SOME PARAMETERS IN FORECASTING OF SOLAR ACTIVE REGION DEVELOPMENT

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1. A dependence between the sunspot group flare activity and its magnetic structure (the orientation of the zero line of the field) was considered by A. N. Koval.

All the sunspot groups were classified into four types in dependence on the direction of the zero field line. Observations of magnetic fields made in 1968, were used: I — unipolar, II — zero line is parallel to the solar meridian, III — the angle between the zero line and the meridian is non-zero, IV — some part of the zero line is perpendicular to the meridian (two spots or pores have opposite magnetic polarities, but the same longitudes). This classification was made for the stage of the most complex structure, which was observed during the sunspots passage over the disk.

The sunspot groups were divided into three classes in dependence on flare activity: (a) only subflares were observed, (b) at least one flare of importance 1 was observed, (c) a flare of importance ≥ 2 was observed. The distribution of sunspot groups with different flare activity and magnetic structure is presented in Table 1.

Table 1

Magnetic structure	Flare activity a	b [%]	c
I	10.5	5	0
II	38	9	0
III	29	13	0
IV	22.5	73	100

Table 1 shows that high level flare activity is observed with the type IV magnetic structure when at least a small part of the zero line is perpendicular to the meridian.

A good correlation was found between the number of days when a part of the zero line in the sunspot group was perpendicular to the meridian and the number of days when flares of importance ≥ 1 were observed in this group. There is a good correlation between the number of flares observed in the group and the duration of the situation when part of the zero line is perpendicular to the meridian. The flare location usually coincides with the point at which the zero line is perpendicular to the meridian.

The dependence between the flare activity and the maximum area of the sunspot groups with flare of importance ≥ 1 was studied. A probability of the appearance of the flare (including flare of importance ≥ 2) in the group is higher when the group area is larger, but flare of importance ≥ 2 may also occur in small groups. Thus, flares of importance ≥ 2 were observed in 10% of the groups with areas of 1—500, in 19% of the groups with areas 500—1000 and in 60% of the groups with areas > 1000 millionths of the visible hemisphere.

A summary of the results shows that the orientation of the magnetic field zero line relative to the meridian can be used as one of the parameters which characterize the flare activity level of the sunspot group. The presence of at least two spots of opposite magnetic polarities in the same longitudes in the group defines the flare activity with a probability of 85%.

2. The relation between the flare activity of the plages and their brightness in H-alpha- and K-lines was studied by N. N. Stepanyan.

The maximum brightness of the plage in H-alpha- and K-lines was measured on spectroheliograms, obtained by means of the Tower Solar Telescope of the Crimean Atrophysical Observatory. The results of these measurements for the plages, which were on the disk, are presented in Figure 1. The dots relate to the plages, which had no flare during the day of the observations and the two

subsequent days. The circles represent plages which had at least one flare in the two days following the day of the observations. In Figure 1 it is possible to distinguish two zones (I and II). The distribution of the plages in these zones is the

see in Figure 2, it is possible to distinguish three regions. Instead of the dots and the circles in Figure 2, the number of events per unit of the diagram area is plotted, $\Delta \log (\text{I fl/Ichr}) = 0.1$. The numerator is the number of class A plages (without the flares),

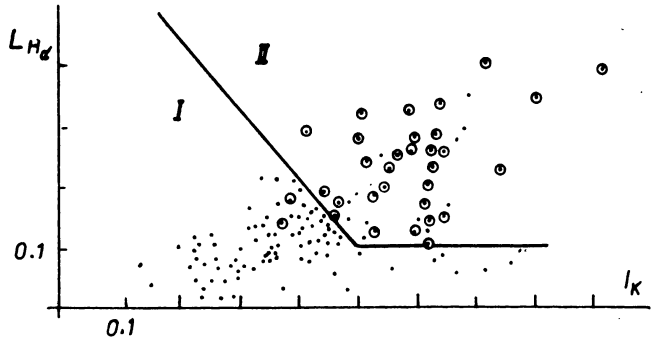

Fig. 1.

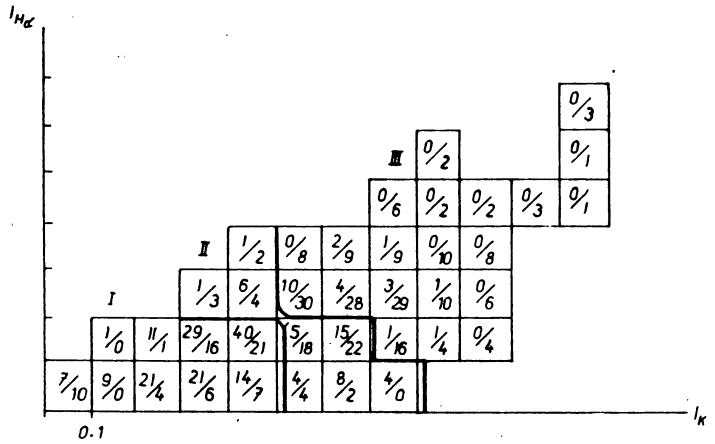

Fig. 2.

following: with 96% of the plages of zone I flares were not observed and with 65% of the plages of zone II flares were observed during the two days following the observations. Thus, if the plage, arising on the disk according to the observations in the H-alpha- and K-lines, is situated in zone I (Fig. 1) it is possible to determine with a probability of 95% that no flare will appear in this plage during the two days. On the contrary, if the plage is in zone II, a flare will appear in this plage with probability of 65% in the two subsequent days.

The same diagram was compiled for all plages independently of their ages. The plages were divided according to their flare activity in another way, namely: the plages with no flares during their passage across the disk were assigned to class A, the plages which had at least one flare during the same time interval were assigned to class B. As one can

the denominator is the number of class B plages (with flares). The distribution of the class A and B plages into three regions (I, II, and III, see Fig. 2) is presented in Table 2. Table 2 indicates that H-alpha and K-brightness measurements for 80% of the plages allow one to estimate the flare activity with a probability of 85%. Only 20% of the plages,

Table 2

Region	All plages		Plages without flares (A)		Plages with flares (B)	
	Number	%	Number	%	Number	%
I	203	39	148	85	55	15
II	109	21	55	50	54	50
III	214	40	23	11	191	89
All plages	526	100	226	43	300	57

which have a definite ratio of the brightnesses of the H-alpha- and K-lines (region II in Fig. 2), display equal probabilities of the presence or absence of flares.

Thus, the brightness of plages in the H-alpha- and K-lines can be used as one of the numerical criteria for forecasting flare activity over a short time interval (1—2 days) and also for 1 solar rotation.