

FOR OFFICIAL USE.

M.O. 236 (Section III.).

AIR MINISTRY.

METEOROLOGICAL OFFICE.

THE BOOK OF NORMALS
OF
METEOROLOGICAL ELEMENTS
FOR THE
BRITISH ISLES

FOR PERIODS ENDING 1915.

Section III.—Maps of the Normal Distribution
of Temperature, Rainfall and Sunshine for
the British Isles.

Published by the Authority of the Meteorological Committee.



LONDON:
PRINTED BY HIS MAJESTY'S STATIONERY OFFICE
And to be purchased from the METEOROLOGICAL OFFICE, Air Ministry,
Kingsway, W.C.2, or Exhibition Road, S.W.7.

1920.

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- (*) Forecasting Weather.—By W. N. Shaw, Sc.D., F.R.S. Constable & Co., Ltd. 12s. 6d. (Demy 8vo) [*Out of print.*]

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MET/2/13/110/d

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THE BOOK OF NORMALS.

SECTION III.

MAPS OF THE NORMAL DISTRIBUTION OF TEMPERATURE, RAINFALL AND SUNSHINE.

The present series of maps is based on the normals for individual stations set out in Section I of this Book of Normals.

Temperature.

The temperatures represented are the tabulated values reduced to sea-level by the application of uniform corrections at the rate of 1° F. for each 300 feet of height above Mean Sea Level. This is the method adopted in compiling the maps for the Monthly Weather Report, but differs from that used in the previous publication of normals, (Weekly Weather Report, App. IV, 1913), where a correction was applied at a rate which varied according to the season and the geographical position of the station. It appears (l.c. p. 265) that the decrease of temperature with increase of height is less marked at the stations in Scotland than in other parts of the British Isles, and (except in Scotland) less marked by night than by day. The question of height is complicated, however, by the influence of the configuration of the land and of distance from the sea, and the simpler plan has, therefore, been followed here.

The principal practical difficulty in drawing the maps is to shew satisfactorily the steep gradients near the coast. The cooling effect of the sea-breezes does not reach far inland and therefore the maximum temperature in summer at places a few miles away is considerably higher than that on the coast line. The converse effect is noticed with the minimum temperature in winter.

The maps show the normal value of the maximum and minimum temperature month by month. For the distribution of mean temperature reference may be made to the *Meteorological Atlas of the British Isles M.O. Official No. 53, 1883*, and to a paper by Scott and Gaster, *Means of the Daily Minimum, Daily Average, etc.* (London, Q. J. Roy. Met. Soc. xxiii, 1897, p. 275). The corresponding maps in *Bartholomew's Physical Atlas*, Vol. III—*Meteorology*, are reproduced from a paper by Buchan, *The Mean Atmospheric Pressure and Temperature of the British Isles* (Edinburgh, J. S. Met. Soc. xi, 1900, p. 3). The periods represented in these three series of maps are 1861–1880, 1871–1895, and 1856–1895 respectively. An interesting map by A. J. Herbertson showing the actual distribution of temperature, without reduction to sea-level, is included in the plate in Bartholomew's Atlas.

For the annual variation of maximum and minimum temperature at the Observatories in the British Isles, curves representing 5-day means are reproduced in *Temperature Tables of the British Isles M. O. Official No. 154, 1902*. Diurnal and Annual Variation are shown together in Climatic Diagrams in *The Weather Map*.

Rainfall.

The rainfall figures are not adjusted to allow for height above sea level and therefore the maps shew in a general way the effect of the configuration of the land on rainfall. In preparing them use has been made of other studies on the subject* so that, whilst they are consistent with the Tables in Section I, they shew certain wet areas which are not represented in the Tables. An adequate representation of the rainfall of the British Isles should be on a far larger scale and based on many more records. The maps by Buchan in Bartholomew's Atlas of Meteorology represent the data which are printed in a Meteorological Office publication (No. 114, 1897), *Rainfall Tables of the British Isles* and which cover the period 1866–1890. By virtue of the fine lithography a considerable amount of detail is shewn in Buchan's maps. As representing normal values for a long period, the present series has some advantages.

For the rainfall of the whole year a wall map by Dr. H. R. Mill and published by the Clarendon Press is available.

A paper read before "The Institution of Civil Engineers" by Dr. Mill "On the Distribution of Mean and Extreme Annual Rainfall in the British Isles," 24th November, 1903 may also be consulted.

In maps which show the total rainfall each month height is a dominating feature. Its influence is eliminated to a certain extent in maps in which the ratio of the monthly rainfall to that of the whole year is plotted. Such maps for the British Isles will be found in a paper by Mill and Salter: *Isomeric Rainfall Maps of the British Isles* (London: Q. J. Roy. Met. Soc. 41, 1915, p. 1.)

Maps of normal annual rainfall on the scale of 2 miles to 1 inch are being drawn for the whole of the United Kingdom by the British Rainfall Organisation, now incorporated in the Meteorological Office. Maps reduced from these to the scale of 10 miles to 1 inch have been published by the Geological Survey, in the Water Supply Memoirs for the counties of Bedfordshire, Essex, Hampshire, Kent, Lincolnshire, Northamptonshire, Nottinghamshire, Oxford, Suffolk, Surrey, Sussex and East Riding of Yorkshire. A similar map on the scale 6 miles to 1 inch for the Forth Valley was published in British Rainfall 1915.

Sunshine.

The maps showing the normal duration of bright sunshine are based on the figures set out in Section I, Table 4, and, therefore, give the duration as measured by the Campbell-Stokes Recorder.

The scale of the maps does not permit of the exhibition of local differences due to the rapid increase of smokiness near the centres of large towns. It has, therefore, been necessary to ignore some low records, such as that for Westminster.† In the case of stations in

* "The Relation of Rainfall to Configuration" by M. de Carle S. Salter (Proc. Inst. Water Engineers, Vol. XXIII, pp. 45–91).

† It has been discovered that the deficiency in Sunshine at Hull indicated by the Table in *The Book of Normals*, Section I, page 73, and attributed hitherto to the obscurity of the atmosphere is not genuine; the recorder in use up to March, 1920, was not of the standard pattern. The table should be deleted.

narrow valleys, notably Strathpeffer and Llangammarch Wells, it is doubtful how far the comparatively low figures are due to the restricted exposure and how far to the formation of cloud over the hills. Perhaps too much generosity has been exercised in allotting the amounts of sunshine indicated by the isopleths in the more mountainous districts. In this connection the following figures for Fort William and Ben Nevis, which refer to the period 1891-1902, are of interest.

Ben Nevis and Fort William.

Sunshine, 1891-1902.

Station ...	Ben Nevis.	Fort William.
Latitude ...	56° 46'	56° 48'
Longitude ...	4° 59'	5° 5'
Above M.S.L. ...	4,405 ft. + 15 ft.	100 ft. + 5 ft
County ...	Inverness.	Inverness.

	Length of day. hr.	Bright sunshine. hr.	%	Length of day. hr.	Bright sunshine. hr.	%
January...	7.44	.64	9	7.43	.78	11
February...	9.40	1.61	17	9.40	1.89	20
March...	11.74	2.06	18	11.74	3.22	27
April...	14.17	2.88	20	14.17	4.71	33
May...	16.36	4.27	26	16.37	5.93	36
June...	17.60	4.14	24	17.62	5.76	33
July...	17.05	2.95	17	17.06	4.20	25
August...	15.10	2.00	13	15.11	3.65	24
September...	12.76	1.91	15	12.76	3.20	25
October...	10.36	1.58	15	10.35	2.53	24
November...	8.11	1.02	13	8.10	.97	12
December...	6.81	.55	8	6.79	.41	7
Whole year...	12.25	2.13	17	12.25	3.10	25

These two stations are only about 3 miles apart but except for mid-winter, when the percentages are about the same, the duration of bright sunshine at the summit of Ben Nevis is only two-thirds of that at the low-level station.

The earliest map of the distribution of sunshine is in a paper by H. N. Dickson *On Sunshine* (Scottish Geographical Magazine, 1893). This map is based on *Ten Years Sunshine in the British Isles, M.O. Official No. 98, 1891*, and refers to the period 1881-1890. The number of stations available at that time was only 46. Maps for the period 1881-1910 are to be found in *Monthly Normals of Temperature, Rainfall and Sunshine* (Weekly Weather Report, 1913, App. IV).

MAPS

SHOWING FOR THE YEARS 1881-1915
THE NORMAL DISTRIBUTION OVER
THE BRITISH ISLES OF

DAY AND NIGHT
TEMPERATURE

(REDUCED TO SEA LEVEL)

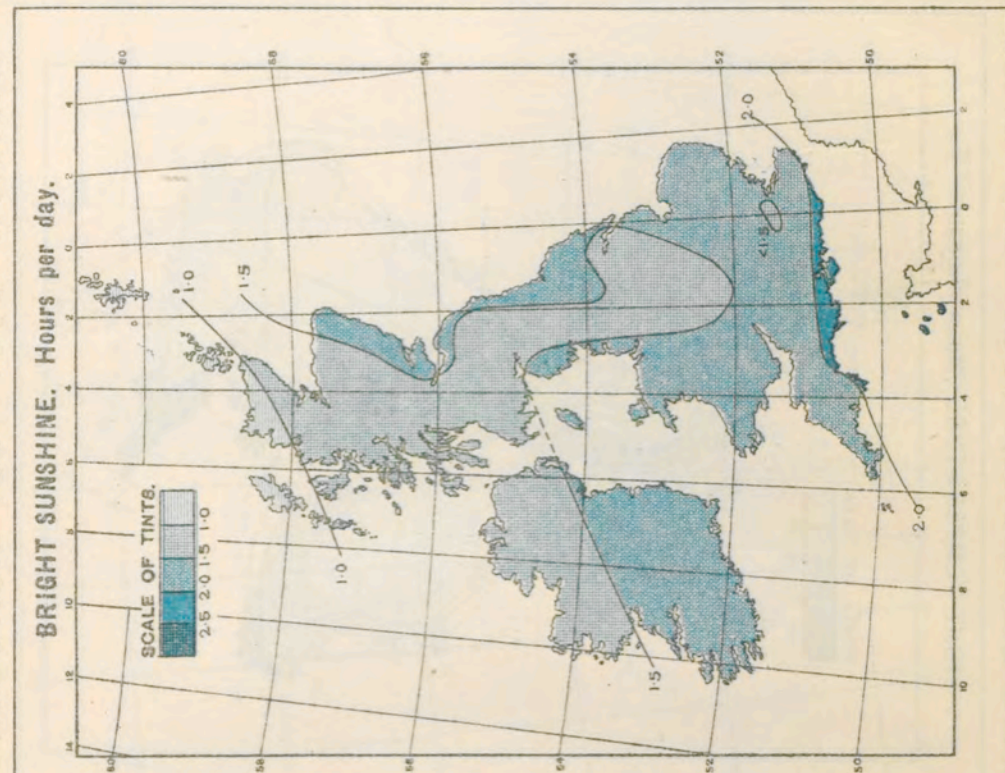
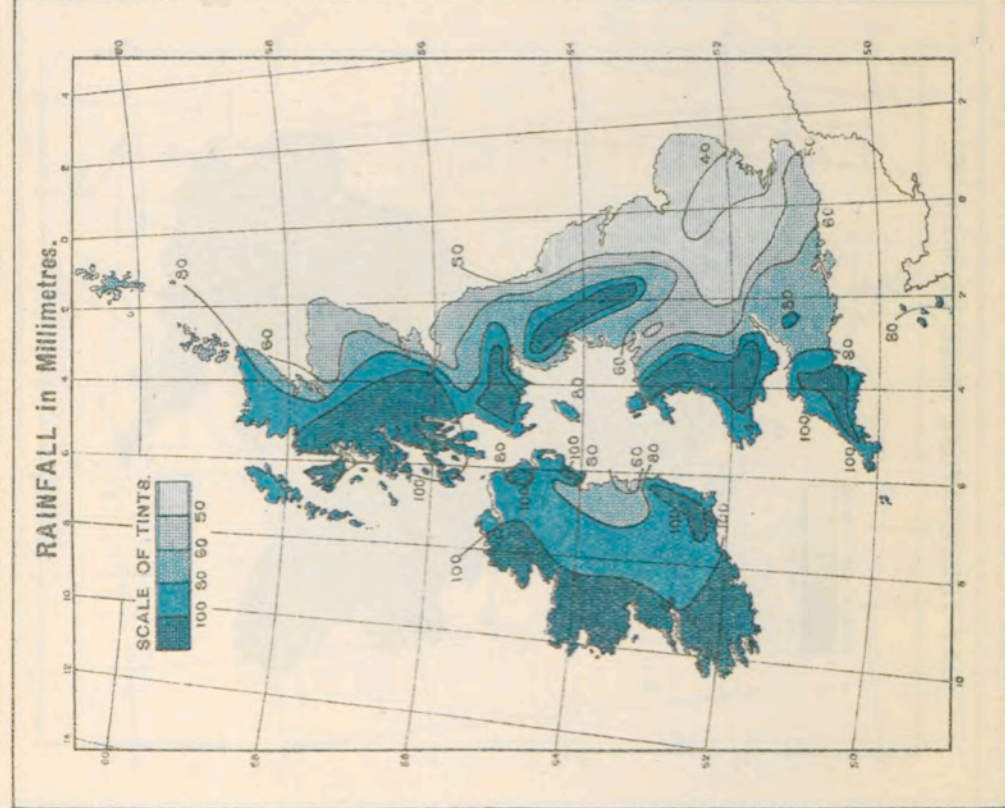
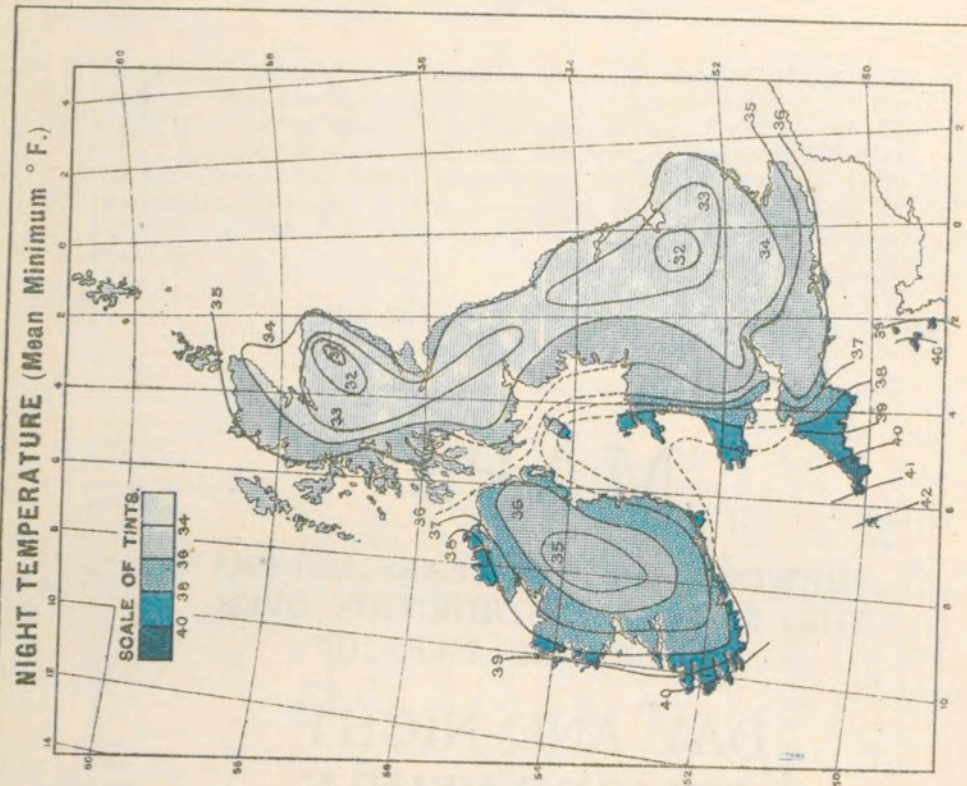
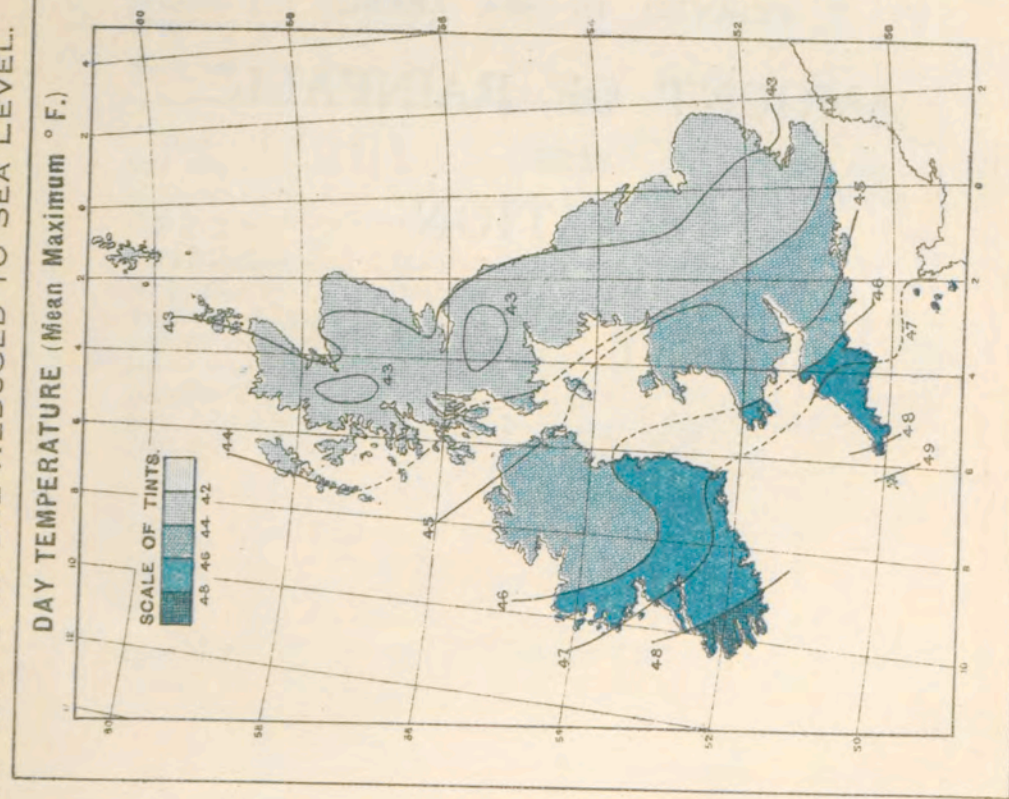
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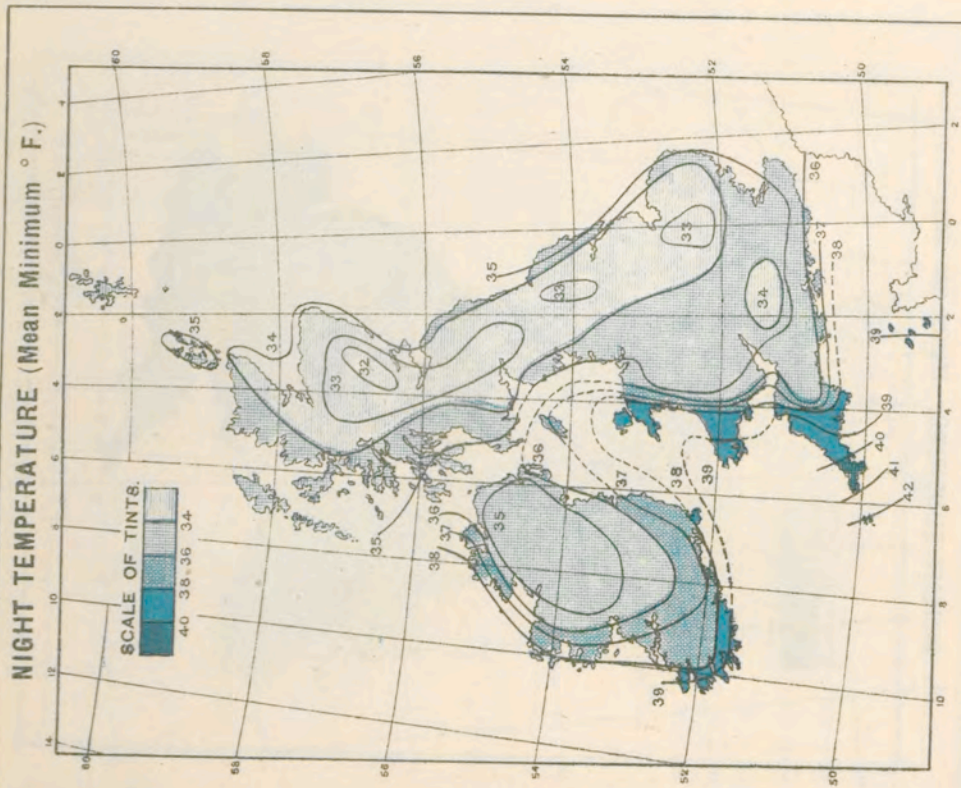
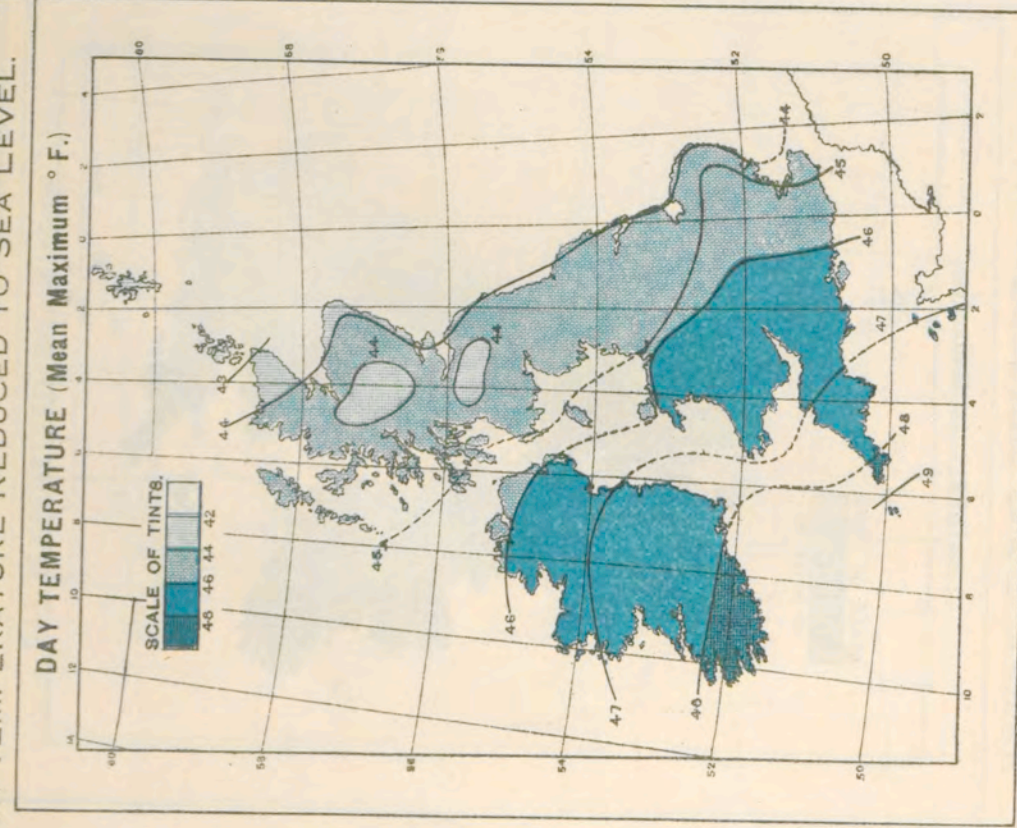
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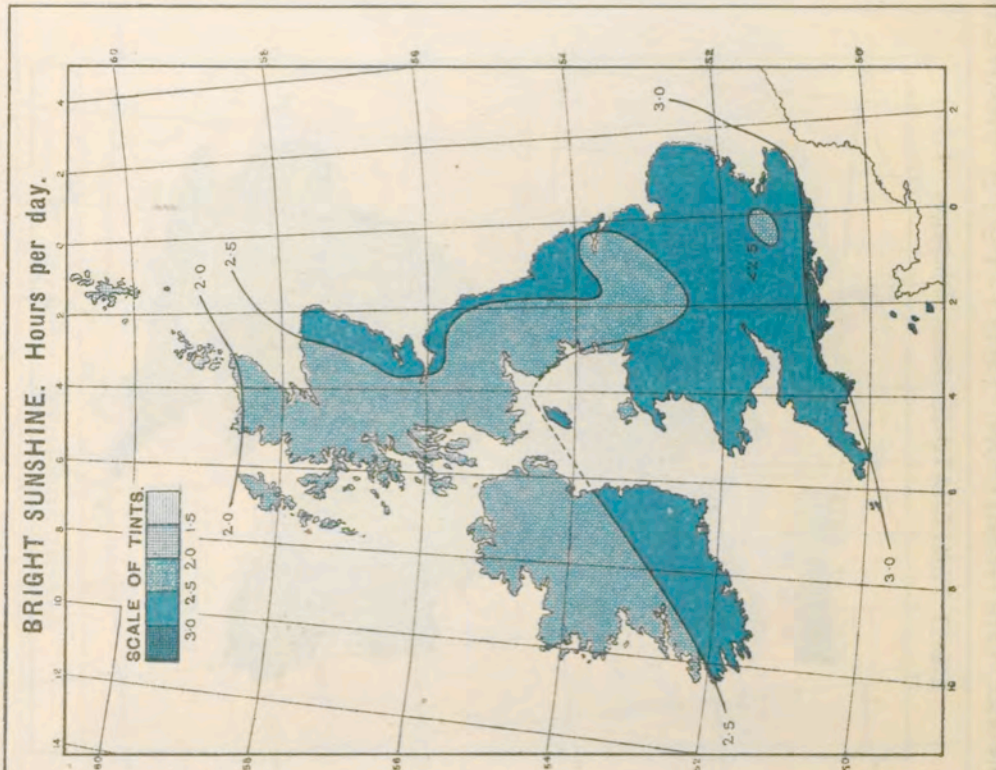
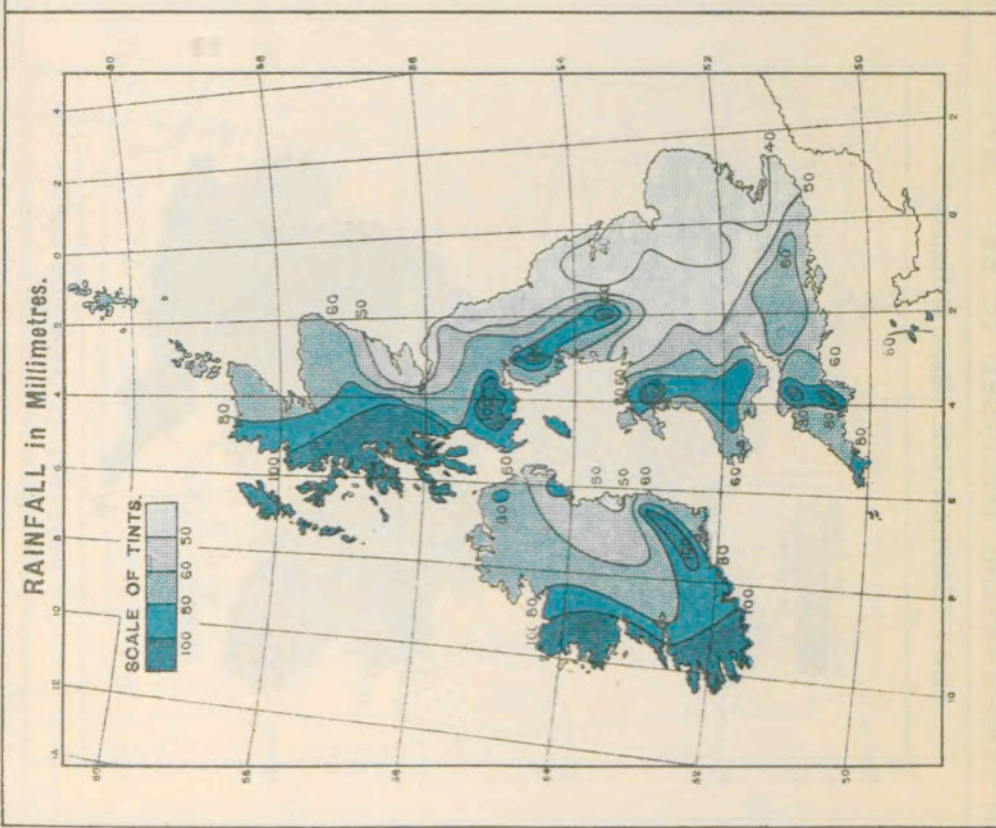
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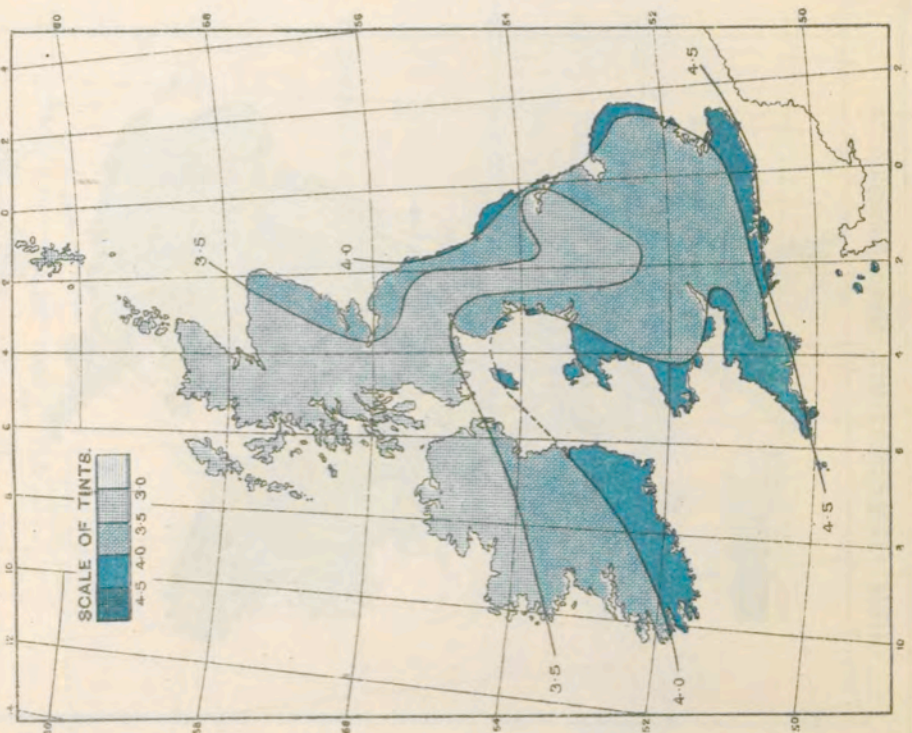
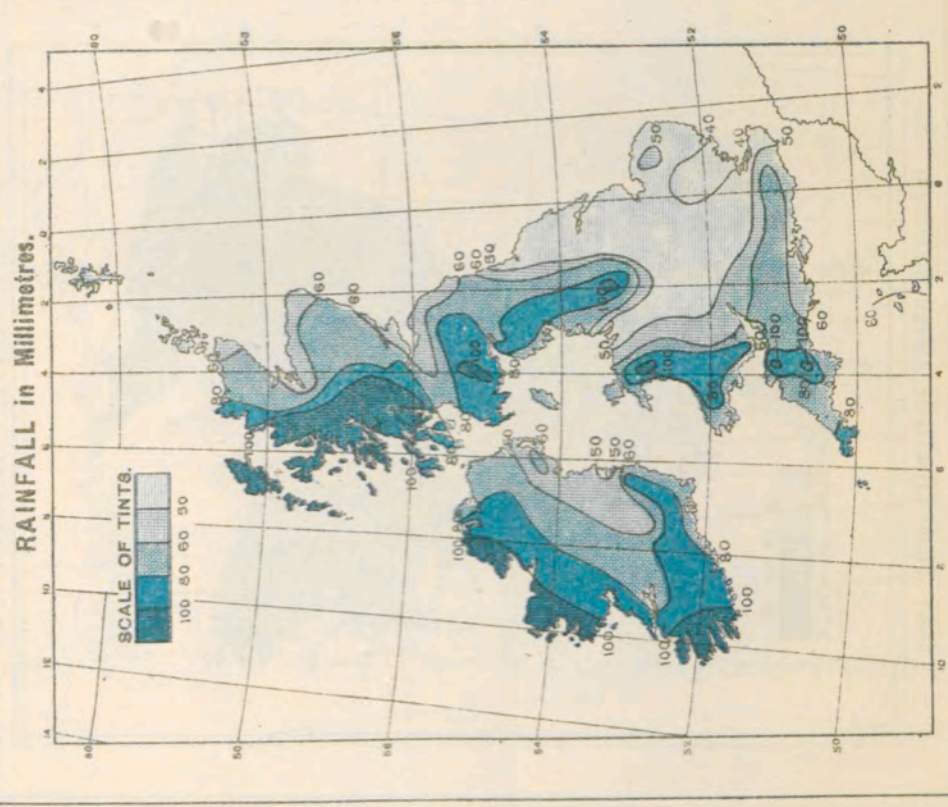
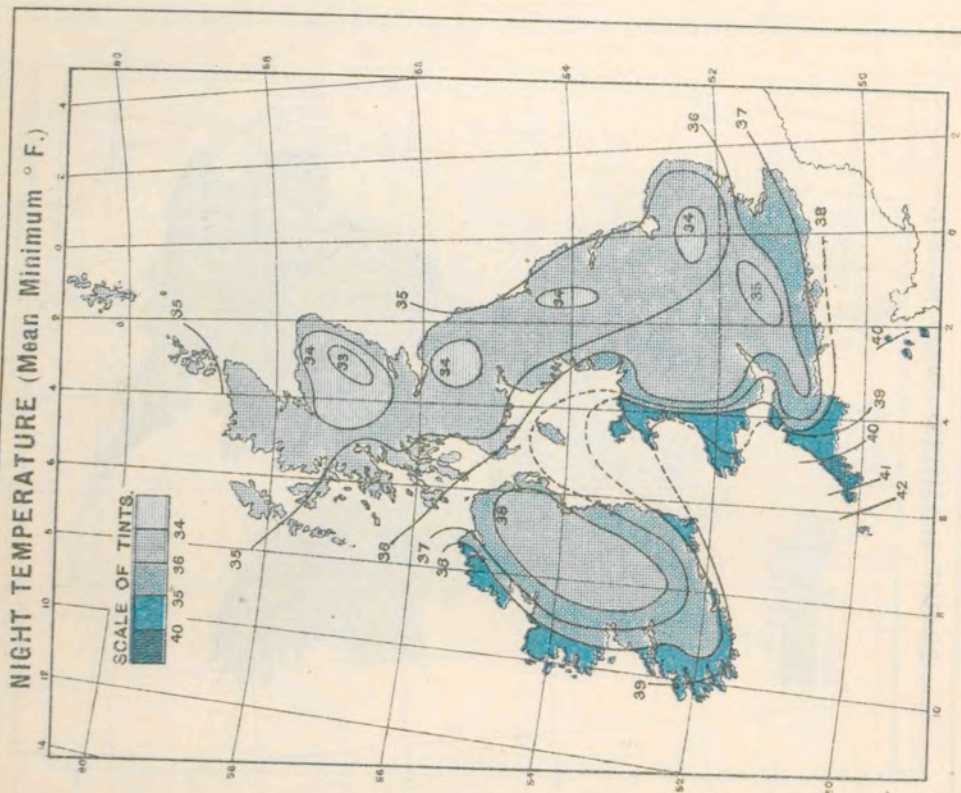
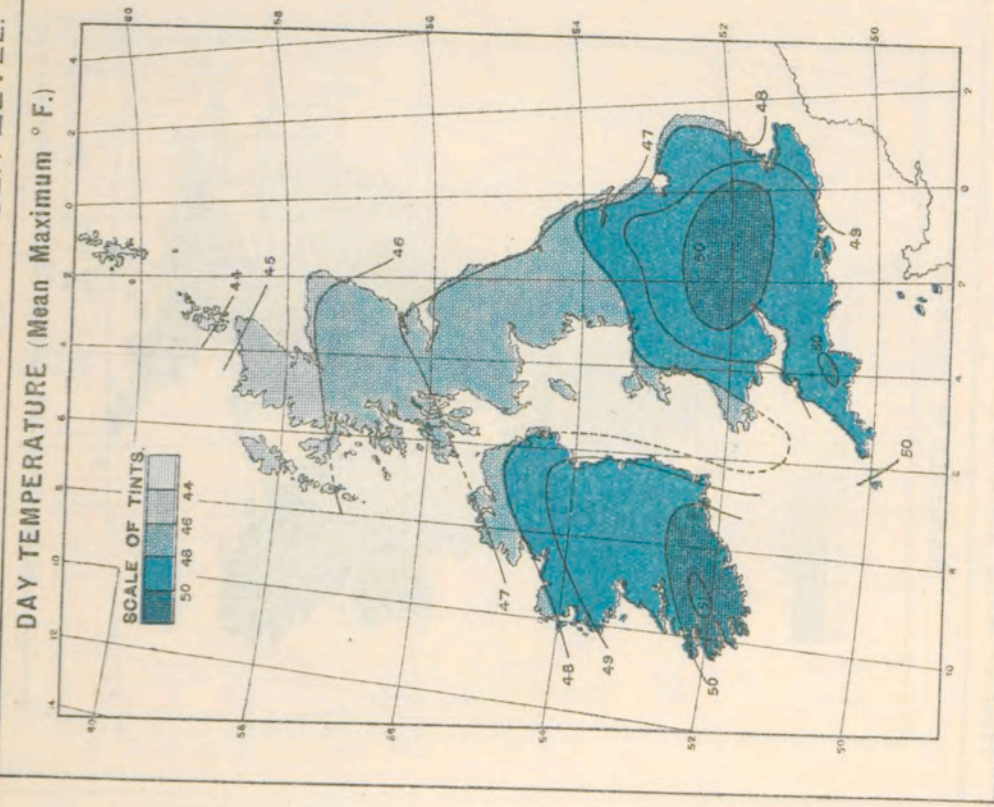
BRIGHT SUNSHINE

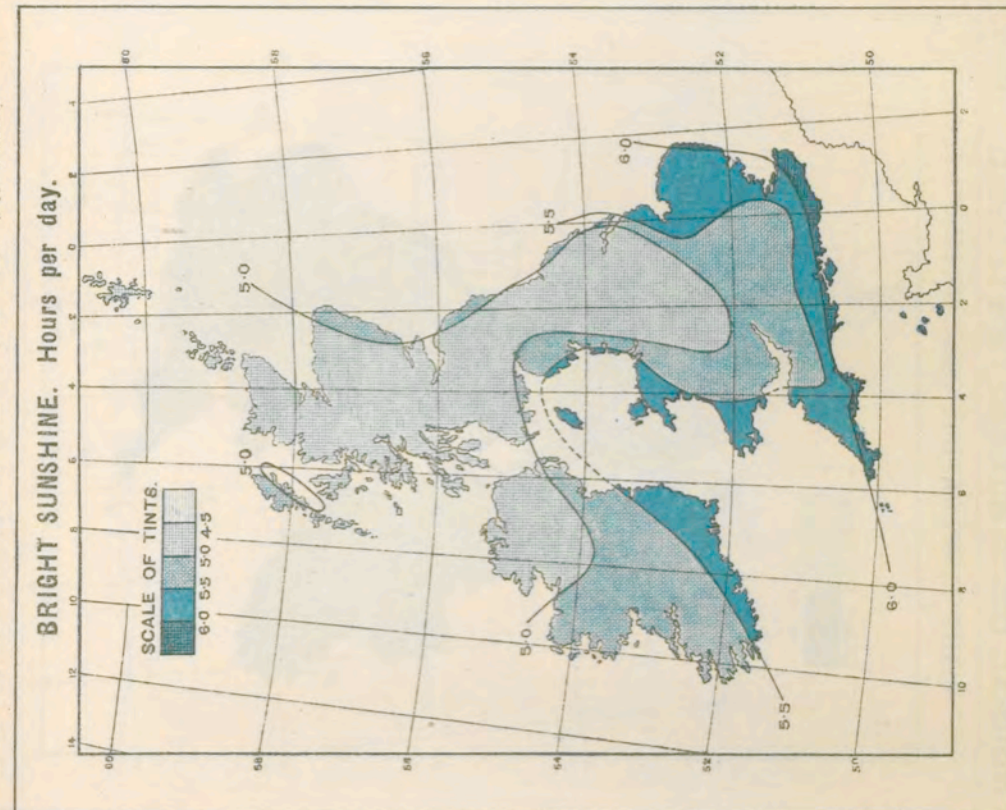
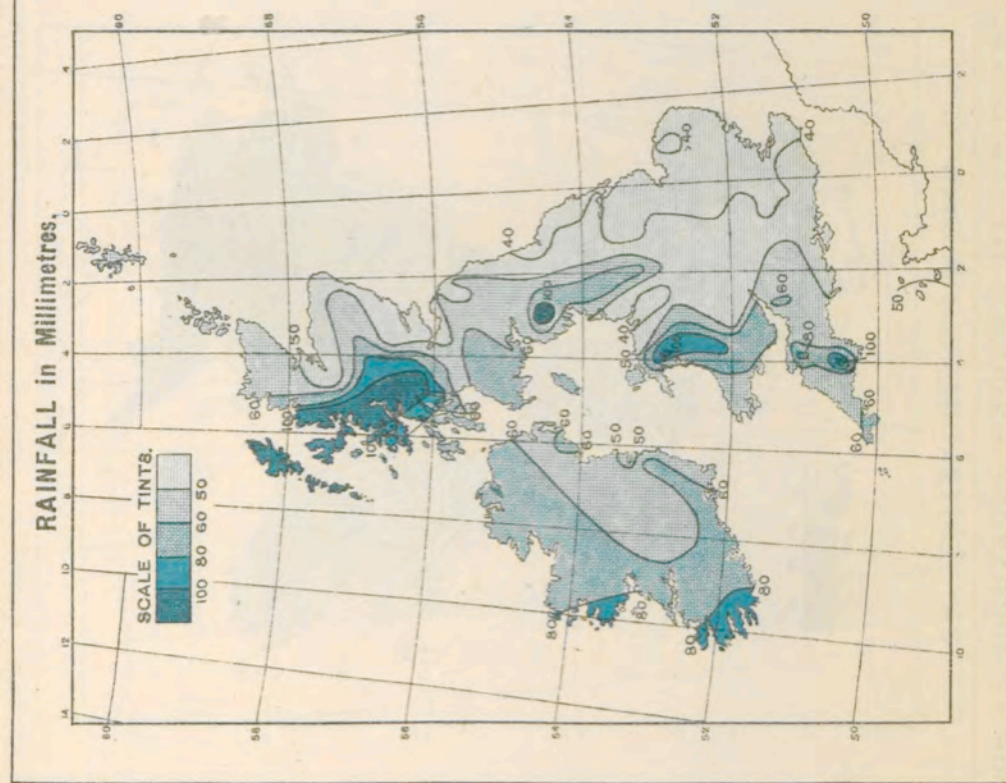
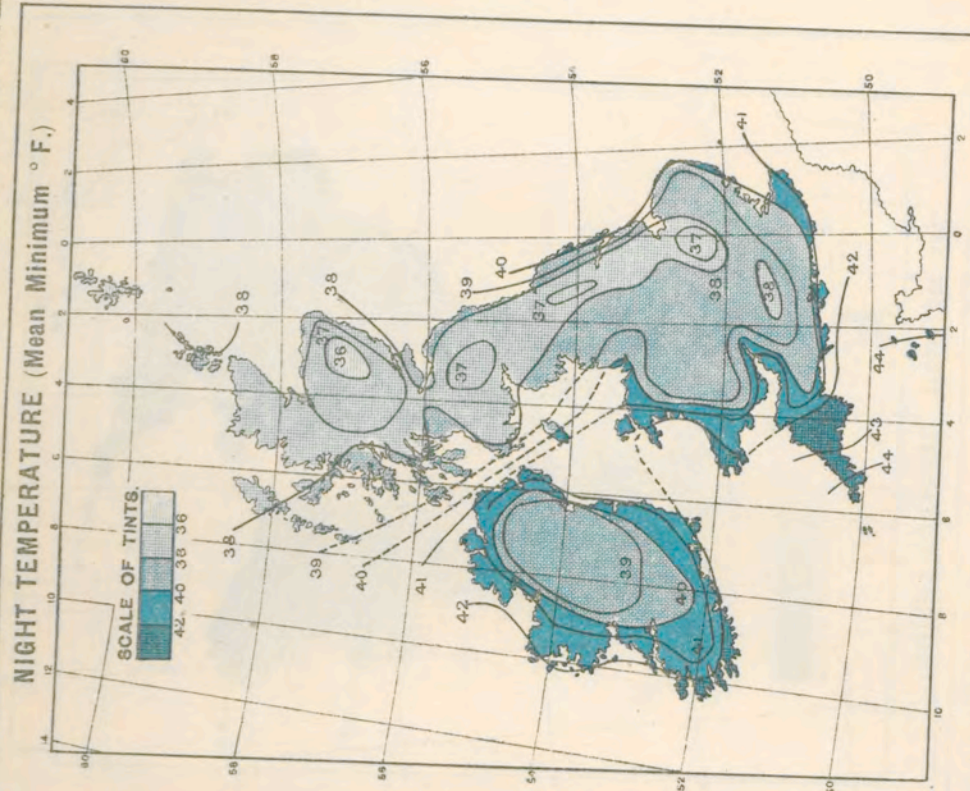
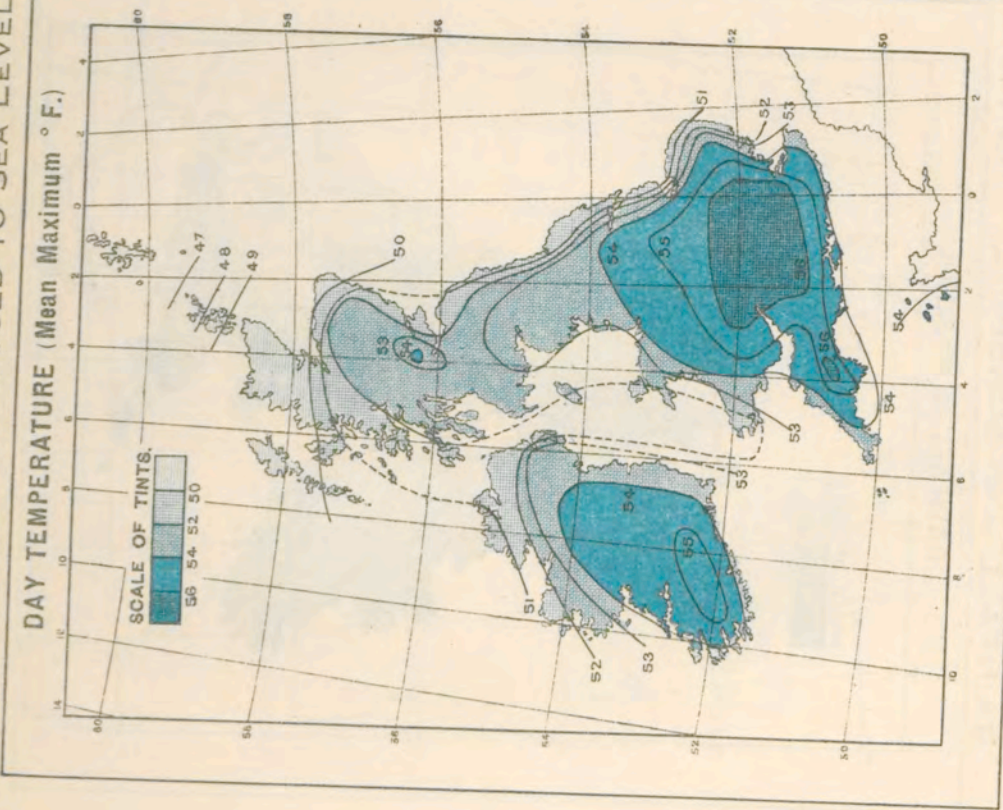




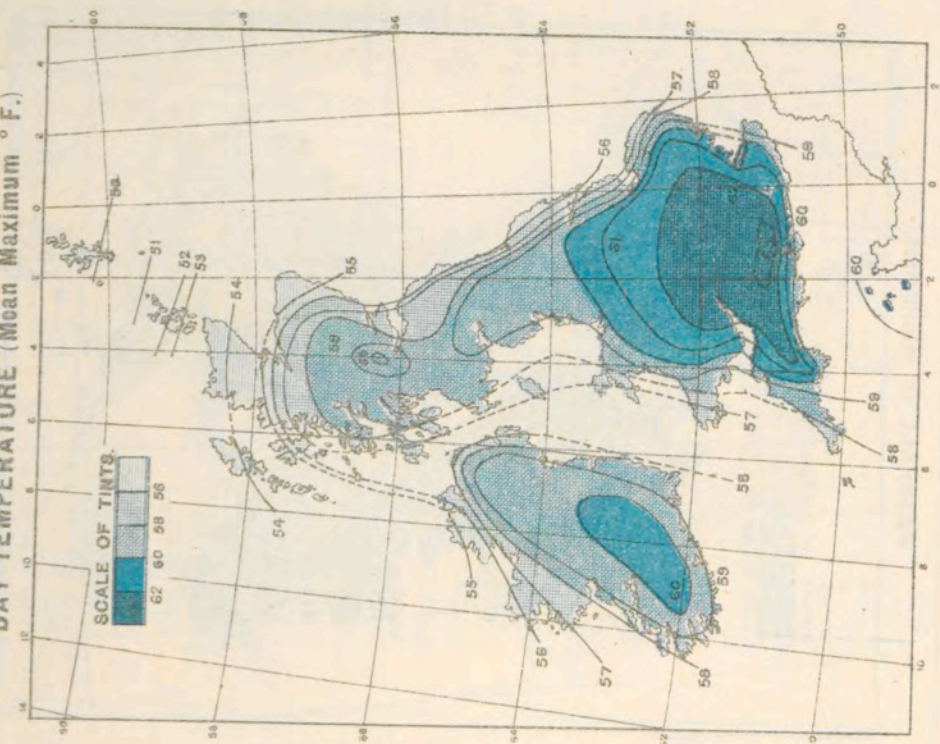
RAINFALL AND SUNSHINE. NORMAL DISTRIBUTION, 1881-1915 FEBRUARY.



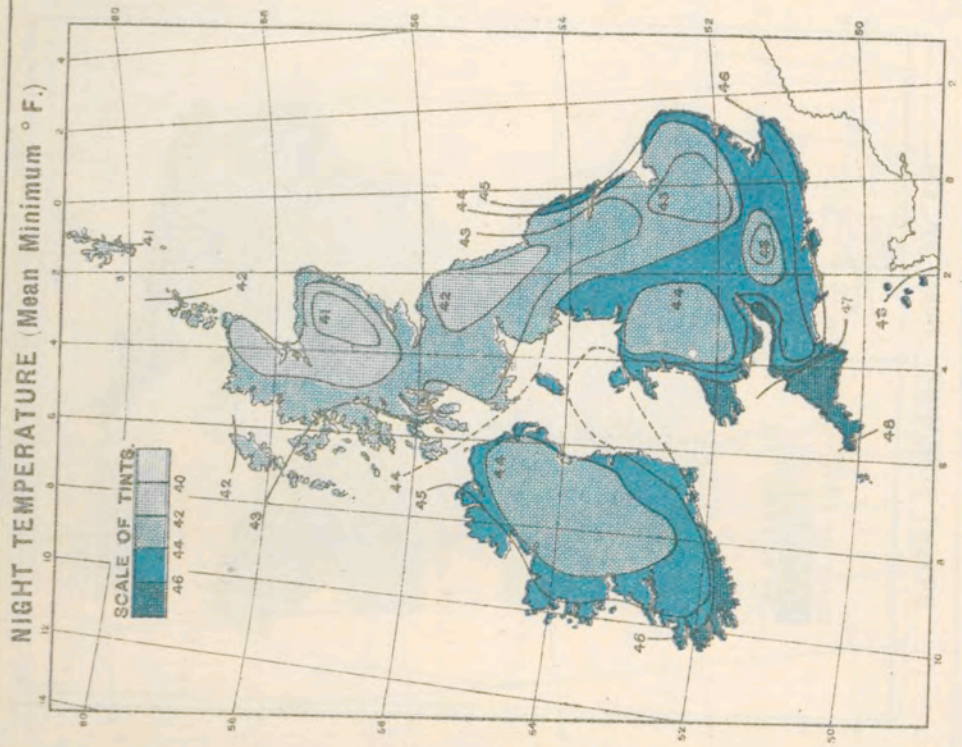




DAY TEMPERATURE (Mean Maximum ° F.)



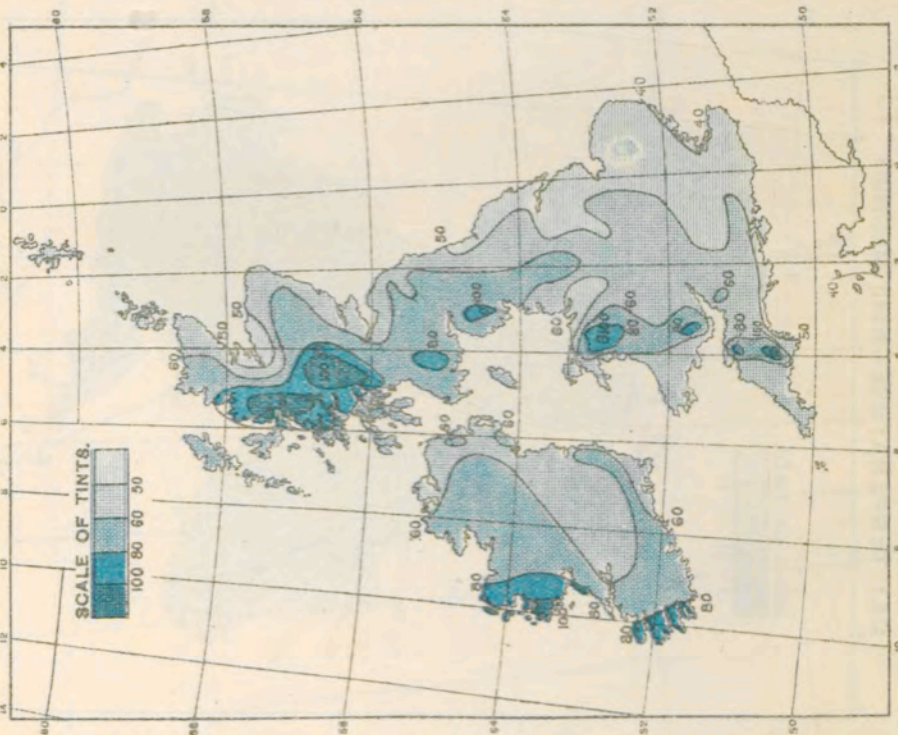
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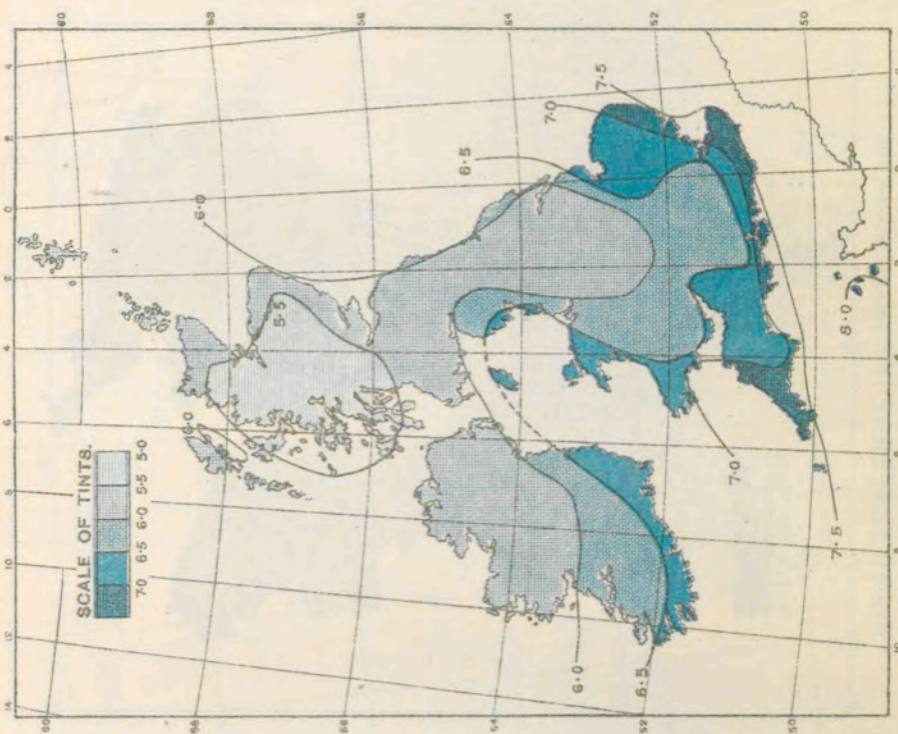
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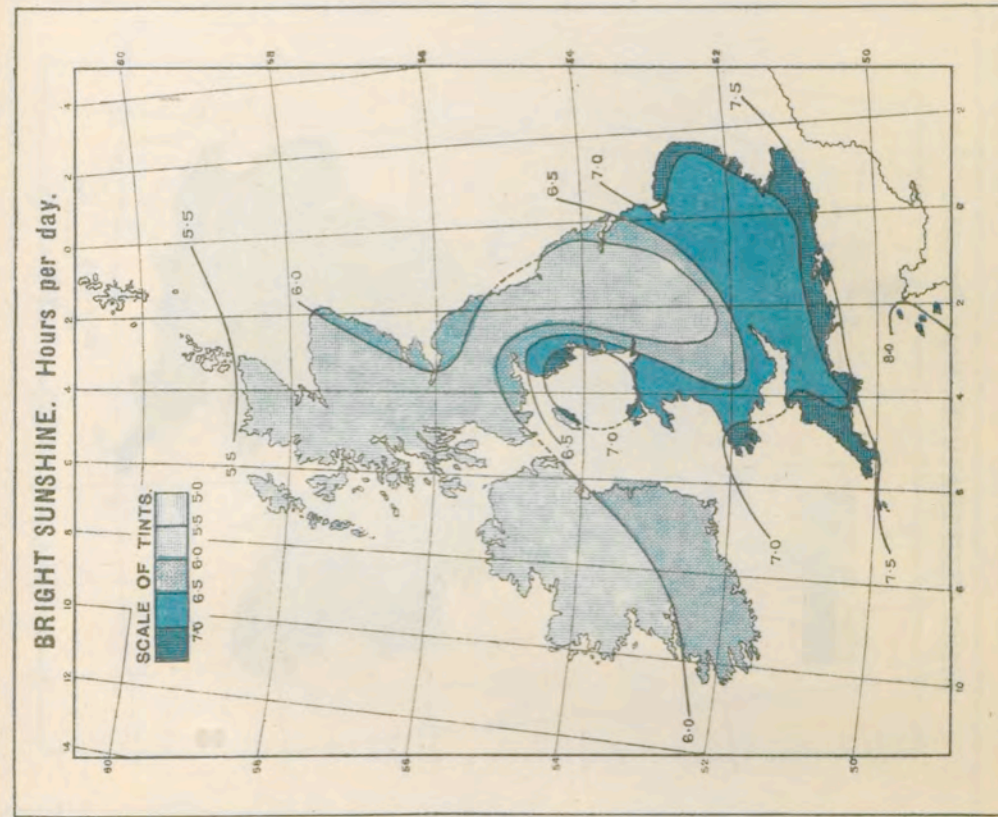
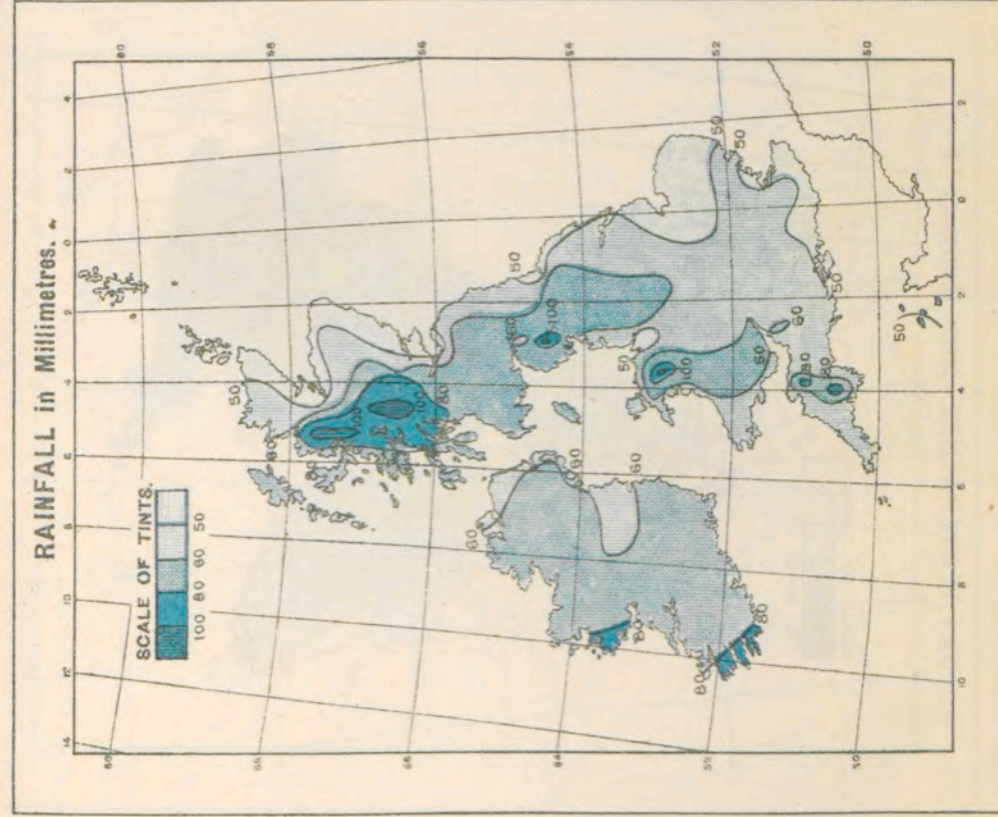
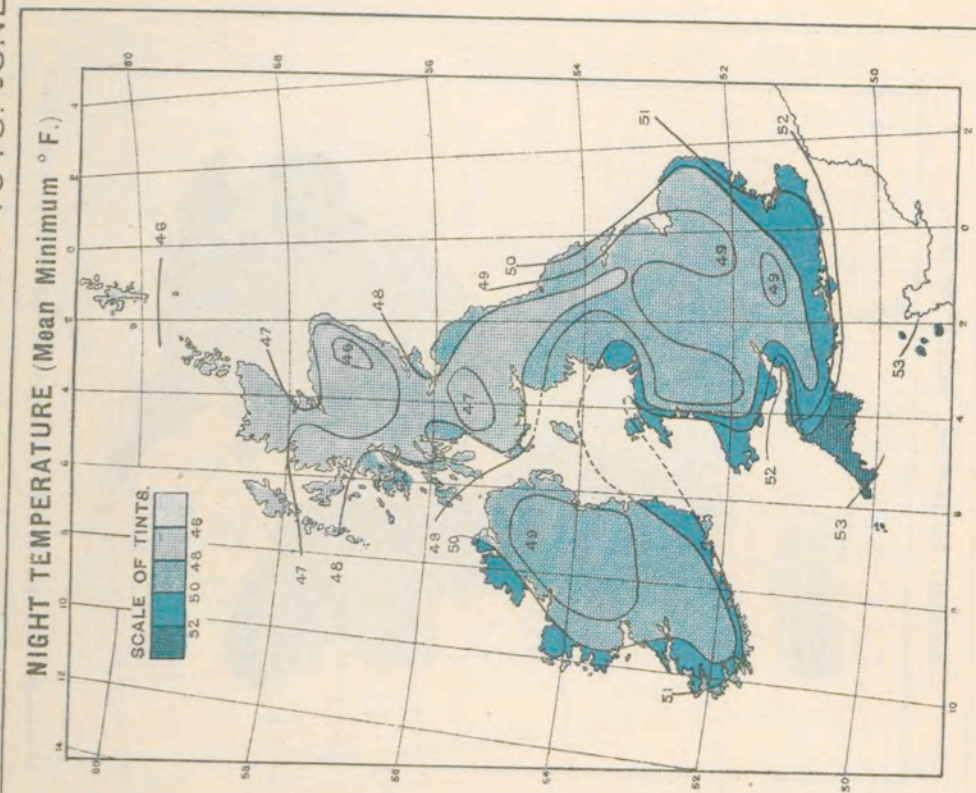
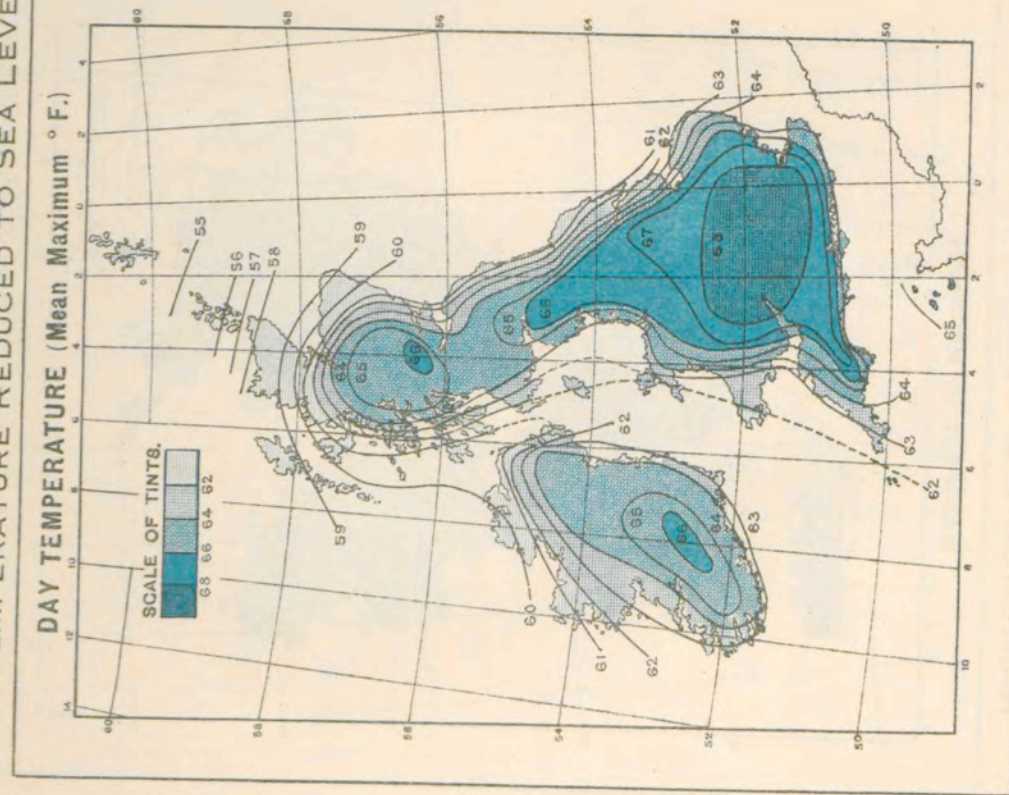
NORMAL DISTRIBUTION, 1881-1915. MAY.

RAINFALL in Millimetres.

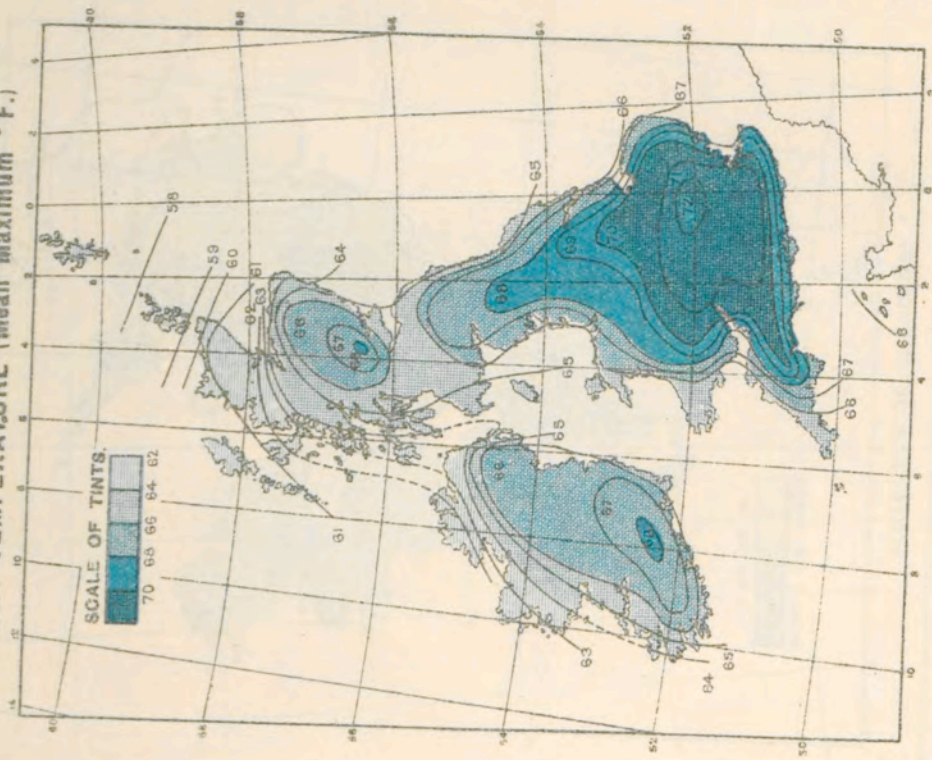


BRIGHT SUNSHINE. Hours per day.



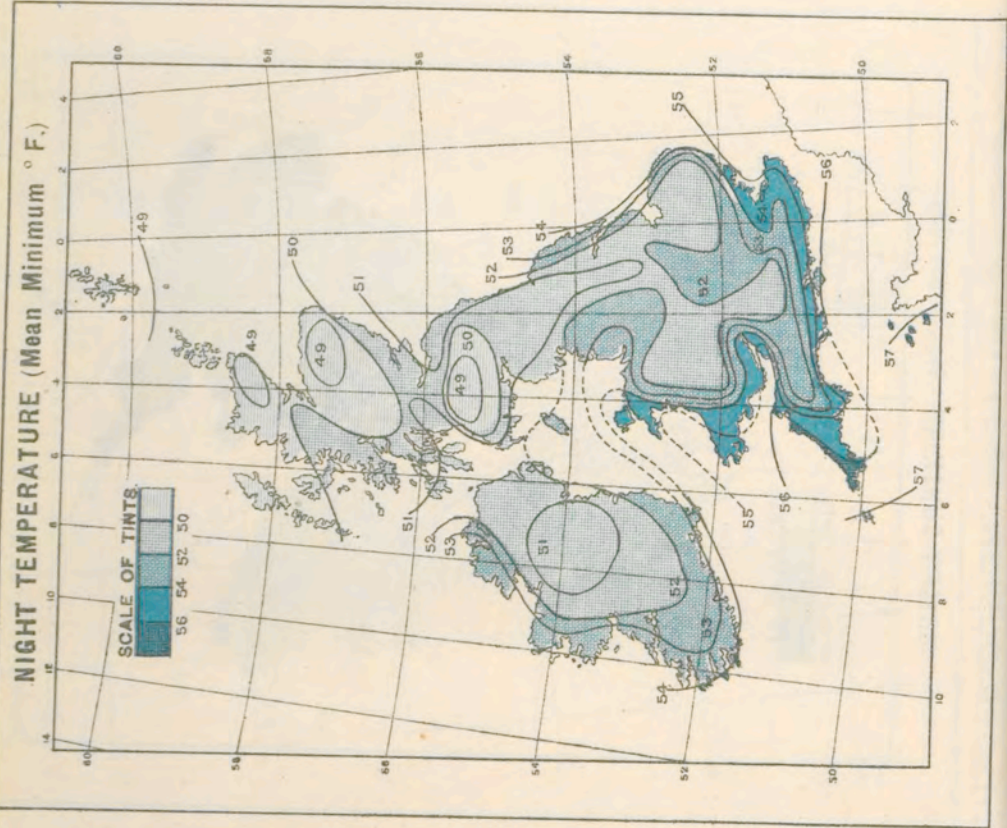
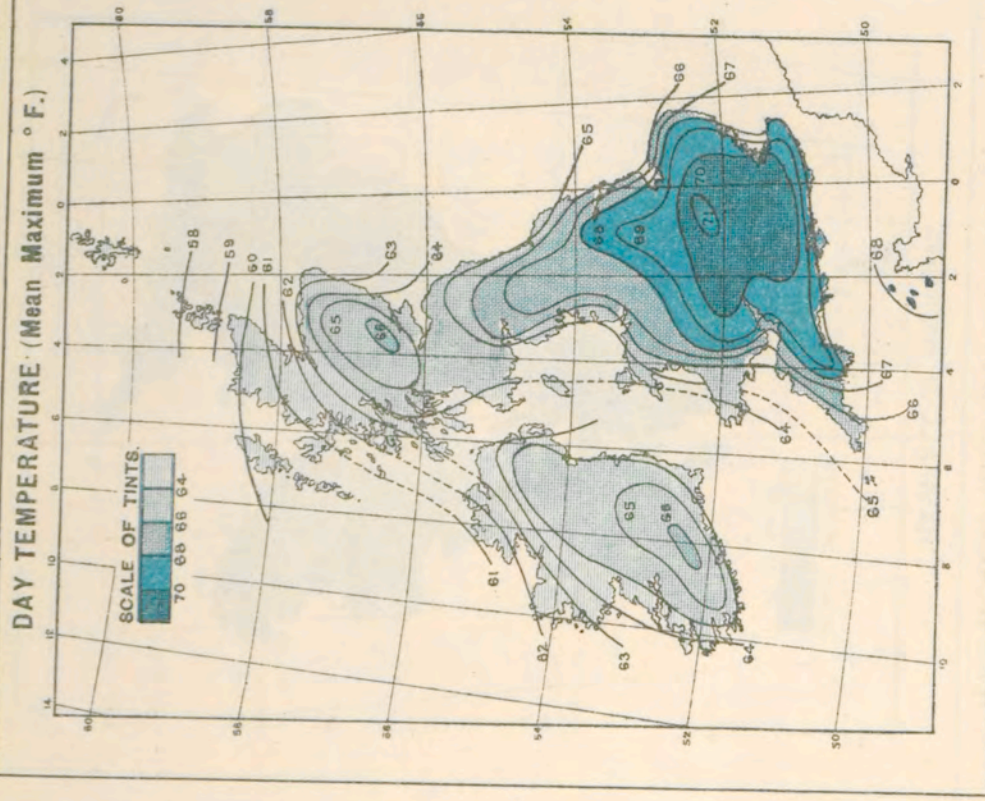


DAY TEMPERATURE (Mean Maximum °F.)



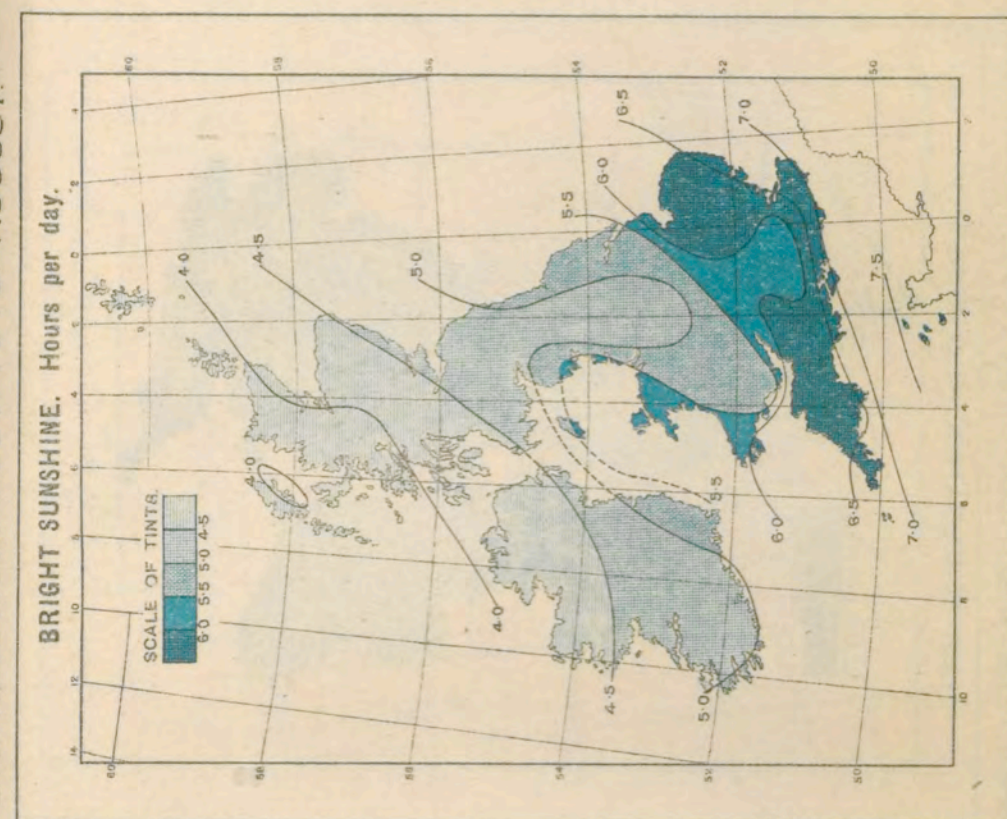
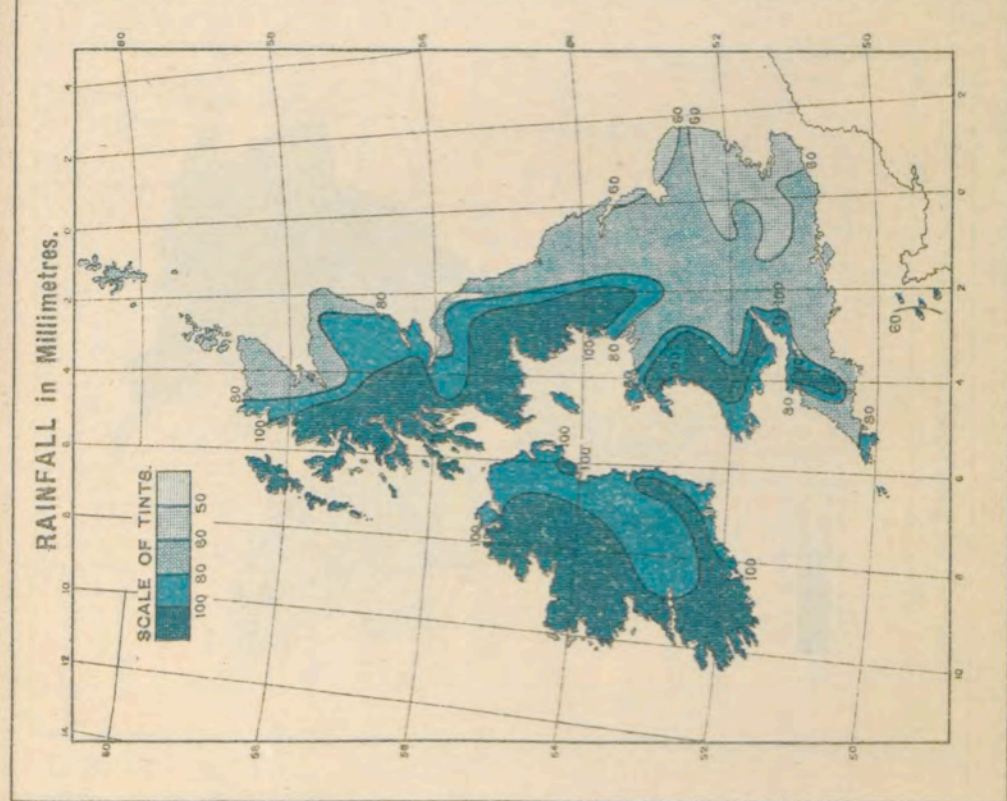
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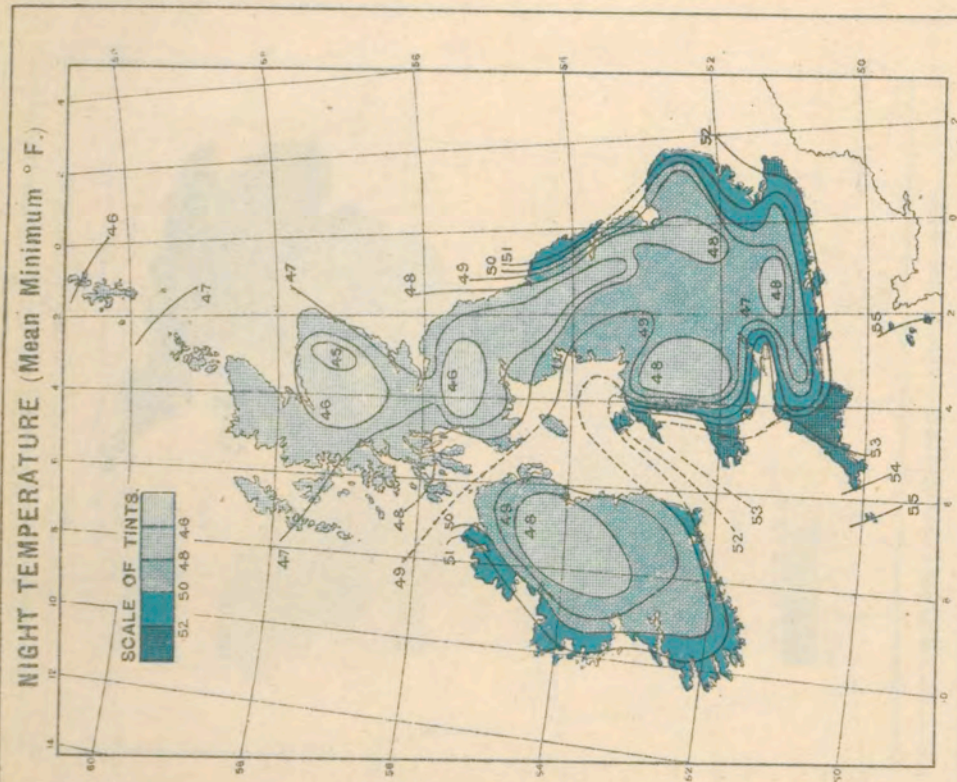
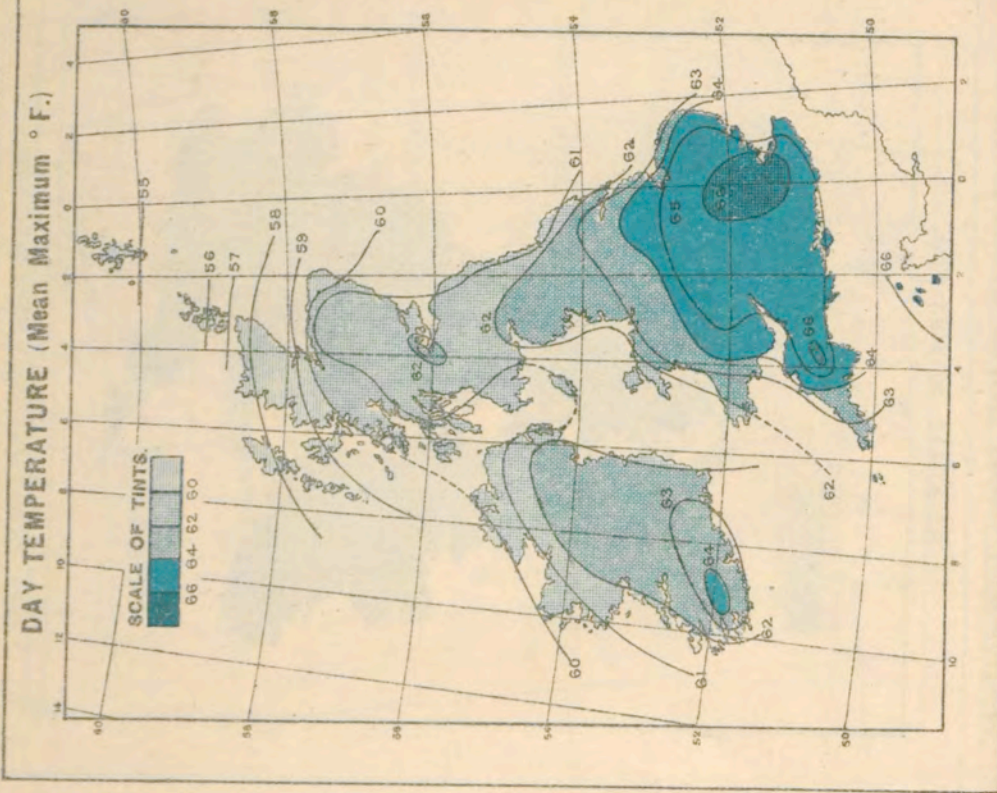
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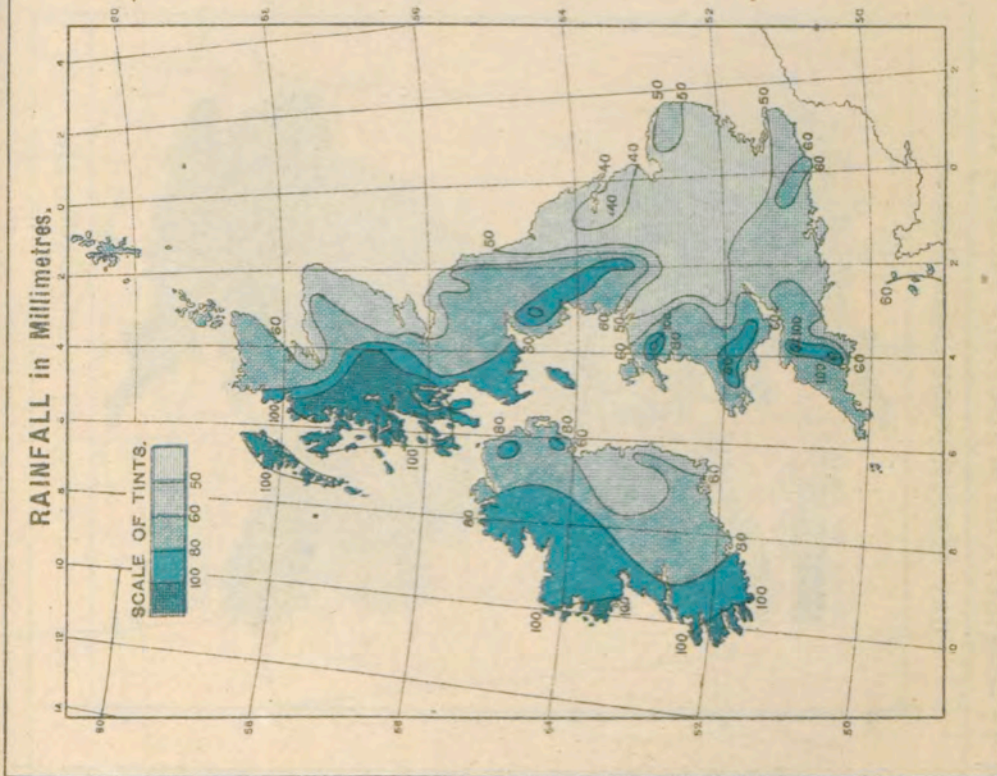
RAINFALL AND SUNSHINE.

NORMAL DISTRIBUTION, 1881-1915. AUGUST.

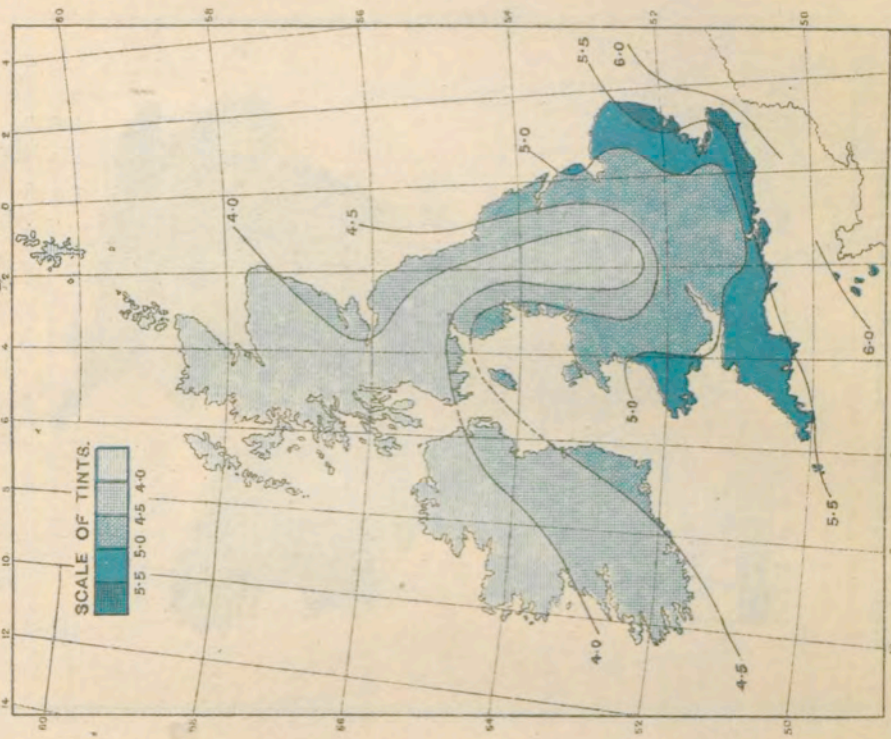




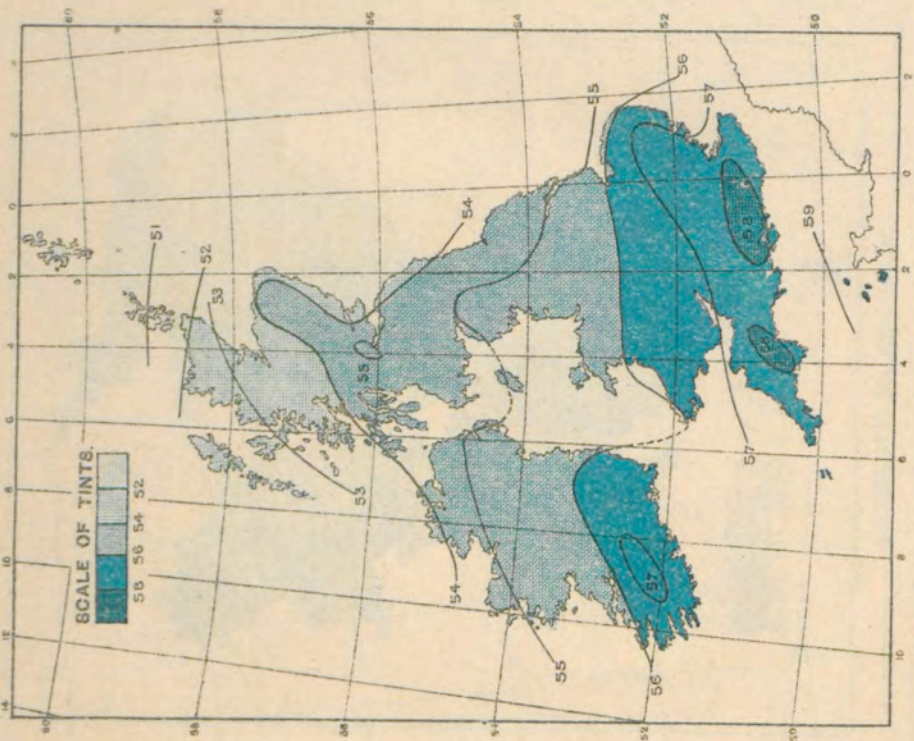
RAINFALL AND SUNSHINE. NORMAL DISTRIBUTION. 1881-1915. SEPTEMBER



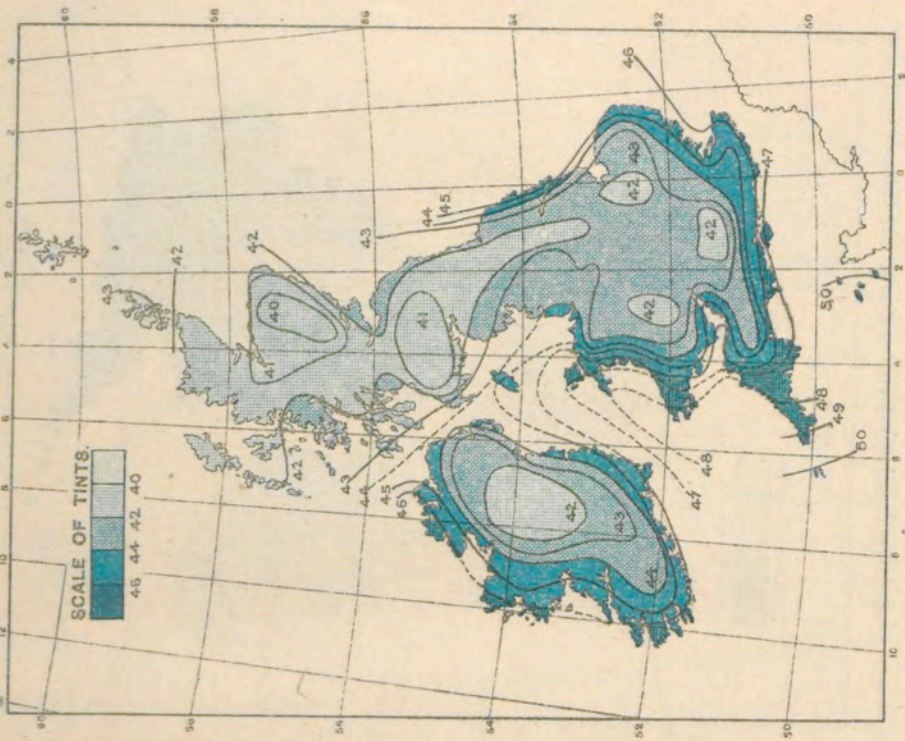
BRIGHT SUNSHINE. Hours per day.



DAY TEMPERATURE (Mean Maximum ° F.)



NIGHT TEMPERATURE (Mean Minimum ° F.)

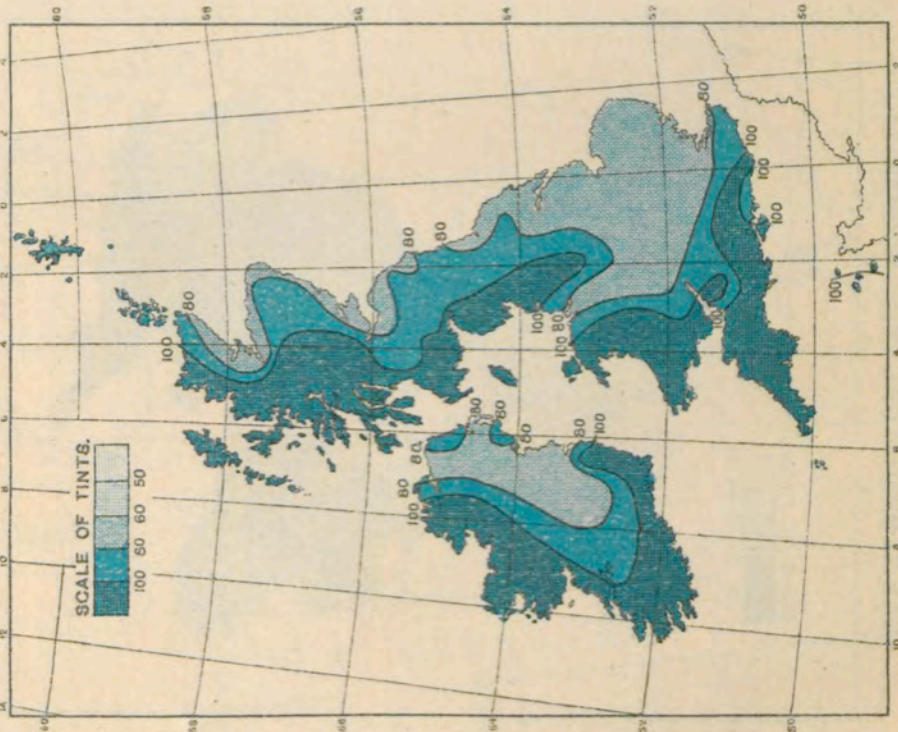


RAINFALL AND SUNSHINE.

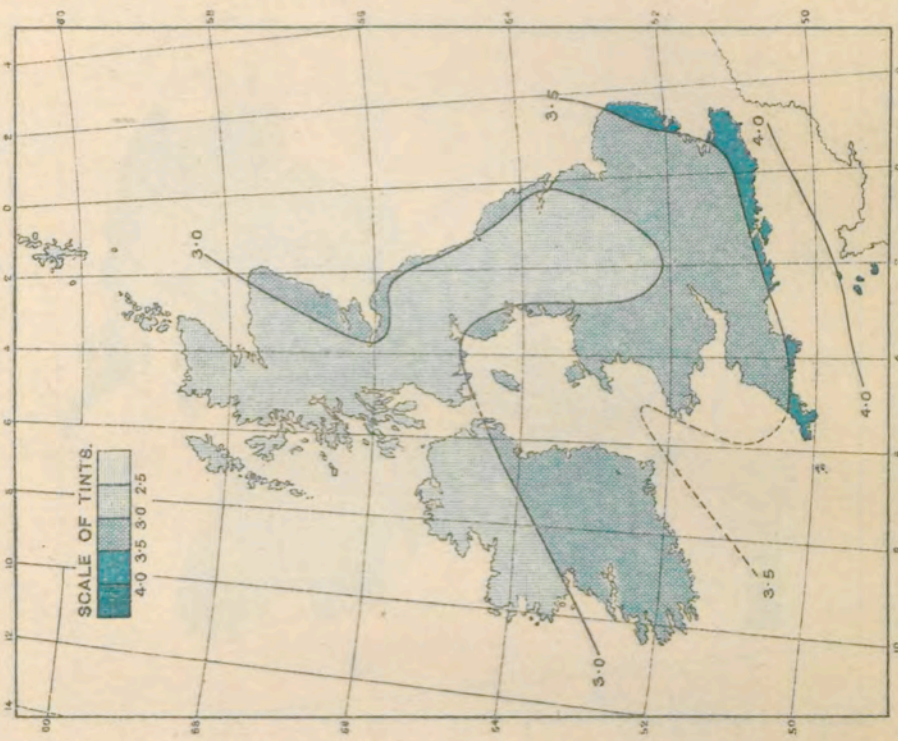
NORMAL DISTRIBUTION.

1881-1915. OCTOBER.

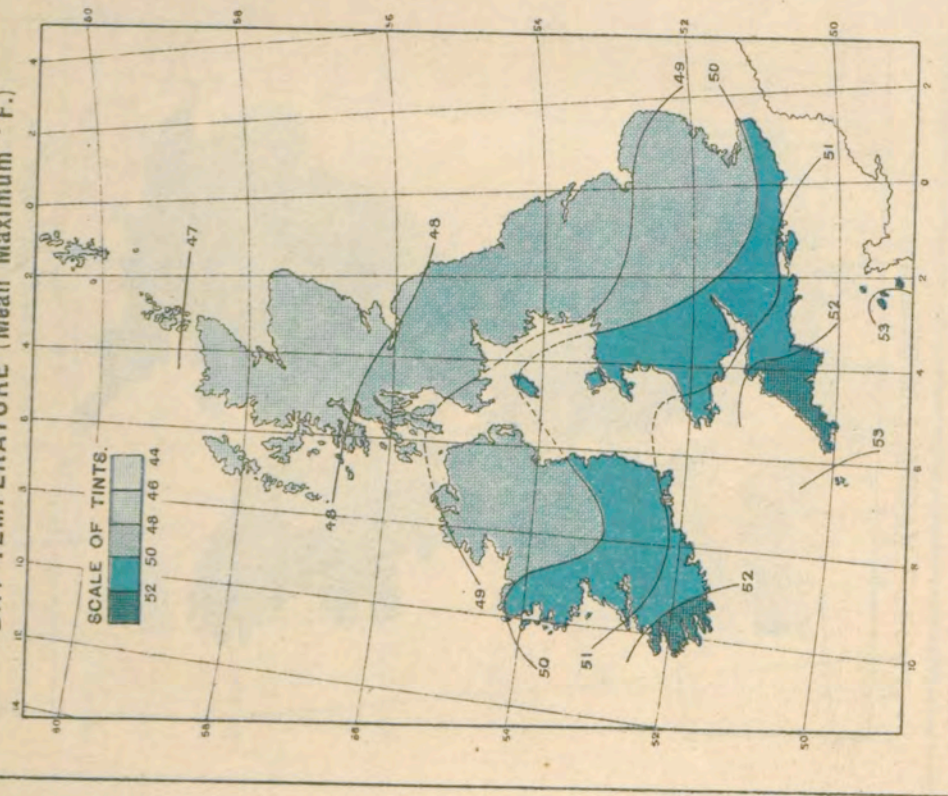
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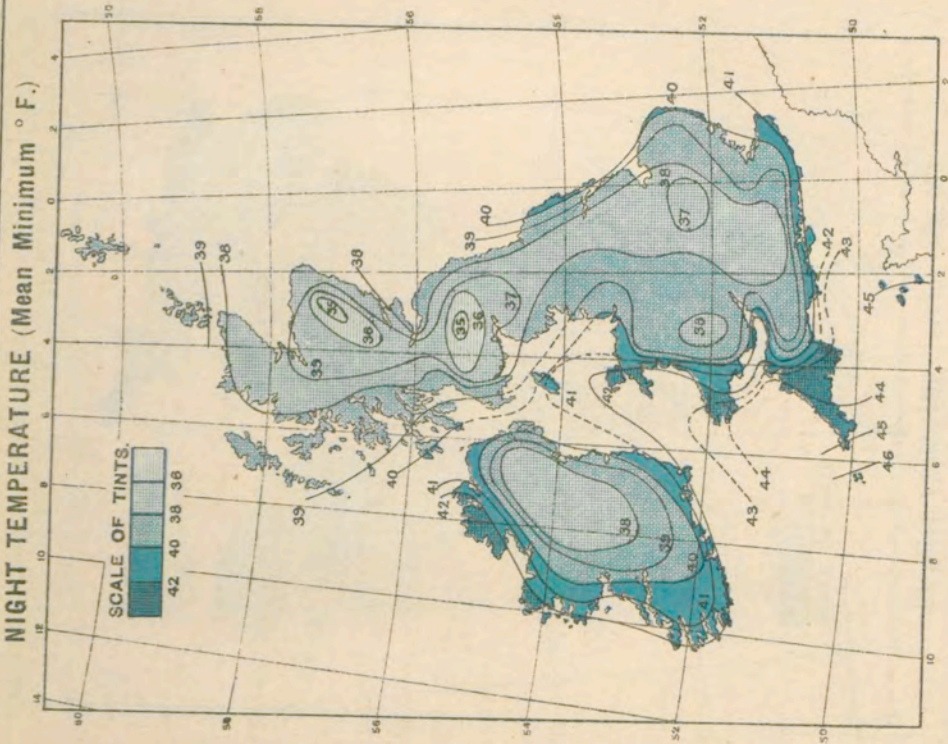
BRIGHT SUNSHINE. Hours per day.



DAY TEMPERATURE (Mean Maximum ° F.)



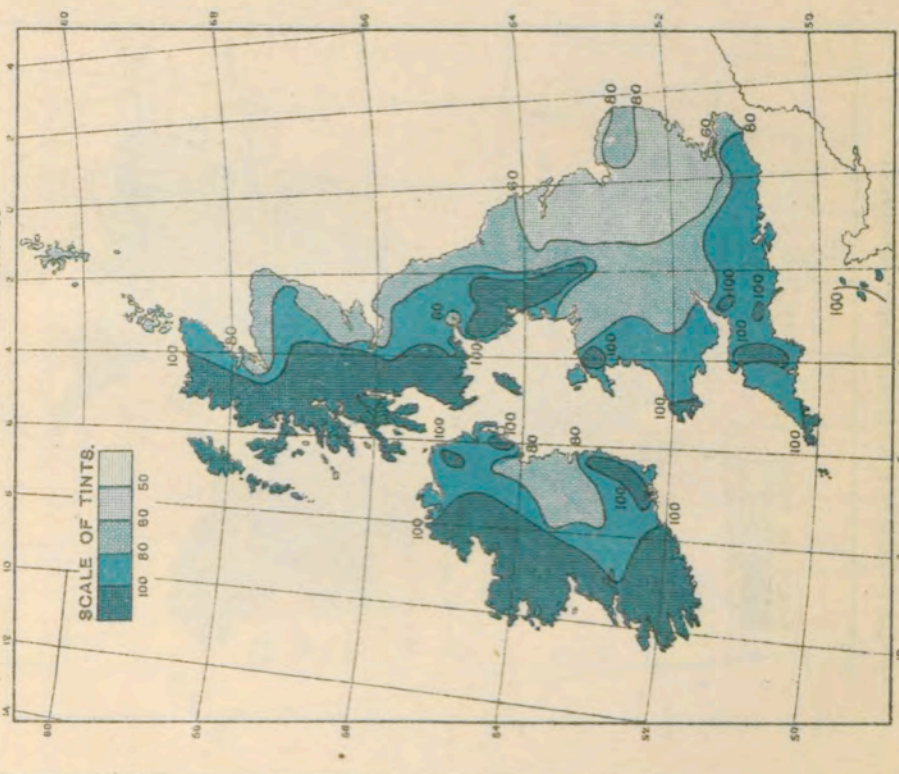
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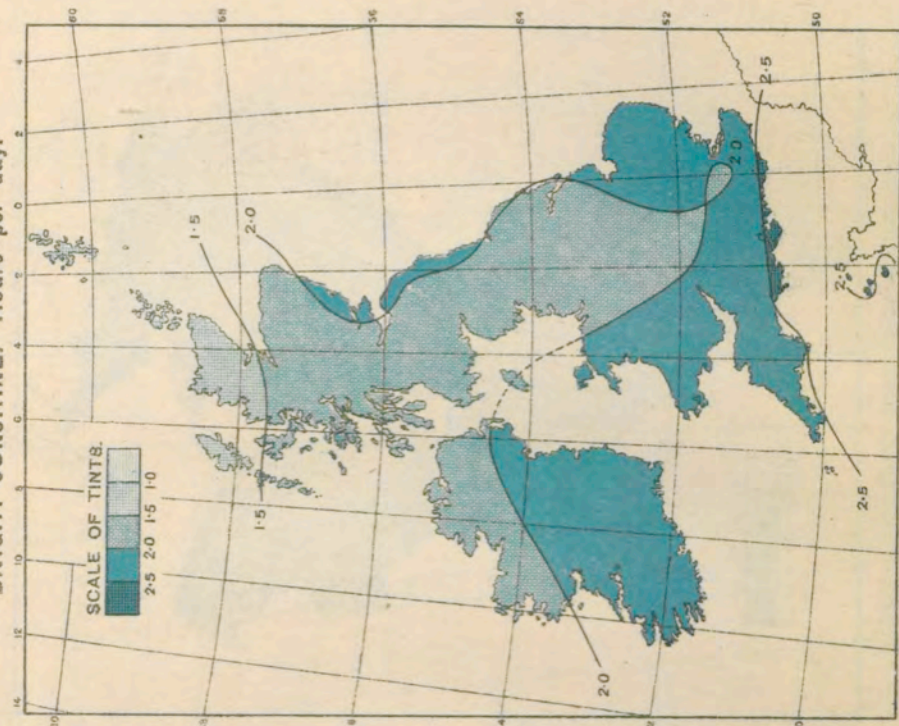
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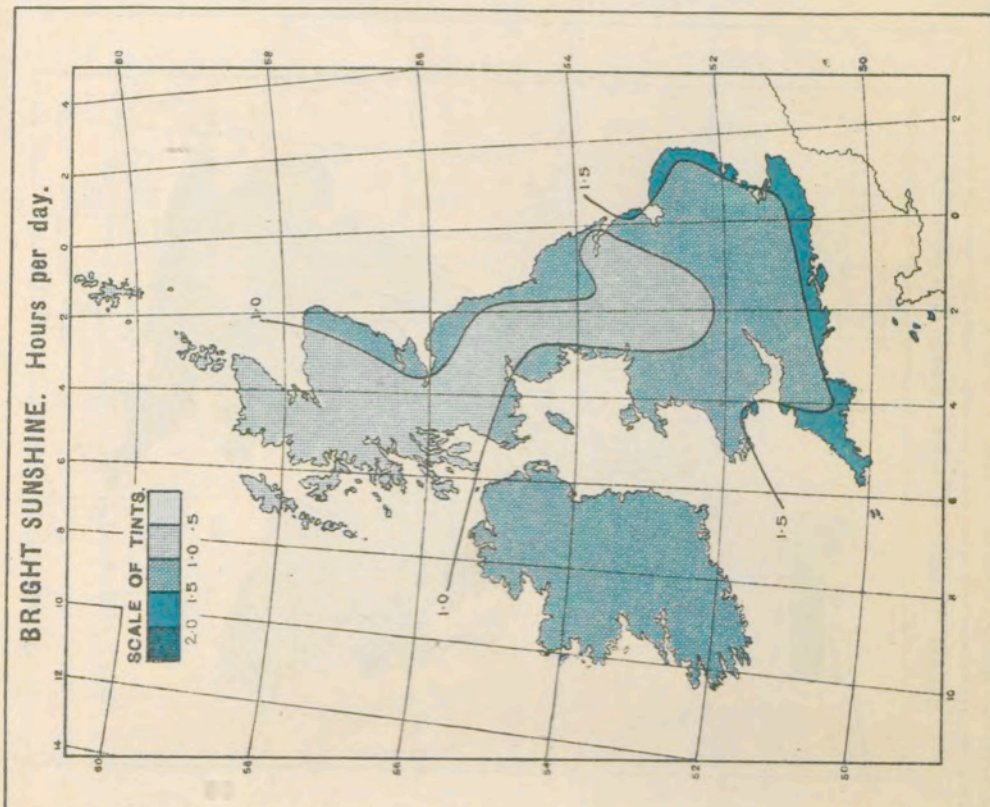
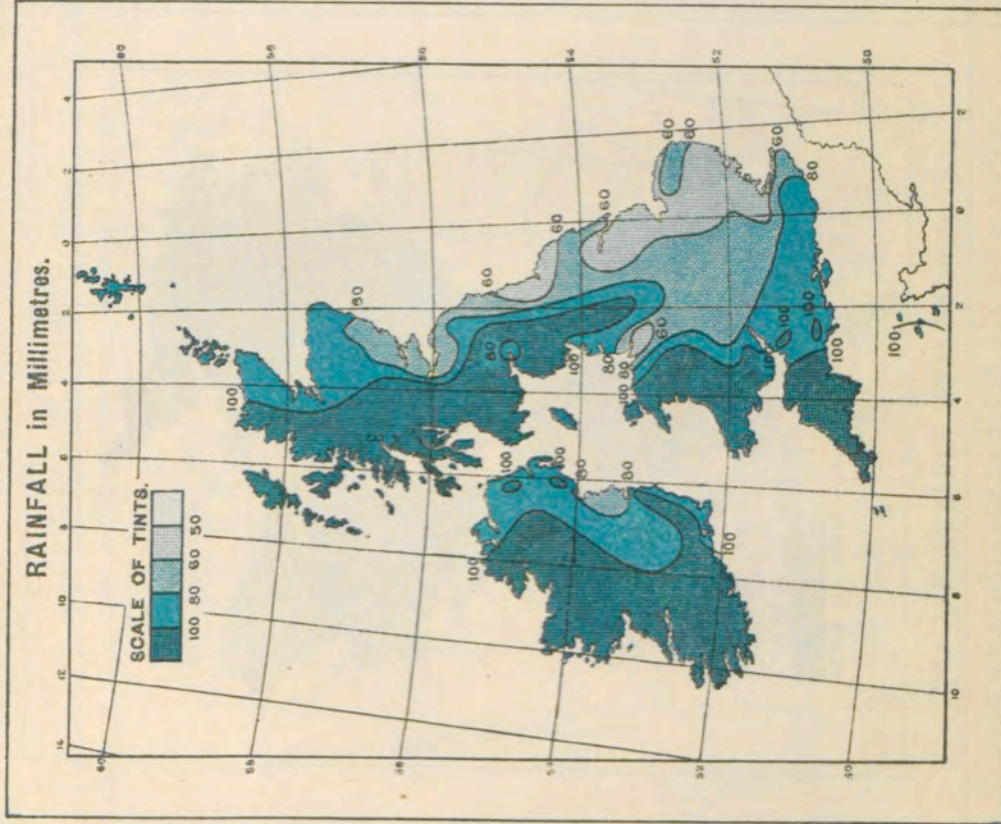
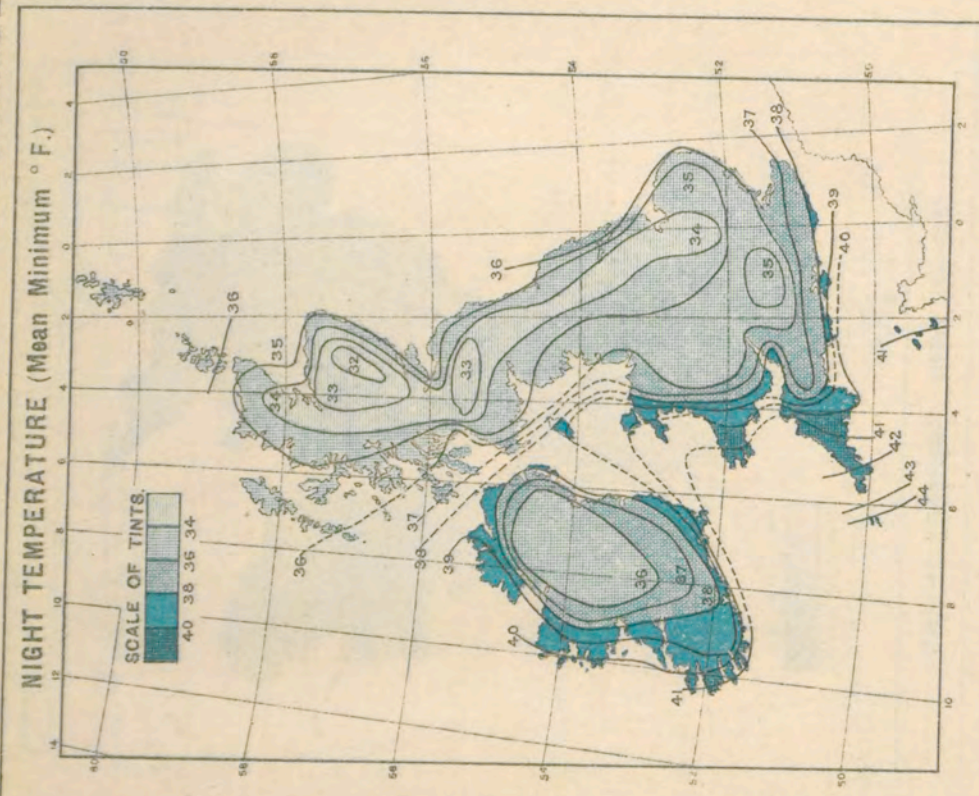
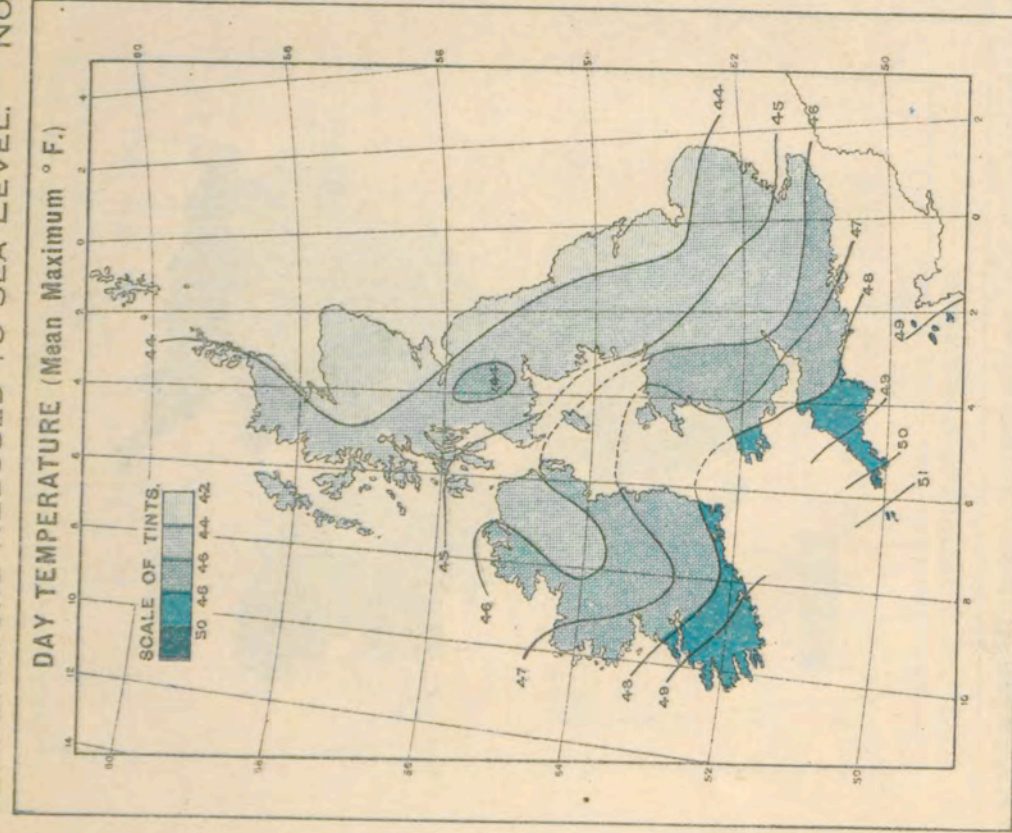
NORMAL DISTRIBUTION, 1881-1915. NOVEMBER.

RAINFALL in Millimetres.

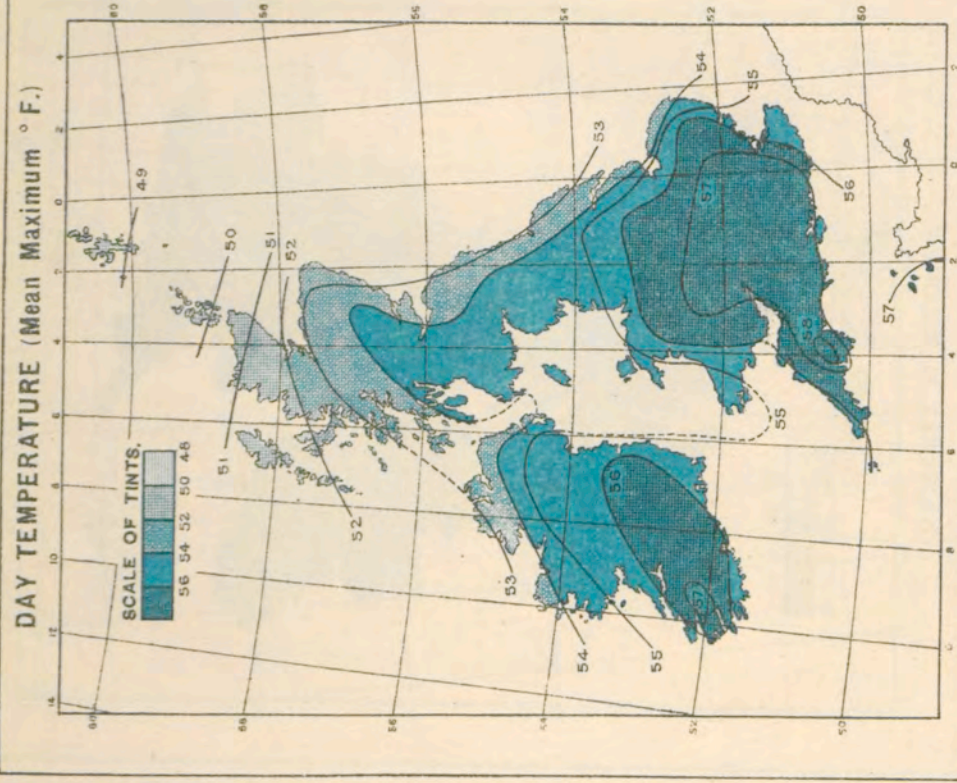


BRIGHT SUNSHINE. Hours per day.

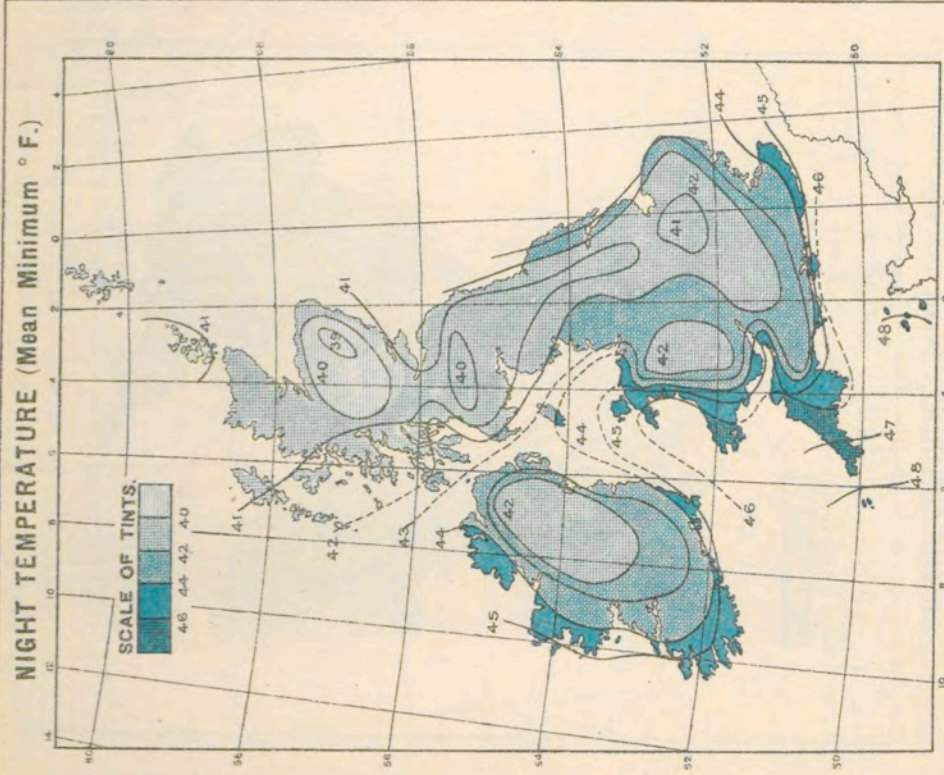




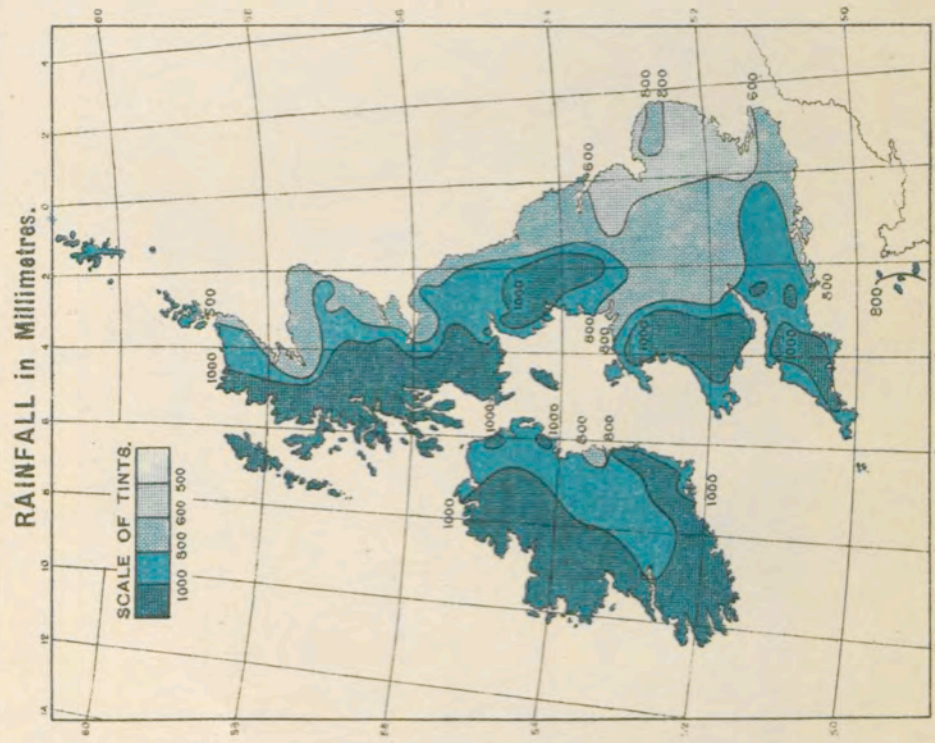
DAY TEMPERATURE (Mean Maximum ° F.)



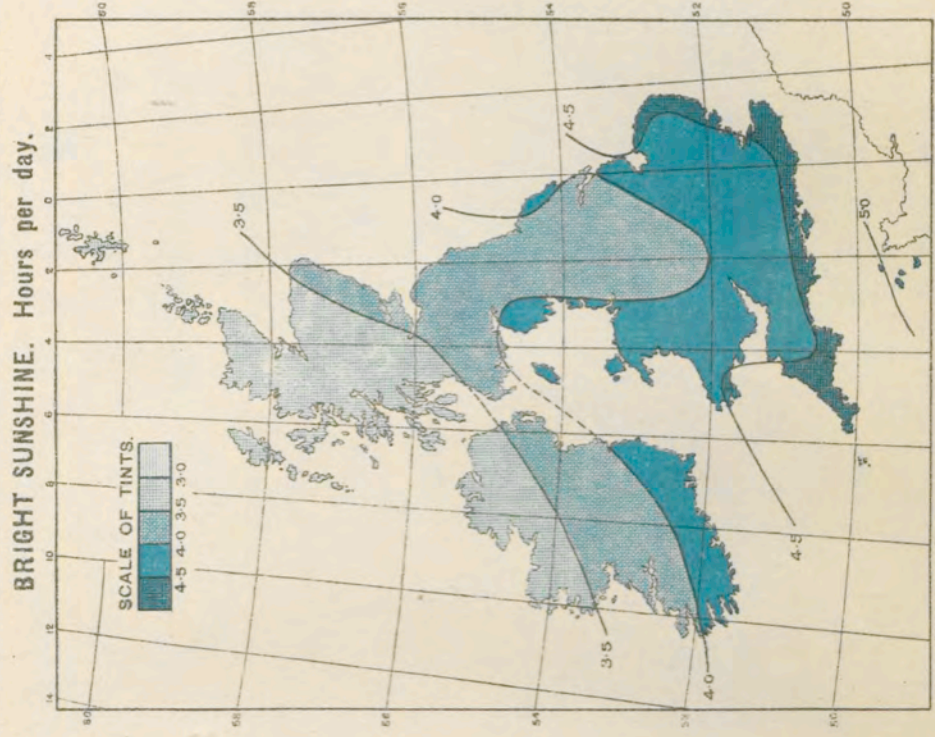
NIGHT TEMPERATURE (Mean Minimum ° F.)



RAINFALL in Millimetres.



BRIGHT SUNSHINE. Hours per day.



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(M) Geophysical Memoirs. (4to).—

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