EVIDENCE FOR THE 22-YEAR-CYCLE IN THE LONGITUDINAL DISTRIBUTION OF SUNSPOTS

(Research Note)

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Abstract. It was shown in an earlier paper that preferred hemispheres of solar activity alternate with the 22-year magnetic cycle, when analyzed in the 27.0 day Bartels rotation. Using data which cover the time between 1818 and 1983 we trace back this result to 1880 (cycle 12). Before 1880 no significant correlations are found.

Investigating the distribution of the daily sunspot relative numbers from 1932 to 1980 in the Bartels rotation of 27.0 days which seems to be relevant for the large-scale solar magnetic fields, we found a strong correlation between the maximum periods of cycle 18 and 19 and cycle 20 and 21, while cycles 17 and 18 were strongly and cycles 19 and 20 weakly anticorrelated (Balthasar and Schüssler, 1983, Paper I).

We tentatively interpreted this result in terms of preferred hemispheres of activity which alternate with the 22-year magnetic cycle.

In this note we use data between 1818 and 1983 covering now 15 cycles. The correlation coefficients between following maximum periods are given in Table I. Beginning with cycle 12 (maximum period 1882–1884) the sign of the correlation coefficients of following cycles is always alternating. From 1900 on only one absolute value is less than 0.7 (see Paper I for a discussion of the significance of correlations of that kind). Before cycle 12 the correlation coefficients are small and their sign is not alternating. However, one should keep in mind that the data before 1860 are incomplete and that the sunspot relative numbers have been reconstructed from drawings for the time before the introduction of this numbers by Wolf in 1849. Thus data before 1880 are less reliable.

Figure 1 shows the longitude distribution of sunspot activity in yearly superimposed epochs. To make the variation more easily visible we transformed the values in the same way as done in Paper I (see formula on p. 29 and Figure 3).

We conclude that from 1880 on always two 11-year cycles beginning with an even cycle in the Zürich counting show one preferred hemisphere of sunspot activity when
analyzed in the 27.0 day Bartels rotation. For the following two cycles the opposite hemisphere is preferred. Thus the result of paper I can be traced back to 1880. For the time before 1880 no significant correlation was found and no definite statement is possible.

Fig. 1. Distribution of the daily sunspot relative number among the Bartels days for individual years between 1818 and 1983 ($P = 27.0$ days). The diameter of the symbols is proportional to the yearly mean value at that Bartels day.