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INCIDENCE OF FOG IN LONDON ON
JANUARY 31ST, 1918,

BY

C. E. P. BROOKS, M.Sc.

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INCIDENCE OF FOG IN LONDON ON JANUARY 31.

The three days January 30th to February 1st (and I think January 31st in particular) were days of fog at quite a number of places over Europe and yet the fog was *local* in the neighbourhood of London. It is as good an example as I know of the general proposition that fog requires certain conditions which are general in a very wide sense and certain other conditions which are local in a very restricted sense. I think the general conditions which were common to nearly the whole of the Europe of our maps were cold ground with a drift of air over it (in this case from the South) and whenever the ground is exceptionally cold, that is to say whenever there is a very sharp rise of temperature from the ground upwards and a slow drift of air over it there must be fog.

The local conditions as exemplified by the valleys of the Thames, Beverley Brook and Wandle may be either high local humidity or relatively slow drift or possibly a colder ground on account of the greater stagnation.

The report which follows gives particulars of the local conditions so far as they are known at the Meteorological Office.

NAPIER SHAW.

Meteorological Office,
18th February, 1918.

THE INCIDENCE OF FOG IN LONDON ON JANUARY 31ST, 1918.

BY

C. E. P. BROOKS, M.Sc.

Thursday, January 31st, 1918, and especially the evening of that day, was marked by the occurrence of a dense fog over parts of London. The distribution of the fog was curiously partial; over most of Central and East London there was nothing noteworthy, but in the district of Earl's Court and Hammersmith it was one of the worst known, and involved some loss of life. The duration of bright sunshine recorded on January 31st agrees with this, being nil at Kew, South Kensington, Camden Square and the City, 1·2 hours at Westminster, 3·5 hours at Hampstead and as much as 6·5 hours at Greenwich.

Development of the Fog.

The growth of the fog took place gradually. It began to form in patches in the City on Tuesday, January 29th, but was not sufficiently dense to hinder traffic. Thick fog swept over Greenwich at 7 a.m. on the 30th, but disappeared about 9.30 a.m., not forming again until 4 p.m. At Westminster the first record of fog is on the night of January 30th–31st, and at Camden Square 7 a.m. on the 31st. At South Kensington fog is entered at 9 a.m. and 1 p.m. on January 30th, after which it cleared until 9 a.m. of the 31st, becoming very dense in the afternoon of that day. At Kew Observatory fog was first recorded at 9 p.m. on January 29th; having once formed, it was very persistent.

The Afternoon and Evening of January 31st.

During the afternoon of Thursday, January 31st, the fog increased steadily over the low-lying parts of Western London, until in places the radius of vision was limited to not more than a yard. Road and rail traffic was absolutely paralysed. I have collected from various members of the Office Staff accounts of their experiences, and from these and other available data I have constructed the following map (fig. 1). The double black line shows the course of the River Thames, and the single continuous lines the Beverley Brook and the River Wandle. The dotted line is the contour line of 100 feet. The figures indicate the foggiess on the intensity scale of 0–5, which is given in the London Fog Inquiry ⁽¹⁾ as follows:—

f_0 Horizon clear.	} No fog or mist.
f_1 Objects indistinct but traffic by rail or road unimpeded.	
f_2 Traffic by rail requires additional caution.	} Slight fog or mist.
f_3 Traffic by rail or road impeded.	
f_4 Traffic by rail or road impeded.	} Moderate fog.
f_5 Traffic totally disorganised.	
	} Thick fog.

(¹). London Fog Inquiry, 1901–02. Report to Meteorological Council by Captain Alfred Carpenter. London, 1903. p. 25.

In compiling the map (from the various personal accounts I have received) I have been guided in my choice of the intensity figure partly by the accounts of the disorganisation of traffic, and partly by comparisons with South Kensington; in this way the numbers, though probably not always correct, afford a fair means of comparing one locality with another. The map covers roughly the period from 5 p.m. to 8 p.m. on January 31st.

The distribution of the intensity shows at once that the thick fog was confined to the low ground in the valley of the Thames, upstream from Fulham, and to the tributary valleys of the Beverley Brook and River Wandle on the south. The high ground on the north and south of the valley was relatively clear, as also was the river valley itself below Chelsea.

On the slopes of the hill which culminates as Wimbledon Common the cessation of the fog was abrupt; it ended against the side of the hill almost like a sheet of water. Wimbledon Common was above the fog and afforded a clear field of view; walking westward uphill from Southfields Station one emerged from the fog into fairly clear air, and looking back, could see the tops of the houses above the fog surface.

In the north, on the other hand, both at 6 p.m. and 8 p.m., the diminution in fog intensity was very gradual. Even at about 300 feet O.D. in West Hampstead there was comparatively little improvement from the low-lying districts at the base of the hill, and north of Hampstead the only change was in the colour of the fog from yellow to white. At Friern Barnet, at 9 p.m., there was even a tendency for the fog to increase again north-eastwards. In the same way, there was an irregular distribution of fog between Barnsbury and Finchley.

Still further east the fog seems to have been light even on the low ground. New Cross was fairly clear; Greenwich merely reports "foggy," without the terms "thick" and "very" employed on the 29th to 30th; I have therefore assumed only a moderate fog (intensity 2-3) there, and at Barking there was only a slight fog. The dense area was therefore confined entirely to the low ground bordering the Thames and its tributaries from Fulham upstream.

Pressure, Wind and Temperature.

The synchronous charts for the period January 28th to February 1st, 1918, show a high pressure area over France and Germany. Until the evening of the 29th S.E. England was outside the isobar of 1030 mb., and experienced southerly winds of sufficient intensity to prevent the extreme accumulation of fog. On the morning of January 30th, however, the anticyclone spread eastwards and the isobar of 1030 mb. remained across the Thames Estuary until the evening of February 1st.

Within the anticyclonic area temperatures at ground level were generally below freezing point except for a short time in the middle of the day. Over Western Europe the wind was light from S.E. or S., and fog was widespread, probably in the form of a thin layer over much of the low and middle ground with local intensifications like those of the Thames Valley.

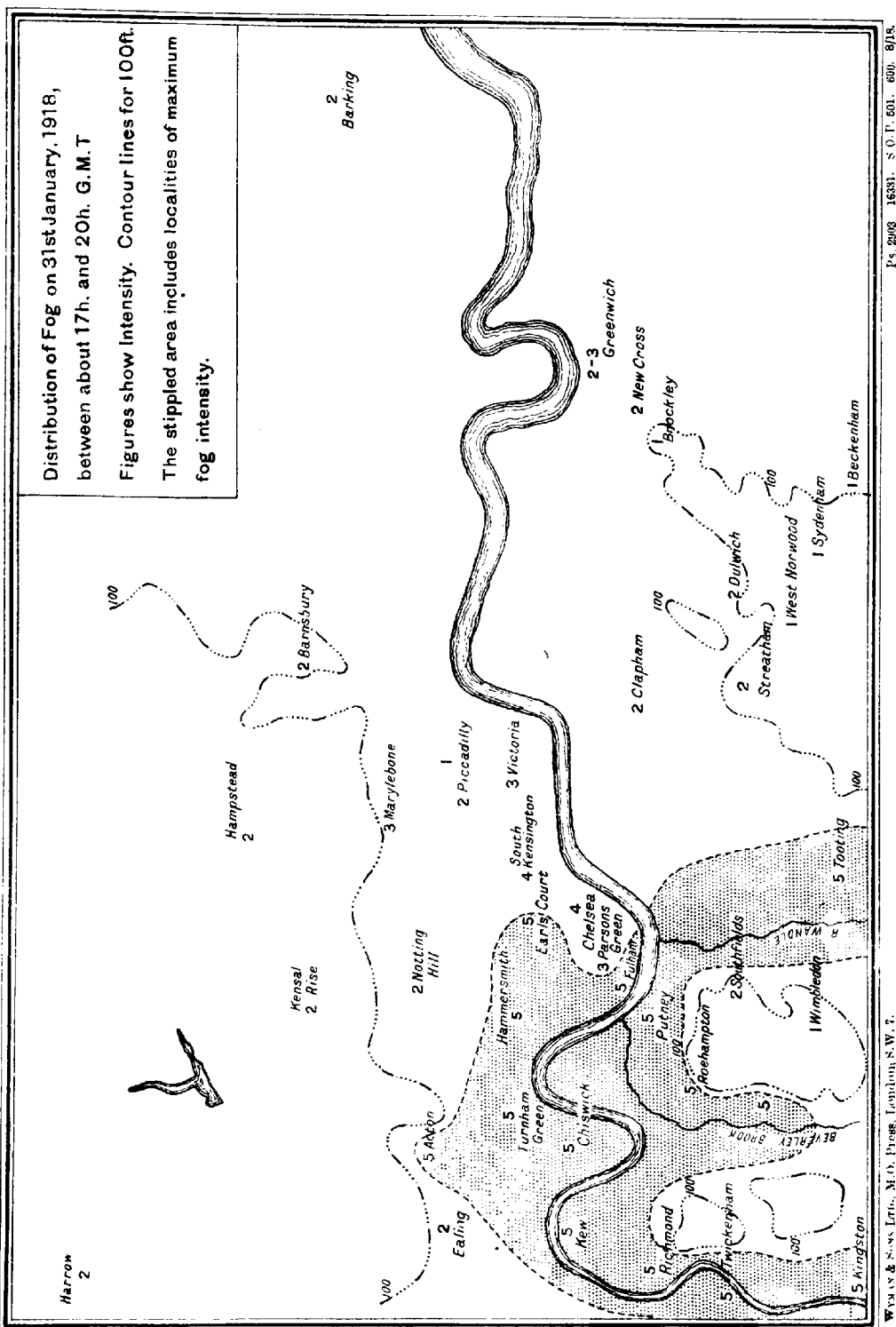


Figure 11.

To face p. 25.

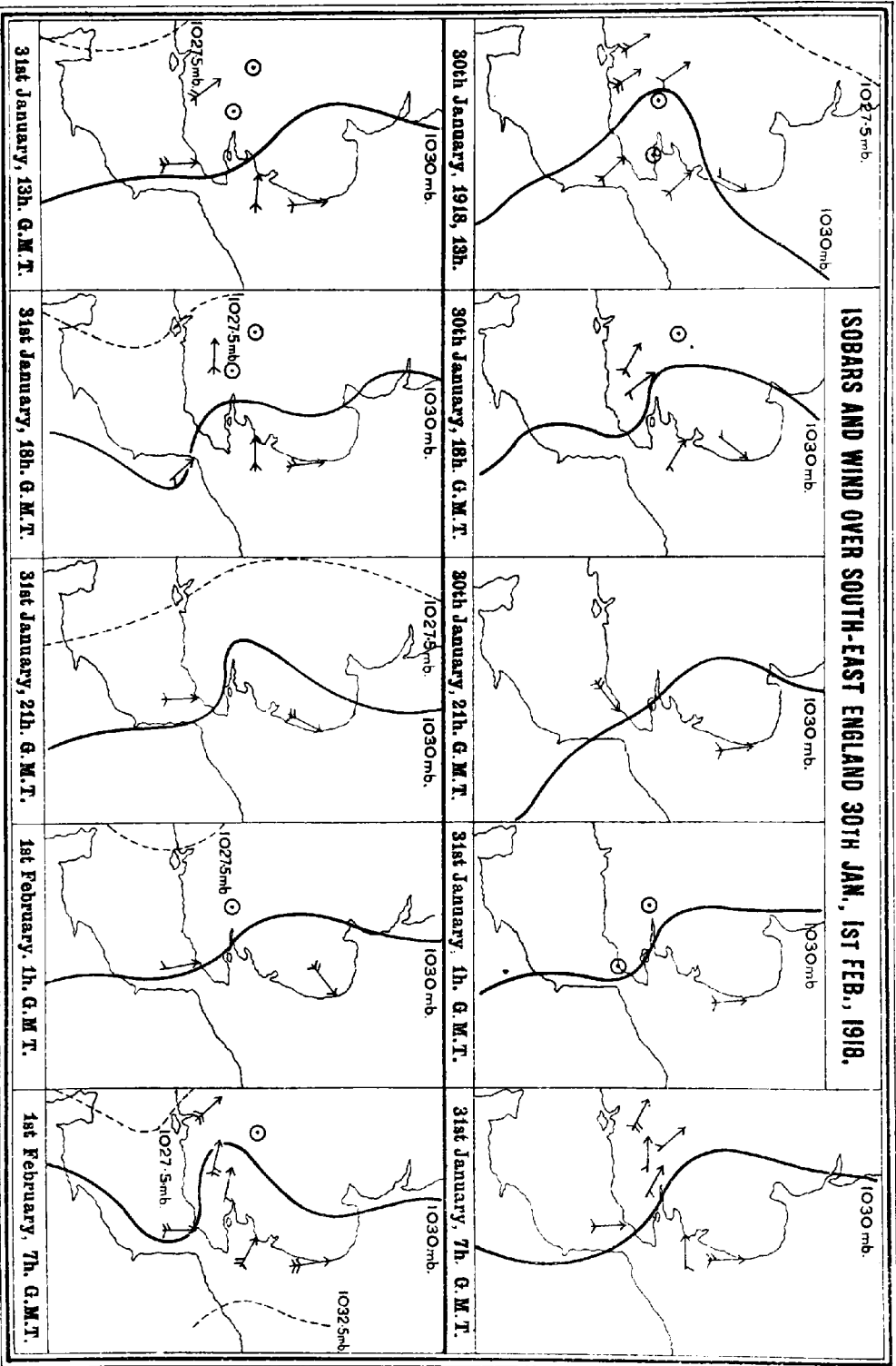


Fig. 2 shows a succession of isobar and wind maps for the south-east of England from January 30th to February 1st. They show the anticyclone over Germany (above 1032.5 mb.) and pressure decreasing westwards, the isobar of 1030 mb. passing across the Thames Estuary, and in nearly every map this isobar shows a curious turn there, running for a time from east to west with the high pressure on its north. This flexure of the isobar, though possibly exaggerated somewhat by slight inaccuracies in some of the barometer readings, appears to be genuine. It was accompanied by light easterly winds up the Thames Estuary, which are well brought out by the arrows on the maps. These were rarely more than light airs, and stations often reported calms. At Walham Green lighted candles could be carried bare without the flames being blown about.

Above the surface a wind of 10 to 20 m.p.h. from S. prevailed, as shown by the following pilot balloon observations at South Farnborough and the Isle of Grain.

Height	South Farnborough.				Grain.			
	Jan. 29.	Jan. 30.	Jan 31.	Feb. 1	Jan. 29.	Jan. 30.	Jan. 31.	Feb. 1.
Feet	15h. 33m.	14h. 53m.	14h. 46m.	15h. 22m.	11h. 30m.	11h. 45m.	16h. 15m.	16h. 0m.
	m.p.h.	m.p.h.	m.p.h.	m.p.h.	m.p.h.	m.p.h.	m.p.h.	m.p.h.
13,000	S'W 21	S'E 33	S 20					
10,000	SW 24	S'E 19	S 23				S 19	S'E 15
8,000	SW'S 19	S'E 15	S 21	S'E 33			S 14	S 17
5,000	SW'S 37	S'E 13	S'W 17	S 30			S 11	S 13
3,000	SW'S 22	S'W 16	S'W 18	S 30	SW 20	S 18	S 8	S 20
Surface	SSW 8	SE 5	SE 8	ESE 7	S 13	Calm	Calm	E 4

This distribution of winds appears to have been accompanied by a temperature inversion. Observations of upper air temperature are not available for January 31st, but at Ipswich, investigations on the afternoons of January 29th and 30th gave the following figures:—

Height.	2,000	4,000	6,000	8,000	10,000	feet.	Probable temperature at ground level 40-42 °F.
Jan. 29th.	42	38	33	30	24	°F.	
Jan. 30th.	43	40	38	30	23	°F.	

It is a fair assumption that similar figures prevailed above the London area on the 31st. The figures may be contrasted with the following observations made at the surface in different parts of London. The low maximum temperature at Richmond, where the fog did not lift throughout the day, is especially noteworthy.

	Richmond	South Kensington	Westminster	Camden Square	Hampstead	Greenwich	East Ham
Max. °F	34*	42*	48	37	43	48	49
Min. °F.	26	31	34	29	30	28	26

* This temperature occurred between 6 p.m. of January 30th and 9 a.m. of 31st. Between 9 a.m. and 6 p.m. of 31st the max. temperature recorded was only 31° at Richmond and 35° at South Kensington.

At South Farnborough on February 3rd there was still a well-developed inversion from 46° at 500 feet to 48° at 2,000 feet. Such inversion is almost invariably found in the western part of an anticyclone in winter; it is probably one cause of the localisation of fog on the lower ground. H. H. Hildebrandsson and L. Teisserenc de Bort refer⁽¹⁾ to a valley fog at Clermont during the very cold winter of 1879-80 when the surrounding hills were clear and in bright sunshine and the temperature on December 26th increased from -15.6° C. at Clermont to 4.7° C. at the summit of the Puy-de-Dôme.

In the Thames valley on January 31st, in addition to the geostrophic east winds referred to above there seem to have prevailed at night, on the sides of the valley, gravitational or katabatic winds—shallow streams of colder air flowing down the sides of the hills. On the southern side of the fairly steep hill at West Hampstead, the fog was rolling downhill in billows. The direction of the air flow here was from the north; at Chelsea the fog was drifting noticeably from the north-west, *i.e.*, directly towards the river.

The fog appears to have been a typical radiation fog of anticyclonic weather; under the influence of the prevailing easterly wind the cold dense fog-laden air drifted gradually up the valley, keeping to the low ground. But going up the valley, we find the hills encroach on either side, thus confining the fog in a narrow space and increasing its density, a process which was aided by the gravitational flow sweeping the fog from the higher ground into the valley and preventing any tendency to overflow north and south.⁽²⁾

Dispersal of the Fog.

The dispersal of the fog appears to have been somewhat irregular but perhaps progressing from east to west. At South Kensington it cleared considerably before 6 p.m., 8.15 p.m. at Chelsea, about 9 p.m. at Walham Green, and 10 p.m. at Hammersmith and in the Wandle Valley. At Richmond the fog did not clear until the night of February 2nd.

The dispersal of the fog was either accompanied or brought about by a slight rise of temperature. The hourly readings of the thermograph at South Kensington were as follows:—

Hour.	Jan. 31st	...	...	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	°F.	...	...	36	36	39	39	37	37	39	41	43	43	43	41	41	39	39

Hour.	Feb. 1st.	...	...	1	2	3	4
	°F.	...	...	37	32	34	34

Between 1 a.m. and 1.15 a.m. on February 1st the temperature fell 3° ; and at Russell Square very dense fog rapidly replaced a clear sky at 12.50 a.m. on that day.

⁽¹⁾ Les bases de la météorologie dynamique. Vol. 2, pp. 108-9.

⁽²⁾ In the "London Fog Inquiry" several cases are mentioned of the accumulation of fog in the leeward parts of London.

The actual disappearance was probably connected ultimately with a steepening of the gradient which by 7h. of February 1st had brought winds of force 3 (10 m.p.h.) into the Thames Valley; according to the "London Fog Inquiry" fogs are rare with a velocity exceeding 3 m.p.h. Masses of fog continued to hang about locally, however, especially in the west, throughout February 1st; by the 2nd they had almost entirely disappeared.

I append remarks on the fog distribution collected from various sources, and used in the foregoing note.

FOG ON EVENING OF JANUARY 31ST; INFORMATION SUPPLIED
BY MEMBERS OF M.O. STAFF.

R. G. K. Lempfert.—12.45 p.m., f_1 South Kensington; 1 p.m., f_3 Earl's Court; 2.35 p.m., f_4 South Kensington; 3 p.m., f_2 Albemarle Street; 4 p.m., f_1 Piccadilly; 5 p.m., f_3 Earl's Court. "The fog was then so dense that I think I may say without exaggeration that I have never seen a denser. Radius of vision limited to about a yard."

F. J. W. Whipple.—Clear on Wimbledon Common; lights visible half a mile away(f_1). Fog began about Parson's Green (f_3). Bad at Earl's Court and very bad at Turnham Green(f_5).

R. Corless.—3 p.m.—4 p.m., traffic unimpeded at Albemarle Street; 5 p.m.—5.45 p.m. extremely thick at Earl's Court and thence to Chiswick Park, decreasing from there to Ealing Common. Traffic unimpeded at Ealing Broadway.

Capt. Hepworth.—Fairly thick at Ealing 180 feet above O.D.

Miss Sawyer.—Slight fog at Harrow.

J. A. Curtis.—Afternoon, between Whetstone and Golder's Green, slight; Earl's Court to Walham Green, very bad. Fairly clear at Southfields 4.30 p.m. Air quite calm at Walham Green. candles could be carried with a naked flame.

Lieut. Cundall.—Piccadilly almost clear at 7 p.m.; fog thickened going west to Hammersmith. Very dense at Shepherd's Bush. Cleared very rapidly at Hammersmith 10.10 p.m. Fog came on again suddenly at Russell Square 12.50 a.m., Feb. 1st, and thickened until 1.50 a.m.

Lieut. Stacey.—Sydenham fairly clear. No impediment to road traffic.

R. Sargeant.—Putney f_3 from 4 p.m., still continuing at 10 p.m. Slight mist only reported at Barking, and very slight fog on the high ground at Brockley Hill.

J. Sheerman.—Thick white mist from London to Tring.

W. Allingham.—Gloucester Road, 5 p.m., f_3 ; Victoria, f_3 ; Clapham Junction to Streatham, say f_2 ; stars visible.

J. E. Belasco.—Chelsea, 7 p.m., f_1 , but stars sometimes visible; fog drifting from N.W. Thicker westward. Fog cleared 8.15 p.m.

W. J. Williams.—Putney to Tooting f_5 . No conveyances at all. Tooting, trams running as usual; slight fog.

A. G. W. Howard.—Visibility 1 yard between Earl's Court and West Brompton, 2 yards at Walham Green, 4 yards at Parson's Green, 12 yards at Putney Bridge, East Putney clear; clear at Southfields, but fog in valley of Wandle, about 6 feet deep. Light E. wind. Cleared by 10 p.m.

H. Keeton.—M.O. 3.15, thick fog; less thick at Victoria 3.30, decreasing through Battersea, Brixton and Peckham. At New Cross, 4 p.m., one could see fully a quarter of a mile. Cleared completely during evening.

Miss Quennell.—West Norwood only misty, no dense fog.

E. J. Hood.—Richmond, Twickenham and Teddington very bad.

Miss Despicht.—Fog very thick at Kew Bridge.

W. E. King.—Dulwich fairly clear.

Miss Smith.—Beckenham clear in evening; Croydon bad mid-day; Victoria slight 1 p.m.

Miss Geake.—Hyde Park, morning, Albert Memorial invisible from steps. Kensington High Street, midday, very dense. Notting Hill, evening, traffic by road as usual.

Mrs. Brooks.—5 p.m.—6 p.m., Barnsbury slight, Highgate denser; Finchley slight.

C. E. P. Brooks.—8 p.m.—9 p.m., Marylebone fairly thick, decreasing very slowly northward; thicker in the valleys. Fog drifting downhill from N. at West Hampstead.

From the "Times" of February 1st—In Western and S.W. districts "heaviest for many years. For two days masses of fog had been floating about the City, but it was not until Thursday morning that it began to affect train and vehicular traffic. By midday it had almost vanished, but as the afternoon wore on the greyness in the atmosphere increased until . . . [everything] . . . was blotted out. In some districts the omnibus and tramway services were brought to a standstill." Traffic was paralysed at: Putney Bridge, Kingston, Roehampton, Wimbledon, Shepherd's Bush, Hammersmith and Acton.

**SUMMARY OF WEATHER REPORTS FROM LONDON STATIONS,
JANUARY 29TH TO FEBRUARY 1ST, 1918.**

<i>Richmond, Kew Observatory.</i> Date.	Hour.	Weather.		Temperature.*		Grass† Min.	Rel. Hum.	Remarks.
		At time.	Since last observation.	Max.	Min.			
	G.M.T.			°F	°F	°F	%	
Tuesday, Jan. 29th.	7	omw	bmz omw	41	32	23	96	Overcast to 10h., fine remainder of the day; fog at night.
	9	omw	omw					
	13	b	omw cb					
	15	bc	bbc				78	
	18	bm	bc bm	49	38		92	
	21	bfw	bm bfw					
Wednesday, Jan. 30th.	7	fx	bfw fx	39	29	25	85	Thick fog all day.
	9	fx	fx					
	13	f	fx f					
	15	f	f	38	29		95	
	18	f	f					
	21	fw	f fw				93	
Thursday, Jan. 31st.	7	fx	fw fx	36	26	23	95	Thick fog throughout the day.
	9	fx	fx					
	13	f	fx f					
	15	f	f	34	27		98	
	18	f	f					
	21	fx	f fx				100	
Friday, Feb. 1st.	7	fx	fx	31	27	27	100	Fog all day—thinned somewhat 11h.-14h. sun visible at times.
	9	fx	fx					
	13	f	fx f					
	15	f	f				97	
	18	fx	f fx	37	30		95	
	21	fx	fx					

<i>South Kensington.</i> Date.	Hour.	Weather.		Temperature.		Rel. Hum.	Wind.		Remarks.
		At time.	Since last observation.	Max.	Min.		Direction.	Force.	
	G.M.T.			°F	°F	%			
Tuesday, Jan. 29th.	9	ofe	bc o	46	39	94	Calm	0-12	
	13	bc	o bc				SSW	0	
	15	b	bc b				S	1	
	18	b	bm b	50	40	84	S	0-1	
Wednesday, Jan. 30th.	1	bc	b _o b ₁	47	36	91	Calm	0	A mist still prevails.
	9	fe ^a					Calm	0	
	13	f					Calm	0	
	15	b	mb	46	38	83	SSE	0-1	
	18	bm	bm				SE	1	
Thursday, Jan. 31st.	1	b _o bm	b	46	33	96	Calm	0	Fog clearing somewhat. Fog cleared considerably, now not much thicker than mist.
	9	fx	bf				Calm	0	
	13	f	f				Calm	0	
	15	f	f				Calm	0	
	18	f	f	35	34	77	Calm	0	
Friday, Feb. 1st.	1	f	f ₁ b _o bm	38	31	85	Calm	0	Thick rime. Fog considerably cleared. Fog dispersed.
	9	f	f				E	0	
	13	f	f				Calm	0-1	
	15	f	f				E	0-1	
	18	b	f ₁ mb	42	33	86	E	0-1	

* Max. and min. temperature during the period ending at 9h. or 18h.

† Min. temperature during the 24 hours ending at 9h.

SUMMARY OF WEATHER REPORTS—*continued.*

Station.	Date.	Hour.	Temperature.†		Grass Min.	Rel. Hum.	Cloud.	Wind.		Weather Remarks.
			Max.	Min.				Direction.	Force.	
West-minster.	Jan. 29	G.M.T. 9	°F 50	°F —	°F 30.5	% 98				morn. bc b bmb m
	30	9	52	—	29.0					bc bc bc bm f
	31	9	52	—	29.0					fb b bm f f
	Feb. 1	9	48	—	26.7					f f f f
Camden Square.	Jan. 29	9	49	37		99				oc
		15				78				bc
	30	9	49	34	29	100				omc
		15				100				bc
	31	9	43	29	25	100				f
		15				100				m
	Feb. 1	9	37	30	25	100				f
		15				100				raf
Greenwich.	Jan. 29	9	49.0	36.3	30.1	96	nil	nearly calm	light	
		15				75	nil	SSW		
	30	9	51.5	30.1	23.0	82	prob. nil	calm		Thick fog from 7h.
		15				70	nil	nearly calm		
	31	9	51.5	28.0	21.8	93	prob. nil	calm		Very foggy.
		15				70	nil	calm		
	Feb. 1	9	47.9	28.4	20.3	92	—	calm		Foggy.
		15				79	nil	calm		

Weather Diary at Greenwich.

Date.	Wind.	Weather.
9h. 29th Jan. to 9h. 30th.	SSW till 16h. then calm.	Fine throughout and nearly cloudless, but thin cloud prevalent after 22h. Slight fog before 10h., and thick fog about 7h. (30th). Misty at night, hoar frost in morning.
9h. 30th Jan. to 9h. 31st.	Nearly calm or calm throughout.	Cloudless, except for a little light cloud at midday; foggy till 9.30, misty at night, becoming very foggy from 4h. (31st.) Hoar frost in morning.
9h. 31st Jan. to 9h. 1st Feb.	Calm throughout.	Foggy till 10h.30, cloudless and very fine till about 3h.; then foggy. Hoar frost at night.
9h. 1st Feb. to 9h. 2nd.	Calm generally throughout.	Overcast till 11.30 with fog till 10h. Cloudless with slight exceptions from noon till 22h.; then becoming hazy to overcast from 23h. to 3h. Variably cloudy till 6h. with hoar frost. Nearly overcast after 6h.

† Max. and Min. temperatures during the 24 hours ending at 9h.