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RELATIONSHIP BETWEEN THE SEASONAL VARIATIONS OF THE INFARCTION MORTALITY IN BULGARIA AND GEOMAGNETIC PC1 PULSATIONS

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Abstract. The statistical medical data one month averaged of the myocardium infarction events in the Bulgarian hospitals in 1970-1985 have been studied. Various categories of the population showed the similar seasonal variations of the infarction mortality, namely, a very much pronounced maximum in the winter period. However, the geomagnetic activity demonstrates different seasonal variations. These data were compared with the occurrence of geomagnetic Pc1 pulsations at the mid-latitude Borok observatory. A rather good similarity between time variations of these phenomena has been found.

Introduction

After the pioneering works by A.L.Chyzhevsky there was published a huge number of different publications describing the influence of the solar and geomagnetic activity on the human health. Very many authors accepted geomagnetic storms and solar flares as one of the strong hazard factor, particularly for cardiology diseases (infarction) [e.g., Novikova and Ryvkin, 1971; Ganelina et al., 1975; Karazjan, 1981]. About 60 articles were reviewed in the paper by Temurjanz et al., 1982. Controversially to traditional assumptions this review shows rather a complicated picture, especially in big cities like Moscow [Benevolensky et al., 1980], Kiev, Minsk, in spite of, the fact that as a rule, people prefer to publish mostly positive results, not the negative ones. Lipa et al.(1976) did not find either any correlation between the infarction mortality in USA and the geomagnetic activity. Sometimes the results of the correlation are not comparable because different authors use in the investigations the different heliogeophysical factors, different methods and different time intervals. To continue these investigations here we present the preliminary results of the analysis of the statistical monthly medical data (infarction mortality) in Bulgaria for the 16-year interval (1970-1985).

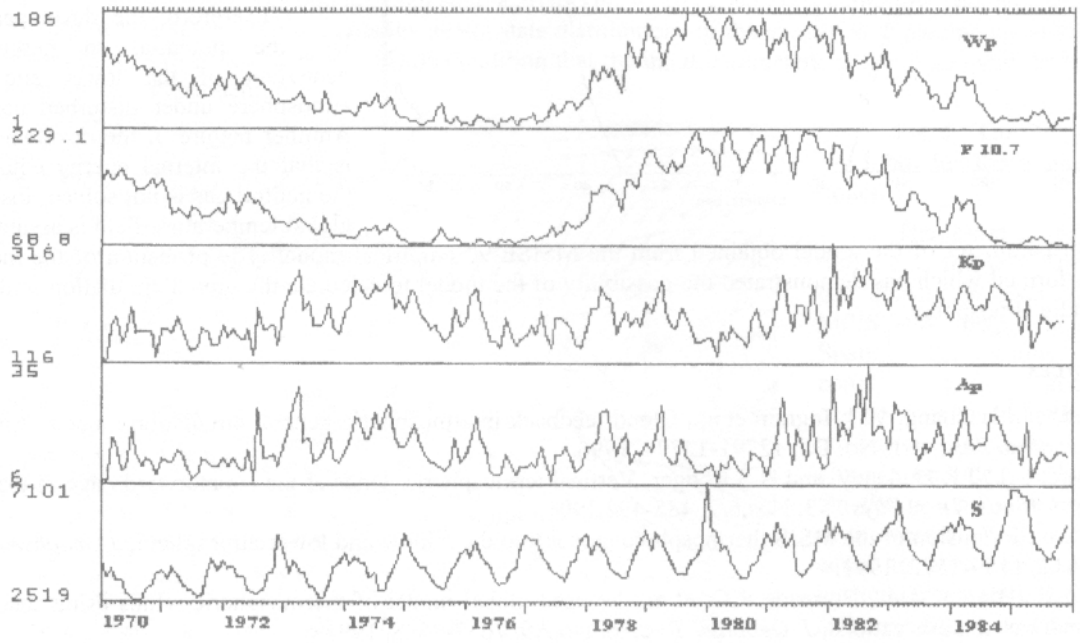

Fig.1 Time distribution of the myocard infarction mortality in Bulgaria (S), geomagnetic indexes (Ap and Kp) and solar activity by the Wolf-numbers (Wp) and solar radio emission intensity (F 10.7).

Results

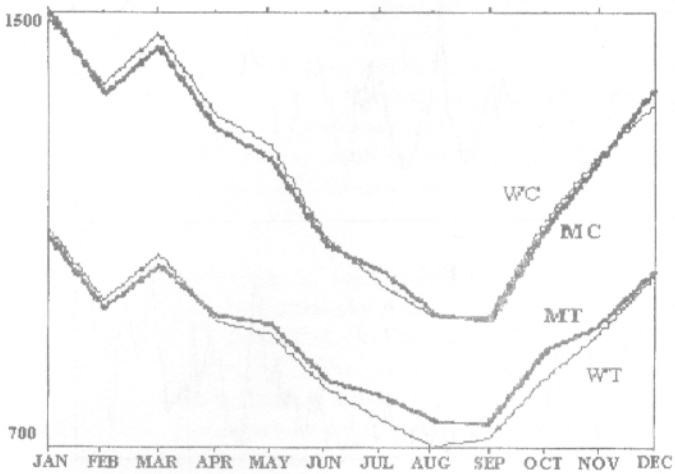

Fig.2. Seasonal variations of the infarction mortality for various different categories of populations (M - men, W – women, T – in towns, C – in the country).

The analysed time interval includes about one and half cycle of the solar activity. It can be seen from Fig.1 where at the upper panels the traditional indexes of the solar activity are shown: the Wolf-numbers of the solar spots (Wp) and the Sun radio emission intensity (F10.7). The middle panels demonstrate geomagnetic activity indexes (Kp and Ap), the bottom panel shows the time variations of the month medical data of the infarction mortality (S) for all Bulgaria population. The same time all subsequent Figures of the numbers of the vertical scale represent the minimum and maximum values of the discussed parameters.

The data in Fig.1 demonstrate clearly expressive at season variations of the mortality with the strong maximum in winter and the minimum in summer. A similar rhythm of the total mortality was shown by Ashoff (1981) in the middle latitudes of the Northern hemisphere. The seasonal variations of mortality in Bulgaria have the same shape for men (M) and women (W) of both the town (T) and the country side (C) Bulgarian populations. The result of the 16 years summation is presented in Fig.2. The minimum of mortality has been in observed summer and the maximum – in winter. The summer minimum of infarction mortality is more expressive for the rural population both for men (WC) and for women (WC) rather than for the urban one. The small maximum of mortality has been also distinguished during the spring (in March). It is interesting to mention that in the spring time the maximum of the women mortality is a little higher than that of the men, both in towns and in the villages.

However, seasonal variations of the geomagnetic activity show the spring (March-April) and autumn (September-October) maximum, which did not coincide with the medical data presented here. More over, the winter maximum of mortality corresponds to the minimum of the planetary geomagnetic activity. The absence of correlation between geomagnetic and medical data can be seen in Fig.3, which shows the year mortality and geomagnetic disturbances (Ap-index). The mortality continuously increases with the time from 1970 to 1985, however the geomagnetic activity is essentially variable. These data demonstrate the absence of the direct influence from the geomagnetic activity on the summarised for one year infarction mortality. But it is necessary to remind, that there is a large number of publications in which there was shown the real good correlation between the infarction enhancement with geomagnetic disturbances during certain strong magnetic storms. It means, that, probably, heliogeomagnetic effects are very delicate and complicated, so the integration methods of the one year data are too rough for such investigation or the use of the Kp and Ap indexes is not correct because these indexes do not include the wave characteristics of the geomagnetic disturbances.

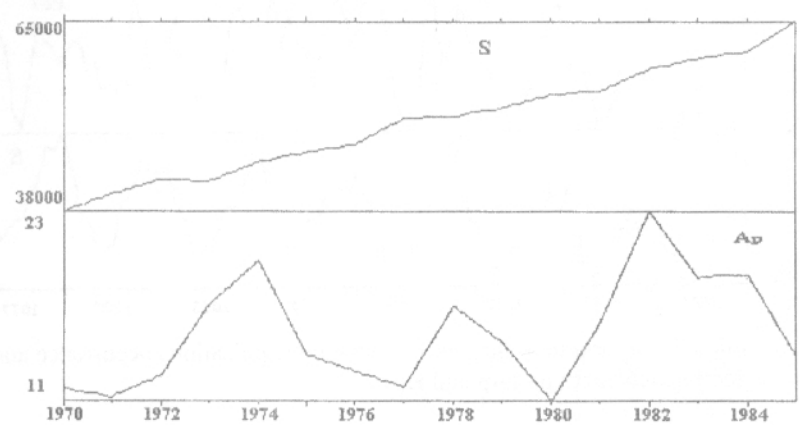

Fig.3. Annual variations of the total infarction mortality in Bulgaria summarised for 16 years and the corresponding distribution of the geomagnetic activity using the planetary Ap-index.

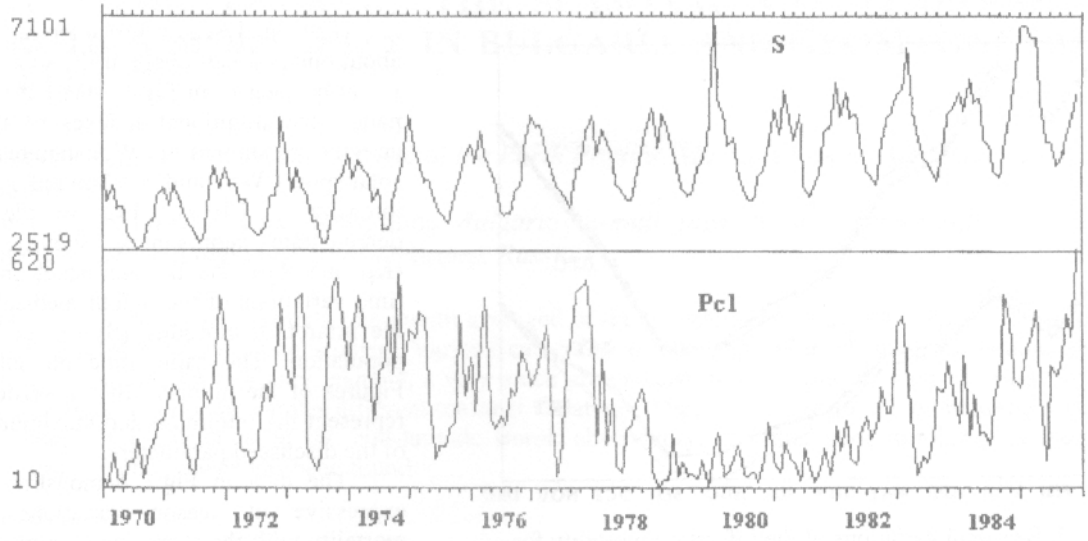

Fig.4. Infarction mortality and duration of the Pc1 geomagnetic pulsations at Borok.

It is well known that the period range of geomagnetic wave variations (geomagnetic pulsations) is very large, from about half a second to several minutes. According to the periods the geomagnetic pulsations are divided in various classes. As the first step of the analysis we have considered the Pc1 class of geomagnetic pulsations because these waves are characterised by the same order of periods as the men heartthrob periods (about 1-2 s). Fig.4 demonstrates variations of the duration of the Pc1 pulsations at the middle latitude Borok observatory and the corresponding time distribution of the infarction mortality. The values of the vertical scale for the Pc1 pulsations

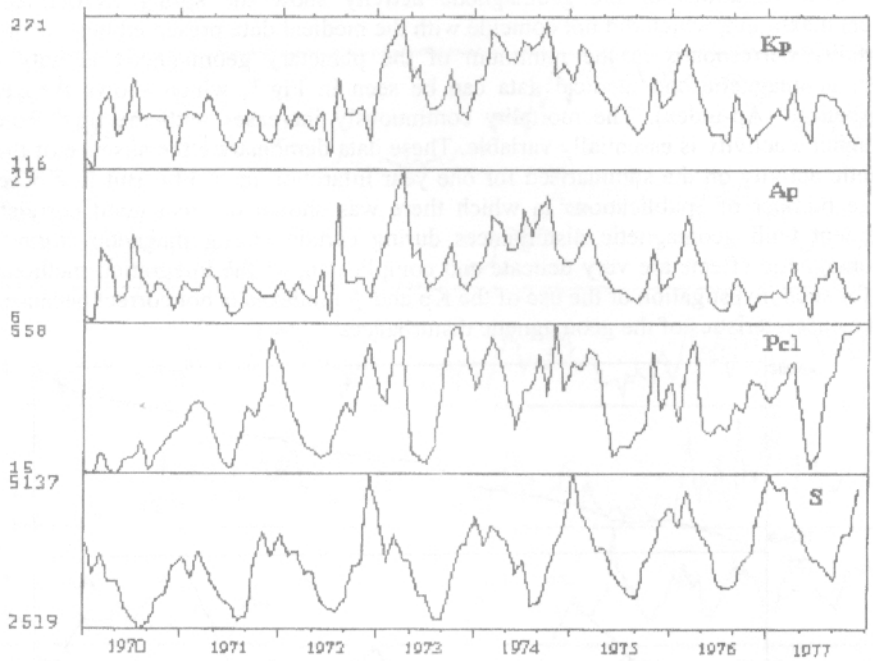

Fig.5. Infarction mortality, Pc1 geomagnetic pulsations occurrence and geomagnetic activity (Ap and Kp).

duration represent the numbers of 15-min intervals with these pulsations occurrence summarised for each month [Matveeva, 1998]. The curves are of rather a similar shape. The almost complete absence of Pc1 geomagnetic pulsations on the ground near the maximum of the solar activity (1979-1981) corresponds to their cycle variations. Fig.5 shows more detail for the interval of 1970-1977. The seasonal variations of the infarction mortality almost continue the season variations of the Pc1 occurrence. There is no correlation of mortality with Ap and Kp except for the period of 1975-1976 years, which corresponded to the minimum of the solar activity (see Fig.1).

The results of our preliminary analysis show that the problem of influence of the solar and geomagnetic disturbances on the human heath is far from the final solution and needs further detailed investigations with mandatory inclusion in the consideration of the geomagnetic pulsations data.

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