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Geophysical variables and human health and behavior

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Abstract

The increasing number of papers during the last years reveals an existence of effect of geophysical factors on human health.

The subject of this paper is to present some results obtained confirming this effect and short review of some scientific opinions about mechanisms, according to which geomagnetic field (GMF) variations could influence on human.

We have investigated the influence of geomagnetic disturbances on physiological parameters of healthy people as well as the relationship with dynamic of myocardial infarction.

Although there are objective difficulties, investigations in that field will be extremely useful for protecting man from harmful effects of geophysical factors.

Keywords: Geomagnetic activity; Human health; Physiological parameters; Myocardial infarction

1. Introduction

The effect of geophysical factors on human health and behavior is not an imagination or fantasy. There are an increased number of papers during the last years that prove the correlation between geomagnetic field (GMF) variations and human health parameters.

Many theoretical hypotheses have been presented in searching the plausible mechanism through which the living systems and human beings perceive and react to GMF changes.

The basic geophysical and environmental factors that could affect human health and behavior are: changes in solar activity, GMF variations, meteorological changes as well as changes in geochemical and tectonic processes. There are facts that all of them could influence mutually each other. That is why it is very difficult to separate the different influences and it is very easy to omit the effects on human beings. It can be summarized that the whole human organism, psychic reactions and behavior respond to sharp changes of different kind in GMF. Our attention for the time being is directed only at the influence of changes in GMF on human.

Fig. 1 presents an attempt to list geophysical processes determined by the variations in solar activity that can affect on health on one hand and the common mechanisms through which human reacts to these effects on the other hand.

Baker (1980) suggested that a very slight difference in the polarity between the Central Nervous

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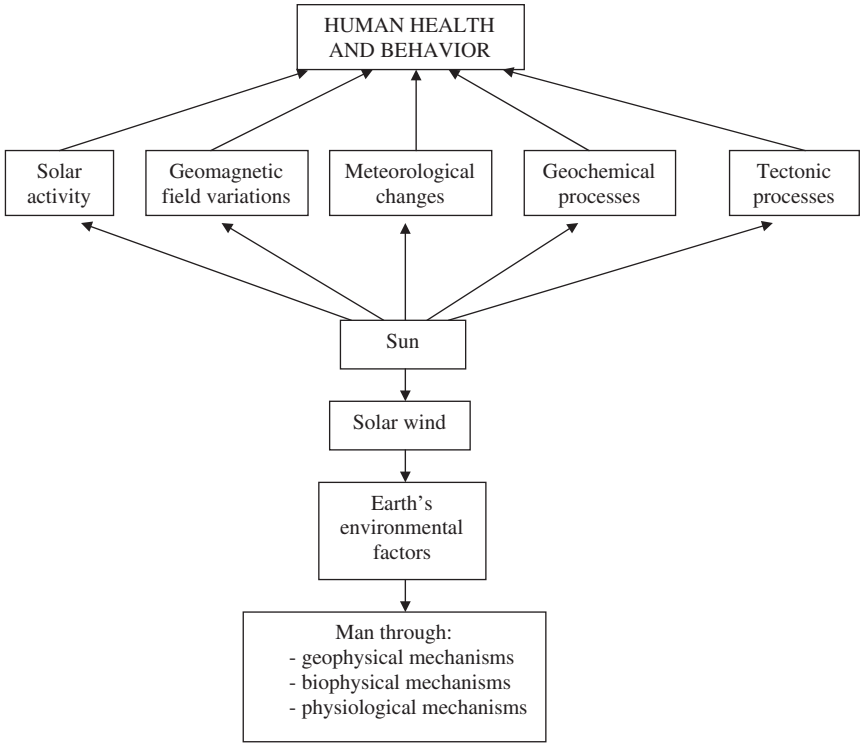

Fig. 1. Scheme for the mechanisms of influence of environmental factors related to solar activity on human health.

System (CNS) and the peripheral nerves of a degree of 15–29 mV could work like a primitive sensor with respect to GMF changes. CNS structures and endocrine glands are very sensitive to small changes in GMF. Some of them are: pineal gland, thymus, gonads, thyroid gland, etc. Those formations are related to the cyclic recurrence of the physiological and psychological processes of the living organisms and "the circadian periodicity could influence basically as well as could increase the psychological dysfunction" (Persinger, 1987).

GMF variations and especially that of a low frequency (less than 100 Hz) easily penetrate the living tissue and thus influence on all living organisms including the man.

Earth's GMF is about 0.5 G that corresponds to 50 000 gamma or 50 μT. Of course, it is not even and varies in the different geographical regions. It is approximately 25 000 gamma at the equator and about 70 000 gamma in the Polar Regions. GMF variations are presented by a variety of indices—Kp, Ap, aa, Dst, etc.

Men possess different degree of sensitivity to GMF changes and perceive them with respect to both GMF wave's intensity and their direction. There are people who discriminate GMF changes of a degree of about 0.1 G/min. Some people even react to changes of 0.01 G/s.

GMF pulsations such as Pc (pulsations continues) and Pi (pulsations irregular) could also have a biogenic meaning. For example, Pc1 pulsations have a period from 0.2 up to 5 s, which corresponds to the cardiac muscle shortening frequency. The appearance of those pulsations could essentially influence on the biological system activity (Kleimenova and Troitskaya, 1992). "It is likely that Pc1 occurrence can play a role of negative stress reaction on the state of the cardio-vascular system" (Breus et al., 2006).

Electrophysiological investigations show that the changes in GMF intensity influence on CNS by a frequency change of the background electrical brain activity (Belov et al., 1998). The changes in that field are of a degree of about 0.002 V/m and they change the frequency of the brain rhythms with 1 Hz (Stoinev et al., 1991). There are also changes in vegetative functions which are presented by changes in cardiac activity, blood pressure values and respiratory parameters.

The vegetative neural system is also sensitive to GMF changes. It is proven that the sympathetic vegetative neural system reacts mainly to slighter