TWENTY-SEVEN DAY RECURRENCES IN TERRESTRIAL-MAGNETIC AND SOLAR ACTIVITY, 1923–1933

By J. Bartels

The well-known effect of the Sun's rotation on terrestrial-magnetic activity has been demonstrated in a diagram showing the 27-day recurrence phenomenon in the international magnetic character-figures *C* for the years 1906–1931.[1] Another diagram is given here, showing side by side, in a somewhat improved and simplified manner, the recurrence phenomenon for the last sunspot-cycle 1923 to 1933 in terrestrial-magnetic activity (*C*) and solar activity (relative sunspot-numbers *R* for the central zone).[2] As before, each day is represented by a square containing one of seven symbols indicating various degrees of activity; the days are arranged in horizontal rows of 27, but, for continuity, the six first days of the next row are added at the right. The date of the first day in each row is indicated on the left. For future reference, the horizontal rows—or rotations—have been numbered beginning with the first row (first day, January 11, 1906) of the former diagram; these numbers for Figure 1 are 231 to 378 and are indicated in the space between the magnetic and solar diagrams. In order to obtain a clear diagram, the symbols are assigned as follows:

Group	0	1	2	3	4	5	6
Symbol	White square	Small dot	Small ring	Larger ring	Black circle	Black octagon	Black square
C	0.0 to 0.1	0.2 to 0.3	0.4 to 0.7	0.8 to 1.0	1.1 to 1.3	1.4 to 1.6	1.7 to 2.0
R	0	1 to 8	9 to 18	19 to 29	30 to 46	47 to 61	over 62

A total of 3996 days has been plotted; the number of days in each group, calculated on the average per 1000 days, is:

Group	0	1	2	3	4	5	6
Frequency of *C*.......	196	165	244	188	113	58	36
Frequency of *R*.......	389	105	174	139	109	49	35

The high frequency of days with $R = 0$ prohibits a better choice of the lower groups, aiming at higher resemblance of the two frequency-distributions; however, in the higher groups of activity 4 to 6, which form, so to speak, the backbone of the [vertical] sequences of disturbed days, the frequencies of *C* and *R* agree satisfactorily.

The magnetic diagram will be found convenient in determining the sequences to which a magnetically disturbed or magnetically quiet day belongs, especially since it includes the period of the Second International Polar Year beginning August 1, 1932. Beyond this practical side, it illustrates, in new observational material, the general results of the former paper. The exceptional length of the sequences at the end of the eleven-year cycle (from about 1929) is striking, as compared with the rather

[1]J. Bartels, Terr. Mag., 37, 1-52 (1932); see also H. W. Newton, Observatory, 55, 256-261 (1932).

[2]*C* has been taken from the annual tables published in this Journal, *R* from the "Bulletin for character-figures of solar phenomena," published quarterly, for the International Astronomical Union, by the Eidgenössische Sternwarte, Zürich.

spotty appearance at the beginning (the fine sequence in 1923 belongs to the preceding cycle).

As to the solar diagram, its main purpose is to invite comparison with the magnetic diagram and reexamination of the results obtained formerly.[3] The last years 1930 to 1933 illustrate again the fact that strong and long-lived magnetically active regions on the Sun persist through long times in which the Sun appears practically spotless, or, in other words, that small or zero sunspot-numbers comprise many different degrees of solar activity with respect to its geophysical influences. The relative sunspot-numbers for the central zone [with a diameter half that of the Sun's disc] have been chosen instead of those for the whole disc because a group of sunspots takes more than 13 days to cross the disc, all the time adding to the relative sunspot-number. Even so, an equatorial point of the Sun needs four or five days to cross the central zone, which accounts for the fact that the diagram for solar activity still shows more series of consecutive days with similar activity, that is, longer horizontal stripes of equal symbols, than the magnetic diagram. This "blurring" of the solar diagram could be avoided by deriving relative sunspot-numbers for still narrower meridional sectors, but this could only be done at an astrophysical observatory and, in fact, seems hardly worth while, because it will in no way help to detect, by direct astrophysical observations, the active *M*-regions on the Sun indicated in the magnetic diagram.

I am obliged to Messrs. W. Zick and C. C. Ennis for work on the diagram.

[3]For more detailed charts of solar activity, see the annual publications of A. Wolfer and W. Brunner in Astronomische Mitteilungen, Zürich. For the first accounts of sunspots in high solar latitudes, appearing October 10 and 28, 1933, and belonging to the next sunspot-cycle, see the provisional publications of Mount Wilson Observatory in Terr. Mag., 39, 77 and 163 (1934).

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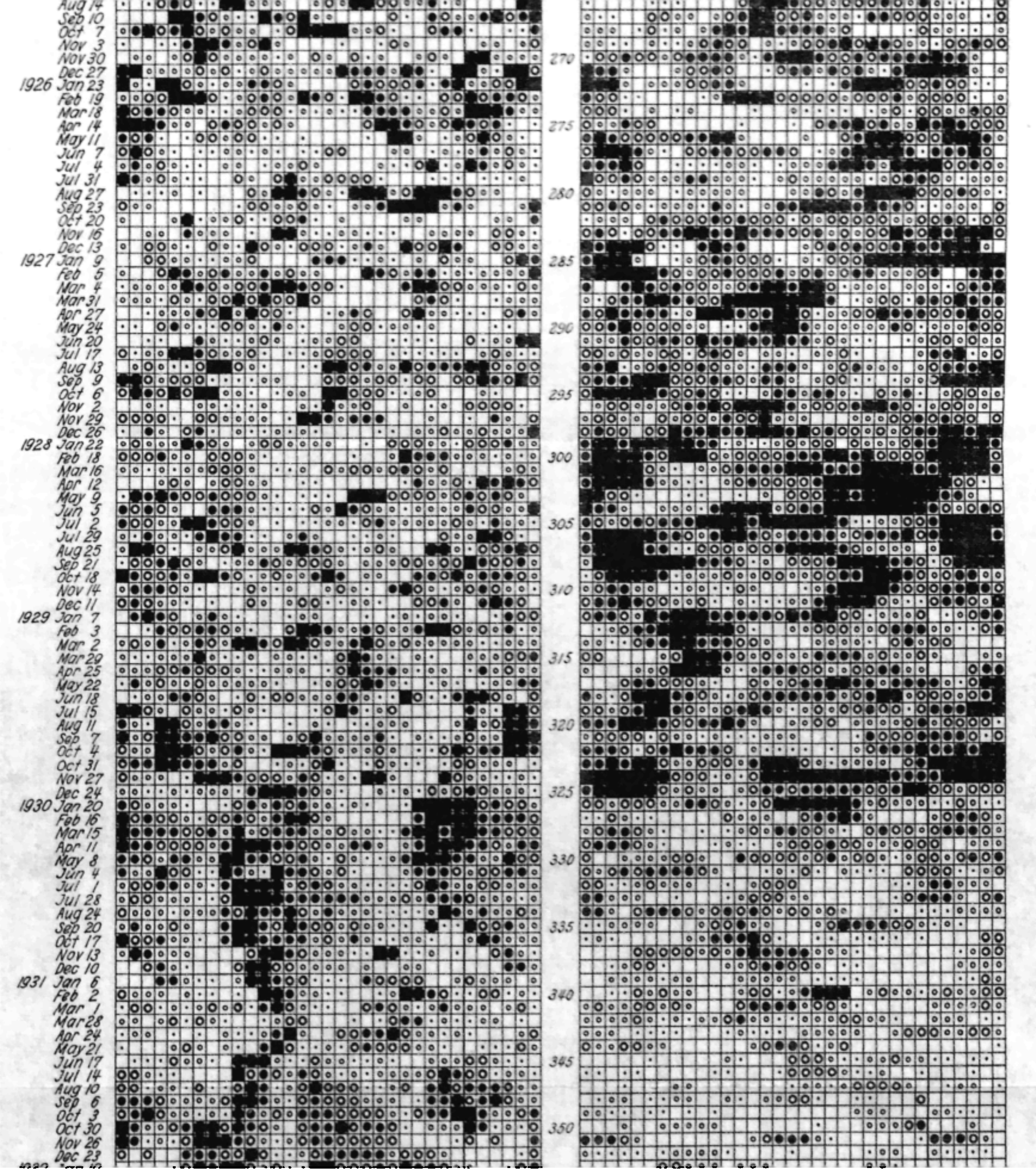

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Sep 23
Oct 20
Nov 16
Dec 13
1927 Jan 9
Feb 5
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1928 Jan 22
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Nov 27
Dec 24
1930 Jan 20
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Mar 15
Apr 11
May 8
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Jul 28
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Nov 13
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1931 Jan 6
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