

A CAUSE OF A VERY HIGH MAXIMUM OF SOLAR ACTIVITY IN CYCLE No. 19

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The 11-year cycle of solar activity No. 19 reached an abnormally high maximum in the Wolf relative number. It is, therefore, very interesting to look at the cause of this abnormal height of the cycle, especially from the point of view of the fact that the Wolf relative number depends on the number of originated spot groups f_0 per time unit and on their average life time T_0 . These two sunspot parameters have different laws of periodicity of their time changes (Kopecký, 1967).

The importance of individual 11-year cycles shows a long-term variation during the so-called 80-year period and this change is caused predominantly by the 80-year period of the average importance of sunspot groups, which means, primarily, by the average life-time of the groups T_0 . Cycle No. 19, as concern the Wolf numbers, is the highest cycle in the whole history of sunspot observations and in the same time it also represents the maximum of the present 80-year period of solar activity. In this case, the mean life-time T_0 should be the highest in cycle No. 19. But this is not true. In cycle No. 19 the value of T_0 is lower than in cycle No. 18, although it is still considerably high. This can be seen in Figure 1, where the lower curve gives the change of T_0 , where T_0 is the average life-time of the spot groups for the whole 11-year cycle, and was determined in the previous papers by Kopecký (1967) and Kopecký and Kopecká (1974) from the Greenwich observational material.

The value of f_{0M} , which in Figure 1 is indicated by full circles, represents the maximum value of f_{0M} in the given 11-year cycle, Σf_0 is the number of spot groups formed throughout the whole 11-year cycle, and in Figure 1 it is represented by empty circles. The values of f_{0M} and f_0 were also determined in previous papers (Kopecký, 1967, 1972; Kopecký and Kopecká, 1974) from the Greenwich observational material.

From Figure 1 one can see that the reason for the high value of the Wolf number in cycle No. 19 may be found in the very high number of originated spot groups f_0 , the highest in cycle No. 19 of all the eight studied 11-year cycles. In the same time the high value of f_0 in cycle No. 19 is a consequence of the systematic increase of f_0 during the last eight cycles of solar activity, as one can also clearly see from Figure 1.

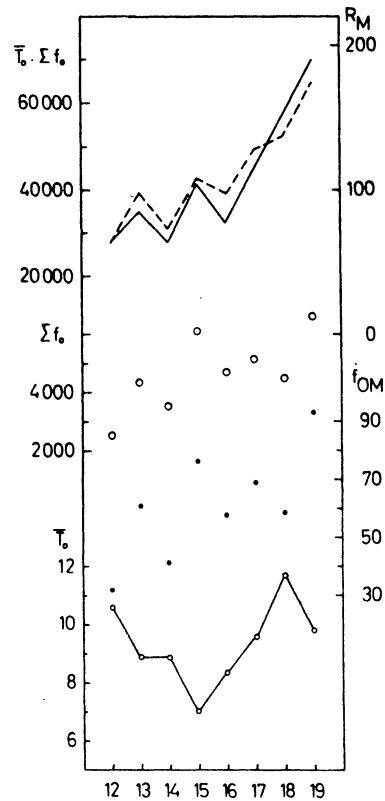


Fig. 1.

The abnormal height of the 11-year cycle No. 19 is then associated both with the relatively high average life-time of spot groups T_0 and with the

high number of originated spot groups f_0 . In the upper part of Figure 1 it can be seen clearly that the value of the maximum Wolf number R_M is above all determined by two parameters, i.e. by T_0 and f_0 . Here the course of R_M is compared with the course of the product of $\bar{T}_0 \cdot \Sigma f_0$ in the individual 11-year cycles.

Conclusion

To conclude we should like to stress the following two main results:

1. Besides a striking 11-year periodicity, the number of newly formed spot groups also show a systematic increase within the investigated interval. This systematic increase may be explained by a very long secular variation of the number of newly formed spot groups. The period of this secular variation is longer than 100 years and may be as long as several hundred years.

2. The very high value of the Wolf number in cycle No. 19 is then the result of superimposing the 80-year period of the mean spot group life-time on the very long secular variation of the number of newly formed spot groups.

References

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