

stronger. Thus, excluding insignificant decimals from the sunspot figures, and taking the mean of three and a half cycles for the Ceylon dates from 1854 to 1891, and from 1864 to 1885 for the sunspots in pairs of years from Wolf's tables (the only sunspot data I have available) we get the following comparison:—

		Ceylon <sup>1</sup> monsoon dates.	Sunspots.
		Mean abnormal.	Mean abnormal.
1856	... 1867-'78	... - 7'5 min.	... - 38 min.
1857	... ..	... - 3'2 "	... - 34 "
1858	... ..	... - 1'0 "	... - 15 "
1859	... ..	... - 4'0 "	... + 27 "
1860	... ..	... + 2'0 "	... + 44 max.
1861	... ..	... + 10'0 max.	... + 37 "
1862	... ..	... + 4'0 "	... + 26 "
1863	... ..	... + 3'0 "	... + 9 "
1864	... ..	... + 1'0 "	... - 9 "
1865	... ..	... - 4'0 "	... - 21 "
1866	... ..	... ± 0'0 "	... - 30 "

Better sunspot data would certainly not invalidate the connection. The lag behind the maximum sunspot data and the apparent tendency to precede the minimum has always been noticed in other phenomena. Moreover, from the analogy between the abnormal of the two elements compared both in quantity as well as sign the same remarks as to the reality of the cycle made by Mr. Blanford in his work (cited ante) p. 254 apply *pari passu* to that in the Ceylon dates.

A similar relation holds good for the little monsoon which may be put into words as early dates in years with increasing sunspot numbers and late dates in years with diminishing sunspot numbers, with a decided maximum of twelve days early in the year immediately succeeding that of maximum sunspots. Even the period between the two bursts shows symptoms of a similar relation to the sun's condition, the mean maximum interval, forty-three days, corresponding to the year of minimum sunspots, and the minimum twenty days occurring two years after that of maximum sunspots. The relation, however, is clearest in the figures for the burst of the big monsoon and seems to show that apart from all indirect influences such as accumulation of snows on the Himalayan outer ranges, and unusual winter rainfall on the plains or the reverse, there is a real fluctuation in the dates of the burst of the big monsoon or burra barsât connected with the sun's condition which appears to be more direct than that exhibited by the amount of rain which falls during its continuance and appears to indicate, as indeed is borne out by what we know from other sources, that in years of many spots the conditions which usher in the summer monsoon rains are earlier developed, and, as the amounts show, probably continue more regularly than in years of few spots.

Granting this as a working hypothesis two important results follow.

(1) The parallel march of the Ceylon dates and the rainfall of the Carnatic shows that the former could be employed to forecast the probable amount of monsoon rainfall about to be enjoyed in the latter district.

(2) That by using the mean abnormal of the year in its position in the sunspot cycle as the true mean instead of the mean of the whole period, the true abnormal for the year can be better estimated and the probable general character of the weather foretold.

As an example let us take the well-known diurnal variation of barometric pressure, whose amplitude in the tropics is so large that it bears a sensible ratio to the abnormal fluctuation produced by a passing disturbance.

In estimating the true abnormal at some particular hour of the day we must evidently compare the value with reference to the normal at that hour.

Similarly for the sunspot period in the case under consideration. If there is reason to believe that the period exists we ought to treat it as a reality, and in constructing graphic abnormal take the curve of the progressive cyclic normal as our abscissa axis instead of a straight line representing an endless repetition of the mean of the whole period. The principle is adopted as regards varying locality in drawing synoptic abnormal charts. It should be equally imperative in cases where the element of time is considered.

Thus in 1894, if the monsoon burst in Colombo twelve days before its time it would be abnormal to the extent of +2. On the other hand, if it were twelve days late, it would be abnormal

<sup>1</sup> These figures are simple means *unsmoothed*.

to the existing mean to the extent of -22, and even to the new mean formed by incorporating this fresh value, to the extent of -16, and we might in such a case infer that some unusual cause was in operation which would certainly bode ill for the Madras agriculturists.

I have put these facts and considerations forward simply as a preliminary inspection of two phenomena which not only occur in Ceylon, but are more or less common to the Indian peninsula, and to show how conditions, the relations between which can at present only be exhibited in an empirical form, may yet be employed as a means of forecasting the character of a season, and also ultimately by further investigation help to elucidate the whole machinery by which the grand weather changes are produced by terrestrial physical conditions in conjunction with alterations in the state of the sun's surface as well as its varying declination. A large field on either side of the equator, embracing one-fourth of the entire area of the world, exists, from which observations are very much wanted to complete our knowledge of the causes of phenomena which, while they are evidently closely related to action-centres (using Teisserenc de Bort's significant expression) at some distance from the equator, are yet, probably to some considerable extent, dependent upon conditions prevailing over the entire equatorial belt, which may, for all we know, fluctuate in stricter unison with solar changes than those which occur in higher latitudes.

E. DOUGLAS ARCHIBALD.

#### Singular Swarms of Flies.

WITH the writer's permission I send you herewith a letter which I have received concerning the subject of my letter which appeared in your issue of June 1.

During the week following the date of my letter I repeatedly saw swarms of similar kind; but smaller and less marked, seldom visible much more than fifty yards away; always under similar atmospheric conditions, which were chronic during the period in question. The swarms always showed much the same slant from vertical (some 30° or so), the direction of the slope in plan being towards such slight draft of air as was perceptible.

R. E. FROUDE.

Gosport, June 12.

I FIND in NATURE, June 1, an inquiry you make about flies forming clouds, resembling smoke.

They are usually produced by the gnats called scientifically *Chironomus*, and have been often mentioned in entomological literature.

I give below several references I can lay my hand on, but there are probably many more recent ones, which I have not noticed—

German, *Magazin für Entomologie* (in German), vol. i. p. 134-140, 1813.

Clapton, J. C. Dale, in *Magaz. Nat. Hist.*, 1833, p. 544. (In Ireland and England.)

Patterson, *Ann. and Mag. of Nat. Hist.*, vol. x. 1842, p. 6-9.

I have seen such clouds myself more than once. Cases have occurred when the smoke-like appearance has caused a fire alarm to be sounded.

C. R. OSTEN SACKEN.

Heidelberg, Germany, June 4.

#### OFFICIAL CATALOGUE OF THE EXHIBITION OF THE GERMAN EMPIRE AT THE COLUMBIAN UNIVERSAL EXHIBITION IN CHICAGO.

GERMANY, not unmindful that America is her best customer, will be worthily represented at Chicago. An elaborate catalogue, in the German language, has already appeared, and an English translation will shortly be published. We have been favoured with an advance copy of the latter, which is by no means a mere enumeration of exhibits. It contains a general introduction, and a number of original articles by leading experts, "intended to supply for each department a concisely descriptive survey of its development and present condition." There is also, in German and English, a special Guide to the collective exhibition of the German chemical