EVOLUTION OF ACTIVE REGIONS ON 21 AND 9 CM

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Abstract: We have studied the evolution of large active regions in radio fluxes. The resulting mean curve of evolution is compared with the spot area and relative number of active regions. The correlation of the fluxes of an active region with its spot area and mean relative number is good.

Introduction

We studied the evolution of a large active region in radio fluxes on wavelengths of 21 and 9 cm. In principle it is the study of the slowly varying component. It has already been stated before that the slowly varying component originates thermally in localized regions of high electron density and magnetic fields, which exist in the vicinity of sunspots and chromospheric plages.

Materials

To study the evolution of active regions on 21 and 9 cm, data from the Solar Geophysical Data (radioheliograms) obtained by the station of Fleurs for 21 cm and Stanford for 9 cm were used. We picked out the data only for isolated regions on the Sun, mostly in the central zone or near the central zone, to exclude the influence of the foreshortening. The data are from the years 1967—1972

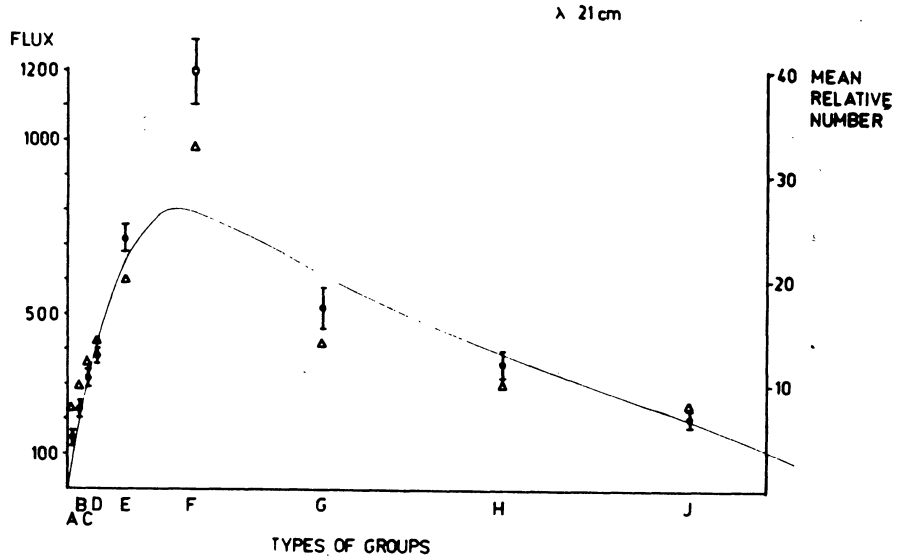

Fig. 1. Evolution of large active regions. Circles correspond to mean values of 21 cm fluxes; bars give the standard deviation. Triangles correspond to mean relative numbers of tho groups (Kleczek, 1953) and the line represents the group area (Waldmeier, 1955). The scale for the area is not given in the figure; it is linear and the maximum peak of the curve is 880 units, i. e. 880 millionths of the visible hemisphere.

(January 1967 to June 1972). In this way we have obtained the following number of values for every type of spotgroup:

Type of spotgroup	21 cm	9 cm
A	11	29
B	14	33
C	51	88
D	41	80
E	37	55
F	8	33
G	7	8
H	10	41

The greatest number of values was obtained for type C, the smallest for type G.

To construct Figure 1, we used the mean values of the fluxes. In this graph the bars give the standard deviation. We were trying to compare the evolution of the active regions in the fluxes on 21 and 9 cm with the spot area after Waldmeier (1955) and with the mean relative number (Kleczek, 1953). Figure 1 shows the course of evolution of the flux of the active regions on 21 cm, as well as the corresponding sunspot area for all the types of spot groups. The correlation is good. Also the correlation between the fluxes on 9 cm and the spot area is very good, as can be seen from Figure 2. There is a certain disagreement for type G. It is probably due to the small number of values for this type of spot group and, thus, to a statistical effect.

Discussion

The evolution at the time of a large radio region, as represented in Figures 1 and 2, corresponds approximately to its spot area and relative number. The changes of the fluxes during the active region's evolution depend on the total amount and density distribution of the plasma, overlying the plage of the region, i. e. of the coronal condensations, but also on its electron temperature. The role of both factors in the resulting flux remains to be determined and it will be specified in an article which will be submitted to BAC.

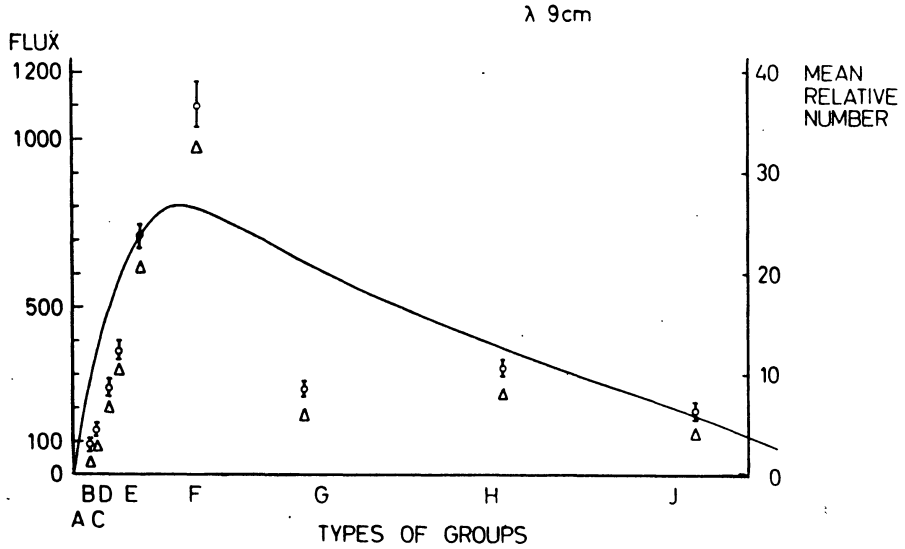

Fig. 2. Fluxes on 9 cm (see caption of Fig. 1).

References

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