

S Y M O N S ' S  
M O N T H L Y  
M E T E O R O L O G I C A L M A G A Z I N E .

CXLII.]

NOVEMBER, 1877.

[ PRICE FOURPENCE  
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ANEMOMETERS AND THE GALE OF OCTOBER 14<sup>TH</sup>-15<sup>TH</sup>.

THE extensive damage produced in the Midland Counties by this gale, induced us to apply to such of our correspondents as we were aware possessed anemometers, for copies of their records, and we have the pleasure of giving a few facts in a table on page 147. It is, however, necessary to preface it with some general remarks. In the first place we do not know of two anemometers of which the records can fairly be compared. By this we wish it to be distinctly understood that, while we admit that a maker may send to Kew a dozen anemometers all of which shall agree within two per cent., we believe that there are no two now at work of which records of 100 miles having passed, would really prove that from 98 to 100 miles had actually been the horizontal motion at each station. There are many reasons for this.

Every anemometer requires oiling; no two anemometers require oiling at equal intervals of time; the frequency depends on climate, dust, smoke, salt in the atmosphere, &c.; moreover the relative attentiveness of the observer is a disturbing element. The friction coefficient depends on the stickiness or otherwise of the lubricating material, and from the day that an anemometer is cleaned and oiled it begins to coagulate, and the friction increases until it is again cleaned. For the reasons previously given, anemometers cannot all be oiled at the same date, and if not, some are in one state, others in the opposite.

There are several sets of observations which prove, and Mr. Glaisher's balloon voyages confirm, the fact that the velocity of the wind is greatly retarded by friction against the earth's surface. Therefore, every foot that the anemometer is placed above the ground puts it in a stratum of which the horizontal movement is greater than at less altitudes. We are not aware that the *amount* of this increase of velocity with altitude has been determined, but of its existence, and of its being a large value there can be no doubt. This compels us to admit that strict comparison can only be made between anemometers placed at equal altitudes above the ground.

There is a very great difference between the wind passing an anemometer mounted on a pole and one placed upon the roof of a house.

The former probably shows (subject to correction for friction) the

velocity of the current at the altitude at which it is fixed ; the latter shows a higher value than the truth, inasmuch as it shows the current due to its altitude, plus that of part of the air which has struck the building on which it is placed. This deflected air will vary with the shape and size of the building, and with the azimuth of the wind. It would be at its minimum when the anemometer was at the top of a conical building, and at its maximum with a rectangular building of considerable extent, when the wind struck perpendicularly upon one of its sides. No attempt has been made to determine the amount and character of the errors thus produced.

The foregoing sources of incomparability are removable. The next is only partially so, viz., the differences due to local surroundings. In examining the progress or intensity of storms we require to know the velocity, &c., say at London and Oxford ; we do not want to know the difference between the velocity in St. James's Park and on Primrose Hill. Hitherto the practice has too often been to fix the site first, and then put up the anemometer on the observatory *because* the observatory is the natural place for it. The reverse method is the proper one : hunt carefully for as perfectly suitable a site as possible for the anemometer, and then plan your observatory.

Few people are aware how very little shelter an anemometer will bear. We have never put any faith in the readings of the Camden Square anemometer, because we thought it sheltered ; yet we find that from S.S.E. through W. to N.N.W. there is nothing more than 2° higher than the cups, and from N.N.W. through E. to S.S.E. nothing more than 10°, and very little so much as that. Yet at Greenwich a total motion of 1179 miles is recorded against 511 at Camden.

From the foregoing and other considerations, upon which we have not time to dwell, such as size of instruments, mode of registering, &c., we conclude that *no two anemometers at present at work are strictly comparable.*

Now a few words respecting the table, and very few are necessary. The Roman numerals indicating patterns of anemometer are—I., small size Robinson's cups (radius about 1 ft.) ; II., large size (radius about 2 ft.) ; III., pressure plates.

We never recollect seeing so many anemometer records together before, but the only real novelty in the table is the last column but one. Finding it hopeless to learn anything by comparing the recorded horizontal velocities, we tried to ascertain if the records of each station were consistent with themselves. For instance, there are five stations within a dozen miles of London, and they record horizontal motions ranging from 1179 miles (Greenwich) through 983, 864, 691 down to 511 at Camden Square. Who can say where the truth is, amid such discordant statements ? We therefore compared the records of the two separate days at each station with the aggregate for 48 hours, and this gave the (generally) very consistent figures in the last column but one, showing (1), that roughly speaking 60 per cent. of the horizontal motion occurred in the first of the two days ; (2), that the

excess of the first day was greatest at the western stations, and vanished at Greenwich.

STATIONS.	AUTHORITIES.	ANEMOMETER.			Total Horizontal motion in 24 hours, ending 9 a.m.		Per cent. of 48 hours in first 24 hours.
		Pattern.	How mounted.	Height.	15th.	16th.	
					feet.	miles.	
Roy. Bot. Gardens, Lond.	W. Sowerby, F.L.S., F.M.S.	I.	{ Column Mound.	26 27	387	304	56 <sup>1</sup>
Camden Square, „	G. J. Symons, Sec. M.S.	I.	Pole.	35	280	231	55 <sup>2</sup>
Addiscombe .....	E. Mawley, F.M.S.	II.	Roof.	50	481	383	56 <sup>3</sup>
Roy. Obs., Greenwich ...	Sir G. B. Airy, K.C.B., F.R.S.	I.	Roof.	60	580	599	49 <sup>4</sup>
Deptford, Kent .....	W. Jeffrey .....	I.	Roof.	65	525	458	53 <sup>5</sup>
Worthing, Sussex ... ..	W. J. Harris, F.M.S. ....	I.	{ Shed. Pier.	15 15	635	..	... <sup>6</sup>
Strathfield Turgis, Hants.	C. H. Griffith, F.M.S. ....	I.	Post.	20	...	...	... <sup>7</sup>
Radcliffe Obs., Oxford ...	R. Main, M.A., F.R.S. ....	I.	Roof.	110	559	418	57 <sup>8</sup>
Aspley Guise, Beds. ....	E. E. Dymond, F.M.S. ....	I.	Post.	13	384	254	60 <sup>9</sup>
Wisbeach .....	W. J. D. Ward ... ..	I.	...	...	412	305	57 <sup>10</sup>
Marlborough, Wilts. ....	T. A. Preston, M.A., F.M.S.	I.	Pole.	19	824	266	76 <sup>11</sup>
Babbacombe, Devon. ...	E. E. Glyde, F.M.S. ....	I.	Pole.	25	662	361	65 <sup>12</sup>
Sidmouth, „ ... ..	W. T. Radford, M.D. ....	III.	Staff.	11	...	...	... <sup>13</sup>
Mid. Inst., Birmingham.	A. Cresswell .....	I.	Roof.	70	552	411	57 <sup>14</sup>
Buxton, Derbyshire .....	E. J. Sykes, F.M.S. ....	I.	Roof.	30	340	235	59 <sup>15</sup>
Barrow, Lancashire .....	F. Slade, C.E. ....	I.	Pole.	36	785 (?)	891 (?)	...
Ulley, Rotherham .....	L. Berry .....	I.	„	5	306	207	60 <sup>16</sup>
„ „ .....	„ .....	II.	„	5	280	196	59 <sup>17</sup>
Hawes, Yorks. ....	J. D. Parker, LL.D., F.M.S.	I.	Post.	10	540	...	...
Kilmarnock, Ayr ... ..	W. H. Dunlop, F.M.S. ....	I.	Stand.	12	427	...	...

REMARKS.

- <sup>1</sup> A good blow, but have often had more.
- <sup>2</sup> Heavy gale, but not exceptionally so. No damage in this neighbourhood.
- <sup>3</sup> Max. velocity 37 m. in the hour, ending 2.45 a.m. on 15th. Wind S.S.E. at 4 p.m. on 14th, W.S.W. at 9 a.m. on 15th.
- <sup>4</sup> Max. velocity 44 m. per hour between 2 and 3 a.m. 15th. Max. pressure 22 lbs. at 4.20 a.m.
- <sup>5</sup> Very violent from 11 p.m. 14th to 9 a.m. 15th.
- <sup>6</sup> On Pierhead, ½-mile from shore; at 9 a.m. on 15th velocity 34 miles per hour. Very strong 2 to 4 a.m. on 15th.
- <sup>7</sup> Anemometer pole broken by very heavy gale at 3.15 a.m. on 15th. Anemometer had run 327 miles in 18½ hours. Min. bar. at 3 a.m. Much damage.
- <sup>8</sup> Bar. min. at 2 a.m. Max. velocity 36 m. per hour at midnight.
- <sup>9</sup> Have had four stronger gales this year. Gale began late in evening of 14th.
- <sup>10</sup> Max. pressure, 20 lbs. at 1 a.m. on 15th.
- <sup>11</sup> Very strong gale, and much damage done.
- <sup>12</sup> Exceptionally violent 11.30 p.m. on 14th to midnight; said to be the strongest gale for 30 years.
- <sup>13</sup> 17lbs. on square foot (= 61 m. per hour) at 9 a.m. on 15th, which is rarely equalled here; much damage.
- <sup>14</sup> Max. pressure 26lbs. at 1.30 a.m. on 15th; max. velocity 40 m. per hour, 2 to 4 a.m. Direction always between S. and W. Barometer pumping very much from midnight to 2 a.m., when sea level min. of 29.25 in. occurred.
- <sup>15</sup> Wind not at all exceptional.
- <sup>16</sup> Anemometer read at irregular intervals, generally strong wind here—this was not excessive.
- <sup>17</sup> Not continuously violent, but heavy gusts—observations taken at 10 a.m., not 9 a.m.

In the following notes we have embodied all the references to the weather of the 14th and 15th of October which have reached us, and they show that in the Midland Counties the gale was of very exceptional violence. Our correspondents have sent few details of damage, but from the newspaper reports, of demolished houses, factories, chapels, &c., it must have amounted to many thousand pounds.

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**ENFIELD CHASE.**—15th. **SIR,**—A gale of extraordinary violence swept over this district this morning. The storm commenced about 11.30 p.m. yesterday, and gradually increased in violence till 2 a.m. this morning, from which time till 4 a.m. the force of the wind was terrific. Vivid flashes of lightning were seen in S.E., between 3 and 4 a.m.; after 4 a.m. the violence of the storm slightly abated, and the wind began to veer from S. to S.W. At 7 a.m., after a sharp shower, the storm ceased, though the wind has continued strong and squally all day. The gale was the most violent that has been experienced here for years, and though in this exposed position, little damage was done, the damage in the more low lying districts, and particularly at Winchmore Hill, where great numbers of trees were blown down, was considerable. One of the most remarkable features of the storm was the excessive temperature which preceded it. At 6 p.m. yesterday the thermometer stood at 61°, at 9 p.m. at 63°·2, and during the night it rose to 64°·8; as the storm passed off, the temperature fell very rapidly, being only 50° at 8 a.m., and at 9 p.m. to-night only 43°·8, or nearly 20° lower than at the same time yesterday. The barometer fell rapidly yesterday evening, but the minimum was only 29·32 in.—Yours truly, *Thos. Paulin.*

**WORTHING.**—14th. Fine morning, with fresh breezes from W.S.W. and S.W. Wind “backed” all day, and in afternoon and evening was S.E. and S.S.E. Barometer fell sharply; sky presented a wild appearance—clouds being, in common parlance, “mare’s tails,” indicative of wind and stormy weather.

15th. During early morning 2 to 4 a.m., wind blew very strong from S.S.W. and W.S.W.; after 4 a.m., barometer began to rise, wind “veering” more W. At 6.30 a.m. and 7.30 a.m. sharp squalls of wind and rain, again, shortly after 8 a.m., a very heavy rain storm came on from S.W. and W.; during its passage, the wind “veered” to W.N.W., sky cleared, and it was fine altogether afterwards.—*Wm. J. Harris.*

- ST. LAWRENCE, ISLE OF WIGHT.—14th. Gale in the early morning.  
15th. A wonderful whirlwind passed along the sea from W. to E. at 2.30 p.m., and drew the water up into a column of considerable height. It was seen by many persons. I have heard of no damage done by it.—*C. Malden.*
- SELBORNE, HAMPSHIRE.—14th. Violent wind, W. to S.  
15th. Much wind, S.W.—*T. Bell.*
- HITCHEN.—15th. Terrific gale, said to be the most violent in living memory.—*W. Lucas.*
- ADDINGTON, BUCKS.—14th. Fine; wind increasing all the afternoon and evening.  
15th. Wind very high in early morning; a great many branches broken off trees, but have heard of no other damage.—*J. Mathison.*
- MAG. COLL., OXFORD.—14th. Damp; very high wind in night, several trees blown down, and other damage done.—*F. Chapman.*
- BANBURY.—14th. Much damage to trees and buildings in the neighbourhood by the gusty wind of this night; very high wind.—*T. Beesley.*
- NORTHAMPTON.—14th. In night of 14th–15th heavy S.W. gale, and great destruction of property.—*H. Terry.*
- CAMBRIDGE.—14th. A warm, fine, summer day; windy in evening.  
15th. Severe S.S.W. gale, without rain, from 0 to 4 a.m.—*G. Warren.*
- CULFORD, SUFFOLK.—15th. High wind.—*P. Grieve.*
- DISS, NORFOLK.—14th. Fine day, and magnificent sunset; violent S.W. gale at night.  
15th.—Tremendous gale, intense at 3 a.m.; a few trees were blown down and stacks unthatched; but the mischief was not so great as I expected.—*T. E. Amyot.*
- SPROWSTON, NORFOLK.—14th. Gale from S.W. at midnight.  
15th. Strong gale, unroofing stacks, but not followed by rain; gale lasted all day, strongest at 3 a.m.—*T. Cozens Hardy.*
- COMPTON BASSETT.—14th. Very fine; hurricane at night which did considerable damage to buildings, and uprooted many large trees.—*J. Allen.*
- BEAMINSTER, DORSET.—14th. Calm, lovely day; sudden change about 4 p.m.; S.W. gale sprung up about 8 p.m., and blew a hurricane at midnight, doing great damage to the church tower.—*A. Codd.*
- KIRKHAM, BABBACOMBE, TORQUAY.—14th. Fine and warm (max. temp. 65°·3), with a fresh southerly breeze till the evening, when the bar., which had been falling all day, fell fast, and the wind rose to a severe gale from S.S.W., which increased to almost a hurricane between 11 p.m.

and 0.15 a.m. of the 15th, it then gradually lulled to force 2 by 7 a.m., and shifted to W.S.W. I append a few observations :—

Day.	Hour P.M.	Bar. at 32° at sea level. in.	Shade temp.		Wind.	Force.	Weather.
			Dry. Deg.	Wet. Deg.			
14th	9.14	29.389	61.1	57.4	S.S.W.	9 ...	cq.
„	11.0	29.290	57.8	52.3	„	11 ..	bq.
„	12.0	(min.) 252	55.2	51.4	„	12 ...	oqp.
	A.M.						
15th	0.15	29.300	55.0	—	„	11 ...	oq.
„	9.14	29.836	46.9	43.5	W.	2 ...	cv.

Rainfall, 0.03 in. in past 24 hours. Shade min.  
in past night, 45°.9.

Enormous quantities of dust and gravel were blown about, rattling against the windows; about a load of gravel was blown away from this garden. Trees have been wrecked, houses unroofed, and vegetation scorched up in every direction; plate glass windows blown in at Torquay, and a yacht ashore.—*E. E. Glyde.*

DRUID ASHBURTON, DEVON.—14th. Very heavy S.W. storm at night.  
15th. Showers early; at 11 a.m. thunder and hail.—*F. S. Amery.*

TAVISTOCK, DEVON.—14th. Fine morning, afterwards windy; a perfect hurricane in the night.—*W. Merrifield.*

CLAWTON, HOLSWORTHY, DEVON.—14th. One of the most severe S.W. gales I recollect; great injury done to trees, many blown over, ricks scattered, and general damage.—*W. W. Melhuish*

LANGTREE, TORRINGTON, DEVON.—14th. Very heavy gale at night, uprooting trees, &c.—*J. E. Bazeley.*

ARLINGTON COURT, BARNSTAPLE.—15th. SIR,—It may interest you to know that this place was visited last night by a real hurricane. It began to blow hard about 11 p.m., 14th. I looked at my barometer at 11.20 p.m.; it stood at 28.65 in. (we are 600 ft. above sea level). I looked again at 11.40 p.m., it had risen to 28.70 in., but at 0.20 a.m. 15th, it had fallen to 28.45 in., and at 9 a.m. it was at 29.29 in. About 0.45 a.m. it was blowing a real hurricane. Very great damage has been done to the roofs of the houses; my observatory had its roof lifted clean off, and deposited some 80 yards off, and from 200 to 300 trees (some of great girth) have been blown down. I measured one 18 ft. in girth. The wind at the early part was S.S.W., but it gradually got round to N. As I write the ground is white with hail.—Yours very truly, *Bruce Chichester.*

ASHLEY DOWN, BRISTOL.—14th. Terrific gale at night.—*W. F. Denning.*

- SHIFNAL, SHROPSHIRE.—14th. A fearful hurricane from S. to W. and N.W., beginning at 9 p.m. and lasting till 4 a.m.; the severest since the memorable one of January 7th, 1839.—*J. Brooke.*
- SANSAW, SHROPSHIRE.—14th. Fearful storm of wind, especially at night.—*F. G. Tippinge.*
- ORLETON, WORCESTER.—14th. Much low drifting cloud, with lofty dusky cirrus above; very fine and warm after 10 a.m., with soft broken clouds, and a strong S. wind; moonlight at 8 p.m., with soft white drifting clouds, and rough wind.  
15th. Great hurricane from 0 to 3.30 a.m., with spots of rain; morning fine, with rough wind. The hurricane was most destructive to the timber trees and buildings; all the roads were blocked up by fallen timber trees, or strewed with boughs and branches. No wind of equal violence has occurred since the hurricane in the night between the 6th and 7th of January, 1839, which was preceded by a similar advance in temperature.—*T. H. Davis.*
- TEAN VICARAGE, NEAR CHEADLE, STOKE-ON-TRENT.—15th. A tremendous gale in night, from S. veering to W. Especially severe from about 1 to 4 a.m. this morning (15th). Some of the gusts terrific, so that even this solidly-built house swayed perceptibly under the pressure. A tree in the field just below this house had its top snapped off. No rain fell during the storm, but a few slight showers, chiefly small hail, since 9 a.m. this morning. Temperature yesterday afternoon (14th) quite summer-like (max. 67°). Sky almost cloudless, and clear atmosphere. Even at 9 p.m. the thermometer stood at 58°, but wind, which had been very brisk even in the afternoon, had then increased to a gale, and subsequently, by about midnight, to a violent storm.—*G. T. Ryves.*
- BICKENHILL, BIRMINGHAM.—14th. Unusually mild; a terrible gale began at 9 p.m., but moderated towards morning; several trees snapped in two, and branches strewed in all directions.—*W. R. Capel.*
- LEICESTER.—15th. A very violent gale in the early morning, which did considerable damage; many trees uprooted.—*H. Billson.*
- COSTON, MELTON MOWBRAY.—14th. Very severe gale at night, unparalleled in the memory of the inhabitants.—*A. M. Rendell.*
- BOSTON.—14th. A very heavy gale, which continued with more or less force all the next day.—*W. H. Wheeler.*

- GRIMSBY, LINCOLN.—14th. Wind rising at night.  
15th. Heavy gale from near midnight till 3 p.m.—  
*J. Byron.*
- MANSFIELD, NOTTS.—14th. Terrific gale at night.  
15th. Terrific gale in early morning Stormy night.—  
*R. Tyrer.*
- STANLEY, WAKEFIELD.—15th. Furious gale in the morning.—*R. Burrell.*
- BUCKDEN, SKIPTON.—14th. Fine ; strong wind at night.  
15th. Rain, a gale, hail, and thunder at night.—*W. R. Metcalfe.*
- N. SHIELDS.—14th. Fine.  
15th. Showery, fine rain.—*R. Spence.*
- SEATHWAITE, CUMBERLAND.—15th. Snow on hill-tops.—*T. Birkett.*
- GAINFORD, DURHAM.—14th. Fine afternoon.  
15th. W.S.W. gale, with rain and sleet.—*A. Atkinson.*
- WOODLANDS, ELTERWATER, WESTMORELAND.—14th. Dull all day,  
and windy ; rain at night.  
15th. Frequent showers of hail and rain.—*E. Tucker, jun.*
- SHAP, WESTMORELAND.—14th. A great storm of wind.  
15th. Wet, and very windy.—*W. Hoggarth.*
- LLANFRECHFÄ, MONMOUTH.—14th. Thunder and lightning.—*F. J. Mitchell.*
- HAVERFORDWEST.—14th. Great storm, very little rain, sky clear ; at  
midnight bar. falling fast ; tremendous gusts at 12 (mid-  
night), between which time and 3 a.m. the force of the  
wind was very great ; much damage done to roofs,  
slates lying in heaps. Near Rosebeach Precelly Slate  
Quarries, a new roof just slated, and firmly nailed  
down, was forcibly lifted entire and carried 50 yards,  
and it came down without injury flat on to the ground.  
The sky was clear, bright, and starlight nearly the  
whole of the night, except at intervals, when enormous  
hailstones fell in heavy showers.—*E. P. Phillips.*
- SOLVA, PEMBROKE.—14th. Heavy gale, increasing towards night.—  
*E. Robinson.*
- CASTLE MALGWYN, CARDIGAN.—14th. Very rough wind, and showery.  
15th. Windy, and small showers.—*H. Howard.*
- ABERDOVEY.—14th and 15th. Great storm of wind, commencing  
about 10 p.m. on 14th.—*D. Charles.*
- LLANDUDNO.—14th. Very windy and warm ; began to rain about  
8 p.m. ; stormy night.  
15th. Very windy day ; two heavy hail showers in  
the afternoon, showery evening, stormy night.—*J. Nicol.*
- HAWICK.—14th. Rough blustering winds, hurricane blowing from  
the west.  
15th. Rough wind, hail showers ; hills white with  
snow, or rather hail.—*D. Elder.*

- KILMARNOCK.—15th. Great storm from W.N.W., reaching force 11 on Beaufort scale; a considerable quantity of grain still standing out in the fields.—*W. H. Dunlop.*
- CESSNOCK PARK, GLASGOW.—14th. Fine morning, hailstorm at noon, rain at night.  
15th. Stormy morning.—*R. Hart.*
- ABERDEEN.—14th. Lightning 9 a.m.—*A. Beverley.*
- KEITH STATION.—14th. Sleet. 15th. Snow.—*J. Masson.*
- AUCHNASHEEN STATION.—14th. Heavy rain and snow, = 2·03.—*The Agent.*
- PORTREE.—14th. The rain poured down in torrents, raising the rivers and streams to an extent never before seen; corn and potatoe fields covered with water, and gravel, several feet deep, rendering several fields unfit for cultivation in all time to come; bridges and roads were swept to the sea, causing damage to the extent of several thousand pounds to the road commissioners, and stopping all our communication throughout the island, except on horseback. At Uig, the whole burial ground, except six graves, was carried completely away; coffins were put ashore by the sea 10 and 20 miles distant. The mansion house garden and all the plantations were also swept away, with the estate manager, who was the only one in the house at the time; not a vestige remains. No such floods here since inhabited by human beings.—*J. Grant.*
- CULLODEN, INVERNESS.—14th and 15th. Constant heavy rain from E.N.E.; barometer in morning, 28·563 at 32°; frequent heavy showers of snow.—*D. Forbes.*
- BUDGATE (NAIRN).—14th. Rain. 15th. Stormy, much wind.—*J. Joss.*
- SANDWICK.—15th. Storm, velocity 69 miles per hour from 7 to 8 p.m.; mean from 5 to 9 p.m. 65 miles. One of the strongest gales for years.—*C. Clouston.*
- DARRYNANE ABBEY.—14th and 15th. Very heavy gale from W.—*D. O'Connell.*
- TRALEE.—A cyclone passed on 13th, 14th and 15th; rainfall on 14th, 2·25 in.—*H. Stokes.*
- WATERFORD.—14th. Wind very high.—*E. Garnett.*
- NEWCASTLE, W.—14th. Storm from W., with rain and hail.  
15th. Storm from N.W., with rain and hail.—*J. T. Hayes.*
- MILLTOWN MALBAY, CLARE.—14th. A furious hurricane, which did some damage.—*M. Molohan.*
- KILRUSH.—14th. Wet, wild, heavy W. gale, veering to N.W. in the evening; very bad, rainfall 1·23 in.  
15th. Wind still N.W. and stormy.—*M. Bourke.*
- KILLALOE.—14th. Storm.—*J. Digan.*
- NAAS, KILDARE.—14th. Dry, windy day; showers from S.W. in evening. 15th. Windy and cold.—*P. Homan.*

- BELVEDERE, MULLINGAR.—14th. Rough, stormy morning; wet afternoon.  
15th. Rough, stormy morning; stormy afternoon.—*G. Curd.*
- KILCONNEL, GALWAY.—15th. Storm from N.W., with hail and occasional thunder.—*H. E. Muriel.*
- BALLINASLOE.—14th. Heavy rain in morning, and very squally, with much rain all day.  
15th. Very squally; lightning at 1.10 p.m.—*W. H. Kempster.*
- NEW BARNSELY, BELFAST.—14th. Stormy rain at night.  
15th. Stormy, with showers.—*J. Firth.*
- POMEROY, DUNGANNON.—15th. Heavy showers, hail and thunder.—*S. A. Brennan.*
- BALLYSHANNON.—13th and 14th. Heavy gales from W.S.W.  
15th and 16th. Heavy hail storm, leaving the mountains quite white.—*H. Allingham.*
- KILLYGARVAN, RAMELTON.—14th. Wind S. in morn, N.W. afterwards; heavy rain (1.37 in.), and great gale for seven hours, at night.  
15th. Heavy squalls; hail.—*C. H. Cochrane.*
- BUNCRANA.—14th. Rainfall 1.84 in. (No notice taken of the wind, though it is specially noted as strong on other days in the month).—*T. Colquhoun.*

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THE RAINFALL OF OCTOBER 14th-15th.

The gale of this date was, in the Eastern counties of England, remarkable for the fact that it was not accompanied by a drop of rain. In the North-West of Scotland, on the other hand, the rainfall was very large. At Portree the fall on the 14th was nearly 5 inches (4.98); it was more than  $1\frac{3}{4}$  inches at the following stations:—

Braemar, Aberdeen ...	1.95 in.	Portree, Skye .....	4.98 in.
Strome Ferry, Ross ...	2.19 in.	Tralee, Kerry.....	2.25 in.
Auchnasheen, ,, ...	2.03 in.	Buncrana, Donegal ...	1.84 in.
*Gairloch, ,, ...	1.94 in.†		

† Gauge allowed to run over.

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REVIEW.

*Observations Météorologiques Suédoises publiées par l'Académie Royale des Sciences de Suède, exécutées et rédigées sous la direction de l'Institut central de Météorologie.* Vol. XV., 2 ième série Vol. I. 1873. P. A. Norstedt & Söner, Stockholm, 1876. 4to. viii.—143 pages.

THIS is the Swedish contribution to international meteorology, and a very creditable one it is—the materials are good, and the paper, printing, and binding superior to either the Russian or the English. It is printed in Swedish and French, but it wants a map, and tells us very little about the instruments employed or their mode of exposure.

Dr. Rubenson has not followed strictly the plan put forward by the

permanent Committee of the Vienna Congress, and there is so much in his remarks upon his departures from that plan, that we translate that part of the introduction :—

“The plan proposed by the permanent Committee for the monthly and annual results did not reach me until after the arrangement of that part of the volume had been settled, and the greater part of the manuscript prepared. The arrangement adopted by me had been previously submitted to the examination of MM. Wild, Mohn, and Hoffmeyer, who approved its general tenour ; thenceforth I considered myself justified in expecting that the final arrangements which we were then awaiting from the permanent Committee, would be chiefly conformable to my own. I considered myself all the more justified in this supposition, because I had drawn up my tables in close conformity with that originally designed by M. Wild. But even had it been possible at the last moment, without too great inconvenience, to have substituted for the form adopted by me that proposed by the permanent Committee, I should have hesitated to do so until many of the European Meteorological Institutes had shown by its adoption that they desired a perfect identity in the forms employed. The uniformity which the permanent Committee have endeavoured to obtain in the publications of various countries, seems to me primarily designed to secure that all the elements of the greatest importance in the present condition of the science, shall always be given. I think it also quite proper that the result of the labours of the Committee should be expressed in the forms drawn up for the use of those interested. But on the other hand, it appears to me that mere differences in the form of publication of various countries are not likely to produce appreciable inconvenience. Whoever devotes himself to the examination of a Meteorological question, and requires to consult the publications of various countries, will soon find that his difficulties arise from differences of temperature scale, barometer scale, and wind force, rather than from differences of formula or form of publication. One rapidly becomes accustomed to any table that one uses, but if, for example, one can only obtain from one country the monthly means of temperature, from another only the five-day means, and from another only the 8 a.m. temperatures, then no matter how abundant the data, there is serious difficulty in using it.

“Some meteorologists seem to be of opinion that the form proposed by the permanent Committee should be used only for a few stations in each country, and that a different form may be adopted for the other stations. But this appears to me rather to complicate matters than to simplify them. Each central institute will naturally desire to publish all its observations uniformly, and according to the above rule it must either employ the Committee's form for all its stations, or print a number of the returns twice over—which will rarely be in accordance with the financial resources of the establishment. In a country so extensive as ours, and one in which the number of observing stations will probably never much exceed those thought

necessary for the international service, the question of dividing the stations into national and international, and publishing the latter separately, can hardly ever arise. The fact of introducing into a work a greater number of records than those usually employed for international work, can scarcely ever give rise to real inconvenience. The separation of the stations can only become important when an international publication is started, which is to contain in one volume the returns from a certain number of stations in each country. Until this is done the introduction of the proposed classification seems to me of little utility.

“In one respect I have departed from all the forms of giving monthly and annual results known to me, namely as regards the direction of the wind. As will be seen, this is given separately for each of the three observation-hours. I have done this because many of our stations are on the coast. An examination of the winds upon our coasts, to which I have devoted considerable time, enables me to state that it is possible to determine from them the daily influence of the land and sea breezes. Therefore I do not believe that it would be desirable to mingle in a single average, the result of the three observations daily; for it would render it impossible to determine from the publication, the daily variation in the wind's direction, or obtain from it the most accurate determination of the prevailing wind.”

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### OZONE.

*To the Editor of the Meteorological Magazine.*

SIR,—As you say in the last issue of the *Meteorological Magazine* that you would like a few opinions about ozone observations, I beg to say that I think the rough way of observing, by hanging an ozone paper from the roof of a thermometer stand, and using no cage or aspirator, may produce very fair results. I observed ozone in this way, in an open stand, at Forest Hill, near London, for six years, and found the papers colour more or less with winds blowing in from the open country, but never colour with N.W. to N. winds, which blew from London, or when the air was calm or foggy.

I have observed the papers in a Stevenson's screen for more than a year in this maritime locality, and have obtained much higher averages than for Forest Hill (as would be expected), though occasionally, in calm weather or with a hazy air from N.E., the papers do not colour. In sea fog, or when the clouds come down to the earth, I generally find ozone developed. At both stations the ozone was most fully developed with S.W. gales, rain, and a low barometer, and least developed with polar winds, or calm dry weather, and a high barometer. I consider that whether acted upon by ozone alone, or by other chemical constituents of the air, they are a fair test of the purity and health-giving property of the air, since the colour is always deepest in strong, pure winds from the Atlantic Ocean, and no colour is ever shown in the impure air of a London fog.

For ordinary observations on the comparative purity or ozone-pro-

ducing capacity of the air, I do not see why an aspirator, drawing a known quantity of air at a given velocity over the paper, need be used, for if more ozone is registered in a strong wind than in a light wind (supposing the amount in the air to be the same), its purifying effect would also be increased, on account of the more frequently renewed supplies.

In drizzle or fog, the papers register better in a closed Stevenson's screen than in an open thermometer stand, as the colour does not get washed out by the wet in the former as it often does in the latter.

The papers I used throughout were Schönbein's, supplied by Casella, but latterly they have been difficult to read, the colour being mottled or in patches, so that I take the greatest depth of tint as the correct account.—I am, yours sincerely,

EDWIN E. GLYDE, F.M.S.

*Kirkham, Babbacombe, Torquay, Nov. 2nd, 1877.*

GREENWICH EXTREME TEMPERATURES.

The extreme Shade Temperatures of the month of October at the Royal Observatory, Greenwich, during the past 36 years.

Year.	Maximum.		Minimum.		Year.	Maximum.		Minimum.	
	deg.	date.	deg.	date.		deg.	date.	deg.	date.
1841	64·6	1	32·2	21	1859	81·0	4	26·5	24
1842	60·9	8	29·5	25	1860	68·5	28	32·4	12
1843	70·4	1	28·5	18	1861	75·6	8	39·6	29
1844	67·4	3	30·8	22	1862	71·7	3	28·5	30
1845	67·6	3	31·4	25	1863	66·5	4	34·0	24
1846	67·7	4	35·0	28	1864	67·2	19	37·5	6
1847	74·4	12	33·0	25	1865	71·7	2	33·5	20
1848	73·6	6	33·1	31	1866	68·1	3	31·0	27
1849	69·7	19	31·5	10	1867	64·8	14	30·8	5
1850	64·5	7	31·5	27	1868	66·6	12	29·3	20
1851	70·1	10	34·7	17	1869	73·9	9	27·9	28
1852	64·0	2	31·0	17	1870	68·6	3	32·4	11
1853	67·0	26	31·7	3	1871	68·4	18	31·2	13
1854	72·8	2, 5	31·3	27	1872	66·6	2	29·1	14
1855	66·8	1	35·0	28	1873	75·1	3	26·7	29
1856	66·2	22	31·4	29	1874	69·6	1	36·0	23
1857	69·0	1	37·8	31	1875	68·8	5	33·5	13, 17
1858	69·5	3	33·0	30	1876	72·2	6	34·5	31

Extremes in 1877, Max. : 68°·8 on 14th ; Min. : 28°·2 on 18th.

	Year.	Max.	Date.	Min.	Date.	Year.
Means of 36 years	...	69·2	8	32·1	21	...
Highest .....	1859	81·0	4	39·6	29	1861
Lowest .....	1842	60·9	8	26·5	24	1859
Range .....	...	20·1	...	13·1	...	...

*Addiscombe, 9th Nov., 1877.*

EDWD. MAWLEY.

OCTOBER, 1877.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which $\frac{1}{4}$ or more fell.	Max.		Min.			
				Dpth	Date.		Deg.	Date.	Deg.	Date.		
		inches	inches.	in.								
I.	Camden Town .....	1.97	-.62	.44	27	16	67.5	14	30.9	19	3	5
II.	Maidstone (Hunton Court)...	2.13	-.86	.47	25	11	...	...	...	...	...	...
	Selborne (The Wakes).....	3.21	-1.00	.81	29	15	64.0	12	21.0	18	9	11
III.	Hitchin .....	1.38	-1.17	.35	23	16	60.0	14	27.0	17	6	...
	Banbury .....	1.64	-.79	.36	24	19	67.0	14	25.0	18	7	...
IV.	Bury St. Edmunds (Culford).	1.34	-1.37	.35	29	11	67.0	14	24.0	17	6	9
	Norwich (Sprowston).....	1.71	...	.55	29	14	...	...	...	...	...	...
V.	Bridport .....	2.19	-1.84	.34	24	15	...	...	...	...	...	...
	Barnstaple .....	3.94	-.18	.71	24	17	73.0	15	32.0	17	1	...
	Bodmin .....	3.69	-1.63	.75	23	19	66.0	1	34.0	17	0	1
VI.	Cirencester .....	2.33	-1.16	.37	29	16	...	...	...	...	...	...
	Shifnal (Haughton Hall) ...	2.30	+ .06	.30	22	20	65.0	14	28.0	18	3	10
	Tenbury (Orleton) .....	2.32	-.91	.33	23	20	63.0	14	24.3	18	5	7
VII.	Leicester (Belmont Villas) ...	1.37	...	.45	27	13	68.5	14	31.8	18	1	...
	Boston .....	2.24	+ .12	.48	29	16	68.0	14	30.0	18	1	...
	Grimsby (Killingholme) ...	1.72	...	.38	29	16	65.0	14	29.0	18	1	...
	Mansfield .....	1.84	...	.35	29	21	67.0	14	28.1	18	2	3
VIII.	Manchester .....	...	...	...	...	...	...	...	...	...	...	...
IX.	York .....	3.02	+ .50	.68	23	17	61.0	13	28.0	18	2	...
	Skipton (Arncliffe) .....	9.15	+ 2.49	1.39	12	21	62.0	2	22.0	28	...	...
X.	North Shields .....	2.61	-.67	.70	23	19	61.4	13	29.0	18	1	1
	Borrowdale (Seathwaite) ...	22.92	+ 6.60	3.58	12	23	...	...	...	...	...	...
XI.	Cardiff (Crockherbtown) ...	4.89	...	.49	29	16	64.5	15	29.0	18	2	...
	Haverfordwest .....	6.22	+ 1.03	1.45	20	15	64.0	14	27.8	17	2	6
	Aberdovey .....	4.69	...	.60	28	21	...	3	36.0	18	0	...
	Llandudno .....	3.36	-.60	.59	22	16	69.0	14	37.3	18	0	...
XII.	Dumfries (Crichton Asylum)	6.27	+ 1.10	.88	24	20	63.8	2	24.6	18	5	9
	Hawick (Silverbut Hall) ...	4.68	...	.61	24	21	...	...	...	...	...	...
XIV.	Kilmarnock (Annanhill) ...	5.04	...	.48	26	23	61.3	4	30.0	18	1	4
XV.	Castle Toward .....	...	...	...	...	...	...	...	...	...	...	...
XVI.	Mull (Quinish) .....	7.52	...	1.07	28	26	...	...	...	...	...	...
	St. Andrews (Cambo Ho.) ...	3.55	...	...	...	...	...	...	...	...	...	...
	Grandtully .....	5.38	...	.65	14	17	...	...	...	...	...	...
XVII.	Braemar .....	5.66	+ 2.91	1.95	14	18	60.0	2	25.7	26	8	18
	Aberdeen .....	2.14	...	.36	12	19	63.1	6	30.2	19	4	13
XVIII.	Gairloch (see foot note) ...	7.41	...	1.94	14	26	...	...	...	...	...	...
	Portree .....	15.37	+ 4.59	4.98	14	28	...	...	...	...	...	...
	Inverness (Culloden) .....	3.79	+ 1.13	1.39	15	13	60.5	3	30.0	25	4	10
XIX.	Helmsdale .....	4.61	...	1.26	15	20	...	...	...	...	...	...
	Sandwick .....	4.57	-.35	.60	15	22	60.0	5	31.7	19	1	9
XX.	Caherciveen Darrynane Abbey	5.86	...	1.13	23	20	...	...	...	...	...	...
	Cork .....	7.18	...	1.25	28	13	...	...	...	...	...	...
	Waterford .....	4.59	+ .19	1.34	20	19	69.0	1	28.0	18	...	...
	Killaloe .....	6.07	+ 1.05	.78	12*	19	73.0	1	29.0	17	1	...
XXI.	Portarlington .....	2.76	- 2.37	.55	29	20	63.0	1	30.0	16	1	...
	Monkstown, Dublin .....	2.11	- 1.81	.54	15	14	64.0	14	29.5	19	2	2
XXII.	Galway .....	5.68	...	.94	18	19	65.0	25	32.0	16†	2	...
	Ballyshannon .....	4.06	...	.68	14	20	...	...	...	...	...	...
XXIII.	Waringstown .....	3.00	...	.45	24	21	65.0	14	29.0	17	2	4
	Edenfel (Omagh) .....	4.07	...	.46	20	23	61.0	3	29.0	17	2	...

\* And 23. + 17.

Gairloch.—Gauge full, if not overflowing, on morning of 15th.

METEOROLOGICAL NOTES ON OCTOBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail S for Snow.

*For Notes on Oct. 14th and 15th, see pages 148 to 154.*

ENGLAND.

SELBORNE.—Remarkably variable night minima from 14th to 22nd, viz., 52°, 48°, 40°, 32°, 21°, 24°, 38°, 46°, 51°·6. Wind very variable, and at times violent.

BANBURY.—Thick fog came on suddenly at 7.30 a.m. on 18th, but soon cleared.

CULFORD.—Variable weather, with prevalent westerly wind.

SPROWSTON.—A fine dry month, sharp frost on 18th, gale on night of 30th.

BODMIN.—Mean temp. 54°·8.

SHIFNAL.—The month opened fine and dry, with thick fog the first five mornings. No R (except a little on 7th) until 10th, afterwards it continued daily (with four exceptions) till 31st. High winds on 27th and 30th from S. Swedes and other roots greatly dwindled by the R and cold nights. Figs, all but three or four, dropped off unripe. Dahlias, &c., cut down by frost on night of 17th. Vast quantities of hips and holly-berries, few haws and acorns.

ORLETON.—Fine bright weather with morning fogs till 10th, afterwards R almost every day. Mean temp. about 2° below the average. Lunar halo 9·30 p.m. on 26th; great wind on 30th.

LEICESTER.—First three weeks very fine and dry; only 0·03 in. of R fell between Sept. 18th and Oct. 11th. Heavy R on 27th, and continuous R on 29th. Mean temp. 48°·5 Wind generally S.W., except for a few days at the beginning of the month.

BOSTON.—Until the R fell towards the end of the month, complaints were general that the land was too dry for working and for sowing the wheat.

KILLINGHOLME.—Very variable month; at first some very pleasant days, but after the 15th it was very unsettled; it has, however, been a good seed time for wheat; brilliant lunar halo on 23rd; R and high wind till 4 p.m. on 29th; high wind all night on 30th.

MANSFIELD.—Mean temp. 47°·0, which is slightly below the average; from 1st to 10th very beautiful autumnal weather, with occasionally foggy nights, afterwards variable.

NORTH SHIELDS.—Fog on several days, chiefly early in the month; L on 11th.

SEATHWAITE.—S on the hill-tops on the 12th, 15th, and 17th; rain every day (except the 15th) from the 9th to the 31st; T on 27th.

WALES.

HAVERFORDWEST.—The magnificent weather of September was prolonged until October 6th, after which an exceedingly wet and stormy period set in.

ABERDOVEY.—Mean temp., 49°·8; stormy and wet towards close of the month; T and L at 6 p.m. on 27th; on 14th and 28th weather quite like May.

LLANDUDNO.—Very fine until 10th, afterwards unsettled, with several heavy gales. On the whole the weather was warm, and the R less than usual. Several showers of H on 16th; H also on 27th.

SCOTLAND.

DUMFRIES.—Dry, with frosty mornings until the 9th, afterwards R almost daily; mean temp. (46°·1) below the average; heavy S.W. gales on 11th and 26th.

HAWICK.—Very fine till 10th, when frost set in, afterwards very wet. Some corn still unripe, and potatoes much diseased.

KILMARNOCK.—Boisterous month, winds chiefly W. and S.W.; T and L on 11th, 12th, and 28th; H on 11th, 12th, 15th, 17th, 27th, and 28th; S on 16th; dense fog on 19th.

QUINISH.—Very wet and stormy; T and H on 22nd.

GRANDTULLY.—S on 10th, 11th, 12th, 15th, and 16th.

BRAEMAR.—Dull and wet; the crops for a few days covered with S, grain consequently of little value; harvest exceptionally late.

ABERDEEN.—Bar. and mean temp. just the average, rainfall below it; S.W. winds more prevalent than usual; L on 11th and 15th.

PORTREE.—Cold, wet, and stormy; only three fair days; S on 16th and 17th;

harvest still out, and in bad condition.

CULLODEN.—Fog on 2nd, 3rd, 20th, 24th, and 25th; L on 11th; S on 12th, 16th, and 17th.

## IRELAND.

DARRYNANE.—Very mild month; T and L on 27th; sea very rough the last three weeks.

WATERFORD.—Prevailing wind, southerly; fog on 25th.

KILLALOE.—The first nine days fine, and very favourable for all out-door work. Month closed with frequent and heavy E.

MONKSTOWN.—Unusually fine October, dry, and mild.

BALLYSHANNON.—First part very mild, remainder of month quite the reverse; 10th and 11th heavy gales from N.W.; 15th and 16th, heavy hailstorm, leaving the mountains quite white; 26th and 27th, heavy gales from N.W., with T & L.

WARINGSTOWN.—First ten days fine and dry, latter part very broken; oats still out in many places.

EDENFEL, OMAGH.—The fine weather which commenced on September 18th unfortunately terminated on October 9th, a fortnight too soon for the in-gathering of the crops, already late, and immature from the cold wet summer, so that now (Nov. 1st) nearly a fourth of the grain in this county remains in the fields, and what is in is threshing out so badly, that with potatoes, turnips, and flax equally unproductive, a winter of much distress is inevitable, especially among the small farmers and dealers.

## SUPPLEMENTARY TABLE OF RAINFALL IN OCT., 1877.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see Met. Mag., Vol. XI., p. 28., but the list is under revision.]

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol .....	1·70	XI.	Llanfrechfa .....	5·76
„	Hailsham .....	4·77	„	Solva .....	3·13
„	St. Lawrence, I. of W. ...	2·78	„	Castle Malgwyn .....	5·42
„	Andover .....	2·03	„	Carno .....	5·26
„	Strathfield Turgiss .....	1·67	„	Rhug, Corwen .....	4·94
III.	Addington Manor .....	1·55	„	Port Madoc .....	6·68
„	Oxford .....	1·68	XII.	Melrose .....	3·70
„	Northampton .....	1·04	XIV.	Cessnock, Glasgow .....	5·90
„	Cambridge .....	1·25	XV.	Gruinart .....	6·24
IV.	Sheering .....	1·48	XVII.	Keith .....	2·32
„	Ipswich .....	1·43	XVIII.	Dalwhinnie .....	12·43
„	Diss .....	1·23	„	Auchnasheen .....	11·96
„	Swaffham .....	1·85	„	Springfield, Tain .....	3·96
V.	Compton Bassett .....	2·03	XX.	Skibbereen .....	...
„	Dartmoor .....	8·58	„	Glenville, Fermoy .....	5·94
„	Teignmouth .....	2·15	„	Tralee .....	7·48
„	Langtree, Torrington .....	3·46	„	Newcastle W., Limerick .....	5·10
„	Cosgarne, St. Austell .....	3·15	„	Kilrush .....	5·97
„	Taunton .....	1·95	XXI.	Kilkenny .....	3·70
VI.	Bristol .....	3·13	„	Kilsallaghan .....	3·07
„	Sansaw .....	2·70	„	Twyford, Athlone .....	5·71
„	Cheadle .....	3·06	XXII.	Ballinasloe .....	4·08
VII.	Coston, Melton Mowbray .....	2·06	„	Kylemore .....	11·68
„	Bucknall .....	1·66	„	Carrick on Shannon .....	4·56
VIII.	Walton, Liverpool .....	3·67	XXIII.	Rockcorry .....	4·34
„	Broughton-in-Furness .....	12·39	„	Warepoint .....	4·13
IX.	Stanley, Wakefield .....	2·98	„	Carnlough, Larne .....	...
X.	Gainford .....	2·78	„	Bushmills .....	4·42
„	Shap .....	8·77	„	Buncrana .....	6·76