be found at the end of this volume.

§ 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 will, 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. VI., 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. 92–8.

§ 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*.

A special article dealing with "The Plains and Peneplains of Australia" will be found in § 8 of this section.

2. **Geological Map of Australia.**—The map of the Geology of Australia on page 51, shews the geographical distribution of the more important geological systems and formations.

3. **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 in § 9 of this section.

§ 6. Climate and Meteorology of Australia.[1]

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

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

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.

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 45, 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[1] 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[2] 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.

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.

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

2. 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."

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, (vi) 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 ..	1,402	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 showing 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.

In Tasmania, although occasionally hot winds may cross the Straits and cause the temperature to rise to 100° in the low-lying parts, the island 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 67) 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 67, 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 67 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"[1] and dams. The magnitude of the economic loss by evaporation will be appreciated from the records on pages 69 and 76 to 81, which shew that the yearly amount varies from about 33 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

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

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 68).

(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. Hence, we find that, 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 from the summer south-east trade winds. Here 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, 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 30 years.

Harvey's Creek in the shorter period of 20 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.

The inland districts of Western Australia have until recent years been regarded as the driest part of Australia, but authentic observations taken during the past decade at 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 74, 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.	Victoria.	Queensland.	South Australia.	Northern Territory	Western Australia.	Tasmania. *	Commonwealth. *
	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

* 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 48.27 inches occupies the chief place, Brisbane, Perth, Melbourne, Hobart and Adelaide following in that order, Adelaide with 21.01 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 73.) 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 nothing 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 slight excesses in April and July ; 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 68.) 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 1918.

Year.	PERTH.			ADELAIDE.			BRISBANE.			SYDNEY.			MELBOURNE.			HOBART.		
	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.
	in.		in.	in.		in.	in.		in.	in.		in.	in.		in.	in.		in.
1840	..	..	..	21.23	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	..	..	..	..	43.31	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	..	24.09	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	..	24.95	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	..	42.28	112	..	22.40	131	..	30.69	..	..
3	39.65	122	..	26.76	161	..	32.22	114	..	46.92	157	..	23.71	130	..	24.05	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	..	24.00	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	18.45	151	23.71
9	39.96	123	..	30.87	143	..	49.36	155	..	57.16	186	..	27.14	125	..	30.80	180	(8 yr.)
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	124	..	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	..
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
Aver.	..	..	33.67	..	..	21.01	..	..	45.81	..	..	48.27	..	..	26.19	..	..	23.75
No.of Yrs.			(43)			(80)			(69)			(79)			(75)			(76)

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 1918, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Anthony ..	28 Mar., 1887	17.14	Maitland W. ..	9 Mar., 1893	14.79
,, ...	15 Jan., 1890	13.13	Major's Creek ..	14 Feb., 1898	12.32
Araluen	15 Feb., 1898	13.36	Marrickville ..	9 Mar., 1913	10.40
Berry	13 Jan., 1911	12.05	Morpeth	9 ,, 1893	21.52
Billambil	14 Mar., 1894	12.94	Mount Kembla ..	13 Jan., 1911	18.25
Bomaderry	13 Jan., 1911	13.03	Mt. Pleasant ..	24 Mar., 1914	10.30
Broger's Creek ..	14 Feb., 1898	20.05	Nepean Tunnel ..	14 Feb., 1898	12.30
,, ,, ..	19 July, 1910	12.22	Nowra	13 Jan., 1911	13.00
,, ,, ..	13 Jan., 1911	20.83	Padstow Park ..	9 Mar., 1913	10.64
,, ,, ..	24 July, 1918	10.30	Prospect ..	28 May, 1889	12.37
Bulli Mountain ..	13 Feb., 1898	17.14	Raleigh Central ..	10 Nov., 1917	13.20
Camden Haven ..	22 Jan., 1895	12.23	Richmond ..	28 May, 1889	12.18
Castle Hill ..	28 May, 1889	13.49	Rosemount ..	23 Mar., 1914	12.62
Colombo Lyttleton	5 Mar., 1893	12.17	Rooty Hill ..	27 May, 1889	11.85
Comboyne ..	18 May, 1914	10.68	Taree	28 Feb., 1892	12.24
Condong ..	27 Mar., 1887	18.66	Terara	26 ,, 1873	12.57
Cordeaux River ..	14 Feb., 1898	22.58	The Hill(Shell Harb.)	24 Mar., 1914	12.00
,, ,, ..	13 Jan., 1911	14.52	Tomago ..	9 ,, 1893	13.76
Dapto West ..	14 Feb., 1898	12.05	Tongarra Farm ..	14 Feb., 1898	15.12
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
Holy Flat ..	12 Mar., 1887	12.00	Sherwood ..	17 June, 1914	10.00
,, ,, ..	28 Feb., 1892	12.24	Stockyard Mt. ..	24 Mar., ,,	10.72
Jamberoo ..	23 Mar., 1914	10.22	South Head (near 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
Leconfield ..	9 Mar., 1893	14.53	Wollongong ..	24 Mar., 1914	12.50
Madden's Creek ..	13 Jan., 1911	18.68			

HEAVY RAINFALLS, QUEENSLAND, UP TO 1918, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Allomba (Cairns) ..	30 Jan., 1913	13.50	Burnett Head (Bundaberg) ..	16 Jan., 1913	15.22
Anglesey	26 Dec., 1909	18.20	Burpengary ..	10 Feb., 1915	11.11
,, ...	10 Feb., 1915	12.00	Bustard Head ..	17 Jan., 1913	14.93
Atherton (Cairns) ..	31 Jan., 1913	16.69	Cairns	11 Feb., 1889	14.74
Ayr	20 Sep., 1890	14.58	,, ...	21 Apr., ,,	12.40
Babinda (Cairns) ..	31 Jan., 1913	12.79	,, ...	5 ,, 1891	14.08
,, ,, ..	1 Feb., ..	20.51	,, ...	11 Feb., 1911	15.17
,, ,, ..	24 Jan., 1916	22.30	,, ...	2 Apr., ,,	20.16
,, ,, ..	25 ,, ,,	13.45	,, ...	31 Jan., 1913	13.94
Banyan (Cardwell)	31 ,, 1913	13.79	,, ...	24 ,, 1916	12.28
Barrine (Cairns) ..	31 ,, ,,	13.34	Calliope ..	9 Feb., 1915	12.09
Batheaston ..	27 Dec., 1916	10.00	Cape Grafton ..	5 Mar., 1896	13.37
Bloomsbury ..	14 Feb., 1893	17.40	Cardwell ..	30 Dec., 1889	12.00
,, ..	10 Jan., 1901	16.62	,, ..	23 Mar., 1890	12.00
Bowen	13 Feb., 1893	14.65	,, ..	18 ,, 1904	18.24
Boynedale ..	9 ,, 1915	11.20	,, ..	3 Apr., 1911	12.84
Bracewell ..	9 ,, ,,	11.59	Clare	26 Jan., 1896	15.30
Brisbane ..	21 Jan., 1887	18.31	Clermont ..	28 Dec., 1916	12.28
Bromby Park(Bowen)	14 Feb., 1893	13.28	Coen	17 Feb., 1914	12.03
Brookfield ..	14 Mar., 1908	14.95	Collaroy ..	30 Jan., 1896	14.25
Buderim Mountain	11 Jan., 1898	26.20	,, ..	28 Dec., 1916	12.79
Bundaberg ..	16 ,, 1913	16.94	Cooktown ..	22 Jan., 1903	12.49
Burketown ..	15 ,, 1891	13.58	,, ..	23 ,, 1914	13.98
,, ..	12 Mar., 1903	14.52			

HEAVY RAINFALLS, QUEENSLAND—*continued.*

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Cooran	1 Feb., 1893	13.62	Halifax	6 Jan., 1901	15.68
,, ...	26 Dec., 1908	14.08	,, ...	8 Apr., 1912	12.75
Cooroy	9 June, 1893	13.60	Hambledon Mill ..	13 Jan., 1909	13.80
,, ...	10 Jan., 1898	13.50	,, ,, ..	2 ,, 1911	18.61
Crohamhurst (Blackall Range)	2 Feb., 1893	35.71	,, ,, ..	10 Feb., ,,	13.97
,, ,, ..	9 June, ,,	13.31	,, ,, ..	30 Mar., ,,	13.04
,, ,, ..	9 Jan., 1898	19.55	,, ,, ..	31 ,, ,,	14.95
,, ,, ..	6 Mar., ,,	16.01	,, ,, ..	1 Apr., ,,	19.62
,, ,, ..	26 Dec., 1909	13.85	,, ,, ..	30 Jan., 1913	17.32
,, ,, ..	10 Feb., 1915	12.98	Harvey Creek ..	8 Mar., 1899	17.72
Crow's Nest ..	2 Aug., 1908	11.17	,, ,, ..	25 Jan., 1900	12.53
Croydon	29 Jan., ,,	15.00	,, ,, ..	25 May, 1901	14.00
Cryna (Beaudesert)	21 ,, 1887	14.00	,, ,, ..	14 Mar., 1903	12.10
Dungeness ..	16 Mar., 1893	22.17	,, ,, ..	11 Jan., 1905	16.96
,, ..	17 Apr., 1894	14.00	,, ,, ..	28 ,, 1906	12.29
Dunira	9 Jan., 1898	18.45	,, ,, ..	14 ,, 1909	14.40
,, ...	6 Mar., ,,	15.95	,, ,, ..	3 ,, 1911	27.75
Eddington(Cloncurry)	23 Jan., 1891	10.33	,, ,, ..	11 Feb., ,,	12.88
Emscote Farm ..	10 Feb., 1915	13.22	,, ,, ..	1 Apr., ,,	13.61
Emu Park ..	18 Jan., 1913	12.75	,, ,, ..	2 ,, ,,	16.46
Enoggera Railway ..	14 Mar., 1908	12.14	,, ,, ..	31 Jan., 1913	24.72
Ernest Junction ..	14 ,, ,,	13.00	,, ,, ..	24 ,, 1916	13.17
Fairymead Plantation (Bundaberg) ..	16 Jan., 1913	15.32	Haughton Valley Herberton ..	26 ,, 1896	18.10
Flat Top Island ..	22 Dec., 1909	12.96		31 ,, 1913	14.00
Floraville ..	6 Jan., 1897	10.79	Hillcrest (Mooloolah)	26 Dec., 1909	13.35
,, ..	11 Mar., 1903	12.86	Holmwood (Woodf'd)	2 Feb., 1893	16.19
Flying Fish Point ..	7 Apr., 1912	16.06	,, ,,	10 Jan., 1898	12.40
,, ,, ..	31 Jan., 1913	16.10	Homebush ..	3 Feb., ,,	12.04
Gatcombe Head (Gladstone) ..	18 ,, ,,	12.88	Howard ..	15 Jan., 1905	19.55
Gin Gin	16 ,, 1905	13.61	Huntley ..	27 Dec., 1916	18.94
,, ...	16 ,, 1913	12.27	Ingham	18 Jan., 1894	12.60
Gladstone ..	18 Feb., 1888	12.37	,, ...	6 ,, 1901	13.59
,, ..	31 Jan., 1893	14.62	,, ...	25 Dec., 1903	12.30
,, ..	4 Feb., 1911	18.83	Inkerman ..	21 Sep., 1890	12.93
,, ..	9 ,, 1915	10.10	Inneshowen (Johnstone River)	30 Dec., 1889	14.01
Glen Boughton ..	5 Apr., 1894	18.50	Innisfail (formerly Geraldton) ..	11 Feb., ,,	17.13
,, ,, ..	31 Jan., 1913	14.92	,, ,, ..	31 Dec., ,,	12.45
,, ,, ..	24 ,, 1916	14.02	,, ,, ..	6 Apr., 1894	16.02
Glen Prairie ..	18 Apr., 1904	12.18	,, ,, ..	18 ,, 1899	13.20
Gold Creek Reservoir	14 Mar., 1908	12.50	,, ,, ..	24 Jan., 1900	15.22
Goldsborough(Cairns)	31 Jan., 1913	19.92	,, ,, ..	29 Dec., 1903	21.22
,, ,,	1 Feb., ,,	12.22	,, ,, ..	11 Feb., 1911	14.48
Goodwood(Bund'b'g)	16 Jan., ,,	13.07	,, ,, ..	1 Apr., ,,	12.35
Goondi Mill(Innisfail)	6 Apr., 1894	15.69	,, ,, ..	2 ,, ,,	15.00
,, ,,	18 ,, 1899	14.78	,, ,, ..	7 ,, 1912	20.50
,, ,,	24 Jan., 1900	13.30	,, ,, ..	8 ,, ,,	12.15
,, ,,	29 Dec., 1903	17.83	,, ,, ..	31 Jan., 1913	20.91
,, ,,	10 Feb., 1911	17.68	Invicta (Kolan R.)	16 ,, ,,	14.58
,, ,,	31 Mar., ,,	12.38	Isis Junction ..	6 Mar., 1898	13.60
,, ,,	1 Apr., ,,	13.60	Kamerunga (Cairns)	20 Jan., 1892	13.61
,, ,,	6 ,, 1912	15.55	,, ,,	6 Apr., 1894	14.04
Goondi	30 Jan., 1913	24.10	,, ,,	5 ,, 1895	12.31
Granada (formerly Donaldson) ..	27 ,, 1891	11.29	,, ,,	11 Feb., 1911	13.07
,, ,, ..	8 ,, 1911	13.50	,, ,,	1 Apr., ,,	14.20
,, ,, ..	9 ,, ,,	14.30	,, ,,	2 ,, ,,	21.00
Halifax	5 Feb., 1899	15.37	,, ,,	31 Jan., 1913	16.00
			Kulara (Cairns) ..	31 ,, ,,	12.69
			Kuranda (Cairns) ..	6 Mar., 1899	14.12

HEAVY RAINFALLS, QUEENSLAND—*continued.*

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Kuranda (Cairns) ..	20 Apr., 1903	14.16	North Kolan		
,, ,, ..	14 Jan., 1909	12.37	(Bundaberg) ..	6 Jan., 1913	12.90
,, ,, ..	11 Feb., 1911	16.30	North Pine ..	16 Feb., 1893	14.97
,, ,, ..	17 Mar., ,,	15.10	Nundah ..	14 Mar., 1908	12.00
,, ,, ..	31 ,, ,,	18.60	Oxenford ..	14 ,, ,,	15.65
,, ,, ..	1 Apr., ,,	24.30	Palmwoods ..	4 Feb., 1893	12.30
,, ,, ..	2 ,, ,,	28.80	,, ..	10 Jan., 1898	15.85
,, ,, ..	31 Jan., 1913	16.34	,, ..	7 Mar., ,,	13.02
Lake Nash ..	10 ,, 1895	10.25	,, ..	25 Dec., 1909	17.75
,, ..	20 Mar., 1901	10.02	Peachester ..	26 ,, ,,	14.91
Landsborough ..	2 Feb., 1893	15.15	Pialba(Marybor'gh)	16 Jan., 1913	17.22
,, ..	9 June, ,,	12.80	Pittsworth ..	11 Mar., 1890	14.68
,, ..	26 Dec., 1909	14.00	Plane Creek (Mackay)	26 Feb., 1913	27.73
Low Island ..	10 Mar., 1904	15.07	Point Archer ..	23 Jan., 1914	13.47
,, ..	31 ,, 1911	14.70	Port Douglas ..	5 Mar., 1887	13.00
,, ..	1 Apr., ,,	15.30	,, ,, ..	10 ,, 1904	16.34
Lucinda	17 Feb., 1906	13.35	,, ,, ..	11 Jan., 1905	14.68
,, ...	10 Mar., 1906	14.60	,, ,, ..	17 Mar., 1911	16.10
Lyndon (*via* Brixton)	3 ,, 1917	17.00*	,, ,, ..	1 Apr., ,,	31.53
Lytton	21 Jan., 1887	12.85	Ravenswood ..	24 Mar., 1890	17.00
Mackay	23 Dec., 1909	13.96	Redcliffe ..	21 Jan., 1887	14.00
Sugar Experimental			,, ..	16 Feb., 1893	17.35
Farm, Mackay ..	23 ,, ,,	12.00	Reid River ..	2 ,, 1917	11.15
Macnade Mill ..	18 Jan., 1894	12.56	Rosedale ..	6 Mar., 1898	12.60
,, ..	17 Apr., ,,	14.26	,, ..	16 Jan., 1913	18.90
,, ..	5 Feb., 1899	15.20	Sandgate ..	16 Feb., 1893	14.03
,, ..	6 Jan., 1901	23.33	Somerset ..	28 Jan., 1903	12.02
,, ..	7 Mar., 1914	12.44	St. Helens (Mackay)	24 Feb., 1888	12.00
,, ..	4 ,, 1915	22.00	St. Lawrence ..	17 ,, ,,	12.10
Maleny	26 Dec., 1909	14.76	,, ..	30 Jan., 1896	15.00
Mapleton ..	14 Mar., 1908	14.29	Tewantin ..	30 Mar., 1904	12.30
,, ..	26 Dec., 1909	15.72	The Hollow(Mackay)	23 Feb., 1888	15.12
,, ..	10 Feb., 1915	12.75	Thornborough ..	20 Apr., 1903	18.07
Marlborough ..	17 ,, 1888	14.24	Townsville ..	24 Jan., 1892	19.20
Milton	14 Mar., 1908	12.24	,, ..	28 Dec., 1903	15.00
,, ...	9 Feb., 1915	10.15	Victoria Mill ..	6 Jan., 1901	16.67
Mirani	12 Jan., 1901	16.59	Walsh River ..	1 Apr., 1911	13.70
Miriam Vale (B'berg)	17 ,, 1913	15.80	Woodford ..	2 Feb., 1893	14.93
,, ,,	9 Feb., 1915	10.22	Woodlands (Yepp'n)	25 Mar., 1890	14.25
Mooloolah ..	13 Mar., 1892	21.53	,, ,,	31 Jan., 1893	23.07
,, ..	2 Feb., 1893	19.11	,, ,,	9 Feb., 1896	13.97
,, ..	6 Mar., 1898	14.43	,, ,,	7 Jan., 1898	14.50
Mount Crosby ..	14 ,, 1908	14.00	Woody Island ..	16 ,, 1913	12.66
Mount Cuthbert ..	8 Jan., 1911	18.00	Woombye ..	26 Dec., 1909	13.42
Mount Molloy ..	31 Mar., ,,	20.00	Wootha	10 Feb., 1915	15.93
,, ..	1 Apr., ,,	20.00	Yandina ..	1 ,, 1893	20.08
,, ..	2 ,, ,,	20.00	,, ..	9 June, ,,	12.70
Mount Mee ..	10 Feb., 1915	12.00	,, ..	9 Jan., 1898	19.25
Mourilyan ..	14 Jan., 1909	13.00	,, ..	7 Mar., ,,	13.52
,, ..	3 ,, 1911	12.70	,, ..	28 Dec., 1909	15.80
,, ..	11 Feb., ,,	17.40	Yarrabah ..	11 Feb., 1911	12.00
,, ..	1 Apr., ,,	13.20	,, ..	2 Apr., ,,	30.65
,, ..	7 ,, 1912	18.97	,, ..	24 Jan., 1916	27.20
,, ..	31 Jan., 1913	15.05	,, ..	25 ,, ,,	18.60
Mundoolun ..	21 ,, 1887	17.95	Yeppoon ..	31 ,, 1893	20.05
Musgrave ..	6 Apr., 1894	13.71	,, ..	8 ,, 1898	18.05
Nambour ..	9 Jan., 1898	21.00	,, ..	3 Feb., 1906	14.90
,, ..	7 Mar., ,,	13.28	,, ..	3 ,, 1911	14.92
,, ..	27 Dec., 1909	16.80	,, ..	18 Jan., 1913	13.00
Nerang	15 June, 1892	12.35	,, ..	8 Oct., 1914	21.70

* Mr. Jas. Laidlaw, of Lyndon, states that this fell in 4 hours.

NOTE.—In Queensland falls of 12 or more inches on coast or 10 or more inches inland are taken.

HEAVY RAINFALLS, WESTERN AUSTRALIA, UP TO 1918, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Alice Downs ..	20 Jan., 1914	8.12	Obagama ..	28 Feb., 1910	12.00
,, ..	21 ,, ,,	5.33	Point Torment ..	17 Dec., 1906	11.86
,, ..	22 ,, ,,	4.04	Port George, W. ..	17 Jan., 1915	11.24
Balla Balla ..	21 Mar., 1899	14.40	Roebuck Plains ..	5 Jan., 1917	14.01
Boodarie ..	21 ,, ,,	14.53	,, ,, ..	6 ,, ,,	22.36
Broome	6 Jan., 1917	14.00	Thangoo ..	17-19 Feb.'96	24.18
,, ...	7 ,, 1917	6.20	Whim Creek ..	2 Apr., 1898	7.08
Cossack	3 Apr., 1898	12.82	,, ,, ..	3 ,, ,,	29.41
,, ...	16 ,, 1900	13.23	,, ,, ..	20 Mar., 1899	8.89
Croydon	3 Mar., 1903	12.00	,, ,, ..	21 ,, ,,	18.17
Cocos Island ..	29 Nov., ,,	14.38	Woodstock ..	21 ,, 1912	13.00
Derby	29 Dec., 1898	13.09	Wyndham ..	27 Jan., 1890	11.60
,, ...	30 ,, ,,	7.14	,, ..	11 ,, 1903	9.98
,, ...	6 Jan., 1917	5.97	,, ..	12 ,, ,,	6.64
,, ...	7 ,, ,,	16.47	,, ..	13 ,, ,,	4.20
Fortescue ..	3 May, 1890	23.36	Yeeda	28 Dec., 1898	8.42
Frazier Downs ..	3 Mar., 1916	11.25	,, ...	29 ,, ,,	6.88
Kerdiadary ..	7 Feb., 1901	12.00	,, ...	30 ,, ,,	6.12
Meda	9 Jan., 1914	2.87	,, ...	2 Mar., 1916	10.70
,, ...	10 ,, ,,	8.72	,, ...	3 ,, ,,	4.80
,, ...	2 Mar., 1916	10.55	,, ...	5 Jan., 1917	2.06
Mt. Anderson ..	6 Jan., 1917	2.16	,, ...	6 ,, ,,	10.20
,, ..	7 ,, ,,	8.60	,, ...	7 ,, ,,	11.75
,, ..	8 ,, ,,	1.17			

HEAVY RAINFALLS, NORTHERN TERRITORY, UP TO 1918, 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 Jan., 1897	11.67
Burrundie ..	4 Jan., 1914	11.61			

HEAVY RAINFALLS, VICTORIA, UP TO 1918, 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 1918, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
The Springs ..	30 Jan., 1916	9.72	The Springs ..	31 Jan., 1916	1.03

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 69.

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, popularly 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 shows 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 their 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, 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.

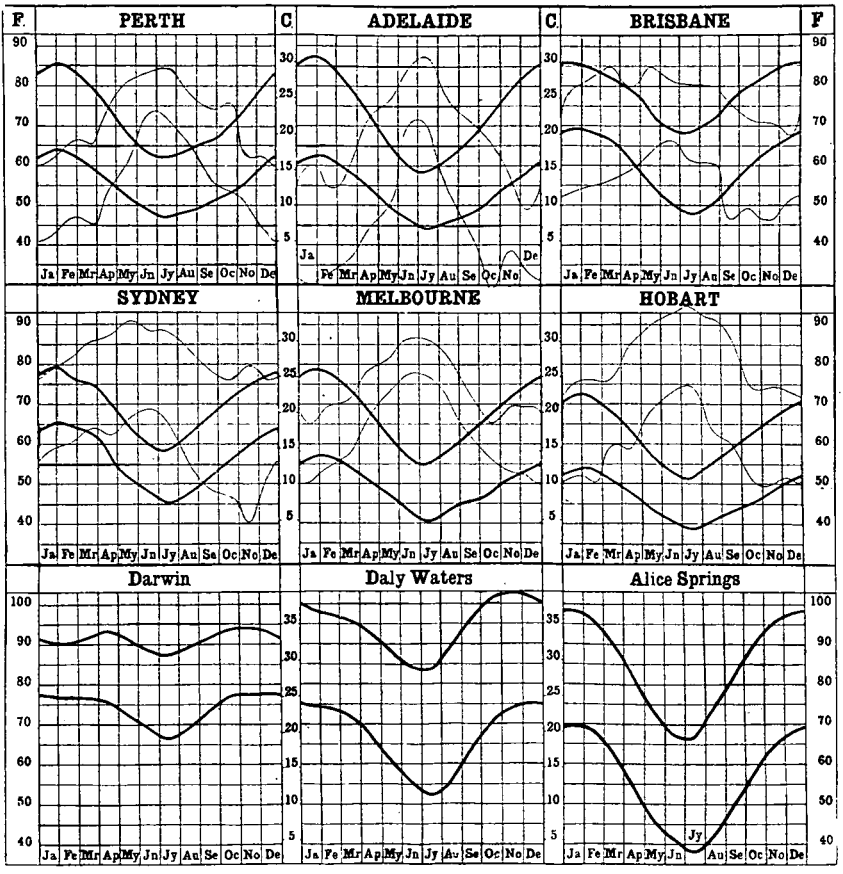
It is the rapid rate of evaporation, induced by both hot and cold winds, which injures crops and makes life uncomfortable on the plains. Whether the forest aids in increasing precipitation there may be doubt, but nobody can say that it does not check the winds and the rapid evaporation due to them.

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.

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.

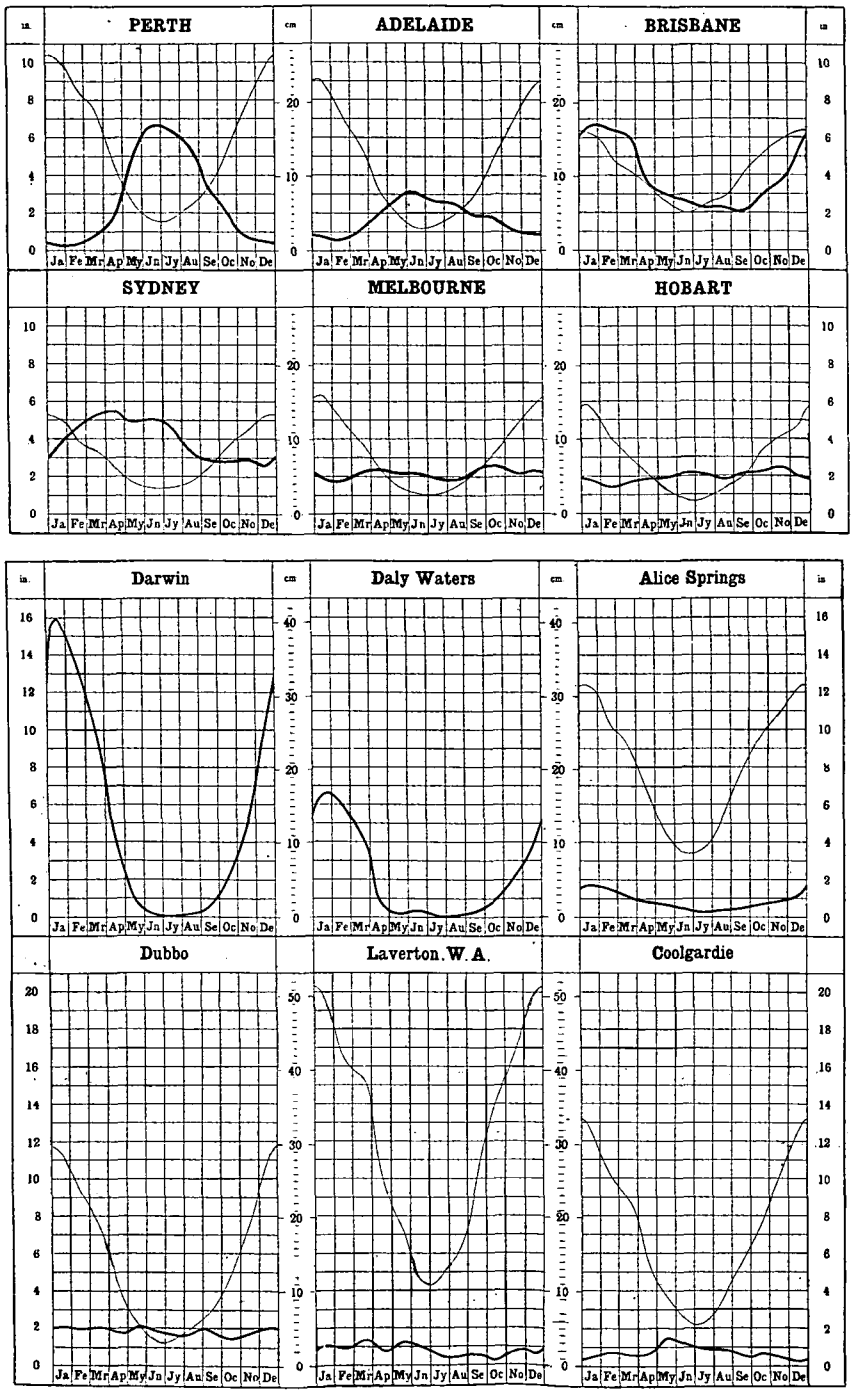
For the thin lines the degree numbers represent relative humidities, or the percentages of actual saturation (absolute saturation = 100).

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.

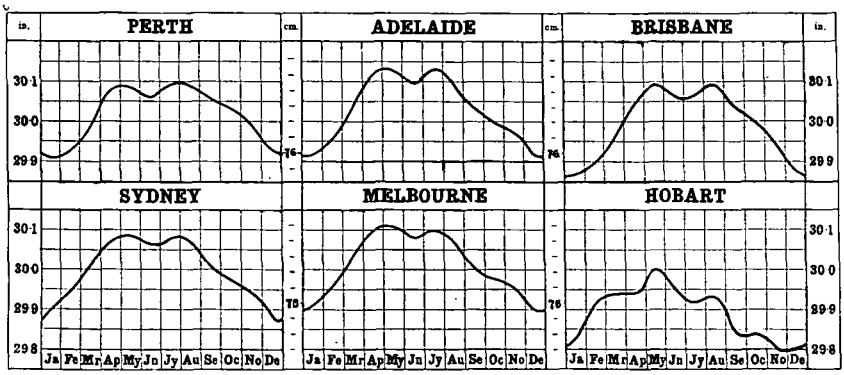
At Perth, Adelaide, Brisbane, Melbourne, Hobart, Alice Springs, and Coolgardie the results have been obtained from jacketed tanks sunk in the ground. At Sydney and Dubbo sunken tanks without water jackets are used, whilst at Laverton (W.A.) the records are taken from a small portable jacketed evaporation 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.	Evaporation.	—	Rainfall.	Evaporation.
Perth ..	33.67	65.98	Darwin ..	61.85	—
Adelaide ..	21.01	54.42	Daly Waters ..	26.35	—
Brisbane ..	46.02	50.10	Alice Springs ..	10.59	95.36
Sydney ..	48.02	37.59	Dubbo ..	22.20	66.37
Melbourne ..	25.56	38.68	Laverton, W.A.	9.65	143.96
Hobart ..	23.75	32.51	Coolgardie ..	9.86	87.72

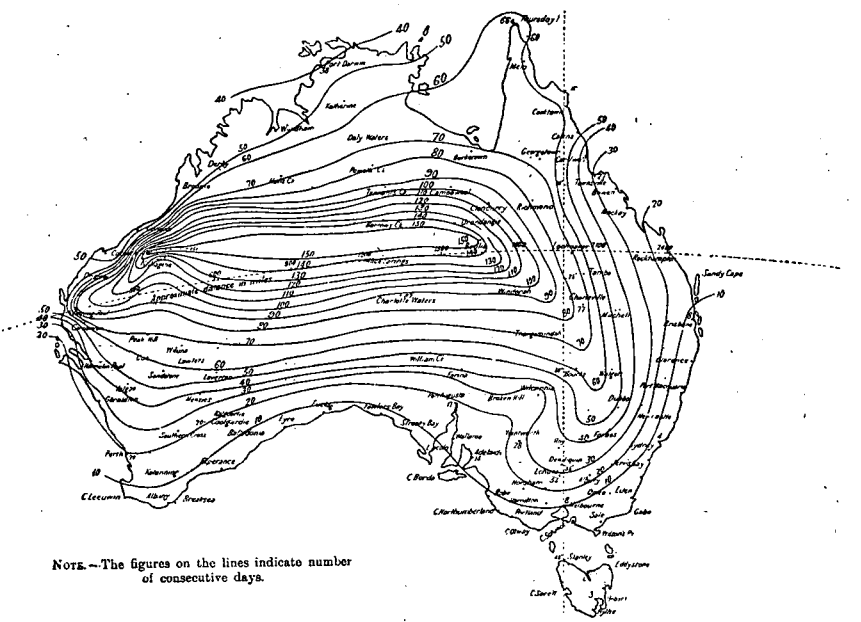
GRAPHS SHEWING ANNUAL FLUCTUATIONS OF MEAN BAROMETRIC PRESSURE FOR THE CAPITALS OF THE SEVERAL STATES OF THE COMMONWEALTH OF AUSTRALIA.



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 2½ 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.

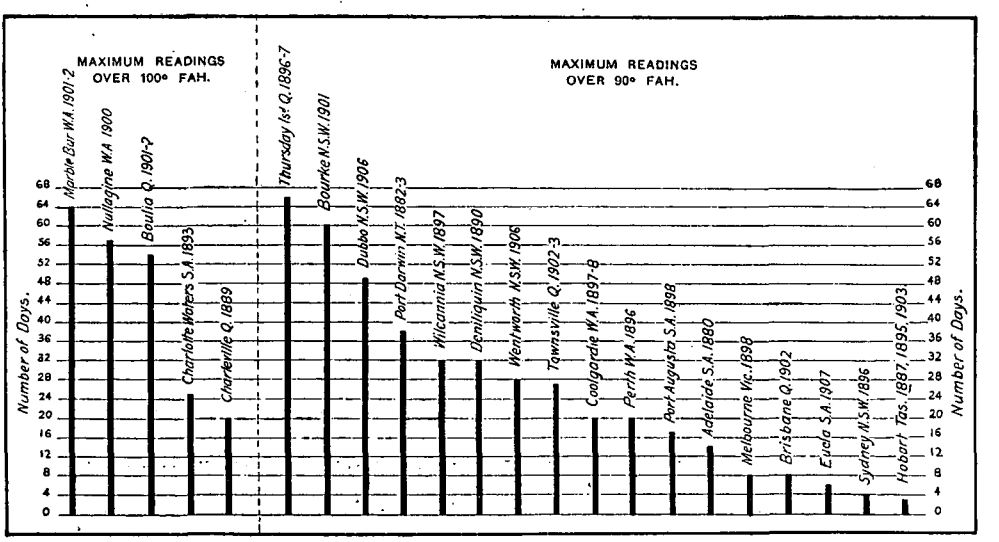
INTERPRETATION OF THE BAROMETRIC GRAPHS.—Taking the Brisbane graph for purposes of illustration, it will be seen that the mean pressure on 1st January is about 29·87 inches, and there are maxima in the middle of May and August of about 30·09 inches.

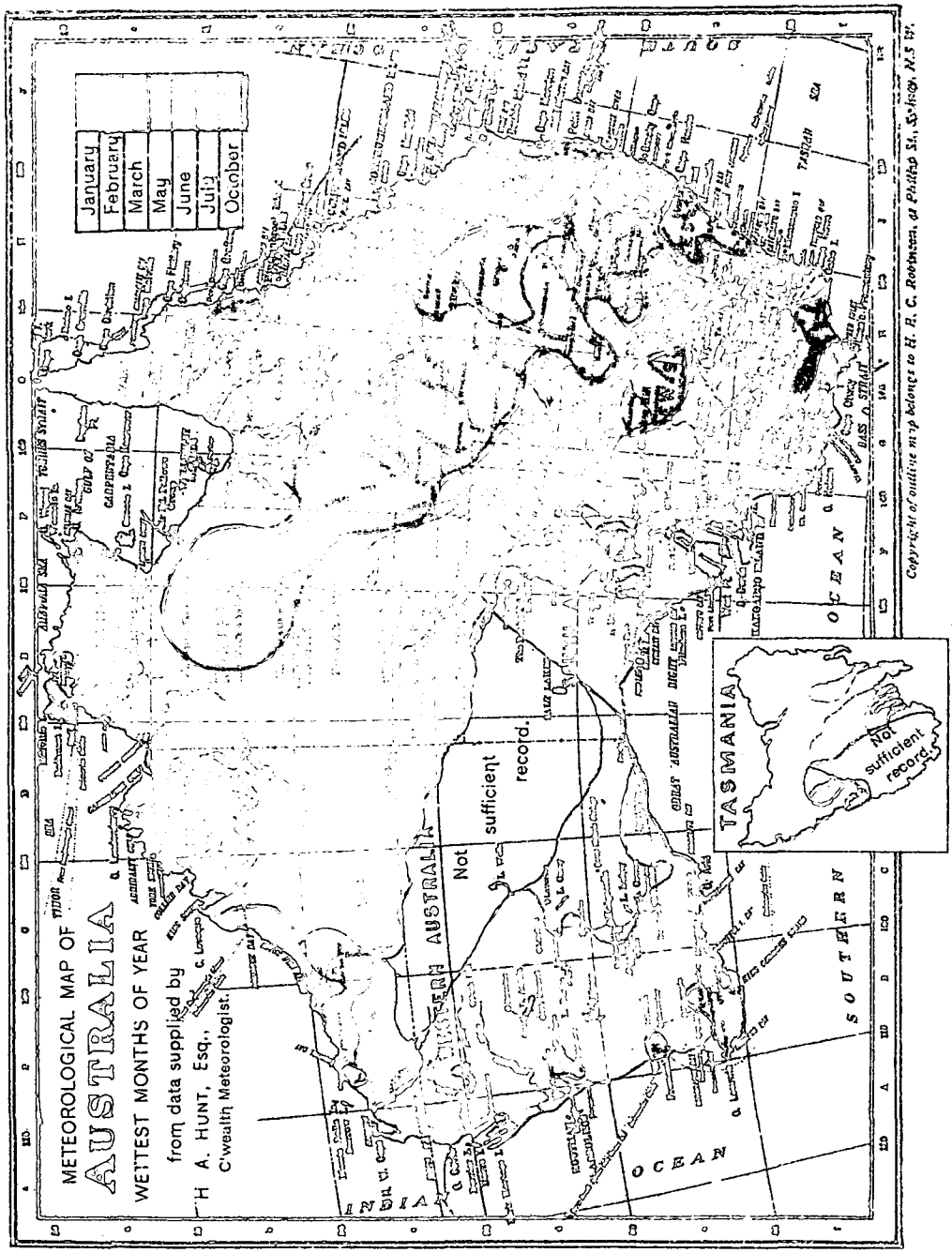
Chart indicating the area affected and period of duration of the Longest Heat Waves when the Maximum Temperature for consecutive 24 hours reached or exceeded 90° Fah.



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 SUB-DIVISIONS.

WEST AUSTRALIA.

No.
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 N.W.
10. West.
11. Upper North.
12. North-East.
13. Lower North.
14. Central.
15. Murray Valley.
16. South-East.

QUEENSLAND.

17. Peninsular.
18. Gulf.
19. Far West.
20. Central.
21. Nth-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 & Manning.
33. Central Tableland.
33a. Metropolitan.
34. Cent. Westn. Slope.
35. Cent. Westn. Plain.
36. Riverina.
37. South-West Slope.
38. Southern Tableland
39. South Coast.

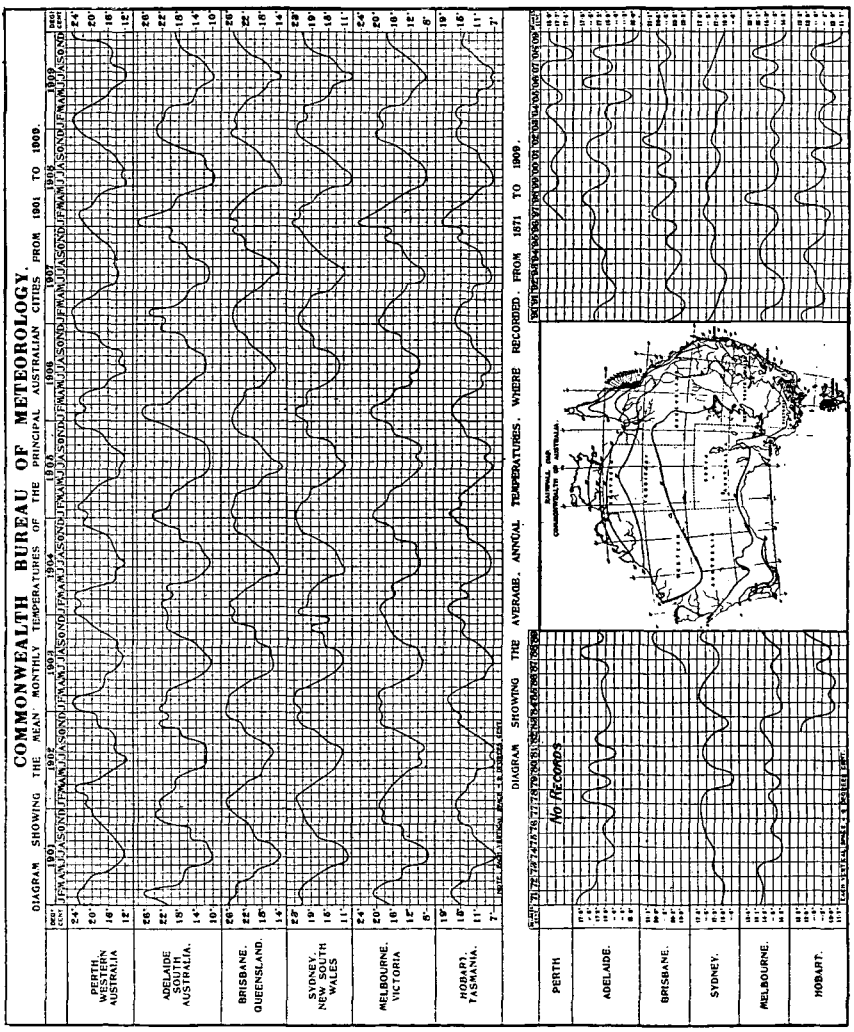
VICTORIA.

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 Mt. Region
50. Central Plateau.
51. Midland.
52. East Coast.
53. Derwent.
54. South-Eastern.

The above are the meteorological sub-divisions adopted by H. A. HUNT Esq., C'wealth. Meteorologist.

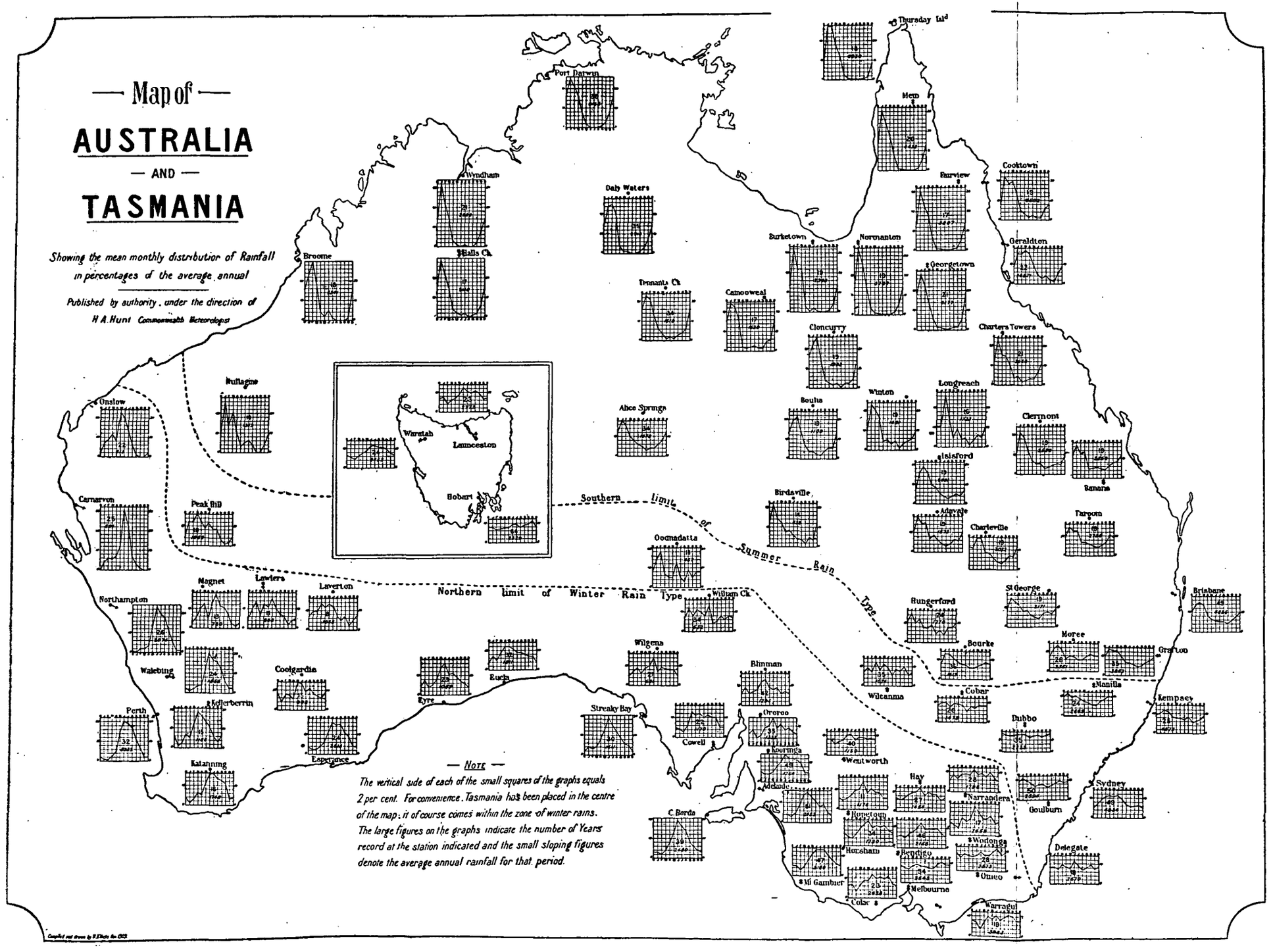


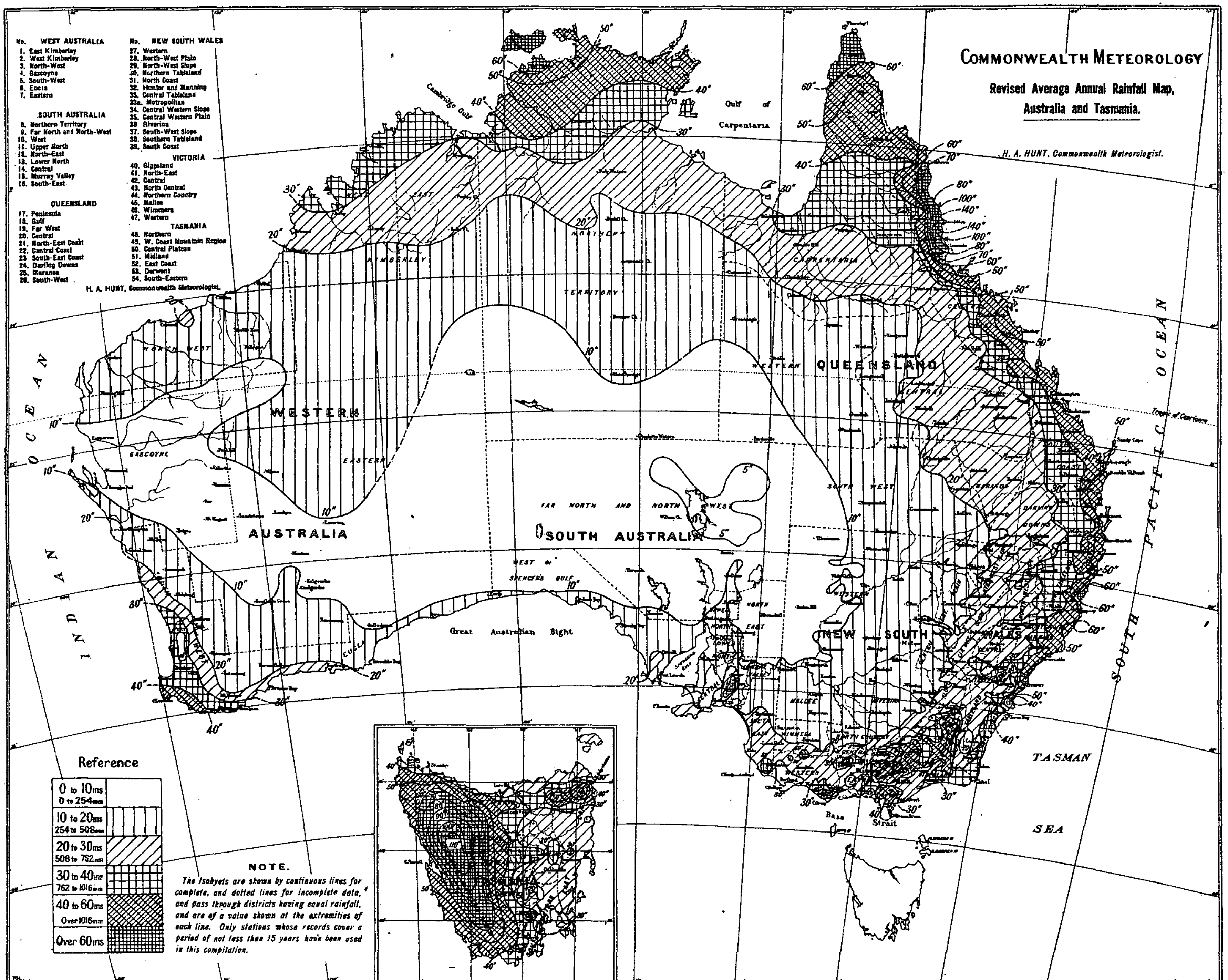
EXPLANATION OF GRAPH.

The six continuous curves on the upper part of the diagram shew the fluctuations of mean monthly temperatures of the Australian capitals from 1901 to 1909. The base of each small square denotes one month, and the vertical side 2° Centigrade or 3·6° Fahrenheit.

The six curves in lower portion of the diagram similarly shew the fluctuations of the mean annual temperatures, from 1871 in the case of Adelaide, Sydney and Melbourne, from 1883, 1887 and 1897 in the case respectively of Hobart, Brisbane and Perth. The base of each rectangle represents one year, and the vertical side 0·3° Centigrade or 0·54° Fahrenheit.

The map on page 74 shews in greater detail the areas affected by given amounts of annual rainfall.


— 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
Port Darwin
Thursday Isl
Normanton
Cooktown
Burketown
Georgetown
Geraldton
Broome
Wyndham
Halls Ck
Daly Waters
Tennants Ck
Camooweal
Cloncurry
Charters Towers
Onslow
Nullagine
Alice Springs
Winton
Longreach
Clermont
Isisford
Barcaldine
Carnarvon
Peak Hill
Birdsville
Charleville
Augustus
Oodnadatta
Southern limit of Summer Rain Type
Northern limit of Winter Rain Type
Northampton
Magnet
Lawlers
Laverton
William Ck
Hungerford
St George
Brisbane
Moree
Bourke
Wilcannia
Cobar
Nyngan
Dubbo
Kempsey
Wiluna
Blinman
Eucla
Eyre
Coolgardie
Kalgoorlie
Perth
Esperance
Streaky Bay
Cowell
Ororoo
Kadina
Adelaide
Wentworth
Hay
Narrandera
Goulburn
Sydney
C. Borda
Renmark
Horsham
Bendigo
Wodonga
Mt Gambier
Melbourne
Colac
Delegate
Warragul
Omeo
Waratah
Launceston
Hobart
Southern limit of Summer Rain Type
— 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.
No. WEST AUSTRALIA
1. East Kimberley
2. West Kimberley
3. North-West
4. Gascoyne
5. South-West
6. Eucla
7. Eastern
SOUTH AUSTRALIA
8. Northern Territory
9. Far North and North-West
10. West
11. Upper North
12. North-East
13. Lower North
14. Central
15. Murray Valley
16. South-East
QUEENSLAND
17. Peninsula
18. Gulf
19. Far West
20. Central
21. North-East Coast
22. Central Coast
23 South-East Coast
24. Darling Downs
25. Maranoa
26. South-West
No. NEW SOUTH WALES
27. Western
28. North-West Plain
29. North-West Slope
30. Northern Tableland
31. North Coast
32. Hunter and Manning
33. Central Tableland
33a. Metropolitan
34. Central Western Slope
35. Central Western Plain
36 Riverina
37. South-West Slope
38. Southern Tableland
39. South Coast
VICTORIA
40. Gippsland
41. North-East
42. Central
43. North Central
44. Northern Country
45. Mallee
46. Wimmera
47. Western
TASMANIA
48. Northern
49. W. Coast Mountain Region
50. Central Plateau
51. Midland
52. East Coast
53. Derwent
54. South-Eastern
H. A. HUNT, Commonwealth Meteorologist.
Reference
0 to 10ins 0 to 254mm
10 to 20ins 254 to 508mm
20 to 30ins 508 to 762mm
30 to 40ins 762 to 1016mm
40 to 60ins Over 1016mm
Over 60ins
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.
Gulf of Carpentaria
Cambridge Gulf
INDIAN OCEAN
SOUTH PACIFIC OCEAN
WESTERN AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
Great Australian Bight
TASMAN SEA
Bass Strait

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	100.0	55.9	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	82.6	79.1
Constantinople ..	245	28.75	42.74	14.78	74.0	43.5	103.6	13.0	75.7	42.0
Copenhagen ..	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	104.2	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	33.60	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
Zurich	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	22.37	41.29	10.45	* 68.4	† 43.9	101.0	20.0	69.7	43.0
THE STATE CAPITALS.										
Perth	197	33.67	46.73	20.21	* 72.9	† 55.9	107.9	34.2	74·0	55.0
Adelaide.. ..	140	21.01	30.87	11.39	73.1	53.0	116.3	32.0	74·1	51.6
Brisbane ..	137	46.02	88.26	16.17	76.7	59.6	108.9	36.1	77·2	58.3
Sydney	133	48.02	82.76	21.49	71.0	53.6	108.5	35.9	71·7	52.5
Melbourne ..	115	25.56	44.25	15.61	66.5	50.0	111.2	27.0	67·5	48.6
Hobart	177	23.75	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 1918. These are given in the tables following.

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.	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	21		21	21	21	20	21	22	22
January	29.906	797	27/98	0.70	11,370	S S E	10.42	1.8	2.8	14.2
February	29.924	650	6/08	0.64	9,942	S S E	8.63	1.3	3.1	11.1
March	29.989	651	6/13	0.55	10,115	S S E	7.62	1.3	3.5	11.5
April	30.074	955	25/00	0.42	8,537	S E	4.74	1.2	4.6	7.3
May	30.082	768	5/12	0.35	8,091	E N E	2.75	1.9	5.4	5.3
June	30.060	861	27/10	0.38	8,079	N	1.74	2.1	6.2	3.0
July	30.092	949	11/99	0.39	8,476	N N E	1.68	2.6	5.6	5.1
August	30.084	966	15/03	0.42	8,880	W	2.37	1.6	5.6	4.8
September	30.056	864	11/05	0.49	9,258	S W	3.31	1.6	5.4	5.5
October	30.030	809	6/16	0.54	9,946	S S W	5.24	1.2	5.2	5.7
November	29.989	777	18/97	0.60	10,230	S	7.68	1.3	4.0	7.8
December	29.928	672	31/98	0.66	11,001	S	9.80	1.5	3.2	12.0
Year Totals	—	—		—	113,925	—	65.98	19.4	—	93.3
Year Averages	30.018	—		0.51	9,494	S	—	—	4.6	—
Year Extremes	—	966	15/8/03	—	—	—	—	—	—	—

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature. Mean Max.	Mean Min.	Mean.	Extreme Shade Temperature. Highest.		Lowest.		Extreme Range.	Extreme Temperature. Highest in Sun.		Lowest on Grass.		Mean Hours of Sunshine.
No. of yrs. over which observation extends	22	22	22	22		22		22	21		20		21
January	84.5	63.6	74.0	107.0	16/97	50.6	25/01	56.4	177.3	22/14	42.4	25/02	324.1
February	84.6	63.4	74.0	107.3	12/15	47.7	1/02	59.6	169.0	4/99	39.8	1/13	273.1
March	81.0	60.6	70.8	106.1	6/14	45.8	8/03	60.3	167.0	19/18	36.7	8/03	268.3
April	75.8	57.0	66.4	99.7	9/10	39.3	20/14	60.4	157.0	8/16	31.0	20/14	215.8
May	68.6	52.4	60.5	90.4	2/07	34.3	11/14	56.1	139.1	7/14	25.3	11/14	180.4
June	63.8	49.4	56.6	81.7	2/14	36.3	29/14	45.4	135.5	9/14	29.0	20/16	144.5
July	62.5	47.5	55.0	73.8	24/99	34.2	7/16	39.6	133.2	13/15	25.2	6,7/16	169.0
August	63.8	48.1	56.0	81.0	12/14	35.3	31/08	45.7	143.2	23/18	27.9	10/11	185.9
September	66.1	50.4	58.2	90.9	30/18	38.9	17/13	52.0	153.6	29/16	29.2	21/16	202.8
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	236.8
November	75.2	56.5	65.8	104.6	24/13	42.0	1/04	62.6	166.6	23/15	35.5	*	291.3
December	80.8	60.6	70.7	107.9	20/04	48.0	2/10	59.9	168.7	25/15	39.1	2/10	326.6
Year Averages	73.0	55.1	64.0	—		—		—	—		—		2818.6†
Year Extremes	—	—	—	107.9	20/12/04	34.2	7/7/16	73.7	177.3	22/1/14	25.2	6, 7/7/16	—

* 6/1910 and 14/1912. † Total for Year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity. Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall. Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.		Least Monthly		Greatest in One Day.		Dew. Mean Amount of Dew.	Mean No. Days Dew.
No. of yrs. over which observation extends	22	22	22	43	43	43		43		43		—	22
January	53	61	42	0.34	3	2.17	1879	nil	*	1.74	28/79	—	2.8
February	54	65	46	0.45	3	2.98	1915	nil	†	1.63	26/15	—	2.8
March	58	66	46	0.73	4	4.50	1896	nil	‡	1.53	17/76	—	5.7
April	64	72	53	1.61	7	4.97	1882	0.05	‖	2.62	30/04	—	9.4
May	72	81	61	4.77	14	12.13	1879	0.98	1903	2.80	20/79	—	12.6
June	79	83	72	6.78	17	12.11	1890	2.16	1877	2.65	16/00	—	11.7
July	78	84	72	6.50	17	11.29	1917	2.42	1876	3.00	4/91	—	13.2
August	74	79	67	5.63	18	10.33	1882	0.46	1902	2.79	7/03	—	11.2
September	68	75	58	3.35	15	7.72	1903	0.34	1916	1.73	23/09	—	8.9
October	62	75	54	2.13	12	7.37	1890	0.49	1892	1.38	15/10	—	5.7
November	55	63	50	0.80	6	2.78	1916	nil	1891	1.11	30/03	—	4.2
December	52	62	44	0.58	4	3.05	1888	nil	1886	1.72	1/88	—	3.0
Year Totals	—	—	—	33.67	120	—		—		—		—	91.2
Year Averages	62	—	—	—	—	—		—		—		—	—
Year Extremes	—	84	42	—	—	12.13	5/79	nil.	§	3.00	4/7/91	—	—

* 1888, 1894, 1897, and 1911. † 1885, 1891, 1896, 1903, and 1913. ‡ 1877, 1884, and 1886. ‖ 1890 and 1894.
§ 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. Greatest Number of Miles in One Day.	Wind. Mean Hourly Pressure. (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction.	Mean Amount of Evaporation.	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	41	41	41	41	49	47	51	37
January	29.916	758 19/99	0.34	7,938	S x W	8.97	2.4	3.5	8.1
February	29.952	691 22/96	0.30	6,844	S	7.32	2.0	3.4	7.0
March	30.035	628 9/12	0.25	6,773	S x W	5.80	2.2	4.0	6.7
April	30.119	773 10/96	0.22	6,206	S W x S	3.38	1.7	5.0	3.9
May	30.124	760 9/80	0.21	6,254	N N E	2.01	1.8	5.8	1.7
June	30.097	750 12/78	0.25	6,642	N x E	1.23	2.1	6.2	1.4
July	30.130	674 25/82	0.25	6,811	N x W	1.29	1.7	5.8	1.7
August	30.097	773 31/97	0.28	7,222	N N W	1.86	2.2	5.6	2.2
September	30.040	720 2/87	0.32	7,386	W S W	2.85	2.4	5.2	3.0
October	29.999	768 28/98	0.34	7,991	S W x W	4.76	3.5	4.9	3.8
November	29.973	677 2/04	0.34	7,632	S S W	6.51	3.7	4.5	5.2
December	29.919	675 12/91	0.34	7,989	S S W	8.44	2.8	3.8	7.2
Year Totals	—	—	—	—	—	54.42	28.5	—	51.9
Year Averages	30.033	—	0.29	7,141	S W x S	—	—	4.8	—
Year Extremes	--	773*	—	—	—	—	—	—	—

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

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature. Mean Max.	Mean Min.	Mean	Extreme Shade Temperature. Highest.	Lowest.	Extreme Range.	Extreme Temperature. Highest in Sun.	Lowest on Grass.	No. of Hours of Sunshine.
No. of yrs. over which observation extends	62	62	62	62	62	62	41	58	37
January	86.5	61.7	74.1	116.3 26/58	45.1 21/84	71.2	180.0 18/82	36.5 14/79	308.7
February	86.1	62.0	74.1	113.6 12/99	45.5 23/18	68.1	170.5 10/00	36.7 24/78	263.3
March	80.8	58.9	69.9	108.0 12/61	44.8 –/57	63.2	174.0 17/83	33.8 27/80	237.3
April	73.1	54.5	63.8	98.0 10/66	39.6 15/59	58.4	155.0 1/83	30.2 16/17	176.9
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	60.2	46.6	53.4	76.0 23/65	32.5 27/76	43.5	138.8 18/79	22.9 12/13	120.4
July	58.7	44.5	51.6	74.0 11/06	32.0 24/08	42.0	134.5 26/90	23.3 25/11	137.1
August	62.0	45.9	53.9	85.0 31/11	32.3 17/59	52.7	140.0 31/92	23.5 7/88	161.6
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	184.1
October	72.4	51.4	61.9	102.2 24/14	36.0 –/57	66.2	158.8 19/82	27.8 2/18	228.1
November	78.6	55.3	66.9	113.5 21/65	40.8 2/09	72.7	166.9 20/78	31.5 2/09	262.7
December	83.4	58.9	71.2	114.2 14/76	43.0 †	71.2	175.7 7/99	32.5 4/84	303.2
Year Averages	72.8	53.1	63.0	—	—	—	—	—	2,532.3‡
Year 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. ‡ Total for year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity. Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall. Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Dew. Mean Amount of Dew.	Mean No. days Dew.
No. of yrs. over which observation extends	51	51	51	80	80	80	80	80	—	47
January	38	59	30	0.72	4	4.00 1850	nil *	2.30 2/89	—	4
February	41	56	33	0.63	4	2.67 1858	nil †	2.24 14/13	—	5
March	47	58	36	1.06	6	4.60 1878	nil ‡	3.50 5/78	—	11
April	57	72	44	1.83	9	6.78 1853	0.06 1910	3.15 5/60	—	14
May	68	76	49	2.72	14	7.75 1875	0.20 1891	2.75 1/53	—	16
June	77	84	69	3.10	16	8.58 1916	0.42 1886	1.97 26/16	—	16
July	75	87	69	2.65	16	5.38 1865	0.36 1899	1.75 10/65	—	17
August	69	77	54	2.50	16	6.24 1852	0.35 1914	2.23 19/51	—	16
September	61	72	44	1.96	14	4.64 1810	0.45 1896	1.42 25/93	—	16
October	51	67	29	1.73	11	3.83 1870	0.17 1914	2.24 16/08	—	12
November	43	57	37	1.16	8	3.55 1851	0.04 1885	1.88 28/58	—	7
December	39	50	33	0.95	6	3.98 1861	nil 1904	2.42 23/13	—	5
Year Totals	—	—	—	21.01	124	—	—	—	—	139
Year Averages	53	—	—	—	—	—	—	—	—	—
Year Extremes	—	87	29	—	—	8.58 6/16	nil §	3.50 5/3/78	—	—

* 1848, 1849, 1878, and 1906. † 1848, 1860, &c. ‡ 1859, &c.
§ January, February, March, and December, various years.

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.		Wind. Mean Hourly Pressure. (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction.	Mean Amount of Evaporation.	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	32	8		8	8	8	10	32	32	10
January	29.869	315	24/14	0.08	3,814	S.Easterly	63.55	5.3	6.1	2.9
February	29.891	340	10/15	0.13	4,461	E. & S.E.	50.01	5.0	6.2	1.9
March	29.949	305	29/16	0.08	3,934	S.E. & S.	44.95	4.0	5.9	4.0
April	30.041	215	8/16	0.07	3,476	S W—E	36.06	3.2	5.0	8.6
May	30.088	200	6/18	0.07	3,516	S W—S	28.04	2.8	4.8	8.3
June	30.058	307	23/16	0.07	3,428	S W & W	20.83	2.1	4.4	8.5
July	30.066	279	19/17	0.06	3,481	S & W	22.59	2.3	3.9	11.7
August	30.088	250	22/17	0.08	3,790	S W	27.09	3.5	4.0	10.5
September	30.028	239	25/17	0.07	3,580	S.Easterly	36.16	5.8	3.9	11.6
October	30.002	325	25/18	0.09	4,016	Easterly*	50.13	7.0	4.5	7.4
November	29.948	265	27/14	0.11	4,288	N E—S E	57.98	8.2	5.1	5.9
December	29.883	295	21/13	0.11	4,509	N E—N	63.66	8.3	5.7	2.9
Year Totals	—		—	—	—	Between	501.05	57.5	—	84.2
Year Averages	29.993		—	0.09	3,858	S E & S W	—	—	5.0	—
Year Extremes	—	340	10/2/15	—	—	—	—	—	—	—

* N.Easterly and many W.

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature. Mean Max.	Mean Min.	Mean.	Extreme Shade Temperature. Highest.		Lowest.		Extreme Range.	Extreme Temperature. Highest in Sun.		Lowest on Grass.		Mean Hours of Sunshine.
No. of yrs. over which observation extends	32	32	32	32		32		32	32		32		10
January	85.5	68.8	77.2	108.9	14/02	58.8	4/93	50.1	166.4	10/17	49.9	4/93	214.4
February	84.5	68.4	76.5	101.9	11/04	58.7	*	43.2	165.2	6/10	49.3	9/89	198.0
March	82.3	66.3	74.3	96.8	16/88	52.4	29/13	44.4	160:0	1/87	45.4	29/13	194.0
April	79.1	61.5	70.3	95.2	†	48.6	17/00	46.6	153.8	11/16	37.0	17/00	207.0
May	73.5	55.2	64.4	88.8	18/97	41.3	24/99	47.5	147.0	1/10	29.8	8/97	193.8
June	69.3	50.7	60.0	88.9	19/18	36.3	29/08	52.6	136.0	3/18	25.4	23/88	161.0
July	68.4	48.1	58.3	83.4	28/98	36.1	‡	47.3	146.1	20/15	23.9	11/90	188.2
August	71.3	49.8	60.6	87.5	28/07	37.4	6/87	50.1	141.9	20/17	27.1	9/99	215.2
September	75.9	54.7	65.3	95.2	16/12	40.7	1/96	54.5	155.5	26/03	30.4	1/89	228.7
October	79.9	59.9	69.9	101.4	18/93	43.3	3/99	58.1	157.4	31/18	34.9	8/89	244.3
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	233.9
December	85.3	67.4	76.4	105.9	26/93	56.4	13/12	49.5	160.4	7/14	49.1	3/94	238.9
Year Averages	78.2	59.6	68.9	—		—		—	—		—		2517.4§
Year Extremes	—	—	—	108.9	14/1/02	36.1	‡	72.8	166.4	10/1/17	23.9	11/7/90	—

* 10/11/04. † 9/96 and 5/03. ‡ 12/94 and 2/96. § Annual mean.

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity. Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall. Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.		Least Monthly.		Greatest in One Day.		Dew. Mean Amount of Dew.	Mean No. Days Dew.
No. of yrs. over which observation extends	32	32	32	67	59	67		67		—		—	32
January	67	79	53	6.51	14	27.72	1895	0.61	1882	18.31	21/87	—	4.2
February	69	82	55	6.57	14	40.39	1893	0.77	1904	8.36	16/93	—	4.5
March	73	85	56	5.92	16	34.04	1870	0.11	1915	11.18	14/08	—	7.4
April	74	79	60	3.62	12	15.28	1867	0.4	1897	4.47	13/16	—	10.7
May	74	85	64	2.90	10	13.85	1876	nil	1846	5.62	9/79	—	11.4
June	74	82	67	2.59	8	14.03	1873	nil	1847	6.01	9/93	—	9.1
July	74	81	61	2.25	8	8.46	1889	nil	1841	3.54	†	—	10.5
August	71	80	61	2.23	8	14.67	1879	nil	*	4.89	12/87	—	8.2
September	64	76	47	2.09	8	5.43	1886	0.10	1907	2.46	2/94	—	8.1
October	61	72	49	2.67	9	9.99	1882	0.14	1900	1.95	20/89	—	6.1
November	60	72	46	3.71	10	12.40	1917	nil.	1842	4.46	16/86	—	3.1
December	63	67	52	4.96	12	13.99	1910	0.35	1865	6.60	28/71	—	2.5
Year Totals	—	—	—	46.02	129	—		—		—		—	85.8
Year Averages	69	—	—	—	—	—		—		—		—	—
Year Extremes	—	85	46	—	—	40.39	2/1893	nil	See above	18.31	21/1/87	—	—

* 1862, 18/69, 18/80. † 15/76, 16/89.

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.	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	59	52	52	52	52	39	59	57	55
January	29.901	721 1/71	0.36	8,187	N E	5.192	4.7	5.8	1.9
February	29.943	871 12/69	0.33	7,034	N E	4.025	4.3	6.1	1.3
March	30.011	943 20/70	0.25	6,802	N E	3.454	4.2	5.6	1.9
April	30.072	803 6/82	0.22	6,194	N E	2.457	4.0	5.0	2.6
May	30.081	758 6/98	0.22	6,394	W	1.688	3.4	4.8	3.2
June	30.059	712 7/00	0.28	7,011	W	1.369	2.2	4.8	3.5
July	30.077	930 17/79	0.28	7,163	W	1.472	2.5	4.4	4.3
August	30.069	756 22/72	0.26	6,903	W	1.790	3.3	4.1	4.4
September	30.005	964 6/74	0.30	7,168	W	2.604	4.1	4.3	4.1
October	29.970	926 4/72	0.33	7,786	N E	3.734	4.9	5.0	2.4
November	29.937	720 13/68	0.34	7,642	N E	4.491	5.5	5.6	1.6
December	29.883	938 3/84	0.36	8,071	N E	5.315	5.7	5.6	1.9
Year Totals	—	—	—	—	—	37.591	48.8	—	33.1
Year Averages	30.001	—	0.29	7,196	N E	—	—	5.1	—
Year Extremes	—	964 6/9/74	—	—	—	—	—	—	—

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature. Mean Max.	Mean Min.	Mean	Extreme Shade Temperature. Highest.	Lowest.	Extreme Range.	Extreme Temperature. Highest in Sun.	Lowest on Grass.	Mean Hours of Sunshine.
No. of yrs. over which observation extends	60	60	60	60	60	60	60	60	8
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	199.3
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	170.5
March	75.5	63.0	69.3	102.6 3/69	48.8 14/86	53.8	150.3 4/89	39.9 17/13	184.6
April	71.0	58.1	64.6	89.0 4/09	44.6 27/64	44.4	144.1 10/77	33.3 24/09	141.1
May	65.1	52.0	58.6	83.5 1/59	40.2 22/59	43.3	129.7 1/96	29.3 25/17	122.8
June	60.6	48.2	54.4	74.7 24/72	38.1 29/62	36.6	123.0 14/78	28.1 24/11	98.3
July	59.0	45.8	52.5	74.9 17/71	35.9 12/90	39.0	124.7 19/77	24.0 4/93	115.7
August	62.4	47.6	54.0	82.0 31/84	36.8 3/72	45.2	149.0 30/78	26.1 4/09	163.6
September	66.6	51.4	59.1	91.1 24/07	40.8 18/64	50.3	142.2 12/78	30.1 17/05	177.2
October	71.1	55.8	63.5	99.7 19/98	43.3 2/99	56.4	151.9 *	32.7 9/05	195.7
November	74.7	59.6	67.0	102.7 21/78	45.8 1/05	56.9	158.5 28/99	36.0 6/06	183.4
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	198.4
Year Averages	69.9	56.2	63.0	—	—	—	—	—	1950.6†
Year Extremes	—	—	—	108.5 13/1/96	35.9 12/7/90	72.6	171.5 4/12/88	24.0 4/7/93	

* 30 and 31/14. † Total for year.

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity. Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall. Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Dew. Mean Amount of Dew.	Mean No. Days Dew.
No. of yrs. over which observation extends	60	60	60	60	60	60	60	60	59	59
January	69	78	58	3.60	14.0	15.26 1911	0.42 1888	7.08 13/11	0.002	1.2
February	72	81	59	4.54	14.2	18.56 1873	0.34 1902	8.90 25/73	0.004	2.0
March	74	85	63	5.11	15.0	18.70 1870	0.42 1876	6.52 9/13	0.008	3.3
April	77	87	63	5.47	13.4	21.49 1861	0.06 1868	7.52 29/60	0.016	5.5
May	76	90	66	4.91	15.0	20.87 1889	0.18 1860	8.36 28/89	0.022	6.3
June	78	89	68	5.05	12.7	16.30 1885	0.19 1902	5.17 16/84	0.018	5.3
July	77	88	65	4.87	12.5	13.21 1900	0.12 1862	5.72 28/08	0.016	5.3
August	73	84	56	3.13	11.4	14.89 1899	0.04 1885	5.33 2/60	0.014	4.9
September	69	79	49	2.91	12.0	14.05 1879	0.08 1882	5.69 10/79	0.008	3.4
October	67	77	47	2.94	12.7	11.14 1916	0.21 1867	6.37 13/02	0.007	3.1
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	2.61	12.8	8.47 1910	0.23 1913	4.75 13/10	0.003	1.5
Year Totals	—	—	—	48.02	158.2	—	—	—	0.122	43.9
Year Averages	72	—	—	—	—	—	—	—	—	—
Year 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. Min. Sea level and Standard Gravity from 9 a.m. & 9 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.	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	61	48	48	48	48	46	11	61	11
January	29.913	583 10/97	0.29	7,301	S W, S E	6.39	2.0	5.1	7.9
February	29.961	566 8/68	0.27	6,347	S W, S E	5.03	2.3	5.1	6.8
March	30.032	677 9/81	0.22	6,313	S W, S E	3.93	2.0	5.5	5.2
April	30.101	597 7/68	0.19	5,697	S W, N W	2.35	0.8	5.9	4.2
May	30.103	693 12/65	0.19	5,894	N W, N E	1.47	0.5	6.5	2.7
June	30.076	761 13/76	0.24	6,387	N W, N E	1.10	1.0	6.7	1.8
July	30.095	755 8/74	0.22	6,350	N W, N E	1.05	0.9	6.3	3.0
August	30.065	637 14/75	0.25	6,813	N W, N E	1.47	0.9	6.3	2.3
September	29.998	617 11/72	0.28	6,993	N W, S W	2.29	1.9	6.1	3.4
October	29.967	899 5/66	0.29	7,277	S W, N W	3.32	2.3	5.9	4.5
November	29.948	734 13/66	0.28	7,000	S W, S E	4.52	2.4	5.9	3.5
December	29.897	655 1/75	0.30	7,439	S W, S E	5.76	2.0	5.5	4.5
Year Totals	—	—	—	—	—	38.68	19.0	—	49.8
Year Averages	30.013	—	0.25	6,651	S W, N W	—	—	5.9	—
Year Extremes	—	899 5/10/66	—	—	—	—	—	—	—

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature. Mean Max.	Mean Min.	Mean.	Extreme Shade Temperature. Highest.	Lowest.	Extreme Range.	Extreme Temperature. Highest in Sun.	Lowest on Grass.	Mean Hours of Sunshine.
No. of yrs. over which observation extends	63	63	63	63	63	63	59	59	37
January	78.2	56.8	67.5	111.2 14/62	42.0 28/85	69.2	178.5 14/62	30.2 28/85	246.1
February	77.8	56.9	67.4	109.5 7/01	40.3 9/65	69.2	167.5 15/70	30.9 6/91	207.7
March	74.4	54.7	64.5	105.5 2/93	37.1 17/84	68.4	164.5 1/68	28.9 *	173.1
April	68.3	50.7	59.5	94.0 6/65	31.8 24/88	59.2	152.0 8/61	25.0 23/97	135.5
May	61.4	46.7	54.1	83.7 7/05	29.9 29/16	53.8	142.6 2/59	21.1 26/16	107.5
June	56.8	44.0	50.4	72.2 1/07	28.0 11/66	44.2	129.0 11/61	20.4 17/95	83.6
July	55.5	41.6	48.6	68.4 24/78	27.0 21/69	41.4	125.8 27/80	20.5 12/03	99.1
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	123.5
September	62.5	45.6	54.0	82.3 30/07	31.1 16/08	51.2	142.1 20/67	22.8 3/18	145.1
October	67.0	48.1	57.6	98.4 21/14	32.1 3/71	66.3	154.3 28/68	24.8 22/18	176.6
November	71.4	51.1	61.2	105.7 27/94	36.5 2/96	69.2	159.6 29/65	24.6 2/96	208.3
December	75.3	54.1	64.7	110.7 15/76	40.0 4/70	70.7	170.3 20/69	33.2 1/04	232.9
Year Averages	67.3	49.5	58.4	—	—	—	—	—	1939.0†
Year Extremes	—	—	—	111.2 14/1/62	27.0 21/7/69	84.2	178.5 14/1/62	20.4 17/6/95	—

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

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity. Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall. Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Dew. Mean Amount of Dew.	Mean No. Days Dew.
No. of yrs. over which observation extends	11	11	11	63	63	63	63	60	—	11
January	58	65	50	1.86	7	5.68 1904	0.04 1878	2.97 9/97	—	2.3
February	61	69	53	1.69	7	6.24 1904	0.03 1870	2.14 7/04	—	3.3
March	64	71	57	2.20	9	7.50 1911	0.18 1859	3.05 15/78	—	7.8
April	71	78	66	2.27	11	6.71 1901	0.33 1908	2.28 22/01	—	8.7
May	77	81	73	2.19	13	4.31 1862	0.45 1901	1.85 7/91	—	7.6
June	83	87	77	2.10	14	4.51 1859	0.73 1877	1.74 21/04	—	9.3
July	83	86	78	1.82	14	7.02 1891	0.57 1902	2.71 12/91	—	11.6
August	76	82	71	1.83	14	3.59 1909	0.48 1903	1.87 17/81	—	8.4
September	69	73	62	2.44	14	7.93 1916	0.52 1907	2.62 12/80	—	6.9
October	62	65	56	2.61	13	7.61 1869	0.29 1914	3.00 17/69	—	7.3
November	59	69	52	2.24	10	6.71 1916	0.25 1895	2.57 16/76	—	2.1
December	57	69	51	2.31	9	7.18 1863	0.11 1904	2.62 28/07	—	1.6
Year Totals	—	—	—	25.56	135	—	—	—	—	76.9
Year Averages	68	—	—	—	—	—	—	—	—	—
Year Extremes	—	87	50	—	—	7.93 9/16	0.03 2/70	3.05 15/3/78	—	—

* 17/1884, 20/1897.

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. Greatest Number of Miles in one day.	Wind. Mean Hourly Pressure. (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction.	Mean Amount of Evaporation.	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	8	8	8	14	8	11	56	12
January	29.830	500 30/16	0.19	5,912	N W & S E	5.56	0.7	5.9	3.3
February	29.919	393 19/13	0.12	4,372	S E & N	3.96	1.4	5.9	2.7
March	29.941	406 8/15	0.11	4,533	N & S E	3.05	1.4	5.9	1.8
April	29.953	432 7/17	0.13	4,738	N W & S E	2.01	0.8	6.0	1.8
May	29.983	411 3/16	0.12	4,740	N & N W	1.34	0.6	6.0	1.8
June	29.949	415 17/12	0.11	4,413	N & N W	0.77	0.7	6.0	1.8
July	29.930	396 17/11	0.11	4,569	N & N W	0.87	0.5	5.7	2.7
August	29.928	459 30/11	0.13	4,906	N & N W	1.22	0.8	5.9	2.4
September	29.843	516 26/15	0.19	5,690	N & N W	1.99	0.8	6.1	1.9
October	29.838	461 8/12	0.18	5,813	N W & S E	3.20	1.0	6.3	1.6
November	29.796	508 18/15	0.19	5,724	N W & S E	3.90	1.0	6.3	1.8
December	29.808	375 21/16	0.18	5,701	N W & S E	4.64	1.5	6.2	1.1
Year Totals	—	—	—	61,111	—	32.51	11.2	—	24.7
Year Averages	29.893	—	0.15	—	N	—	—	6.0	—
Year Extremes	—	516 26/9/15	—	—	—	—	—	—	—

TEMPERATURE AND SUNSHINE.

Month.	Mean Temperature. Mean Max.	Mean Min.	Mean.	Extreme Shade Temperature. Highest.	Lowest.	Extreme Range.	Extreme Temperature. Highest in Sun.	Lowest on Grass.	Mean Hours of Sunshine.
No. of yrs. over which observation extends	48	48	48	72	72	72	31	51	24
January	71.5	53.0	62.2	105.0 1/00	40.3 *	64.7	160.0 †	30.6 19/97	209.4
February	71.5	53.2	62.4	104.4 12/99	39.0 20/87	65.4	165.0 24/98	28.3 –/87	178.0
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	167.7
April	62.6	47.6	55.1	90.0 2/56	30.0 25/56	60.0	142.0 18/93	25.0 –/86	134.9
May	57.3	43.6	50.4	77.5 1/41	29.2 20/02	48.3	128.0 ‡	20.0 19/02	127.3
June	52.7	40.9	46.8	75.0 7/74	28.0 22/79	47.0	122.0 12/94	21.0 6/87	99.4
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	122.0
August	54.9	41.0	48.0	77.0 3/76	30.0 10/73	47.0	129.0 –/87	20.1 7/09	140.0
September	58.6	43.0	50.8	80.0 9/72	30.0 12/41	50.0	138.0 23/93	22.7 –/86	139.1
October	62.7	45.3	54.0	92.0 24/14	32.0 12/89	60.0	156.0 9/93	23.8 §	163.2
November	66.1	48.2	57.2	98.0 20/88	35.2 5/13	62.8	154.0 19/92	26.0 1/08	191.4
December	69.5	51.2	60.4	105.2 30/97	38.0 13/06	67.2	157.0 30/18	27.2 –/86	189.0
Year Averages	62.3	46.4	54.3	—	—	—	—	—	1,861.4‖
Year 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.	Humidity. Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall. Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Dew. Mean Amount of Dew.	Mean No. days Dew.
No. of yrs. over which observation extends	38	38	38	76	75	76	76	52	—	9
January	64	75	51	1.79	9	5.91 1893	0.03 1841	2.96 30/16	—	1.2
February	65	76	51	1.45	8	9.15 1854	0.07 1847	4.50* 25/54	—	2.3
March	70	76	59	1.64	10	7.60 1854	0.02 1843	2.06 14/11	—	4.8
April	74	85	60	1.90	11	6.50 1909	0.07 1904	5.02 20/09	—	10.2
May	79	90	68	1.88	13	6.37 1905	0.10 1843	3.22 14/58	—	12.1
June	83	94	73	2.19	14	8.15 1889	0.22 1852	4.11 14/89	—	7.2
July	81	97	74	2.13	14	5.98 1849	0.30 1850	2.00 27/78	—	8.3
August	78	92	64	1.85	13	10.16 1858	0.23 1854	4.35 12/58	—	7.1
September	72	87	60	2.15	14	7.14 1844	0.39 1847	3.50 29/44	—	3.8
October	67	75	51	2.25	15	6.67 1906	0.26 1850	2.58 4/06	—	3.3
November	64	74	50	2.55	14	8.92 1849	0.16 1868	3.97 6/49	—	1.7
December	62	73	51	1.97	11	9.00 1875	0.11 1842	2.48 13/16	—	1.2
Year Totals	—	—	—	23.75	146	—	—	—	—	63.2
Year Averages	72	—	—	—	—	—	—	—	—	—
Year Extremes	—	97	50	—	—	10.16 8/1858	0.02 3/1843	5.02 20/4/09	—	—

* 4.18, 26/54 also.

§ 7. The Climatic Factors Influencing Settlement in Australia.

A specially contributed article dealing with this subject appears in Official Year Book No. 11, pp. 84 to 101.

§ 8. The Plains and Peneplains of Australia.[1]

1. Definition of Terms.—In order to obtain a clearer idea of the geographical features here dealt with, it is necessary in the first place to consider the generally accepted definitions of plain and peneplain, and to compare them with the Australian conception of those terms. For the different continents have different characteristics, and definitions applicable, say, to European conditions will not fit exactly in the case of Australia.

A "plain" has been defined as an extensive stretch of land with a few inequalities of surface only, and a "peneplain" as an area which has been worn by streams and wind action almost to the level of the ocean, sea, or lake into which the streams of the area discharge. Hence a peneplain may be a high plateau, or it may be a surface near sea level, but it is almost a "plain."

In Australia, connotation of the term "plain" is somewhat elastic. It may have reference to an area of great size, level almost to the point of monotony, and covered in many places with growths of timber so dense as to cause travellers to mistake their way. Here and there open spaces of variable size and covered with grass, or herbs, stand out in striking contrast to the areas of dense timber surrounding them. The great North-western Plains of New South Wales, for example, extend from the foothills of New England to the Darling or Barwon River, with practically negligible irregularities in their topography. For many miles the traveller may pass through dense and high growths of belah (*Casuarina Cambagei*) or brigalow (*Acacia harpophylla*). Here and there open grass or herb lands occur, varying from 100 yards to 10 or 20 miles in diameter. These open spaces are known also as "plains." Fine examples are the Old Man, Tycannah, and Edgeroi Plains.

The great "Riverina," and the North-western district of Victoria furnish other fine examples, as also the country west of the plateaus in southern and central Queensland.

In the plateau country of Eastern Australia a rolling surface, either treeless, or with comparatively few trees, is known as a plain. Good examples are the Darling Downs, the plains of New England, the Bathurst, Goulburn, Yass, Monaro, and Omeo Plains. Small open spaces in areas of heavy forest or jungle are also called plains, such as the Paddy's and Little Plain in the Dorrigo jungle, The Little Manning Plain, and so on. Basaltic and slate areas in the high plateaus sparsely covered with trees, and clothed with dense coarse grass growths, are also known as plains, such as Kelly's Plains, in New England (Tantangra, Twelve Mile and others), The Flour Bag, Cobungra, Dargo, and the Bogong High Plains in Victoria.

These plains, so called, are plateaus, and the Bathurst, Goulburn, and allied types, have the appearance of wide valley floors with undulating surfaces, hemmed in on two sides, at least, by plateau remnants, and such upland "plains" or plateaus pass into areas of forest without losing their main topographic features. If followed far enough downstream they merge either into the inland plains of denudation or accumulation or they terminate in wild ravines, separated by ridges rising, generally, to similar heights.

1. Contributed by E. C. Andrews, B.A., F.G.S., Geological Surveyor, Mines Department, Sydney.

To the Riverina, the North-western Plains of Victoria and New South Wales, and similar areas elsewhere in Australia, it is proposed to apply the term "plain." To the mountain or foothill type it is proposed to apply the term "peneplain" or "upland plain."

In this article, therefore, a plain is taken to be an extensive area, approximately level, not raised much above sea-level, forming open land in places, but covered with forest or "scrub" over large areas.

A "peneplain" is defined as an extensive area of plateau or low land with undulating surface, bounded by plateaus or plateau remnants, the latter rarely rising as much as 2,000 feet above the "peneplain" at its base.

The peneplains of Australia have no exact counterpart in any other country.

2. **Geographical Distribution of Plains and Peneplains in Australia.**—Broadly considered, Australia may be said to have a plateau periphery, varying both in width and height, but broken at the place where the drainage of the Murray basin passes to the sea.

This plateau periphery is widest in Western Australia and narrowest round the East Australian coast from Thursday Island to the neighbourhood of Stawell in Victoria. Its greatest heights are to be found along the relatively narrow eastern and south-eastern portions, while the great plateau of Western Australia has only a low average height. The explanation of this feature is suggested later.

Australia, however, may be regarded in another way, namely, as consisting of three portions—Eastern Australia with a peripheral ring of high and relatively narrow plateaus; Western Australia consisting mainly of a low broad plateau; and a third portion relatively low in height, separating Eastern from Western Australia. This central zone is bordered on the north by plateaus or rising ground from which the Diamantina and associated streams in part take their rise.

North and East of Australia lies a zone of sea or sunken land subparallel to the trend of the associated coast of Australia. Thus the Tasman, Coral, and Javan, seas, on the side distant from Australia are bordered by belts of narrow and very high plateaus, now in part dissected by streams. Good examples of these plateaus are the Alps of New Zealand, the snow-clad ranges of northern New Guinea, and the Javan plateaus.

A fivefold arrangement of plateau and sunken area may therefore be made.

1. A low broad plateau forming the south-western and western portion of the Australian continent.
2. A sunken centre, drained by the Diamantina and Murray river systems.
3. A narrow ring of high plateau, discontinuous in places, from Thursday Island through New England, Monaro, and the Victorian Alps, to the Grampians.
4. A deep sunken area occupied by the Tasman, Coral, Arafura, and other seas and islands.
5. A series of rings of *very high* plateaus associated with active volcanoes, from New Zealand to Java.

This fivefold division may be reduced by future observers to threefold, the sunken area of Australia being taken as one feature and the peripheral plateaus as one feature also.

It may here be noted that the easterly rings of plateaus have suffered much from denudation, and the waste so derived has been deposited partly in the central area of drainage and the peneplains or plateaus. Traced backward the gorges may be seen to head in the plateaus separated therefrom by high waterfalls or successions of cascades, while the narrow ridges bounding the ravines merge on both sides into the massive plateau itself.

Inland again lie the great plateau remnants, such as those traversed by the railway at Mt. Lofty, Petersburg, Ballarat, The Kilmore Gap, Monaro, Hilltop to Yass, the Blue Mountains to Orange, New England, the Darling Downs and Barron Falls to Mareeba.

The High Plains of Victoria, the Kosciusko Plateau, Kiandra, and Guy Fawkes, are magnificent examples also of the plateaus or peneplains in Eastern Australia.

The plateau surface, so far from being level, consists of a series of very broad valleys surrounded by other plateau masses. These valley surfaces are undulating and occur at heights above sea-level varying from 100 to 6,500 or 7,000 feet. They appear to have been excavated within a former plateau of variable but low altitude. Instead of forming a vast unbroken surface like the Riverina they are composed of many independent but branching valley systems, the valleys being of great width and separated by low divides varying in height. The whole area has the appearance of a series of plains in the initial stage which have been near sea-level and which have been pushed gently upward so as to maintain their continuity with the old inland surface.

The inland drainage has cut deeply into this plateau surface also.

The larger portion of the inland area of both Eastern and South Australia is a low peneplain rarely exceeding 500 feet in height above sea-level, but it has the appearance of a plain more than the raised peneplain of Eastern Australia. The explanation is supplied in 4 *infra*.

In this description much of the central peneplain is included with the Inland Plain of denudation. Fine examples of these peneplains occur within, and in the neighbourhood of, the Great Australian Artesian Basin, the Nullarbor Plains, the South-east of South Australia, the North-west of Victoria and the district to the South and South-east of Darwin.

These lowland peneplains of the inland areas may be covered with pebbles, either of residual or later concretionary origin, long parallel ridges of sand 200 to 1,000 yards apart and 10–50 feet high, or with clay pans, blown dust, or alluvium.

Within the great peneplain areas of the central and southern portions of Australia which have not been raised much above sea-level, the Diamantina, Murray, and Darling River systems have formed enormous plains of accumulation, in places monotonously level. They are frequently composed of deep rich black, reddish, or grey soil, as, for example, along the great Diamantina, Murray, and Darling streams.

Plateaus or faulted and warped peneplains raise their heads abruptly from some of the central plains. Examples of these are the Barrier Ranges of Broken Hill (mentioned by Benson) and the Mt. Lofty and other ranges in South Australia.

Splendid examples of plains of accumulation are the Riverina, the Black and Red Soil Plains along the great rivers, the North-western plains of New South Wales, the plains of central and southern Queensland, the plains (Mundi Mundi, Willangee and so on) stretching north-westerly from Broken Hill into South Australia, the Adelaide Plains, the Spencer's Gulf Plains, the Willochra Plains and the plains southerly and easterly from Darwin.

Sandy and calcareous plains occur also in the more southern and eastern portions of South Australia, while the Adelaide Plains and the Port Pirie Plains are good examples of the coastal plains type.

In the central area it may be stated broadly that the plains coincide more or less with the area occupied by the artesian and sub-artesian basins, such as the Great Artesian Basin, the Murray River Basin, the Nullarbor Plains, the Adelaide Plains, and the plains bordering Spencer's Gulf.

The large sub-continent of Western Australia consists mainly of a low plateau, especially in the central and south-western portions, bordered with coastal plains. The Nullarbor Plains extend also from South Australia into Western Australia.

3. **Principal Plains and Peneplains of Australia.**—A list of some of the well-known plains and peneplains in Australia is given hereunder :—

A. *Peneplains.*

1. The Eastralian Peneplain (figures supplied herewith are approximate average heights above sea-level)—
   - (*a*) The Bellenden Ker or Stannary Peneplain (1,500–2,800 feet).
   - (*b*) The Charters Towers Peneplain (1,000–1,200 feet).
   - (*c*) The Mount Morgan Peneplain (1,000–1,400 feet).
   - (*d*) The Darling Downs (1,000–2 000 feet).
   - (*e*) *New England* (including Tenterfield (2,800–3,000 feet), Ben Lomond (4,300–4,500 feet) or Guyra, Glen Innes (3,500–3,700 feet), Guy Fawkes (4,200–4,600 feet), Armidale (3,200–3,500 feet), Walcha (3,500–3,700 feet), Tomalla (4,000–4,500 feet), and Barrington (4,000–4,500 feet) peneplains.
   - (*f*) *Central Tableland,* including Blue Mountains (600–4,000 feet), Sunny Corner (3,500–4,000 feet), Hill End (3,000–3,300 feet), Bathurst (2,100–2,700 feet), Orange (2,800–3,200 feet), Goulburn (2,100–2,500 feet), Yass (1,600–2,000 feet), Moss Vale (2,200–2,400 feet), Braidwood (2,200–2,400 feet), Breadalbane (2,200 feet), Crookwell (3,000 feet), and Tomago (2,200 feet) peneplains.
   - (*g*) *Monaro,* including Cooma (2,700–2,800 feet), Kiandra (4,500–5,000 feet), Kosciusko (5,000–6,500 feet), Bombala (2,500 feet), Nimitabel (3,500–3,700 feet), and other peneplains.
   - (*h*) *Victorian High Plains,* including Omeo (2,100–2,400 feet), Dargo (4,500–5,000 feet), Cobungra (5,000–5,500 feet), Bogong (6,000 feet), Ballarat (1,500–1,800 feet), and other peneplains.
2. Barrier Ranges of Broken Hill (1,000–1,400 feet).
3. *Great Lowland Peneplain* of the more central portion of Australia (250–1,000 feet).
4. *South Australian Highlands,* of which the Mt. Lofty (1,000–1,500 feet) and Petersburg peneplains (1,000–2,000 feet) are types.
5. *Northern Territory Tablelands.* Barkly Tableland may be taken as a type. A lower peneplain appears to be associated with these low tablelands.
6. *Westralian Peneplain.* The Darling, Kalgoorlie, and other peneplains, mentioned by Jutson, may be taken as types. Most of these peneplains have co-extensive surfaces. According to Jutson they vary mainly between 1,000 to 2,000 feet above sea-level with an average of 1,250 to 1,500 feet.

B. *Plains.*

1. *Coastal Plains* less than 200 feet above sea-level from Thursday Island to Camperdown in Victoria. These are small and scarcely deserve specific rank. Most of them, as the Hunter Plain between Newcastle and Maitland, are areas which have been recently submerged, then silted to, or near to, sea-level, and which now lie a few feet above sea-level by reason of recent land emergence.

   The Emu Plain is a small type of the plain of accumulation along the Nepean River near Penrith which has been deposited by the Nepean River, under the shelter of the monoclinal fault of the Blue Mountains.

   The coastal plains of Western Australia and of South Australia, such as The Swan, Spencer's Gulf, and Adelaide plains are types of plains of accumulation lying at the feet of fault, or warp, scarps of late geological age.

   The large coastal plains of Northen Australia appear to be similar to to those of Eastern Australia, only on a much greater scale.

2. *Interior Plains* (less than 800 feet above sea-level)—

(*a*) Great Central and Southern Queensland plains. These are partly plains of accumulation and partly peneplains.

(*b*) Plains of the Bulloo, Cooper and Diamantina.

(*c*) Great North-western plains of New South Wales. These also in the north-eastern portion merge into peneplains.

(*d*) Great Central plains of New South Wales (300–800 feet).

(*e*) Riverina (less than 600 feet above sea-level).

(*f*) Darling River plains (less than 400 feet above sea-level).

(*g*) Murray Basin plains in south-eastern corner of South Australia. This is in great measure a peneplain formed from an old plain of accumulation.

(*h*) Broken Hill plains, including Mundi Mundi, Willangee, and other plains.

(*i*) Nullarbor plains (these might be classed as a lowland peneplain or plain of denudation).

4. **Origin of Plains and Peneplains.**—For a long period of time Australia has been isolated from the other great land blocks of the world, and there are strong indications that this isolation was effected about the time when the chalk of England was deposited. The great ocean basins then became overfull and spilled over the lower portions of the continents, thus forming enormous continental seas. The sea which crept into Australia occupied much of the area now known as Queensland and New South Wales, as well as portions of South Australia and the Northern Territory. There is reason to believe, also, that this great sea extended from the Malay Archipelago to the Southern Ocean, thus cutting Australia into an eastern and a western portion.

Both before, and during, the period of encroachment of the land by the ocean, the continents were being worn down slowly towards sea-level by the weather and by streams. In this way the Eastern and Western Australian land surfaces were converted into peneplains raised but very little above sea-level. A similar condition of affairs obtained in New Zealand, New Guinea, and other lands to the north of Australia.

This period of sea extension and of peneplanation was closed by a period of mountain-making along the zones indicated by the rings of islands surrounding Australia to the north and east. The effect produced was as if a gigantic force had been directed against Australia from the south-east, the east and the north, but a force which had met a buffer of great strength interposed between it and its objective. High plateaus and fold mountains were formed in rings around the buffer. The force appeared to travel in wave fashion, and Hedley suggests that the Tasman and Coral seas mark a trough of the movement. The next crest of the movement is indicated by the eastern periphery of Australia. This, however, was a much-diminished crest. Central Australia marks the next trough, while the Westralian Plateau marks some movement still weaker, but wider and more general.

The plateaus and ranges under consideration did not grow at once to their present heights. The earlier types were low in altitude, and long periods of still-stand of the land and subpeneplanation occurred between the periods of *revival* of uplift. In this way the present peneplains were formed.

Finally came a great period of mountain making, or rather, a revival of the old mountain making on a gigantic scale. The great Alps of New Zealand and New Guinea were formed, and the younger Eastralian peneplain was raised in sympathy, but variably, so as to form the present Blue Mountains and all the Eastern Highlands. The Westralian peneplains of much less altitude were also hoisted at this time to form the present plateau.

During the same period the central area of Australia had been sinking. Far below sea-level, the old land surface sank unequally, forming the famous Artesian basins of Australia. As the land sank the old basins were filled gradually by the outwash from the

surrounding plateaus. In this way were laid the foundations of the great central plains of the present time. In the north, however, these old plains had been raised well above sea-level at least once.

After the time of the great elevation, now known as the Kosciusko Period, the streams ran much more swiftly than heretofore because of the steepening of their channel slopes, and the great river systems had therefore gnawed their way backward quickly into the high peneplains or plateaus. Deep and even profound ravines were formed in this way. A visit to the Buffalo, Bogong, or Blue Mountains, or to the ravines of New England would impress the geographer with the power of streams to cut the plateaus to pieces. Similar fine examples of erosive action may be noted between Omeo and the summit of the Bogong Mountain, at Kosciusko, on the Blue Mountains, or at Guy Fawkes and the Macleay gorges, and on the plateaus around Cairns. The material which once filled these wonderful gorges and ravines has been deposited in part by the streams in the interior, thus forming the great plains of the Artesian, Murray, Darling, and other areas.

While the plains of accumulation extend in the central region, the grand peneplains, once with co-extensive surface from south to north of eastern Australia, are in places dissected beyond recognition. Thus the plains are built up from the destruction of the raised peneplains. The death of the one is the life of the other. To decipher the story of the peneplains one must go into the central plateaus, for the intermediate areas tell very little.

5. **Some Characteristics of the Plains and Peneplains.**—(*a*) *Soils.* (i) *Plains.* The deep soil of the plains of accumulation is black in those places where it is periodically flooded, and reddish or greyish where it is not subject to periodical and sustained flooding. Hence the deep alluvium of the river banks near the eastern plateaus is black, but the Riverina and the higher alluviums of the more arid west are reddish and greyish.

The soils of the plains of erosion may be of reddish sand arranged in long crests and troughs, as in the country extending far to the north of Broken Hill; they may be reddish or greyish as in the mallee and saltbush country of south-central Australia.

The red soil may exist in areas of aridity, semiaridity, or of heavy precipitation. Long spells of hot dry weather are sufficient to develop the colour, which is due to a form of iron oxide.

Greyish concretionary masses of travertine or impure limestone occur in the southern portion of South Australia, and elsewhere. This type, however, may be mainly referred to the soils of lowland peneplains.

(ii) *Peneplains.* Immense stretches of sandy or clay soil occur within the great plains of erosion or lowland peneplains of the centre which overlie or are in the vicinity of the Great Artesian Basin. Over extensive areas these are littered with pebbles, large and small, either formed as concretions in place or scattered as remnants of older conglomerates.

The soils of the plateaus have, in the main, been derived in place, and they indicate, generally, the nature of the surrounding rocks. Thus the extensive deep black and red soils of the high plateaus arise chiefly from the decay of basalts, andesites, some slate and allied rock types; the black soils occupying the areas subject to flooding, and the red and chocolate soils forming the drained hillsides. The hungry sandy soils originate from the decomposition of the Sydney sandstones and allied types and the sandy granites and quartzites, forming the older plateaus. The cold, hungry, and acid clays owe their existence to the decomposition in place of felsites, certain porphyries, and many Palæozoic slates, while the light loams arise from the decomposition of the darker granites, and from an intermingling of soils by stream action on dark and sandy rocks associated in the same district.

(*b*) *Vegetation.* The flowering plants of Australia have caused more discussion among students of plant distribution, perhaps, than those of any other area of equal size. One hundred years ago travellers to Australia were besought to bring "home" seeds of of the plants peculiar to Australia. To the botanists of that period the strange appearance of the Australian types was referred to a special creation, but the explanation thereof is simple enough if studied in connection with the remarks in the preceding section.

When Australia became isolated, as stated above, the great families of the flowering plants of the world were all represented within the island continent. These included the myrtle, the daisy, heath, geebung, pea and bean, acacia, euphorbia, citrus, cassia, labiate, umbellate, and many other families, but once cut off from intercourse with the same types in the other continents they became modified in Australia to meet the climatic changes which were being ushered in about the time of isolation. These climatic changes were in the nature of recurrent and increasing dryness, and hence arose in Australia a dominant type of xerophytic plant, one which had to contend either with a drying atmosphere or with conditions which do not yield a generous supply of moisture to the plant.

Hence arose the eucalypts, the leafless type of acacia, the geebungs, the waratah, the needle wood, the oak, the quandong, the Christmas bush, the wild currant, the five corner, the native pear, the porcupine grass, and many others.

Strange as it may seem, it was not the deep black and red soils of the plains which the plants found most suited for their preservation. After much experiment they reached their maximum development as individuals, species, genera, and families on the hungry sandy soils of the peneplains and dissected peneplains. Splendid examples of this development are to be found around Sydney, the Blue Mountains, the lower Clarence hills, and the country from Perth to Albany.

These soils were light and porous, and were not subject to hard baking in drought time.

Herbs were not in such great abundance in those days of development as they are now, and most of the flowering plants of the period prior to the Australian isolation were handsome, luxuriant shrub and tree growths. Even the aster, the groundsel, the veronica, the bignonia, and other types were small woody shrubs or large trees.

Thus the great groups of the myrtles, the tree legumes, the rues, the proteads, the euphorbias, the labiates, the heaths, the lilies, the saxifrages, and others developed the wonderful assemblage of plants peculiar to Australia on the sandy peneplains of eastern and western Australia. In vain does one search for other than traces of these strange assemblages on the deep alluvium of the plains.

There were *some* herbaceous types in those days, and from them sprang the wonderful and peculiar terrestrial orchids, the lily-like types, the iris, amaryll, grass, reed, and rush types of the sandy plateaus and coastal plains.

The vegetation of the inland peneplains and plains differs materially from that of the well watered plateaus and coastal areas.

The tree types survived in great measure even on the subarid to arid centre, especially types such as the leafless *Acacia*, the dog or sandal wood, needle wood, quandong, oaks, and a few eucalypts, but the herbaceous and undershrub types became dominant.

Thus the family of the beets and docks (saltbush, blue bush, Kochias, Bassias, Enchylænas), that of the Myoporaceæ (teaplant of the west, the Buddtha, turpentine, kangaroo bush, sandalwood, and so on), allied to the verbenas, the herbaceous legumes (Darling pea, gilgai pea, desert pea, the *Swainsonas*), the crucifers, the composites (everlastings, sifting bushes, asters, and so on), the Zygophyllums, and certain grasses became the dominant types.

The myrtles, heaths, the proteads, the rues, and the woody pea plants, which are the glory and marvel of the sandy peneplains and coastal plains, are conspicuous by their absence on the great inland plains, save for a few hardy eucalypts along the plain watercourses and the deep sheltered valleys, a couple of oaks, a needle wood, a beef wood, and a leopard wood.

On the great north-western plains in the spring of 1903 the marsh-mallows and the variegated thistles were as much as 10 to 12 feet high in places, and the trefoil and other edible herbs made a tangle over knee deep to the limit of vision. Flowers of all shades sprang into being by hundreds of millions, making the plains like a gigantic carpet, beautiful as the finest heath-covered wolds. One week the blue flowers predominated, later it was a mosaic of yellow, red, and white. In the great plains beyond Broken Hill in 1918 the gentle slopes were covered with flower associations of indescribable beauty. White and yellow everlasting flowers in countless millions formed the general setting, while amid these shone the red tips of the spiked bassias and the quaint grey of the small saltbush types.

(c) *Animals.* Both peneplains and plains abound with animal life. As with the plants, so also the fauna of these regions is specially adapted to its environment. Even the arid plains, so called, teem with life.

§ 9. The Building Stones of Queensland.*

1. **Bibliography.**—While little has been done in regard to the utilisation of the ornamental and building stones of Queensland, large quantities of good material are readily available in many areas.

The literature on the subject is scant, and the following list comprises the more important contributions :—" The Sandstone Quarries of the Southern District," Votes and Proceedings III., Queensland Parliament 1888, pp. 1021, 1044 ; " Queensland Stones for Architectural and Monumental Purposes," by L. C. Ball, B.E., Government Mining Journal 1905, p. 457 ; " Limestones in the Central and Southern Districts," by L. C. Ball, B.E., Pub. 194, Queensland Geological Survey, 1904 ; " Building Stones of Queensland," by H. C. Richards, D.Sc., Proc. Roy. Soc. Qld., 1918, pp. 97–157 ; also a small paper by the same author on the " Building Stones of St. John's Cathedral, Brisbane," Proc. Roy. Soc. Qld., 1911.

2. **Distribution.**—(i) (*a*) *General-Granites* occur in many widespread areas throughout the State and frequently in close association with the more important centres of population. Only in Brisbane, however, have granites been used to any extent, and while the local stone from Enoggera has been largely employed, it will probably be supplanted by other granites, *e.g.*, from Greymare, unless the objections to the pyrites can be overcome.

(*b*) *Trachytes and Rhyolites* are abundant in the south-east portion of the State, and are found close to Brisbane. These rocks have not yet been used, but they will undoubtedly be drawn upon in the future. At the Glass House Mountains, the Flinders Range near Ipswich, and near Esk, excellent material occurs of good appearance, free working qualities, and in close proximity to the railway line.

(*c*) *Sandstones* of Triassic and Jurassic Age are distributed throughout large areas in Queensland, and material from many localities has been tried. The sandstones are freshwater lacustrine deposits, and considerable variation occurs in the beds. In the south-eastern portion of the State several good sandstones have been worked, but some of the best weathering material, *e.g.*, from Goodna and Murphy's Creek, has been worked out.

At the present time warm brown sandstones in large quantities are available at Helidon, and at Yan Gan, near Warwick. Both these stones give very good results in the Southern Queensland climate if kept free from moisture ; they wear cleanly and give a sharp arris.

In the central district at Stanwell, 20 miles west of Rockhampton, abundant quantities of a very serviceable light-brown easy-working sandstone occur. This stone is also one of the Mesozoic lake deposits.

In Northern Queensland a sandstone is found between Pentland and Torrens Creek to the west of Charters Towers. This stone has given good results when used for monumental purposes at Charters Towers and Townsville.

It will be seen, therefore, that in Southern, Central, and Northern Queensland good serviceable sandstones are available.

(*d*) *Marbles and Limestones.* It is within recent years only that Queensland has commenced to exploit local deposits of marble and limestone for monumental purposes. Hitherto the limestones have been used for fluxing and lime-producing purposes only.

(*e*) *Serpentine.* Queensland serpentine has not so far been used, although there are large deposits in different parts of the State. The value for ornamental work has not yet been determined, but near Kilkivan a dark-green serpentine of good quality occurs over a considerable area. At Cawarral there is a large belt running north-west from the mouth of the Fitzroy River. At Broken River, 130 miles west of Townsville, specimens taking a good polish have been obtained. At Pine Mountain, near Ipswich, and in other localities in the Brisbane Valley, deposits of serpentine have also been found.

(ii) *Tabular Statement of Distribution, &c.* Tables A, B, and C hereunder give detailed information in regard to name, locality, character, approximate quantities available, and extent of use of the igneous, sedimentary, and metamorphic building stones of Queensland.

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* Contributed by H. C. Richards, D.Sc., Professor of Geology, University of Queensland, Brisbane.

(A) IGNEOUS

Building Stone.	Locality.	Quantity.
Granite (light gray)	Enoggera, 3 miles west of Brisbane	Unlimited quantity, abounding over an area of about 12 square miles
Granite (dark gray)	Mount Crosby, 30 miles west of Brisbane, near Brisbane River	Unknown, but probably fairly extensive ..
Granite (gray) ..	Greymare, 20 miles west of Warwick and 180 miles from Brisbane	Unlimited quantity, but no proper quarries yet opened up. Only large surface boulders have been worked, these being remarkable for their freshness
Granite (pale pink)	Magnetic Island	Unknown .. ..
Granite (pink to gray)	Mackay, near the mouth of the Pioneer River	About 1 mile in diameter .. .. ..
Granite (red) ..	Townsville	About 1 mile in diameter near the town, but a much larger area to the east of Townsville
Granite (light gray)	Cooktown	Area 3 miles in diameter .. .. ..
Granite (pale red) ..	Stanthorpe	A very extensive area .. .. ..
Granite (dark gray)	Wallangarra	Abundant .. ..
Rhyolite and Trachyte (light gray)	Glass House Mountains, 40 miles north of Brisbane (several peaks)	Unlimited .. ..
Rhyolite (light yellow-brown)	Glen Rock, Esk, 70 miles from Brisbane	Abundant .. ..

* Dates in brackets as above indicate

(B) SEDIMENTARY

Building Stone.	Locality.	Quantity.
Sandstone (light brown), Triassic Age	Breakfast Creek, Brisbane ..	Quarries which have been opened up are now worked out

STONES.

Character.	Examples.
Light-coloured, fine-grained granite of pepper-and-salt appearance, composed of clear quartz, cloudy felspar, and black mica, and, in some cases, hornblende. Abundant small crystals of pyrites which, on exposure, oxidise to limonite. Average grain size, 1.5 to 2 mm.; density, 2.59. The stone shows considerable variation, and certain portions of the granitic area are comparatively free from pyrites. Free from acid and basic segregations	Base of the Executive Building, Brisbane (1901–5)*; Shaw and Sons' building, Brisbane (1904); steps of Central Technical College, Brisbane (1912–14); kerbing stones along tram lines in city of Brisbane (1916)
Dark-gray rock of medium grain, average grain size being 2 mm., composed of plagioclase, felspar, augite, and biotite. It is a very handsome stone, and works well	Three courses in the base of the Executive Building, Brisbane (1901–5); base of the Royal Insurance Building, Brisbane (1906); cutwater in the Albert Bridge, Indooroopilly (1893–5)
A light-gray granite made up of quartz, felspar, and black mica. The rock exhibits a slight gneissose character. It is an even-grained rock of medium grain size, quartz and felspar crystals averaging 2 mm. in length, and the biotite flakes 1 mm. The most suitable gray granite yet used in Brisbane; works freely; density, 2.66	Base and kerbing of the Technical College, Warwick; base of the Government Savings Bank, Brisbane (1914)
Very light-coloured pink granite of medium grain, composed of quartz, felspar, biotite, hornblende, and magnetite; the dark minerals very much in the minority	Base course and steps of the Customs House, Townsville
Pink to gray rock of very variable composition and appearance ..	Breakwater at the mouth of the Pioneer River
Medium to coarse-grained red granite composed of clear quartz, felspar both pink and white,—the former predominates—and small patches of chlorite	Used in breakwater
Light-gray porphyritic stone	Base of Captain Cook's Monument
Pale-red granite composed of quartz, orthoclase, and biotite. Average grain size, 3–4 mm.	Limited use for monumental purposes
Dark-gray porphyritic granite; coarse-grained, with large crystals of light-pink orthoclase up to 1¼ inches long set in a ground mass of quartz, orthoclase, plagioclase, hornblende, augite, and sphene; dark minerals much more abundant	..
Light-gray fine-grained rocks, sometimes distinct bluish-gray, composed of sanidine, felspar, and augite. Many of the stones are of extremely handsome appearance, and show very pretty markings owing to the distribution of the dark minerals throughout the rocks. They are free working stones and occur in easy conditions for quarrying and handling. Density, 2.47–2.71	..
A very fine-grained rock composed of quartz and felspar; works easily and takes a sharp arris. Density, 2.43	Not used to date, except for road metal

years of erection of building.

STONES.

Character.	Examples.
Very friable coarse sandstone; average grain size, .5 mm.; felspathic cement forming more than 50 per cent. of the stone. Rather variable, and not a good weathering stone	Upper story, Commercial Banking Co. (1866); old portion of G.P.O., Brisbane (1871–4); facings of St. Stephen's Cathedral (1874); base course, Roma-street Railway Station (1875); Australian Bank of Commerce; &c.

(B) SEDIMENTARY

Building Stone.	Locality.	Quantity.
Sandstone (light brown), Triassic Age	Goodna, 15 miles west of Brisbane	The best stone which occurred in Jeay's Quarry was worked out, but will probably be picked up again in adjacent areas if required
Sandstone (dark brown), Triassic Age	Calvert, 41 miles west of Brisbane	Fairly abundant .. ..
Sandstone (gray), Triassic Age	Lockyer Creek, 76 miles west of Brisbane	Fairly abundant .. ..
Sandstone (brown, white, pink), Jurassic Age	Helidon, 72 miles west of Brisbane	Large quantities available, but rather scattered ; good quarries not usual
Sandstone (white), Triassic Age	Murphy's Creek, 82 miles from Brisbane	Has not been worked of recent years, as the best quarries have been worked out ; amount available unknown
Sandstone (white), Jurassic Age	Highfields, 90 miles from Brisbane	A large amount available .. .. ..
Sandstone (brown), Jurassic Age	Yangan, 13 miles from Warwick and 172 miles from Brisbane	Large quantities readily available .. ..
Sandstone (brown), Triassic Age	Swan Creek (Mount Sturt), 9 miles from Warwick	A moderate amount available .. ..
Sandstone (brown), Triassic Age	Warwick, 159 miles from Brisbane	A large quantity still available .. ..
Sandstone (light brown)	Stanwell, 20 miles west of Rockhampton	Abundant .. ..
Tuff (white, brown, pink, and gray)	Brisbane	Unlimited .. ..

STONES—*continued.*

Character.	Examples.
Medium-grained sandstone, with a clayey cement, average grain size being .25 mm. Colour, light brown or light pink, frequently with well-marked concentric bandings. The stone has a warm appearance, wears cleanly, and has excellent weathering properties. The stone obtained from Jeay's Quarry has weathered excellently; that obtained from Geary's Quarry and used in St. Stephen's Church, Brisbane, has weathered very poorly	Jeay's Quarry supplied the stone for the old Government House (University) (1862); Brisbane Town Hall (1864); Parliament House (1865–7)
Very friable, soft, dark-brown sandstone; fine-grained, with an average grain size of .20 mm.; particles angular to sub-angular set in clayey cement stained with limonite	In railway tunnels and culverts between Grandchester and Helidon; stone facings in Perkins' Brewery, Brisbane
Gray sandstone, of medium grain size	Used for kerbings in the Dry Dock, South Brisbane (1867–71)
There are several varieties of this sandstone, and the following have been used:—White, brown, buff, and pink. The pink stone has the best weathering properties, while the brown stone has a very warm appearance and has given excellent results. A large number of quarries have been opened up, but most of them are of a shallow nature. The stone has rather a high percentage of clayey cement, which may be stained with iron oxide or with iron and manganese oxides. It has an average grain size of .25, the grains being angular to sub-angular. Concentric iron banding is very common. The stone works freely, giving a good arris, and weathering cleanly	*Brown Stone.*—Executive Building, Brisbane (1901); Anglican Cathedral, Brisbane (1909); Government Savings Bank, Brisbane (1915) *White Stone.*—Central Railway Station (1901); second wing of Treasury Building (1890) *Pink Stone.*—Central Railway Station (1901); South Brisbane Town Hall (1891)
A coarse-grained white stone, rather irregular; average grain size, .4 mm.; cementing medium clayey and abundant. It is a very good weathering stone, and one of the best used in Brisbane	Portion of G.P.O. (1871); Public Library (1877); Queensland National Bank, Brisbane (1882); colonnades of Parliament House
A soft white stone, even grained; average grain size, 4 mm.; cementing clay material very abundant; bedding pronounced. Stone very variable in quality	First wing of Treasury Building, Brisbane (1887)
Fine-grained stone, warm brown in colour, frequently presenting concentric iron staining; average grain size, .20 mm. Works freely, takes a very sharp arris; thick beds in good position for working; excellent weathering stone	Executive Building, Brisbane (1901); Royal Insurance Company's Building, Brisbane (1906); in Warwick—in the Police Building, Post Office, and Technical College
Brown sandstone, of a somewhat similar character to the Yangan sandstone, but rather more cement, and considerably inferior in quality	Warwick Town Hall fronts and old Railway Station, Warwick (1888)
Several quarries have been worked. The stone is rather coarse-grained, and shows frequent current bedding, brown in colour, and with abundant clay cement. Only used in Warwick	*Mount Tabor Quarry.*—Police Building (1885); rear portion of Town Hall; Queensland National Bank (1880) *Sidling Quarry.* — Anglican Church (1867); R.C. Church; Methodist Church; and Masonic Hall *Mitchell's Quarry.* — Convent (1892)
Medium-grained, light-brown sandstone, which works well; takes a fair arris, and weathers very cleanly; average grain size, .5 mm.; stone needs careful selection. Used in Rockhampton very largely	The following Rockhampton structures:—Anglican Cathedral, Commonwealth Bank, Bank of Australasia, Post Office, R.C. Cathedral, and Customs House
Pyroclastic of a Rhyolitic character, which has been much silicified. Colours—white, brown, pink, and green, occurring with iron and manganese staining. Stone composed of quartz, orthoclase, and plagioclase set in a devitrified felspathic ground mass. Needs very careful selection, as there is great variability in its weathering properties	Normal School (1863); St. Stephen's Cathedral (187-); St. Paul's Presbyterian Church (1887); St. John's Cathedral (1909); very largely used for base courses of several Brisbane buildings; also for kerbing, and for road metal subject to light traffic

(C) METAMORPHIC

Building Stone.	Locality.	Quantity.
Marble	Ulam, 25 miles south of Rockhampton	Unknown, but believed to be considerable ..
Marble	Gladstone	..
Marble	Raglan, 10 miles above the mouth of the Fitzroy River	Considerable deposits occur .. .. ..
Marble	Rockhampton District ..	..
Marble	Northumberland Island, 14 miles from the mainland, midway between Rockhampton and Mackay	..
Marble	Broken River, 130 miles west of Townsville	..

TESTS ON

3. **Tests of Queensland Sandstones.**—The following table shews the results of tests of

Stone.	Quarry.	Colour.	Specific Gravity.	Weight in lbs. per cubic foot.	Absorption in per cent. of dry weight.
Helidon Sandstone	Wright	Brown ..	2.42 2·42	151 151	4.80 4.80
Helidon Sandstone	Wright	Brown ..	2.26 2.26	141 141	.. 2.8
Helidon Sandstone	Wright	Brown ..	2.30 2.30	143 143	.. 3.55
Helidon Sandstone	Miller	Brown ..	2.31	144 148 148	4.36 .. ..
Helidon Sandstone	Pearson	White ..	2.21 2.21	138 138	.. 3.66
Helidon Sandstone	Pearson	Pink ..	2.37 2.37	148 148	.. 3.35
Helidon Sandstone	Pearson	Brown ..	2.26 2.26	141 141	.. 4.20
Helidon Sandstone	Phippard	White ..	2.33 2.33	145 145	.. 2.73
Yangan Sandstone ..	Midson	Brown ..	2.18 2.18 2.18	136 136 136	.. 8.7 ..
Murphy's Creek Sandstone ..	..	Brown ..	2.41 2.41 2.41	150 150 150	.. .. 5.0
Calvert Sandstone	Beatty and Walsh ..	Brown ..	2.39 ..	149 ..	4.47 ..
Murphy's Creek Sandstone ..	..	White ..	2.18 2.30	136 144	5.1 3.7
Highfields Sandstone ..	..	White ..	.. ..	.. ..	4.8 7.0
Moggill Sandstone	Lyons	..	2.40 2.39	150 149.4	3.04 3.0
Lockyer Creek Sandstone ..	..	..	2.45	153	3.7

STONES.

Character.	Examples.
A coarse white marble, which is now being opened up, and is of considerable promise for mural and staircase purposes	..
Several deposits of white to fine-grained pink, blue, and red marble, much of which is fit for monumental purposes. The most conveniently situated deposits are at Calliope	..
..	..
Large areas of pink to blue limestone to the north of the Fitzroy River at 4 and at 20 miles above Rockhampton. At Marmor, 26 miles south of Rockhampton, there are large deposits of marbles of different colours, particularly dark-blue marble, with large encrinites	Hitherto used mostly as a flux at Mount Morgan
White, pink, and blue marbles, uniform in colour, also variegated and mottled varieties, occur on Marble, Hunter, and Iron islands	..
Fine marbles, taking a good polish	..

QUEENSLAND SANDSTONES.

various Queensland sandstones :—

Resistance to Crushing.					Reference Authority.	Remarks as to object of Tests and Character.
Size of Specimen in inches.	Cracking Pressure in lbs.	Crushing Pressure in lbs.	Crushing Resistance in tons per sq. foot.	Crushing Resistance in lbs. per sq. inch.		
4 x 4 x 4	36,000	39,590	159.10	2,475	P.W.D.* ..	Executive Building tests, 1901
4 x 4 x 4	42,500	49,690	201.20	3,130		
4 x 4 x 4	..	81,900	326.00	5,076	P.W.D. ..	Cent. Tech. Col., 1911, cr. dry on bed
4 x 4 x 4	..	58,940	233.00	3,634		Cent. Tech. Col., 1911, cr. wet on bed
6 x 3 x 3	..	43,680	310.13	4,824	Rly. Dept. ..	Crushed dry on bed, C.R.S.,† 1900
6 x 3 x 3	..	33,720	238.55	3,710		Crushed wet on bed, C.R.S., 1900
..	..	..	328.50	5,110		
4 x 4 x 4	42,560	51,744	..	3,234	P.W.D. ..	Govt. Printing Office tests, 1911
4 x 4 x 4	41,440	41,440	..	2,590		Govt. Savings Bank tests, 1915
6 x 3 x 3	..	53,570	388.7	6,047	Rly. Dept. ..	Crushed dry on bed
6 x 3 x 3	..	37,470	268.5	4,176		Crushed wet on bed
6 x 3 x 3	..	79,050	558.1	8,682	Rly. Dept. ..	Crushed dry on bed
6 x 3 x 3	..	63,480	450.4	7,007		Crushed wet on bed
6 x 3 x 3	..	46,760	332.2	5,168	Rly. Dept. ..	Crushed dry on bed
6 x 3 x 3	..	27,210	197.7	2,997		Crushed wet on bed
6 x 3 x 3	..	50,760	360.7	5,612	Rly. Dept. ..	Crushed dry on bed
6 x 3 x 3	..	32,780	231.8	3,606		Crushed wet on bed
4 x 4 x 4	..	40,560	163.0	2,535	P.W.D. ..	Executive Building tests, 1901
4 x 4 x 4	..	43,120	173.2	2,695		
4 x 4 x 4	..	50,610	203.3	3,163		
4 x 4 x 4	..	52,470	210.9	3,280	P.W.D. ..	Executive Building tests, 1901
4 x 4 x 4	..	57,670	231.8	3,605		
4 x 4 x 4	..	59,400	238.7	3,712		
..	..	..	240.6	3,733	Rly. Dept. ..	Bremer Bridge test, 1896
..	..	..	288.3	4,485		
..	..	..	..	..	Rly. Dept. ..	Brisbane Dry Dock tests, 1875
..	..	..	..	..		
..	..	..	..	..	W. Hamlet	Treasury Building tests, 1888
..	..	..	..	..	W. H. Dixon	1886
..	..	..	..	..	Rly. Dept. ..	Brisbane Dry Dock tests, 1875
..	..	..	..	..		
..	..	..	..	..	Rly. Dept. ..	Brisbane Dry Dock tests, 1875

† C.R.S. tests, 1900

* P.W.D.—Public Works Department. † C.R.S.—Central Railway Station.