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METEOROLOGICAL OFFICE

GEOPHYSICAL MEMOIRS, No. 25

(*Fifth Number of Volume III.*)

SURFACE AND GEOSTROPHIC WIND COMPONENTS

AT

DEERNESS, HOLYHEAD, GREAT YARMOUTH AND SCILLY

BY

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Published by the Authority of the Meteorological Committee

LONDON:
PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE
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1925

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SURFACE AND GEOSTROPHIC WIND COMPONENTS AT DEERNESS, HOLYHEAD, GREAT YARMOUTH AND SCILLY

ABSTRACT

Hitherto, the Robinson anemometer records at Deerness, Holyhead, Great Yarmouth and Scilly published in the *Geophysical Journal* have not been utilised for a discussion of surface winds. In this paper an attempt is made to work out the available data for a preliminary study of the average surface winds and also to investigate their relationship to the geostrophic winds derived from charts of the average pressure distribution. As a result of the enquiry the following points are found to be of outstanding importance in the neighbourhood of the British Isles :—

(1) In the winter the *total* movement of air along parallels of latitude is greater than that along meridians except at Deerness, the northernmost station, where the opposite is the case.
(2) In the summer the *net* movement of air along meridians and latitudes is almost negligible.
(3) The annual variation of wind components is more pronounced at Deerness and Scilly than at Holyhead and Great Yarmouth. At the latter two stations the growth of the convective winds tends to obliterate the seasonal fluctuation.
(4) In each month the geostrophic winds derived from charts of average pressure distribution are found to be stronger than the net resultant movement of the surface air, which, in the majority of cases, maintains the characteristic incurvature with respect to the geostrophic wind.
(5) The development of convective winds in summer is the most conspicuous at Great Yarmouth on the east coast. It is found that here the sea breeze is often stronger than the land breeze. At Holyhead there are signs of the growth of convective breezes, but no definite conclusions could be arrived at regarding Deerness and Scilly, which are on small islands rather distant from big land masses.

§ 1. INTRODUCTORY

THE records which are utilised in this paper cover a period of eight years, 1911–1918, and refer to the chief anemograph stations, Deerness, Holyhead, Great Yarmouth and Scilly. The data, which consist of wind components along the geographical co-ordinates at 3h, 9h, 15h and 21h, G.M.T., and calms for each day of the month, have been published in the *Geophysical Journal*, 1911–1918. The wind speed is given in metres per second and occasions on which the speed averages less than 1·6 m/s are reckoned as calms. The monthly sums and differences of the south and north components and also those for west and east components are set out at the foot of Table 8 of the *Journal*. These sums and differences have been corrected for minor errors and revised tables are published already in the Annual Supplement to the *Geophysical Journal* for 1918. The present paper is mainly based on these corrected data.

At all the four stations the Robinson cup anemometer is in use. Particulars regarding this instrument will be found in the *Geophysical Journal*. It will be seen from Figure 4 that the four stations are well distributed over the British Isles. An account of the exposure at each station is given in a paper by Messrs. Lempfert and Braby,* entitled " A method of summarising anemographs with wind roses for Deerness, Scilly, Yarmouth and Holyhead."

The subject matter of the paper is presented in the following order :—

(1) The annual variation of the frequency of the wind components and calms.
(2) The annual variation of the wind components with a brief reference to the diurnal variation in the different seasons.
(3) The diurnal variation of components and resultant drifts in summer.
(4) The resultant drifts and geostrophic winds from monthly charts of pressure distribution.
(5) The development of convective winds with special reference to the diurnal variation of the components and their frequencies in the summer months.

* *Q.J. R. Meteor Soc.*, Vol. 38, 1912, p. 221.

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§ 2. Frequency of Wind Components and Calms, Annual Variation.

The frequencies of wind components and calms as counted from Tables 8 of the *Geophysical Journal* are set out in Table IA to D. With regard to these frequencies, it is important to bear in mind that for each wind-direction there are usually two entries in the columns for components except in the case of calms and winds blowing from due south, west, north or east. For simplicity, the percentage frequencies in Table II are based on the number of days on which records are available. The number of such days corresponding with each hour is published in the Annual Supplement already referred to, and the total number of observations in each month for the eight years' period is quoted in Table II. The following example illustrates the method by which Table II has been derived from Table I.

At the rate of four observations per day, the total number in eight Januaries would be 992, of which 983 are available. Counting all the hourly observations it is found from Table IA for Deerness that there are 643 south, 305 north, 517 west, 378 east components and 4 calms, giving a total of 1,847 entries. Thus the frequency of the south component is 65·4 per cent. of 983 observations and similarly for other components and calms. It should be added that percentage frequencies of the several components and calms computed in this way do not add up to 100 as is ordinarily the case. Nevertheless, Table II illustrates the annual variation of the frequencies of the components and calms at the four stations.

The frequencies of the components are generally consistent with the prevailing pressure gradient over the country, but, in the summer months, the abnormally high frequencies of the east component at Great Yarmouth and the west component at Holyhead are of special interest. The preponderance of the north component in spring is also noteworthy. As is to be expected, calms are more frequent in summer and autumn than in winter or spring.

§ 3. Monthly Averages of Wind Components.

It will be noticed that the sums of the components, such as S+N and W+E, published in the *Geophysical Journal* may be regarded as representing the total movement of air along meridians and parallels of latitude, whilst differences, such as S−N and W−E, the net movement along those lines. S+N is called the " meridional flow," S−N the " meridional drift," W+E the " latitudinal flow " and W−E the " latitudinal drift." The vector obtained by plotting W−E against S−N will be called the " resultant drift."

Monthly sums of the individual components can be easily found from the data of the drift and flow. The monthly averages of the several components are then obtained by dividing the monthly totals by the number of days on which observations are available. For instance, it will be found from the Annual Supplement to the *Geophysical Journal*, 1918, that, at Deerness, in eight Januaries $\Sigma\,(S+N)=1401\cdot9$ m/s and $\Sigma\,(S-N)=610\cdot7$ m/s at 3h G.M.T., so that $\Sigma\,S=1006\cdot3$ m/s and $\Sigma\,N=395\cdot6$ m/s. During the period in question there are 246 observations at 3h G.M.T., and, therefore, the average values of the south and north components are $S=4\cdot1$ m/s and $N=1\cdot6$ m/s, respectively. It should be observed that monthly averages obtained in this way mean that all the components are equally distributed to each day of the month. The monthly averages for 3h, 9h, 15h, 21h and for all hours are set out in Tables IIIA to D.

(a) *Annual Variation.*—The nature of the diurnal variation of the several components in each month can be easily gathered from the tables. As far as the annual variations of the flow, the drift and the components are concerned we shall restrict ourselves to monthly averages based on all the hourly observations.

Figure 1 depicts the annual variation of the meridional and latitudinal flows at the four stations. The meridional and latitudinal flows are represented by continuous and broken lines, respectively. The fact that in winter the meridional flow exceeds the latitudinal flow at Deerness only is to be attributed to the greater frequency of the centres of cyclones in the Icelandic regions at this time of the year.

FIG. 1.

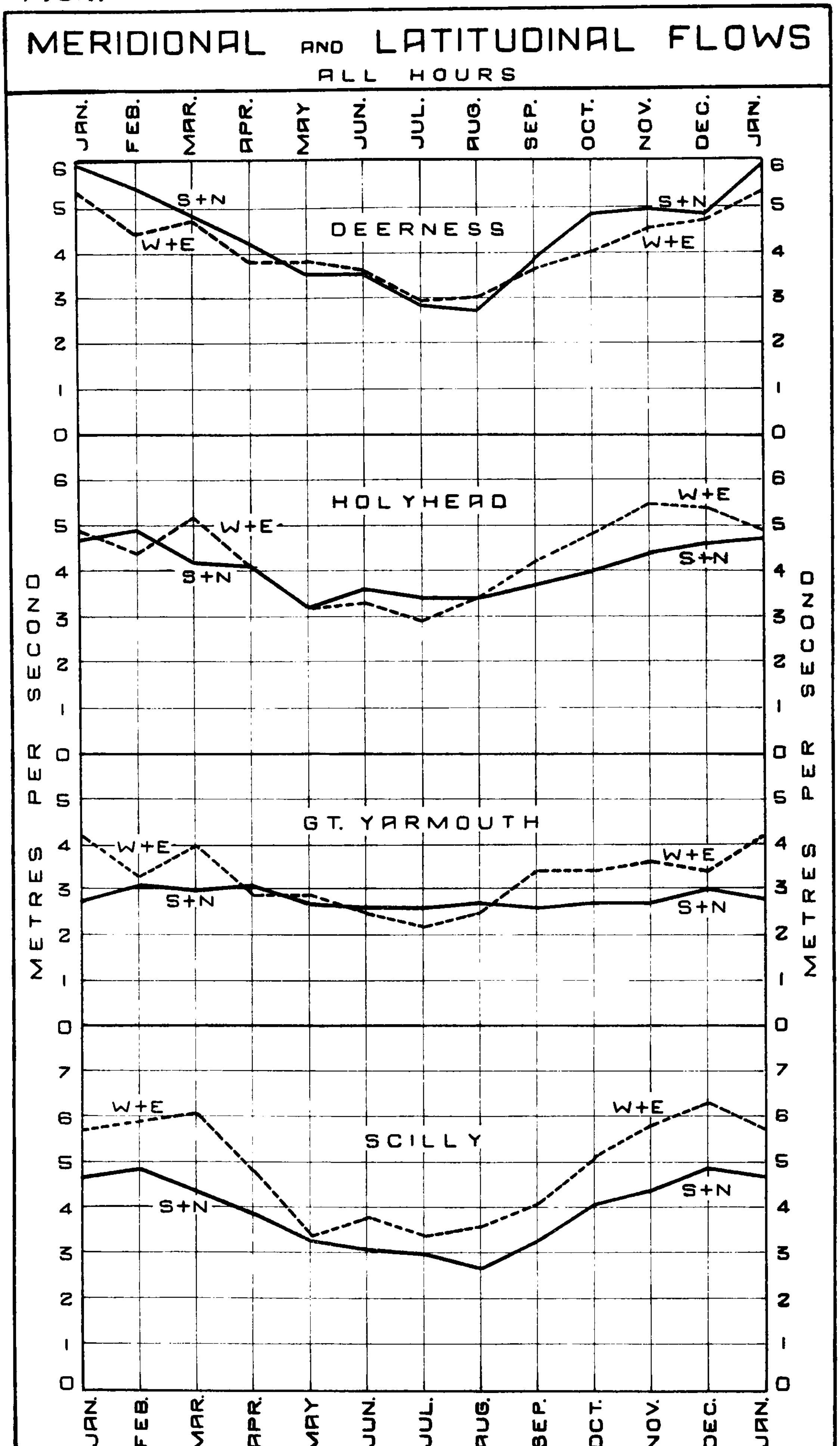

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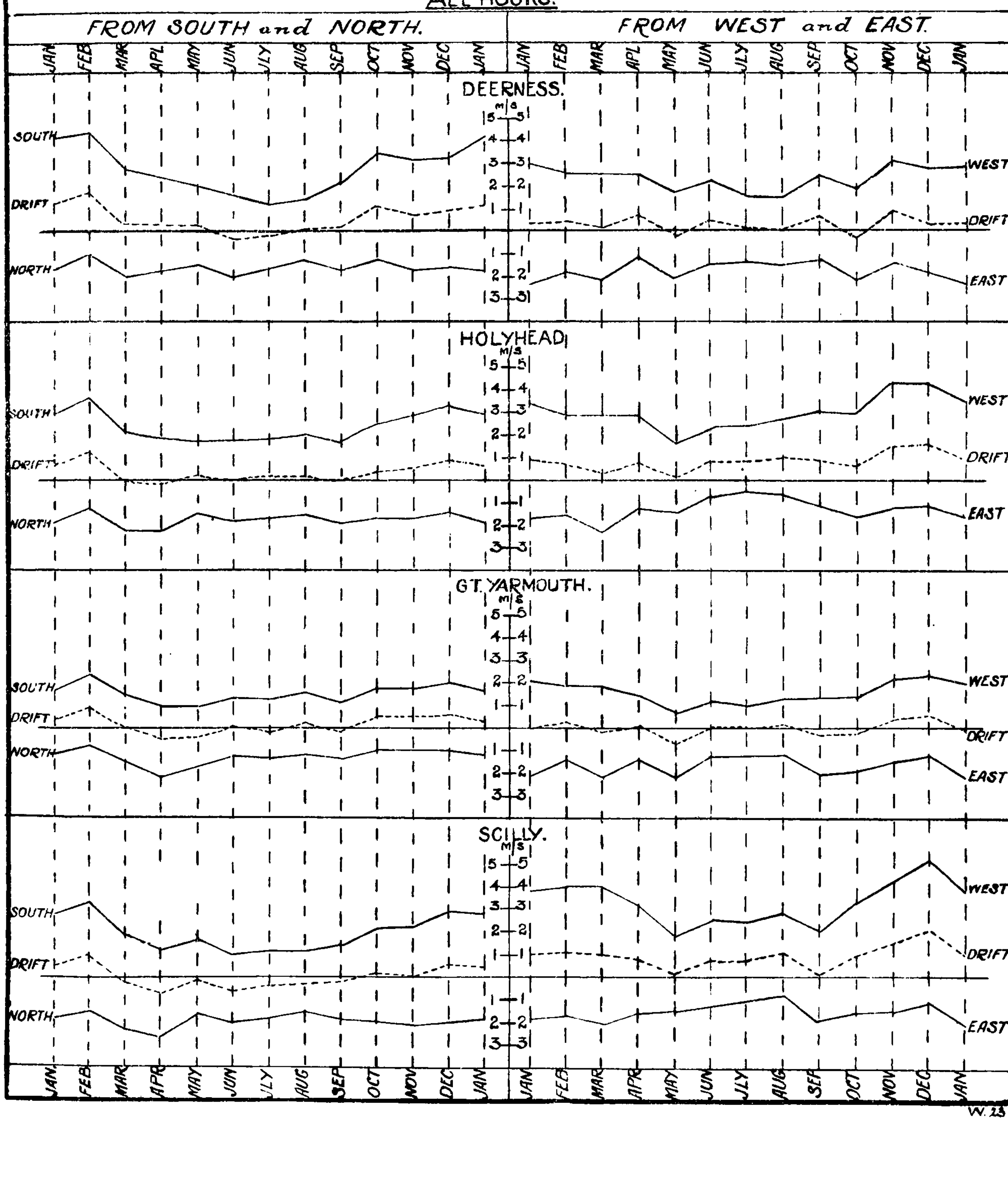
FIG. 2. MEAN WIND COMPONENTS. 1911-1918. ALL HOURS. TO FACE PAGE 168.



DIURNAL VARIATION OF WIND COMPONENTS.

FIG. 3. SUMMER. (MAY, JUNE, JULY, AUGUST) 1911–1918. TO FACE PAGE 169.

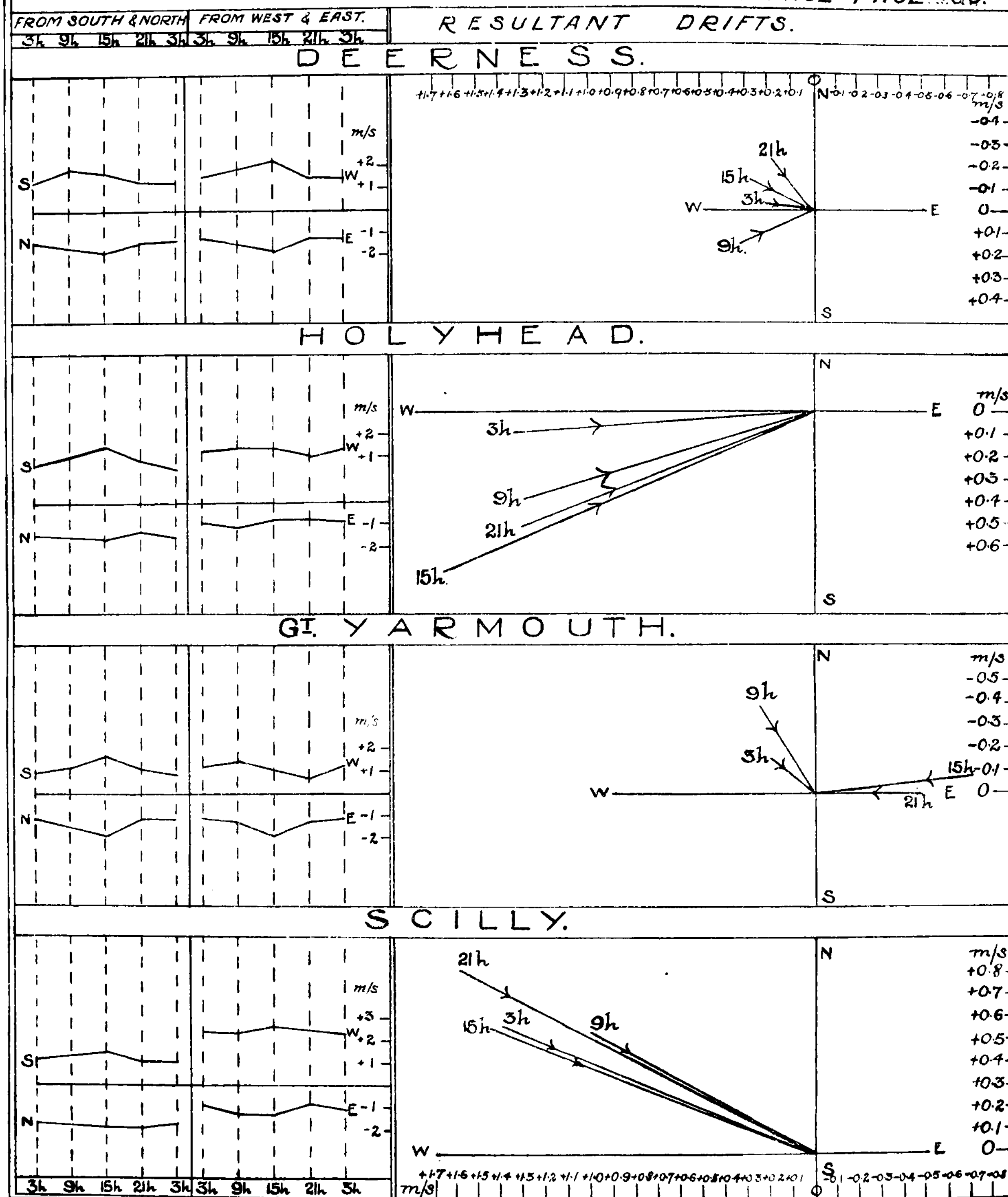


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Figure 2 illustrates the annual variation of the components and the meridional and latitudinal drifts. The left-hand side of the figure pictures the annual variation of the south and north components and meridional drifts whilst the right-hand side shows the variation in the case of the east and west components and latitudinal drifts. From a common base line the monthly averages of the south component are plotted upwards and those for the north component downwards. The intercepts on the ordinates between the continuous zig-zag lines on both sides of the base line represent the meridional flows and the intercepts of the ordinates between the base line and the broken zig-zag line, which bisects the strip, represent the meridional drifts. Actually the latter intercepts, as seen in Figure 2, are equal to $\frac{1}{2}$ (S—N). Exactly the same scheme has been adopted for the west and east components and the latitudinal drifts.

In the winter months the average strengths of the south and west components are greater than the average strengths of the north and east components, respectively, and, therefore, the average drift across the British Isles is from the south-west. In the summer months, however, there is a general weakening of the components under anticyclonic conditions and the net drift over the British Isles is very small.

Yearly averages based on all the hourly observations show that the south component increases and the west component diminishes with latitude. The only exception to this generalisation is Great Yarmouth, which is obviously at a disadvantage compared with the other three stations as far as the exposure to winds in the south-western quadrant is concerned.

(b) *Seasonal Variation.*—Means of wind components for the four seasons which have been worked out from Tables IIIA to D are set out in Table IV. These are also arithmetical means derived in exactly the same way as the monthly means. Months utilised for computing the seasonal averages are noted in Table IV. An examination of the data in this table will show the appropriate diurnal variation in each season. It will be noticed that the maximum of the north component occurs between 9h and 15h G.M.T. at all the four stations irrespective of the season.

§ 4. The Diurnal Variation of Wind-Components and Resultant Drifts in Summer.

(a) *Wind Components.*—The summer months are characterised by light pressure gradients over the British Isles. The diurnal variation of the components is therefore expected to be the most marked at this time of the year. The summer data of the components in Table IV are utilised in the construction of the left-hand side of Figure 3. From a common base line the hourly values of the south component are plotted upwards and the north downwards. The same scheme has been adopted for the east and west components. As far as could be gathered from only four observations per day the maximum of the components occurs in the neighbourhood of 15h, and the minimum between 3h and 21h G.M.T. The variation is, therefore, consistent with the view that the wind speed increases as the turbulence increases with the progress of the day.

(b) *Resultant Drifts.*—The data for the resultant drifts are also taken from Table IV. The variations of the resultant drifts at the four stations in summer are depicted on the left-hand side of Figure 3 which is to be studied along with the right-hand side of the diagram. The scales are shown on the diagram itself. A few more interesting points in this connection will be noted in the concluding section of this paper.

§ 5. The Resultant Drift and the Geostrophic Wind.

It is now proposed to investigate the relationship between the resultant drift based on all the published observations and the geostrophic wind derived from monthly charts of pressure distribution. The monthly averages of pressure for the period 1911–1918 were computed for a number of telegraphic reporting stations (about 30) from the lustrum sheets kept at the Meteorological Office, South Kensington. The observations refer to 7h G.M.T.

The peculiar insular position of the British Isles renders the determination of the geostrophic wind at such stations as Deerness and Scilly extremely difficult, especially in the summer months, owing to the flatness of the pressure distribution. The geostrophic wind was therefore only tabulated when it was possible to measure the distance between consecutive isobars on each side of the station with at least some degree of confidence.

Figures 4, 5 and 6 consist of a series of twelve charts. The isobars on these charts are drawn in broken lines at intervals of a millibar. The geostrophic winds* over each station were obtained in the usual way. The components of the geostrophic wind, along with meridional and latitudinal drifts (*see* Tables IIIA to D), for all hours are set out in Table V. The data in this table are utilised in the construction of the vector diagrams in Figures 4, 5 and 6. The thick line G is the geostrophic wind and the thin line R the resultant drift. When no geostrophic wind is available only the resultant drift R is shown on the maps. A wind scale for use with these vector diagrams is shown on each chart. As the geostrophic wind has very little diurnal variation its comparison with the resultant drift based on all the hourly observations is probably justified.

The chart for May practically has no pressure gradient, and so it has not been possible to compute geostrophic winds for this month. The resultant drifts at the four stations as shown on the charts, however, represent an anticyclonic circulation. It will be noticed that most of the vector diagrams are consistent regarding the relationship between the geostrophic wind and the surface drift. In a few instances the geostrophic wind and the surface drift coincide. In such cases the wind strengths G and R are to be measured with the station as origin. The approach of the resultant surface drift to the geostrophic wind is closest at Scilly, the greatest departure being noted at Deerness. The peculiarity of some of the vector diagrams for Great Yarmouth is to be attributed to the development of convective winds which are discussed in the next section.

§ 6. The Growth of Convective Winds in Summer.

(a) *Percentage Frequency of Wind-Components and Calms. Diurnal Variation.*—Table VI gives the percentage frequency of the wind components and calms in May, June, July and August. The following example illustrates the method of computation. It will be seen from Table IA that at Deerness during the four summer months there are 466 south, 408 north, 443 west, 423 east components and 37 calms at 3h G.M.T. For the period in question there are 981 days on which observations are available at 3h G.M.T. Thus the frequency of the south component is 47·5 per cent of 981 observations and similarly for other components and calms. Frequencies appropriate to other hours are obtained in exactly the same way. These percentage frequencies do not add up to 100 as in the case of monthly frequencies. From Table VI it is clear that there is very little diurnal variation of the frequency of the components at Deerness and Scilly. It is also interesting to note that the occurrence of the minimum frequency of calms at 15h G.M.T. is rather more sharp and short-lived at Holyhead and Great Yarmouth than at Deerness and Scilly.

(b) *The Convective Winds.*—It should be pointed out that the land breeze at Holyhead and the sea breeze at Great Yarmouth are opposed to the usual pressure gradient over the British Isles. The phenomena are in evidence at these stations only when the general gradient is light, as in the summer months. Deerness and Scilly, however, are on small islands distant from big land masses. Of all the stations Great Yarmouth is the most favourably situated for the growth of convective winds. The average trend of the coast line is from north to south at this station, and the pressure gradient is extremely light in the summer months (*see* Figure 5) so that the convective winds are from east or west.

* *The Computer's Handbook*, Section II, § 3, p. 49.

The following is a summary of the chief facts which suggest the growth of convective winds at Holyhead and Great Yarmouth:

(1) *Land Breeze*

(i) At Great Yarmouth the falling off of the frequency of the west component from 56·2 per cent at 3h to 48·7 per cent at 9h G.M.T. is characteristic of the decaying land breeze. (*See* Table VI.)

(ii) At Holyhead the decrease of the frequency of the east component from 26·3 per cent at 3h to 25·9 per cent at 9h and to 18·4 per cent at 15h G.M.T. points to the decay of the land breeze and growth of the sea breeze. (*See* Table VI.)

(2) *Sea Breeze*

(i) At Great Yarmouth the frequency of the east component increases from 39·4 per cent at 9h to 48·8 per cent at 15h G.M.T. This phenomenon is certainly due to the prevalence of the sea breeze in summer afternoons and evenings. (*See* Table VI.)

(ii) The maximum frequency of the east component at Great Yarmouth in May as shown in Table II is significant. The resultant drift at Great Yarmouth in the chart for May (*see* Figure 4) is approximately at right angles to the coast line. This shows that the sea breeze is stronger than the land breeze at this time of year.

(iii) It will be noticed from Figure 3 that at Great Yarmouth there is a simultaneous falling off of the west component and the growth of the east component between 9h and 15h G.M.T., a feature which is not present in the diagrams for other stations. The phenomenon is certainly due to the growing easterly sea breeze.

(iv) The diurnal variation of the resultant drift at Great Yarmouth shown on the right-hand side of Figure 3 is the most striking diagram of its kind. The gradual veering of the resultant drift from 3h G.M.T. to 21h G.M.T. illustrates the transition from the land to the sea breeze. At 21h the resultant drift is practically at right angles to the coast line.

(v) The peculiarity of some of the vector diagrams (Figures 4 and 5) for Great Yarmouth is due to the sea breeze being stronger than the land breeze.

(vi) At Holyhead the remarkable increase of the frequency of the west component in the summer months as shown in Table II in comparison with other stations may be regarded as evidence of the development of the sea breeze.

(vii) From Table VI it will be noticed that at Holyhead the frequency of the west component increases from 64·8 per cent at 9h to 72·9 per cent at 15h G.M.T. This phenomenon also points to the growth of the sea breeze at Holyhead.

From the preceding remarks it is quite clear that of the four stations Great Yarmouth and Holyhead show signs of the development of convective winds. At Holyhead, however, the evidence obtainable is not so convincing as at Great Yarmouth. The limitations of the Robinson cup anemometer, should be taken into account in this study of convective winds.

Fig. 4.

Average Geostrophic Winds G and Resultant Drifts R at Deerness, Holyhead, Gt. Yarmouth and Scilly.

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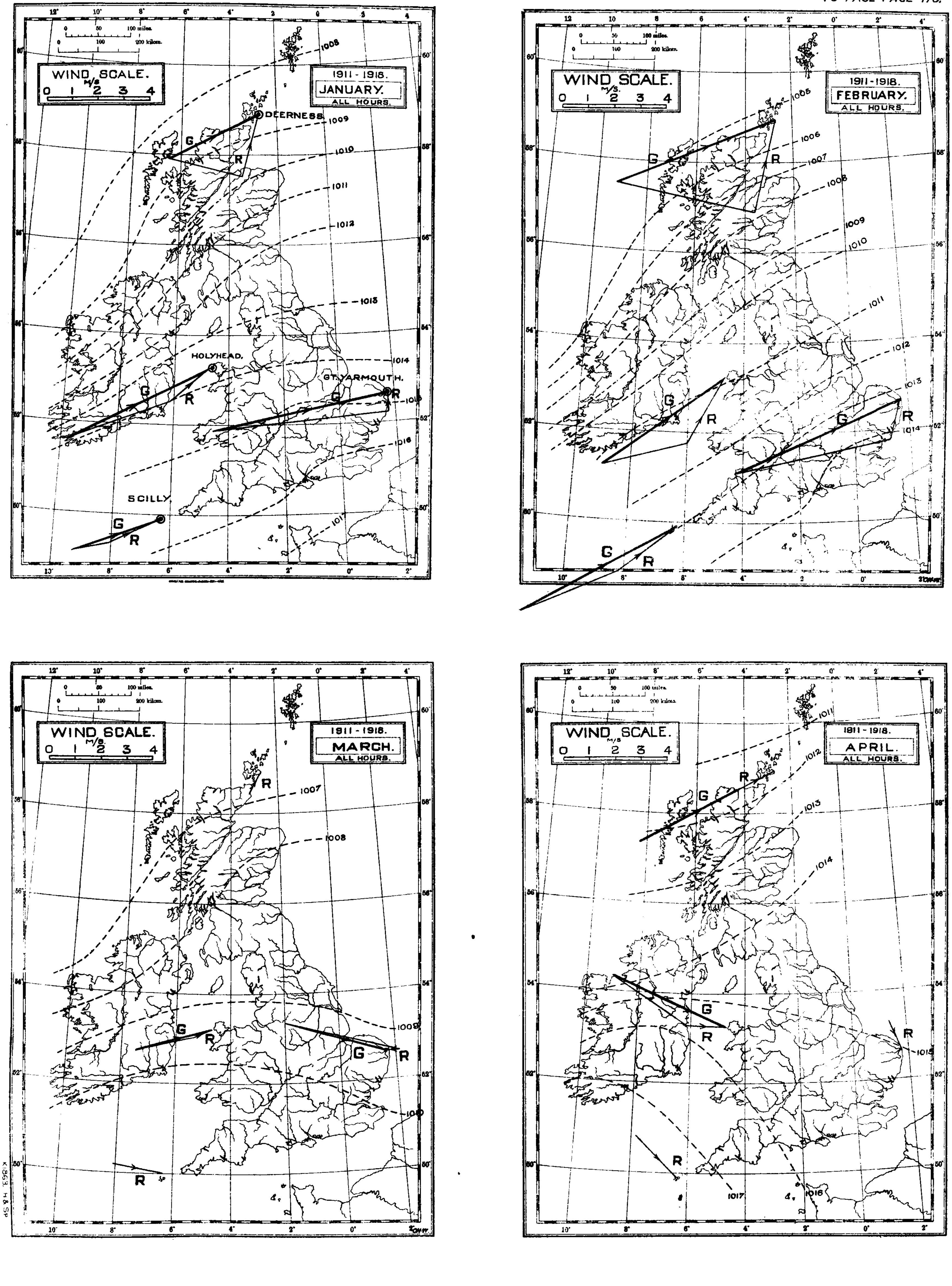

Fig. 5.

Average Geostrophic winds G and Resultant Drifts R at Deerness, Holyhead, Gt. Yarmouth and Scilly.

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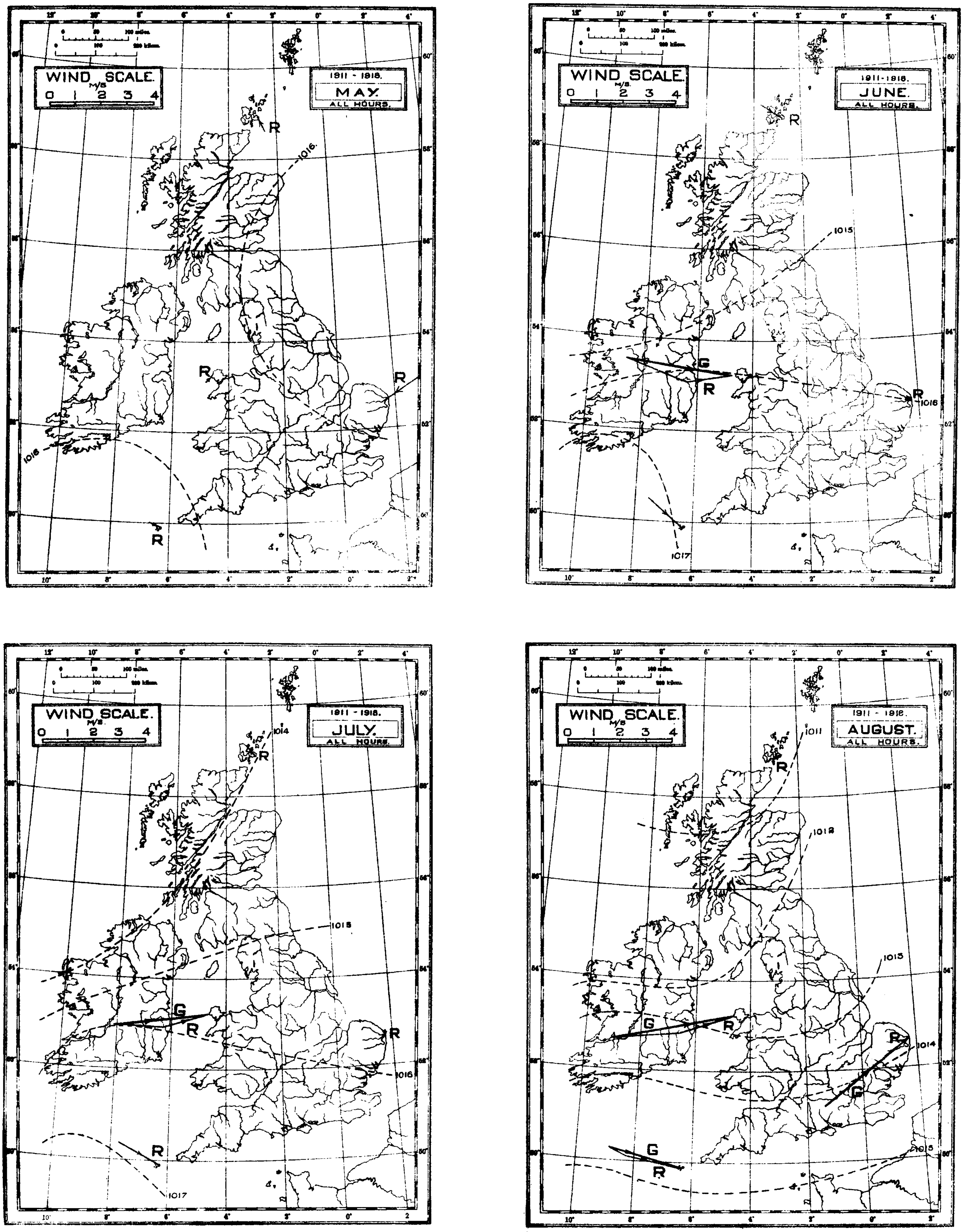

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Fig. 6.

AVERAGE GEOSTROPHIC WINDS G AND RESULTANT DRIFTS R AT DEERNESS, HOLYHEAD, GT. YARMOUTH AND SCILLY.

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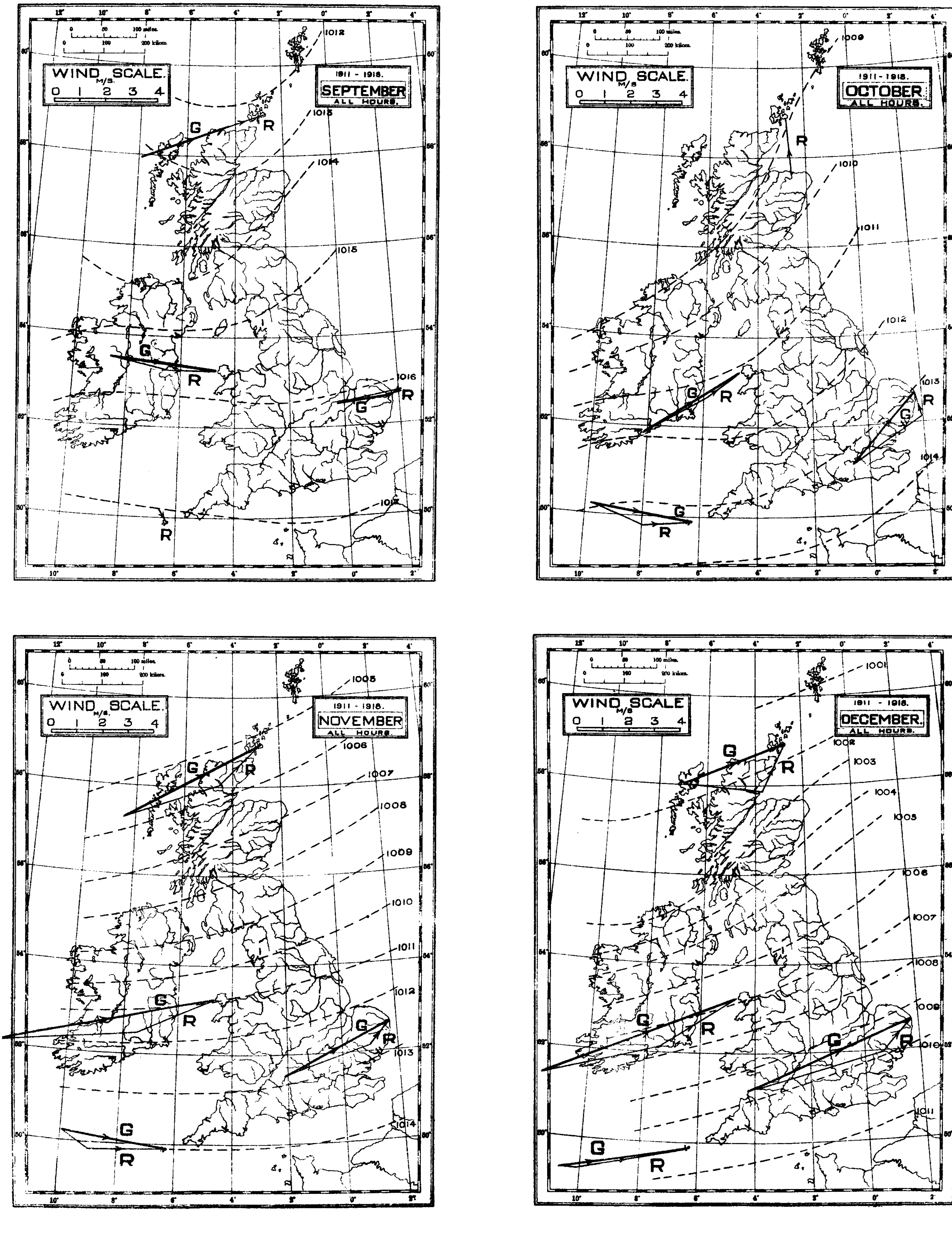


TABLE IA.—FREQUENCY OF WIND COMPONENTS AT DEERNESS, 1911–1918.

Months	South Component					North Component					West Component					East Component					Calms				
	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hrs.
January ..	156	164	163	160	643	81	75	73	76	305	130	130	127	130	517	88	96	93	101	378	2	1	0	1	4
February ..	156	155	163	161	635	54	52	52	57	215	115	120	120	118	473	86	80	85	86	337	1	1	0	0	2
March ..	138	127	132	138	535	92	101	98	89	380	132	127	123	125	507	101	100	97	109	407	1	1	0	2	4
April	121	132	127	112	492	92	92	99	105	388	137	122	124	131	514	77	85	90	84	336	6	1	0	4	11
May	135	138	125	124	522	85	93	92	99	369	114	102	95	104	415	109	119	133	118	479	6	0	2	7	15
June	109	98	104	93	404	106	116	116	118	456	107	112	102	107	428	102	95	117	107	421	8	1	0	5	14
July	113	120	110	99	442	107	109	117	115	448	116	112	99	113	440	97	110	125	111	443	13	3	1	8	25
August ..	109	123	115	114	461	110	103	108	105	426	106	110	106	104	426	115	109	111	111	446	10	3	3	8	24
September ..	121	124	126	121	492	95	101	87	93	376	140	138	127	133	538	73	79	86	85	323	6	2	2	4	14
October ..	153	160	163	148	624	74	62	72	72	280	108	90	105	109	412	107	113	113	114	447	4	9	2	2	17
November ..	130	132	136	132	530	82	77	84	80	323	147	149	148	149	593	59	66	59	65	249	7	7	5	6	25
December ..	138	144	136	145	563	84	79	79	81	323	154	139	139	148	580	69	80	81	76	306	7	7	7	4	25
Year	1,579	1,617	1,600	1,547	6,343	1,062	1,060	1,077	1,090	4,289	1,506	1,451	1,415	1,471	5,843	1,083	1,132	1,190	1,167	4,572	71	36	22	51	180

TABLE IB.—FREQUENCY OF WIND COMPONENTS AT HOLYHEAD, 1911–1918.

Months	South Component					North Component					West Component					East Component					Calms				
	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hrs.
January ..	139	145	151	147	582	87	77	80	83	327	141	135	144	137	557	93	97	87	95	372	1	1	1	0	3
February ..	140	142	145	137	564	76	68	70	73	287	132	122	128	117	499	76	83	66	83	308	0	1	1	1	3
March ..	110	116	113	109	448	102	103	113	110	428	132	125	139	134	530	94	102	81	93	370	4	2	1	0	7
April	99	103	100	100	402	119	115	130	121	485	140	144	171	154	609	78	79	60	72	289	4	3	0	4	11
May	117	110	103	119	449	99	108	129	109	445	127	128	161	134	550	89	88	61	85	323	11	8	2	8	29
June	98	106	111	110	425	108	118	119	113	458	156	166	181	164	667	63	56	39	48	206	13	2	2	9	26
July	113	109	121	130	473	108	107	116	104	435	174	174	191	186	725	54	50	37	38	179	6	7	4	3	20
August ..	116	119	130	126	491	106	108	105	96	415	171	170	189	181	711	53	61	45	56	215	3	3	0	2	8
September ..	104	118	112	105	439	98	94	115	111	418	144	129	167	141	581	76	84	55	78	293	5	7	0	2	14
October ..	131	138	128	124	521	95	90	97	97	379	125	126	146	134	531	106	106	88	100	400	3	1	0	1	5
November ..	133	139	141	144	557	77	75	70	68	290	151	158	165	150	624	74	66	61	68	269	4	6	2	5	17
December ..	148	148	149	150	595	69	67	71	74	281	157	154	160	163	634	68	74	68	64	274	2	4	4	3	13
Year	1,448	1,493	1,504	1,501	5,946	1,144	1,130	1,215	1,159	4,648	1,750	1,731	1,942	1,795	7,218	924	946	748	880	3,498	56	45	17	38	156

Note.—The figures give the number of occurrences of components *from* each of the four cardinal points for each hour of tabulation separately, and also the total number of such occurrences for the four selected hours.

TABLE Ic.—FREQUENCY OF WIND COMPONENTS AT GREAT YARMOUTH, 1911–1918.

Months	South Component					North Component					West Component					East Component					Calms				
	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hrs.
January ..	114	117	117	108	456	86	80	88	83	337	148	147	142	138	575	65	64	69	73	271	3	3	1	2	9
February ..	140	138	136	144	558	66	62	64	56	248	135	143	119	123	520	65	55	77	72	269	0	1	0	1	2
March ..	110	108	98	118	434	105	102	115	102	424	143	142	126	131	542	83	82	94	91	350	4	0	1	3	8
April	77	69	75	77	298	118	126	123	126	493	120	118	90	107	435	68	70	108	89	335	3	1	1	1	6
May	101	91	101	110	403	113	128	132	109	482	104	80	43	62	289	111	134	180	141	566	11	6	0	15	32
June	115	94	112	121	442	88	115	112	92	407	135	119	77	107	438	72	93	137	96	398	10	7	3	13	33
July	110	88	97	101	396	90	113	112	101	416	131	108	71	96	406	61	76	129	95	361	6	3	1	9	19
August ..	115	108	112	130	465	96	113	107	90	406	158	150	100	131	539	61	66	104	81	312	9	3	1	5	18
September ..	104	83	98	99	384	83	104	95	88	370	117	114	84	101	416	78	84	108	92	362	2	1	0	3	6
October ..	127	115	128	135	505	72	74	77	69	292	131	123	102	115	471	74	81	95	84	334	4	8	2	2	16
November ..	130	129	129	132	520	84	77	88	76	325	158	159	161	168	646	58	56	58	58	230	9	10	6	4	29
December ..	132	126	130	123	511	59	62	64	61	246	145	139	147	144	575	48	57	48	41	194	8	3	5	5	21
Year	1,375	1,266	1,333	1,398	5,372	1,060	1,156	1,177	1,053	4,446	1,625	1,542	1,262	1,423	5,852	844	918	1,207	1,013	3,982	69	46	21	63	199

TABLE Id.—FREQUENCY OF WIND COMPONENTS AT SCILLY, 1911–1918.

Months	South Component					North Component					West Component					East Component					Calms				
	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hrs.
January ..	125	124	121	135	505	86	89	79	70	324	135	129	143	138	545	84	85	82	87	338	1	4	4	4	13
February ..	123	117	121	120	481	79	83	83	78	323	124	122	120	125	491	77	78	81	73	309	3	1	0	2	6
March ..	99	98	107	108	412	123	114	116	109	462	136	135	133	136	540	100	98	99	97	394	1	0	0	1	2
April	60	63	74	64	261	159	139	144	149	591	119	99	123	123	464	98	106	103	93	400	5	5	0	3	13
May	94	108	113	98	413	123	113	112	119	467	105	106	111	106	428	108	119	114	106	447	7	1	1	10	19
June ..	77	77	78	65	297	134	134	136	144	548	136	127	136	137	536	76	83	70	74	309	3	2	0	8	13
July	69	83	79	71	302	138	141	137	141	557	146	140	139	141	566	71	75	69	66	281	6	3	3	11	23
August ..	81	92	95	77	345	117	128	127	140	512	160	160	167	161	648	60	68	66	60	254	15	1	1	11	28
September ..	103	101	106	85	395	119	111	104	118	452	105	108	113	103	429	113	111	111	108	443	4	4	0	11	19
October ..	110	107	115	114	446	103	107	110	107	427	127	127	132	128	514	91	93	97	99	380	7	2	1	8	18
November ..	94	92	95	87	368	91	86	94	90	361	135	131	138	131	535	61	58	60	59	238	3	3	0	2	8
December ..	104	104	108	116	432	91	89	97	87	364	158	153	165	161	637	53	53	53	52	211	6	10	8	6	30
Year	1,139	1,166	1,212	1,140	4,657	1,363	1,334	1,339	1,352	5,388	1,586	1,537	1,620	1,590	6,333	992	1,027	1,011	974	4,004	61	36	18	77	192

TABLE II.—PERCENTAGE FREQUENCY OF WIND COMPONENTS. ANNUAL VARIATION, 1911–1918.

Months	Deerness						Holyhead					
	S	N	W	E	Calm	No. of observations	S	N	W	E	Calm	No. of observations
January ..	65·4	31·0	52·6	38·4	0·4	983	58·6	33·0	56·2	37·6	0·3	992
February ..	70·6	24·0	52·6	37·4	0·2	899	62·4	31·8	55·2	34·0	0·3	904
March ..	54·0	38·4	51·2	41·0	0·4	992	46·2	44·2	54·6	38·2	0·7	970
April	51·2	40·4	53·6	35·0	1·1	960	41·8	50·6	63·4	30·2	1·1	960
May	53·0	37·4	42·0	48·6	1·5	986	45·4	45·0	55·4	32·6	2·9	991
June	42·4	47·8	44·8	44·2	1·5	954	44·2	47·8	69·4	21·4	2·7	960
July	44·6	45·2	44·6	44·6	2·5	992	47·6	43·8	73·0	18·0	2·0	992
August ..	46·4	43·0	43·0	45·0	2·4	992	49·6	41·8	71·8	21·6	0·8	991
September ..	51·2	39·2	56·0	33·6	1·5	960	46·0	43·8	60·8	30·6	1·5	956
October ..	64·4	29·0	42·6	46·2	1·8	968	52·6	38·2	53·6	40·4	0·5	992
November ..	55·2	33·6	61·8	26·0	2·6	960	58·0	30·2	65·0	28·0	1·8	960
December ..	57·0	32·8	58·8	31·0	2·5	986	60·2	28·4	64·2	27·8	1·3	988

Months	Great Yarmouth						Scilly					
	S	N	W	E	Calm	No. of observations	S	N	W	E	Calm	No. of observations
January ..	49·6	36·6	62·6	29·4	1·0	919	51·2	32·8	55·2	34·2	1·3	988
February ..	62·4	27·8	58·2	30·0	0·2	895	53·8	36·0	54·8	34·6	0·7	895
March ..	44·6	43·6	45·6	36·0	0·8	974	41·6	46·6	54·4	39·8	0·2	992
April ..	35·0	58·0	51·2	39·4	0·7	851	27·4	62·2	48·8	42·0	1·3	951
May	41·2	49·2	29·4	57·8	3·3	980	42·0	47·4	43·6	45·6	1·9	982
June	46·8	43·0	46·4	42·0	3·5	946	31·0	57·2	56·0	32·2	1·3	958
July	45·0	47·4	46·2	41·0	2·2	879	30·8	56·8	57·8	28·8	2·4	979
August ..	49·0	42·8	56·8	32·8	1·8	949	34·8	51·8	65·6	25·6	2·8	989
September ..	46·0	44·2	49·8	43·4	0·7	836	41·4	47·4	45·0	46·4	2·0	953
October ..	56·4	32·6	52·6	37·4	1·8	895	45·6	43·6	52·6	38·8	1·8	978
November ..	54·4	34·0	67·6	24·0	3·0	956	44·8	43·8	65·0	29·0	1·0	823
December ..	59·4	28·6	67·0	22·6	2·4	859	46·8	39·4	68·8	22·8	3·2	925

Note.—It should be noted that each observation of wind corresponds with two entries of components, except in the case of calms or of winds from one of the cardinal points; hence the percentages given in this table do not add up to 100.

TABLE IIIA.—MEANS OF WIND COMPONENTS AT DEERNESS, 1911–1918.

Months	3h. G.M.T.						9h. G.M.T.						15h. G.M.T.						21h. G.M.T.						All Hours					
	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E
	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s
Jan. ..	4·1	1·6	2·5	3·0	2·2	0·8	4·4	1·8	2·6	3·0	2·3	0·7	4·2	1·8	2·4	2·9	2·3	0·6	4·1	1·6	2·5	3·0	2·4	0·6	4·2	1·7	2·5	3·0	2·3	0·7
Feb. ..	4·4	1·0	3·4	2·4	1·7	0·7	4·3	1·1	3·2	2·4	1·7	0·7	4·7	1·0	3·7	3·1	1·8	1·3	4·4	0·8	3·6	2·4	1·8	0·6	4·4	1·0	3·4	2·6	1·8	0·8
March ..	2·9	1·7	1·2	2·4	2·0	0·4	2·9	1·9	1·0	2·5	2·2	0·3	2·7	2·3	0·4	2·9	2·2	0·7	2·7	2·0	0·7	2·4	2·0	0·4	2·8	2·0	0·8	2·6	2·1	0·5
April ..	2·3	1·5	0·8	2·4	1·0	1·4	2·8	1·8	1·0	2·7	1·3	1·4	2·5	2·1	0·4	3·0	1·4	1·6	2·0	1·7	0·3	2·3	1·1	1·2	2·4	1·8	0·6	2·6	1·2	1·4
May ..	1·8	1·2	0·6	1·4	1·7	—0·3	2·4	1·6	0·8	1·9	2·0	—0·1	2·2	1·7	0·5	2·2	2·4	—0·2	1·7	1·4	0·3	1·6	1·9	—0·3	2·0	1·5	0·5	1·8	2·0	—0·2
June ..	1·4	1·7	—0·3	1·8	1·2	0·6	1·8	2·2	—0·4	2·4	1·4	1·0	1·7	2·3	—0·6	2·6	1·7	0·9	1·1	1·9	—0·8	2·0	1·3	0·7	1·5	2·0	—0·5	2·2	1·4	0·8
July ..	1·0	1·4	—0·4	1·4	1·0	0·4	1·5	1·7	—0·2	1·6	1·4	0·2	1·5	1·9	—0·4	1·9	1·7	0·2	0·9	1·4	—0·5	1·4	1·2	0·2	1·2	1·6	—0·4	1·6	1·3	0·3
Aug. ..	1·2	1·1	0·1	1·4	1·3	0·1	1·7	1·3	0·4	1·7	1·4	0·3	1·6	1·5	0·1	1·9	1·7	0·2	1·3	1·2	0·1	1·3	1·3	0·0	1·4	1·3	0·2	1·6	1·4	0·2
Sept. ..	2·0	1·5	0·5	2·3	1·0	1·3	2·3	1·8	0·5	2·5	1·2	1·3	2·2	1·8	0·4	2·9	1·3	1·6	1·9	1·7	0·2	2·4	1·2	1·2	2·1	1·7	0·4	2·5	1·1	1·4
Oct. ..	3·1	1·2	1·9	1·8	1·9	—0·1	3·7	1·4	2·3	1·7	2·1	—0·4	3·7	1·5	2·2	2·2	2·2	0·0	3·4	1·1	2·3	1·9	2·2	—0·3	3·5	1·3	2·2	1·9	2·1	—0·2
Nov. ..	3·2	1·8	1·4	2·9	1·3	1·6	3·2	1·8	1·4	3·1	1·4	1·7	3·1	1·7	1·4	3·2	1·3	1·9	3·2	1·6	1·6	3·1	1·4	1·7	3·2	1·7	1·5	3·1	1·4	1·7
Dec. ..	3·2	1·7	1·5	2·8	1·7	1·1	3·4	1·6	1·8	2·6	1·9	0·7	3·4	1·5	1·9	2·9	1·9	1·0	3·3	1·6	1·7	2·8	1·9	0·9	3·3	1·5	1·8	2·8	1·9	0·9
Year ..	2·5	1·5	1·0	2·2	1·5	0·7	2·9	1·7	1·2	2·3	1·7	0·6	2·8	1·8	1·0	2·7	1·8	0·9	2·5	1·5	1·0	2·2	1·6	0·6	2·7	1·6	1·1	2·3	1·7	0·6

TABLE IIIB.—MEANS OF WIND COMPONENTS AT HOLYHEAD, 1911–1918.

Months	3h. G.M.T.						9h. G.M.T.						15h. G.M.T.						21h. G.M.T.						All Hours					
	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E
	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s
Jan. ..	2·8	1·9	0·9	3·4	1·6	1·8	2·9	1·7	1·2	3·1	1·7	1·4	3·3	1·8	1·5	3·5	1·6	1·9	3·0	1·7	1·3	3·4	1·6	1·8	3·0	1·7	1·3	3·3	1·6	1·7
Feb. ..	3·4	1·2	2·2	3·1	1·4	1·7	3·6	1·3	2·3	2·9	1·6	1·3	4·0	1·3	2·7	2·8	1·6	1·2	3·7	1·2	2·5	2·8	1·5	1·3	3·7	1·2	2·5	2·9	1·5	1·4
March ..	2·0	2·1	—0·1	3·1	2·3	0·8	2·2	1·9	0·3	3·2	2·6	0·6	2·5	2·1	0·4	2·7	2·1	0·6	2·2	2·0	0·2	2·8	2·2	0·6	2·2	2·0	0·2	2·9	2·3	0·6
April ..	1·7	2·0	—0·3	2·9	1·3	1·6	2·1	2·1	0·0	3·0	1·5	1·5	2·3	2·3	0·0	3·0	1·3	1·7	1·7	1·8	—0·1	2·6	1·2	1·4	2·0	2·1	—0·1	2·8	1·3	1·5
May ..	1·6	1·1	0·5	1·6	1·5	0·1	1·9	1·4	0·5	1·7	1·7	0·0	2·1	1·7	0·4	2·0	1·3	0·7	1·8	1·3	0·5	1·5	1·3	0·2	1·8	1·4	0·4	1·7	1·5	0·2
June ..	1·4	1·6	—0·2	2·5	0·8	1·7	2·0	1·9	0·1	2·6	0·8	1·8	2·4	1·7	0·7	2·5	0·7	1·8	1·8	1·4	0·4	2·2	0·7	1·5	1·9	1·7	0·2	2·5	0·8	1·7
July ..	1·5	1·6	—0·1	2·4	0·7	1·7	1·8	1·5	0·3	2·4	0·8	1·6	2·4	1·6	0·8	2·4	0·6	1·8	1·9	1·5	0·4	2·1	0·5	1·6	1·9	1·5	0·4	2·3	0·6	1·7
Aug. ..	1·6	1·5	0·1	2·6	0·7	1·9	2·1	1·5	0·6	2·8	0·9	1·9	2·6	1·5	1·1	2·8	0·6	2·2	2·0	1·2	0·8	2·6	0·6	2·0	2·0	1·4	0·6	2·7	0·7	2·0
Sept. ..	1·4	1·8	—0·4	3·1	1·1	2·0	1·9	1·8	0·1	2·9	1·4	1·5	2·2	1·9	0·3	3·0	1·0	2·0	1·5	1·9	—0·4	2·8	1·1	1·7	1·8	1·9	—0·1	3·0	1·2	1·8
Oct. ..	2·3	1·6	0·7	2·9	1·7	1·2	2·6	1·6	1·0	2·9	1·8	1·1	2·6	1·6	1·0	3·1	1·7	1·4	2·3	1·5	0·8	3·0	1·8	1·2	2·4	1·6	0·8	3·0	1·8	1·2
Nov. ..	2·6	1·7	0·9	4·2	1·5	2·7	2·8	1·6	1·2	4·2	1·3	2·9	2·9	1·5	1·4	4·3	1·2	3·1	2·7	1·5	1·2	4·1	1·3	2·8	2·8	1·6	1·2	4·2	1·3	2·9
Dec. ..	3·3	1·3	2·0	4·3	1·1	3·2	3·2	1·4	1·8	4·0	1·3	2·7	3·4	1·6	1·8	4·3	1·2	3·1	3·1	1·5	1·6	4·2	1·1	3·1	3·2	1·4	1·8	4·2	1·2	3·0
Year ..	2·2	1·6	0·6	3·0	1·3	1·7	2·4	1·6	0·8	3·0	1·5	1·5	2·7	1·7	1·0	3·0	1·2	1·8	2·3	1·5	0·8	2·8	1·2	1·6	2·4	1·6	0·8	3·0	1·3	1·7

Table IIIc.—Means of Wind Components at Great Yarmouth, 1911–1918.

Months	3h. G.M.T.						9h. G.M.T.						15h. G.M.T.						21h. G.M.T.						All Hours					
	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E
	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s
Jan. ..	1·7	1·1	0·6	2·3	2·0	0·3	1·6	1·1	0·5	2·0	2·0	0·0	1·7	1·1	0·6	2·0	2·0	0·0	1·8	1·0	0·8	2·1	2·3	−0·2	1·7	1·1	0·6	2·1	2·1	0·0
Feb. ..	2·2	0·8	1·4	1·8	1·3	0·5	2·2	0·8	1·4	2·1	1·3	0·8	2·3	0·9	1·4	2·0	1·5	0·5	2·3	0·7	1·6	1·7	1·6	0·1	2·3	0·8	1·5	1·9	1·4	0·5
March ..	1·5	1·2	0·3	1·8	2·0	−0·2	1·7	1·3	0·4	2·2	2·2	0·0	1·4	1·9	−0·5	2·1	2·1	0·0	1·4	1·5	−0·1	1·5	2·0	−0·5	1·5	1·5	0·0	1·9	2·1	−0·2
April ..	0·8	1·7	−0·9	1·5	1·1	0·4	1·1	2·2	−1·1	1·9	1·2	0·7	1·3	2·4	−1·1	1·7	1·7	0·0	0·9	1·9	−1·0	1·3	1·4	−0·1	1·0	2·1	−1·1	1·6	1·3	0·3
May ..	0·7	1·4	−0·7	0·9	1·7	−0·8	1·0	1·8	−0·8	1·0	2·0	−1·0	1·4	2·0	−0·6	0·7	2·5	−1·8	0·9	1·4	−0·5	0·5	2·1	−1·6	1·0	1·7	−0·7	0·8	2·1	−1·3
June ..	1·0	1·0	−0·0	1·3	0·9	0·4	1·3	1·6	−0·3	1·7	1·1	0·6	1·8	1·7	0·1	1·2	1·7	−0·5	1·3	1·0	0·3	1·0	1·1	−0·1	1·3	1·3	0·0	1·3	1·2	0·1
July ..	0·8	1·0	−0·2	1·3	0·8	0·5	1·1	1·6	−0·5	1·5	1·0	0·5	1·6	1·9	−0·3	1·0	1·6	−0·6	1·1	1·3	−0·2	0·8	1·1	−0·3	1·2	1·4	−0·2	1·1	1·1	0·0
Aug. ..	1·1	0·9	0·2	1·5	0·9	0·6	1·4	1·3	0·1	1·8	1·0	0·8	1·9	1·5	0·4	1·4	1·4	0·0	1·4	1·0	0·4	1·1	1·1	0·0	1·5	1·2	0·3	1·4	1·1	0·3
Sept. ..	1·1	1·1	0·0	1·4	1·6	−0·2	1·0	1·4	−0·4	1·8	1·8	0·0	1·4	1·6	−0·2	1·5	2·0	−0·5	1·2	1·3	−0·1	1·2	2·0	−0·8	1·2	1·4	−0·2	1·5	1·9	−0·4
Oct. ..	1·5	0·9	0·6	1·6	1·6	0·0	1·8	1·0	0·8	1·7	1·8	−0·1	2·0	1·0	1·0	1·5	1·8	−0·3	1·8	0·9	0·9	1·3	1·9	−0·6	1·8	0·9	0·9	1·6	1·8	−0·2
Nov. ..	1·7	0·9	0·8	2·2	1·4	0·8	2·0	0·9	1·1	2·4	1·4	1·0	1·7	0·9	0·8	2·2	1·4	0·8	1·9	0·9	1·0	2·1	1·4	0·7	1·8	0·9	0·9	2·2	1·4	0·8
Dec. ..	2·0	0·8	1·2	2·4	1·0	1·4	2·1	0·8	1·3	2·2	1·2	1·0	2·1	0·9	1·2	2·3	1·1	1·2	2·0	0·9	1·1	2·3	1·1	1·2	2·0	0·8	1·2	2·3	1·1	1·2
Year ..	1·3	1·1	0·2	1·7	1·4	0·3	1·5	1·3	0·2	1·9	1·5	0·4	1·7	1·5	0·2	1·6	1·7	−0·1	1·5	1·2	0·3	1·4	1·6	−0·2	1·5	1·3	0·2	1·6	1·5	0·1

Table IIId.—Means of Wind Components at Scilly, 1911–1918.

Months	3h. G.M.T.						9h. G.M.T.						15h. G.M.T.						21h. G.M.T.						All Hours					
	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E	S	N	S—N	W	E	W—E
	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s
Jan. ..	2·8	2·0	0·8	3·6	1·8	1·8	2·8	2·0	0·8	3·5	1·9	1·6	2·8	1·9	0·9	4·0	1·8	2·2	2·9	1·7	1·2	3·9	2·0	1·9	2·8	1·9	0·9	3·8	1·9	1·9
Feb. ..	3·2	1·5	1·7	4·0	1·9	2·1	3·2	1·6	1·6	3·8	1·9	1·9	3·3	1·8	1·5	4·1	1·8	2·3	3·4	1·6	1·8	4·0	1·8	2·2	3·3	1·6	1·7	4·0	1·9	2·1
March ..	1·8	2·4	−0·6	4·2	2·2	2·0	1·9	2·3	−0·4	3·7	2·2	1·5	2·1	2·4	−0·3	4·0	2·0	2·0	2·0	2·4	−0·4	4·2	2·0	2·2	2·0	2·4	−0·4	4·0	2·1	1·9
April ..	1·1	2·5	−1·4	3·2	1·5	1·7	1·2	2·7	−1·5	2·8	1·9	0·9	1·3	2·8	−1·5	3·4	1·8	1·6	1·1	2·6	−1·5	3·3	1·4	1·9	1·2	2·7	−1·5	3·2	1·6	1·6
May ..	1·4	1·7	−0·3	1·8	1·5	0·3	1·6	1·7	0·1	1·7	1·7	0·0	1·8	1·8	0·0	2·1	1·7	0·4	1·4	1·7	−0·3	1·8	1·3	0·5	1·6	1·7	−0·1	1·9	1·5	0·4
June ..	1·0	1·8	−0·8	2·5	1·1	1·4	1·1	2·1	−1·0	2·3	1·4	0·9	1·2	2·2	−1·0	2·7	1·2	1·5	0·8	2·2	−1·4	2·7	1·1	1·6	1·0	2·1	−1·1	2·6	1·2	1·4
July ..	1·0	1·8	−0·8	2·6	0·8	1·8	1·2	2·0	−0·8	2·4	1·0	1·4	1·3	2·1	−0·8	2·6	1·0	1·6	1·0	1·8	−0·8	2·5	0·8	1·7	1·1	1·9	−0·8	2·5	0·9	1·6
Aug. ..	1·0	1·5	−0·5	2·7	0·6	2·1	1·2	1·6	−0·4	2·7	0·9	1·8	1·3	1·6	−0·3	3·2	0·8	2·4	1·0	1·8	−0·8	3·0	0·6	2·4	1·1	1·6	−0·5	2·9	0·7	2·2
Sept. ..	1·4	1·8	−0·4	2·2	1·7	0·5	1·4	1·8	−0·4	2·1	1·9	0·2	1·5	1·9	−0·4	2·3	1·9	0·4	1·3	2·0	−0·7	2·3	1·9	0·4	1·4	1·9	−0·5	2·2	1·9	0·3
Oct. ..	2·2	2·0	0·2	3·3	1·4	1·9	2·0	2·1	−0·1	3·5	1·6	1·9	2·1	2·1	0·0	3·6	1·6	2·0	2·3	1·9	0·4	3·5	1·7	1·8	2·1	2·0	0·1	3·5	1·6	1·9
Nov. ..	2·3	2·3	0·0	4·6	1·4	3·2	2·1	2·2	−0·1	4·3	1·4	2·9	2·2	2·2	0·0	4·6	1·3	3·3	2·3	2·2	0·1	4·3	1·5	2·8	2·2	2·2	0·0	4·4	1·4	3·0
Dec. ..	2·9	2·1	0·8	5·0	1·2	3·8	2·9	2·1	0·8	5·3	1·0	4·3	2·8	2·0	0·8	5·7	0·9	4·8	2·9	1·9	1·0	5·3	1·1	4·2	2·9	2·0	0·9	5·3	1·0	4·3
Year ..	1·9	1·9	0·0	3·3	1·4	1·9	1·9	2·0	−0·1	3·2	1·6	1·6	2·0	2·1	−0·1	3·5	1·5	2·0	1·9	2·0	−0·1	3·4	1·4	2·0	1·9	2·0	−0·1	3·4	1·5	1·9

TABLE IV.—MEANS OF WIND COMPONENTS FOR THE FOUR SEASONS, 1911–1918.

Wind components and drifts	Spring March and April					Summer May, June, July and August					Autumn September and October					Winter Jan., Feb., Nov. and Dec.				
	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours	3h.	9h.	15h.	21h.	All hours
	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s
Deerness																				
S	2·6	2·9	2·6	2·4	2·6	1·3	1·9	1·7	1·3	1·5	2·6	3·0	2·9	2·7	2·8	3·7	3·8	3·8	3·8	3·8
N	1·6	1·9	2·2	1·8	1·9	1·4	1·7	1·9	1·5	1·6	1·4	1·6	1·7	1·4	1·5	1·5	1·6	1·5	1·4	1·5
W	2·4	2·6	3·0	2·3	2·6	1·5	1·9	2·2	1·6	1·8	2·1	2·1	2·5	2·2	2·2	2·8	2·8	3·0	2·8	2·9
E	1·5	1·8	1·8	1·5	1·7	1·3	1·6	1·9	1·4	1·5	1·5	1·6	1·7	1·7	1·6	1·7	1·8	1·8	1·9	1·8
S—N	0·98	1·00	0·41	0·54	0·73	−0·03	0·16	−0·14	−0·22	−0·06	1·18	1·40	1·28	1·24	1·28	2·20	2·24	2·33	2·38	2·20
W—E	0·93	0·84	1·18	0·79	0·94	0·22	0·34	0·29	0·18	0·26	0·61	0·47	0·80	0·44	0·58	1·05	0·98	1·20	0·95	1·05
Holyhead																				
S	1·9	2·2	2·4	2·0	2·1	1·6	2·0	2·4	1·9	1·9	1·9	2·2	2·4	1·9	2·1	3·0	3·1	3·4	3·1	3·2
N	2·1	2·0	2·2	1·9	2·1	1·5	1·6	1·6	1·3	1·5	1·7	1·7	1·8	1·7	1·7	1·5	1·5	1·6	1·5	1·5
W	3·0	3·1	2·8	2·7	2·9	2·3	2·4	2·4	2·1	2·3	3·0	2·9	3·0	2·9	3·0	3·8	3·6	3·7	3·6	3·7
E	1·8	2·0	1·7	1·7	1·8	0·9	1·1	0·8	0·8	0·9	1·4	1·6	1·4	1·4	1·5	1·4	1·5	1·4	1·4	1·4
S—N	−0·21	0·13	0·19	0·03	0·04	0·09	0·39	0·71	0·52	0·43	0·15	0·54	0·64	0·19	0·38	1·54	1·64	1·85	1·67	1·68
W—E	1·22	1·04	1·11	0·97	1·09	1·35	1·31	1·66	1·32	1·41	1·60	1·33	1·68	1·45	1·52	2·33	2·08	2·34	2·25	2·25
Great Yarmouth																				
S	1·1	1·4	1·4	1·2	1·3	0·9	1·2	1·7	1·2	1·2	1·3	1·4	1·7	1·5	1·5	1·9	2·0	2·0	2·0	2·0
N	1·5	1·8	2·2	1·7	1·8	1·1	1·6	1·8	1·2	1·4	1·0	1·2	1·3	1·1	1·1	0·9	0·9	0·9	0·9	0·9
W	1·7	2·1	1·9	1·4	1·8	1·3	1·5	1·1	0·8	1·2	1·5	1·8	1·5	1·2	1·5	2·2	2·2	2·1	2·1	2·1
E	1·6	1·7	1·9	1·7	1·7	1·1	1·3	1·8	1·3	1·4	1·6	1·8	1·9	1·9	1·8	1·4	1·5	1·5	1·6	1·5
S—N	−0·33	−0·40	−0·78	−0·55	−0·52	−0·15	−0·39	−0·07	0·00	−0·15	0·29	0·19	0·42	0·43	0·33	1·00	1·09	1·01	1·14	1·06
W—E	0·12	0·34	0·03	−0·29	0·05	0·19	0·25	−0·74	−0·50	−0·20	−0·07	−0·04	−0·46	−0·70	−0·32	0·73	0·70	0·66	0·48	0·69
Scilly																				
S	1·4	1·6	1·7	1·6	1·6	1·1	1·3	1·4	1·1	1·2	1·8	1·7	1·8	1·8	1·8	2·8	2·7	2·8	2·9	2·8
N	2·5	2·5	2·6	2·5	2·5	1·7	1·8	1·9	1·9	1·8	1·9	1·9	2·0	2·0	1·9	2·0	2·0	2·0	1·9	1·9
W	3·7	3·2	3·7	3·8	3·6	2·4	2·3	2·6	2·5	2·5	2·8	2·8	3·0	2·9	2·9	4·3	4·2	4·6	4·4	4·4
E	1·8	2·0	1·9	1·7	1·9	1·0	1·3	1·2	0·9	1·1	1·6	1·8	1·8	1·8	1·7	1·6	1·5	1·5	1·6	1·6
S—N	−1·05	−0·95	−0·90	−0·95	−0·96	−0·57	−0·54	−0·57	−0·82	−0·63	−0·09	−0·24	−0·19	−0·17	−0·17	0·86	0·78	0·78	1·04	0·87
W—E	1·87	1·21	1·80	2·07	1·74	1·40	1·01	1·46	1·59	1·37	1·19	1·08	1·23	1·09	1·15	2·74	2·70	3·13	2·79	2·84

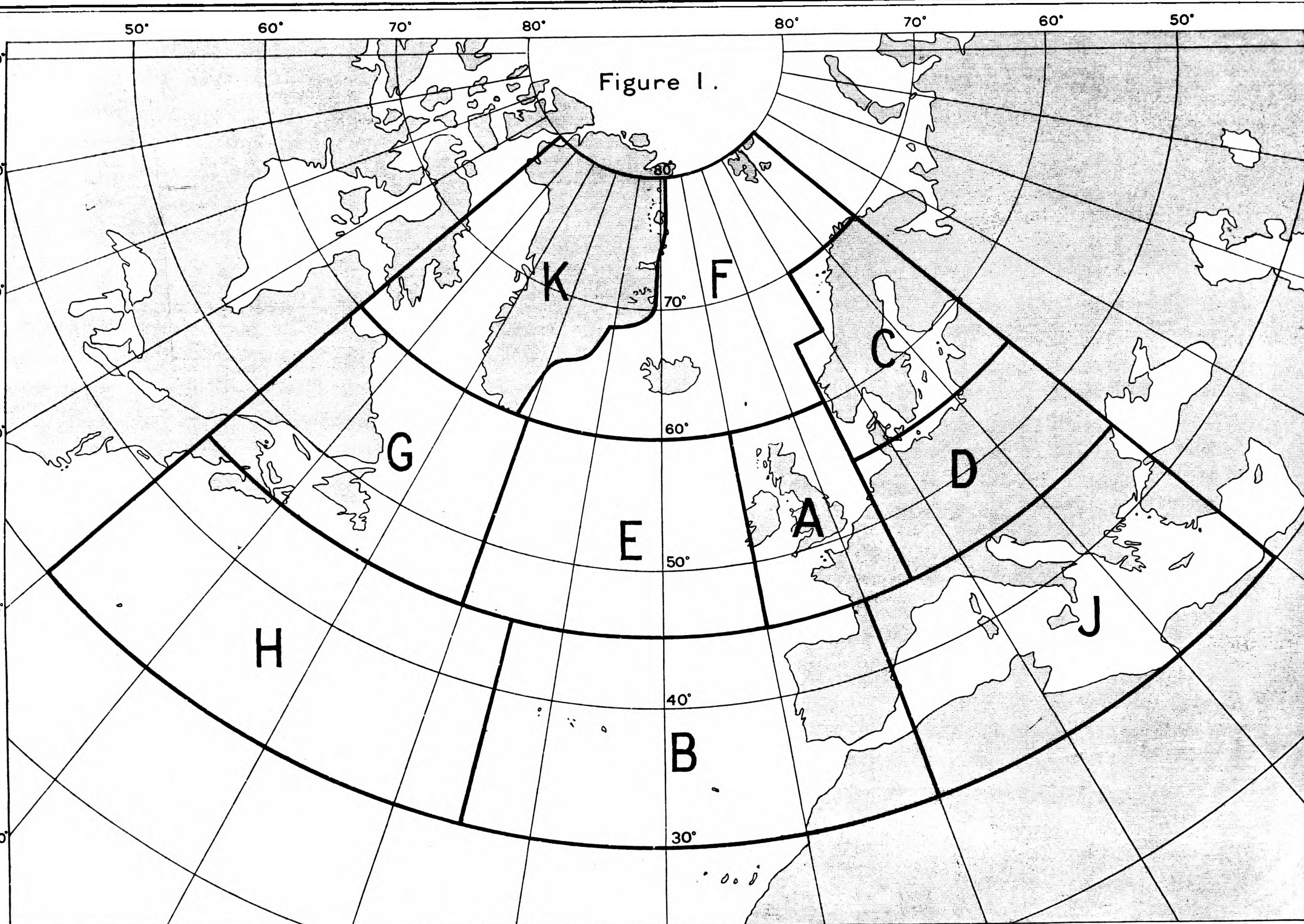
TABLE V.—RESULTANT DRIFTS AND GEOSTROPHIC WIND COMPONENTS, 1911–1918.

Months	Deerness				Holyhead				Great Yarmouth				Scilly			
	Surface Drift (All hrs.)		Geostrophic		Surface Drift (All hrs.)		Geostrophic		Surface Drift (All hrs.)		Geostrophic		Surface Drift (All hrs.)		Geostrophic	
	S—N	W—E	S→N	W→E	S—N	W—E	S→N	W→E	S—N	W—E	S→N	W→E	S—N	W—E	S→N	W→E
	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s
January ..	2·5	0·7	1·7	3·6	1·3	1·7	2·7	5·7	0·6	0·0	1·0	6·9	0·9	1·9	1·3	3·5
February ..	3·4	0·8	2·2	6·1	2·5	1·4	3·3	4·7	1·5	0·5	2·4	6·6	1·7	2·1	3·5	6·0
March ..	0·8	0·5	?	?	0·2	0·6	0·8	3·0	0·0	—0·2	—1·4	4·0	—0·4	1·9	?	?
April ..	0·6	1·4	2·5	5·3	—0·1	1·5	—2·1	4·4	—1·1	0·3	?	?	—1·5	1·6	?	?
May ..	0·5	—0·2	?	?	0·4	0·2	?	?	—0·7	—1·3	?	?	—0·1	0·4	?	?
June ..	—0·5	0·8	?	?	0·2	1·7	—0·7	4·1	0·0	0·1	?	?	—1·1	1·4	?	?
July ..	—0·4	0·3	?	?	0·4	1·7	0·3	3·6	—0·2	0·0	?	?	—0·8	1·6	?	?
August ..	0·2	0·2	?	?	0·6	2·0	0·8	4·7	0·3	0·3	2·4	3·4	—0·5	2·2	—0·8	2·9
September ..	0·4	1·4	1·5	4·8	—0·1	1·8	—0·7	4·1	—0·2	—0·4	0·2	2·2	—0·5	0·3	?	?
October ..	2·2	—0·2	?	?	0·8	1·2	2·2	3·8	0·9	—0·2	2·6	2·6	0·1	1·9	—0·7	4·0
November ..	1·5	1·7	2·6	5·5	1·2	2·9	1·5	8·5	0·9	0·8	1·9	4·2	0·0	3·0	—0·7	4·1
December ..	1·8	0·9	1·4	4·0	1·8	3·0	2·8	7·6	1·2	1·2	2·4	6·6	0·9	4·3	0·9	5·0

TABLE VI.—PERCENTAGE FREQUENCY OF WIND COMPONENTS AND CALMS IN SUMMER (MAY, JUNE, JULY AND AUGUST). DIURNAL VARIATION, 1911–1918.

Hours	Deerness						Holyhead						Great Yarmouth						Scilly					
	S	N	W	E	Calm	No. of obs.	S	N	W	E	Calm	No. of obs.	S	N	W	E	Calm	No. of obs.	S	N	W	E	Calm	No. of obs.
3h. ..	47·5	41·6	45·1	43·2	3·8	981	45·1	42·8	63·8	26·3	3·4	984	46·9	41·2	56·2	32·5	3·8	940	32·9	52·4	56·0	32·3	3·2	977
9h. ..	48·8	42·9	44·4	44·1	0·7	981	45·1	44·8	64·8	25·9	2·0	984	40·7	50·1	48·7	39·4	2·0	937	36·8	52·6	54·4	35·2	0·7	978
15h. ..	46·3	44·2	41·0	49·6	0·6	980	47·0	47·4	72·9	18·4	0·8	982	45·1	49·5	31·1	48·8	0·5	936	37·4	52·4	56·7	33·3	0·5	976
21h. ..	43·4	44·1	43·2	45·1	2·8	982	49·2	42·9	67·5	23·1	2·2	984	49·2	41·7	42·1	43·9	4·5	941	31·9	55·8	55·8	31·4	4·1	977

MAP OF EUROPE AND THE NORTH ATLANTIC SHOWING SUB-DIVISION INTO TEN AREAS.



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