ON THE PREDICTION OF THE (D, E, F, G) SUNSPOT GROUP CHARACTERISTICS

M. Jakimiec[1] J. Paciorek[1] N.N. Stepanian[2]
[1]Astronomical Institute of Wroclaw University, Wroclaw, Poland
[2]Crimean Astronomical Observatory, Nauchny, Crimea, USSR

EXTENDED ABSTRACT

Our analysis concern the active regions in which were observed sunspot groups classified as D, E, F, and G. We define the variables describing plage, sunspot group, magnetic field and flare activity.

We try to investigate the possibility of prediction one and two days forward for the sunspot group and flare activity characteristics.

Begining our analysis we have tried to divide the sunspot group observational data into parts, taking the evolution phase and the life time of the groups into consideration. The sunspot groups emerging from behind the sun limb and the groups apearing on the visible sun disk are investigated separately. The increase or decrease of group area qualified the sunspot group evolution phase.

We have tested the hypothesis that the our samples are taken from the same population. To obtain the answer we have compared the mean values and the variances of all studied variables.

The mean values and the variances did not reveal the statistically significant differences in the samples for two evolution phases. There is, however, the evident difference of the variances for many variables when confronted the samples refering to old and young groups. Namely, we found higher values of the variances for the older groups. We give up such a data division for further data analysis because the sample size of the groups is not great, that means, we take into consideration one sample of size N = 248.

Using the principal components method we have examined the real dimentionality of our twenty seven defined variables and we obtained that the first three components describe the essential part (52%) of the whole variance of the variable set. The contribution of each further component is insignificant, smaller than 5%.

The interconnection structure of the considered variables was investigated by the common factor analysis method.

One can see that the specifical variance which presents the random part of the variable variance, only for the variables characterizing the area of sunspot group and the total magnetic flux is so low that we may expect these variables to be well predicted one and two days forward. The calculated interconnection structure parameters showed that sunspot area and total magnetic flux are displayed in one and the same factor. The same is for three succesive days. One may conclude, that sole sunspot group characteristics which can be successively predicted one or two days forward are the sunspot group area and total magnetic flux.

Continuing our investigation we applied two variants of multivariable regression analysis, the linear and the quadratic ones, We calculated the determination coefficient RR values computed for two variants and for each of the predicted variables. This coefficient represent measure of the prediction quality. Just, as the previously obtained result, the high determination coefficients belong to the variables characterizing sunspot group area and total magnetic flux. We found also that the quadratic regression model gives no radical improvement of the prediction quality.

This paper will be published elsewhere in more detailed form.