High winds are also frequent along the dry prairie region bordering on the Rocky Mountains. An interesting table is given, showing the relation between the wind's velocity and the barometric gradients, which may be accepted as rough approximations, but the stations in the United States and in Canada from which the isobaric lines have been drawn, are by far too wide apart from each other to supply the data required in dealing with this important phase of weather.

UNDER the heading of a "Brief Sketch of the Meteorology of the Bombay Presidency in 1876," Mr. Fred. Chambers introduces some original suggestions regarding the Indian drought of that year. His method of examination proceeds on the supposition that the droughts of India may be connected with the varying states of the sun's surface as regards temperature, and in the light of the consequences which result from this supposition the observations made in the presidency, from Kurrachee, in the north, to Belgaum in the south, are discussed from which it is shown that the abnormal barometric movements of 1876 were mainly variations in the intensity of the usual seasonal movements; and that, as regards the rainfall, among the causes which produced the drought in 1876, were those very causes which in ordinary years produce a less average rainfall in the eastern than in the western districts of the Presidency. The general conclusion which is drawn, explicitly for the guidance of further inquiry, is that the same principles which explain the usual alternation of the seasons, also explain in a great measure the varying rainfalls of different years. This mode of discussion deserves to be widely adopted in dealing with secular variations in meteorological phenomena, particularly in view of the large scientific issues involved in the relations between the solar and terrestrial atmospheres.

PROF. MOHN publishes a brief account of the fall of the volcanic ash which was shot up into the air during the eruption in Iceland on March 29, 1875 (NATURE, vol. xi. p. 514), and thence carried eastward by the strong westerly winds which then prevailed; and a map is given showing by curved lines the hours at which the ash began to fall along the extensive track stretching 980 miles from Iceland to Stockholm. The most interesting point in the inquiry is the manner in which the lofty mountain range of Scandinavia appears to have influenced the hour of the fall of the ash. Since the time between the ash leaving Iceland and falling on the coast to the east of Stockholm was twenty-seven hours, the mean rate at which it was borne onward was thirty-six miles per hour. During the first twelve hours of its course it drifted eastwards at a uniform rate of fifty miles an hour. It had then approached to from sixty to eighty miles of the mountains of Norway, but thereafter its speed suddenly fell from fifty to twenty-seven miles an hour. The interesting point is that a mountain system such as that of Norway, lying across the wind's path, would appear to exercise a decided influence in reducing the velocity of the aerial current under its level to the extent of nearly one-half, at a distance of sixty to eighty miles to windward.

OUR ASTRONOMICAL COLUMN

THE TOTAL SOLAR ECLIPSES OF MAY 16, 1882, AND AUGUST 18, 1887.—There will be two total eclipses of the sun within the next ten years, which may be observed without entailing a long sea-voyage from this country. The first will take place on May 16 (or May 17, civil reckoning), 1882. In this eclipse the central line commences in long. 3° 11′ W., lat. 10° 40′ N.; totality will occur with the sun on the meridian in 63° 44′ E. and 38° 35′ N., and at sunset in 138° 51′ E. and 25° 25′ N. The duration of total eclipse on this occasion is comparatively short. Probably if observers proceed from England to the central line, they would station themselves in Upper

Egypt, not far from one of the points whence the late transit of Venus was successfully observed. In 32° E. and 26° 44′ N. close to this line, totality commences at 20h. 32m. 45s. and continues 1m. 10s. At a point upon the same, not far from Sherm, at the extremity of the peninsula of Sinai, on the Gulf of Akaba, in 34° 28′ E., and 28° 2′ N., the duration of totality is 1m. 17s. The eclipse will be total at Teheran for 1m. 4s. with the sun at an altitude of 67°, commencing May 16, at 22h. 36m. 10s. local mean time; the central line passes about fifteen miles south of this place. A total eclipse may also be witnessed, though for a few seconds only, near Shanghai.

The second of the eclipses to which reference has been made is the one long mentioned in our popular treatises as the next eclipse that will be total in England, but the central line commences in Germany. The following are the elements—

G.M.T. of conjunction in R.A., 1887, August 18, at 17h. 14m. 33s.

R.A.	148 7	45·2
Moon's hourly motion in R.A.	36	38·2
Sun's ,, ,, ...	2	19·5
Moon's declination	13 33	10·1 N
Sun's ,, ...	12 54	5·2 N
Moon's hourly motion in declination	9	13·0 S
Sun's ,, ,, ...		48·8 S.
Moon's horizontal parallax	60	12·4
Sun's ,, ,, ...		8·75
Moon's true semi-diameter	16	24·4
Sun's ,, ,, ...		15.48·9

The central eclipse begins at 16h. 10·2m. in 11° 39′ E. and 51° 38′ N., and ends in 173° 47′ E. and 24° 32′ N.; and the eclipse is central with the sun on the meridian in 102° 15′ E. and 53° 46′ N.

The following are also points upon the central line:—

° ′	° ′	° ′	° ′
21 36 E.	53 50 N.	34 15 E.	56 5 N.
24 9	54 21	38 23	56 40
29 19	55 17	42 1	57 7

It will be seen that the track of the eclipse is chiefly over Russian territory. In the longitude of Moscow and in latitude 56° 33′, totality will continue 2m. 30s.; in Moscow itself the eclipse will also be total, though for about fifty seconds only, commencing at 18h. 44m. 40s. mean time, with the sun at an altitude of 17°. By a direct calculation for Berlin a total eclipse for 1m. 40s. results, but the sun is barely at an altitude of 3° when it ends. It is likely that a person wishing to view the phenomena of a total eclipse with the sun at fair elevation, will find Moscow, or its vicinity, the most accessible position; we will therefore append formulæ by which the times of beginning and ending of totality in this neighbourhood, as also the track of the central eclipse, and the north and south limits of totality may be determined, and will also take the opportunity of illustrating the process by a further example, seeing that many experience difficulty in the application of such formulæ. Following the methods described by Mr. W. S. B. Woolhouse in his excellent paper on the calculation of eclipses, transits, and occultations, in the Appendix to the *Nautical Almanac* for 1836, with slight change of notation, we have from the above elements for computation of beginning and ending of total phase at any place not far from Moscow:—

Cos. w = + 58·7257 − [1·92757] sin. l + [1·43336] cos. l. cos. (L − 75° 51′·8).
t = 17h. 32m. 29·6s. ∓ [1·87565] sin. w − [3·11123] sin. l.
　　　　− [3 81636] cos. l. cos. (L − 23° 34′·5).

And for determination of latitude of central line, and of north and south limits of totality in any assumed longitude not far from that of Moscow, putting

n . sin. N = + [1·92757]
n . cos. N = + [1·43336] ccs. (L − 75° 51′·8).

We have

$$n \cdot \cos (N + l) = \begin{cases} - [1\cdot77616] & \text{for N. limit.} \\ - [1\cdot76883] & \text{for central eclipse.} \\ - [1\cdot76137] & \text{for S. limit.} \end{cases}$$

In these formulæ, as has been previously explained when presenting similar ones, all quantities within square brackets are logarithms; l is the *geocentric* latitude, or the geographical latitude diminished by the angle of the vertical; L the longitude from Greenwich, counted positive towards the east; and t results in mean time at Greenwich.

First, let it be required to find the latitude of the central line and the north and south limits in the longitude of the Observatory at Moscow, 2h. 30m. 17s., or 37° 34'·3 east of Greenwich.

Longitude	+37 34·3
Constant	-75 51·8
A	-38 17·5
n. sin. N	+1·92757
Constant	+1·43336
Cos. A	+9·89480
n. cos. N	+1·32816
Tan. N	+0·59941
N	75 52·9
Sin. N	+9·98668
n	+1·94089

For. Central Line.

Constant	-1·76883
n	+1·94089
Cos. (N + l) ...	-9·82794
N + l	132 17·4
N	75 52·9
... ...	56 24·5
Add angle of vert...	10·6
Lat. of central line.	56 35·1

For North Limit.

Constant	-1·77616
n	+1·94089
Cos. (N + l) ...	-9·83527
N + l	133 11·0
N	75 52·9
l	57 18·1
Angle of vert. ...	10·5
Lat. of N. limit ...	57 28·6

For South Limit.

Constant	-1·76137
n	+1·94089
Cos. (N + l) ...	-9·82048
N + l	131 24·5
N	75 52·9
l	55 31·6
Angle of vert. ...	10·8
Lat. of S. limit ...	55 42·4

In this manner by assuming other longitudes near that of Moscow we trace out the belt of totality.

Next, to find the times of beginning and ending of the total phase at any point in the vicinity. Calculating for the observatory of Moscow, the geographical latitude of which is + 55° 45'·3, we proceed thus :—

Geographical latitude...	+55 45·3	Constant ...	-23 34·5
Angle of the vertical ...	10·7	L	+37 34·3
Geocentric latitude (l)..	+55 34·6	B	+13 59·8

Constant	-1·92757	Constant	+1·43336
Sin. l	+9·91639	Cos. l	+9·75228
		Cos. A	+9·89480
	-1·84396		
			+1·08044
No.	-69·8167		
	+70·7604	No.	+12·0347
Nat. cos. w	+ 0·9437	Constant	+58·7257
			+70·7604
Log. cos. w	+9·9748·3		

Constant 1·87565		Constant -3·11123		Constant -3·81636	
Sin. w... 9·51962		Sin. l ... +9·91639		Cos. l ... +9·75228	
				Cos. B... +9·98691	
1·39527		-3·02762			
				-3·55555	
No. ... 24s·8		No. ... -1065s·6			
		-3593s·8		No. ... -3593s·8	
		-4659s·4			

	h. m. s.	
	- 1 17 39·4	
Constant	17 32 29·6	
	16 14 50·2	
Long. E.	2 30 17·0	
Middle..	18 45 7·2	Moscow M.T.
	∓24·8	
Totality } begins	18 44 42·4	,, ,,
Totality } ends.	18 45 32·0	,, ,,

GEOGRAPHICAL NOTES

THE *Japan Gazette* publishes an account of a visit recently paid by a Japanese steamer to the Bonin Islands, about which but little is known. Some eighteen months ago the Japanese took possession of the islands (which are in N. lat. 27°, about 520 miles from Yokohama), and established their head-quarters at Port Lloyd, Peel Island, which is the only harbour in the Bonins. The islands are described as high, rocky, and even mountainous; and the shores are, for the most part, precipitous, and lined with coral reefs. The vegetation is chiefly tropical, palms of various kinds being abundant. Wild goats and pigs abound on all the islands, and deer on one of them. Lemons, sweet potatoes, bananas, Indian corn, &c., thrive there; but the attempt to introduce cocoa-nut trees has not yet proved successful. On the return voyage the steamer visited the outlying Japanese island of Hachijo, which has an area of forty miles, and is said to contain 10,000 inhabitants. It is mountainous, and its sides to a great extent precipitous. At the northern end of the island there is a volcanic peak, rising to a height of 2,800 feet above the sea. The roads on the island are mere narrow and stony paths, and the people are poor. Three-fifths of the population are said to be women. Almost every available spot on the hill-sides in Hachijo is terraced and cultivated, but sufficient rice cannot be grown, so that sweet potatoes form one of the principal articles of food.

AT the meeting of the subscribers to the African Exploration Fund held the other day, a resolution was passed to adopt the route recommended by the Committee, from Dar-es-Salaam, towards the northern end of Lake Nyassa, and thence, if possible, to the south end of Lake Tanganyika. The return journey might be made as far as possible along the valley of Lufigi. As we have already intimated, Mr. Keith Johnston, with whom will be associated another European, will lead the expedition, which will probably leave England in October next.

THE distribution of prizes of the Geographical Society of Paris, which had been postponed owing to the forthcoming exhibition, will take place at the Sorbonne on the 27th inst. Mr. Stanley, it is understood, will be present to receive the gold medal awarded him. The National Geographical Congress will take place in the beginning of September in the hotel built by the Paris Geographical Society, and which will be inaugurated on this occasion. It is said on good authority that the presidency of that Congress will be given to M. de Lesseps.