Geomagnetic activity influence on the season variations of myocardial infarction in subauroral (Yakutia) and low latitudes (Bulgaria)

S.N. Samsonov[1], N.G. Kleimenova[2,3], P.G. Petrova[4]

[1]*Shafer Institute of Cosmophysical Research and Aeronomy, Siberian Branch, Russian Academy of Sciences, Yakutsk, Russia*

[2]*Schmidt Institute of Physics of the Earth, Russian Academy of Sciences, Moscow, Russia*

[3]*Space Research Institute, Russian Academy of Sciences, Moscow, Russia*

[4]*Medical Institute at Ammosov North_Eastern Federal University, Yakutsk, Russia*

Abstract

The problem of possible influence of the solar and geomagnetic activity on the human health has been discussed during the last decades. It was established that the heart and cardiovascular system could be the main targets of this negative action.

Here we present the results of the comparison of the seasonal variations of the emergency medical calls for myocardial infarction in Yakutsk (subauroral geomagnetic latitudes) with planetary geomagnetic activity near maximum (1992) and minimum (1998) solar activity and found their good agreement. There are several maxima coincided with increase of geomagnetic activity.

However, the seasonal behaviour of deaths from myocardial infarctions at low latitudes (Bulgaria) exhibited significant differences. In Bulgaria, the maximum of infarctions was in winter without a strong correlation with magnetic activity, but controlled by Pc1 geomagnetic pulsations at periods of about 0.5–2.0 Hz.

We suppose that, in subauroral latitudes, unlike low latitudes, a major role in the increase in the number of infarctions is played those magnetic storms which demonstrate strongest disturbances (substorms) in local (i.e. in Yakutsk) night. Typically, substorms are accompanied by irregular 0.3-4.0 Hz geomagnetic Pi1 pulsations quickly decreasing with latitude and therefore seldom observing at low latitudes. We suppose that Pi1 at subauroral latitudes like Pc1at low ones could be biotropic.

The number of infarction (MI) in Yakutsk

One can see that sharp and strong Kp-index increase is accompanied by increasing of the emergency medical calls for myocardial infarction number (MI).

There are several MI maxima coincided with increase of geomagnetic activity.

Near SA maximum

Near SA minimum

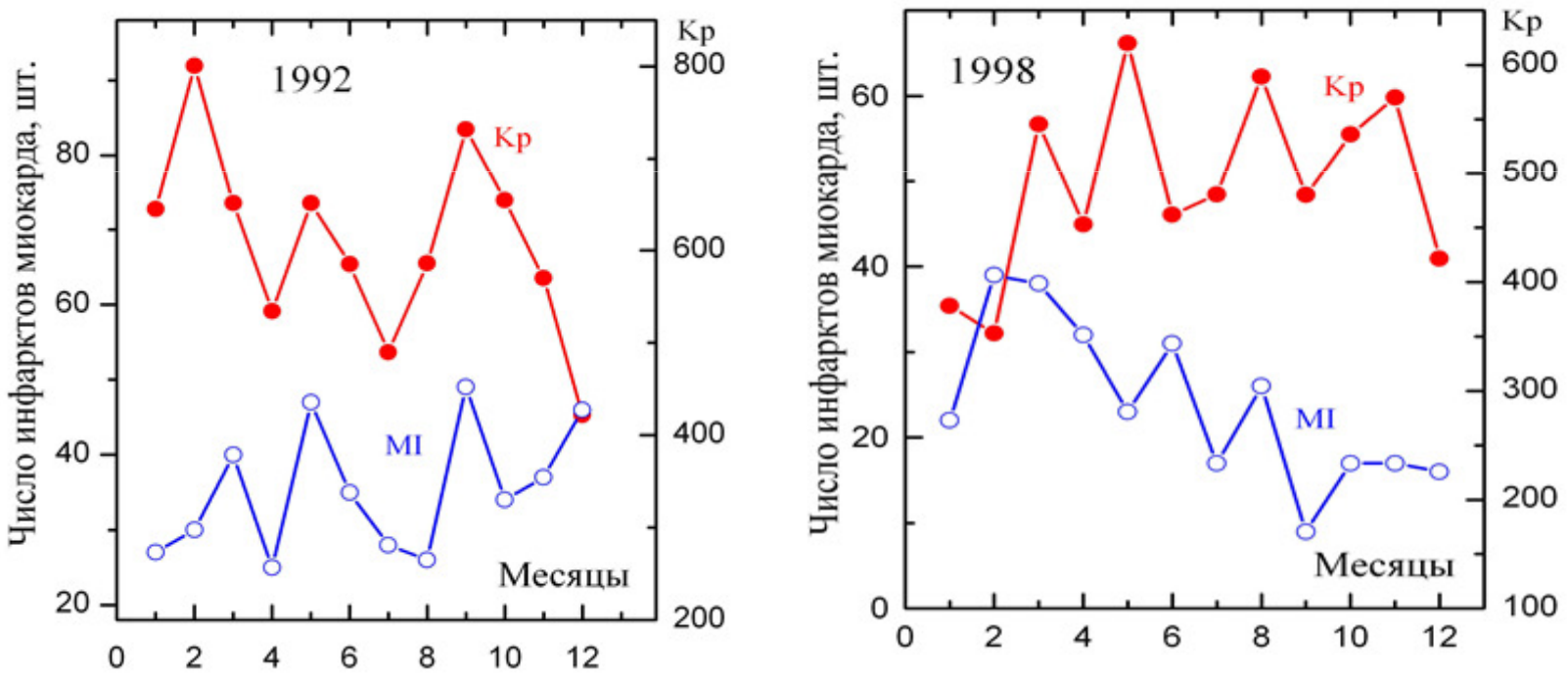
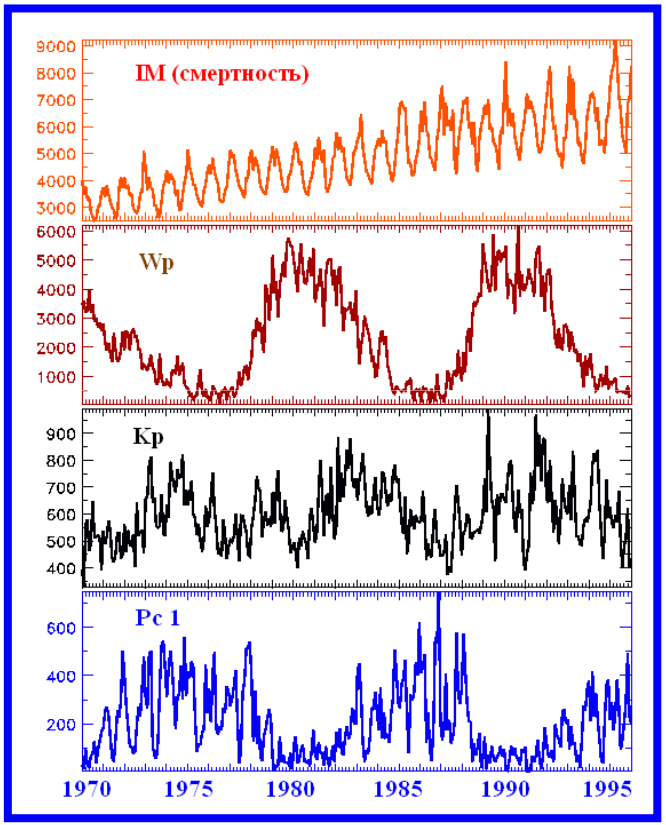
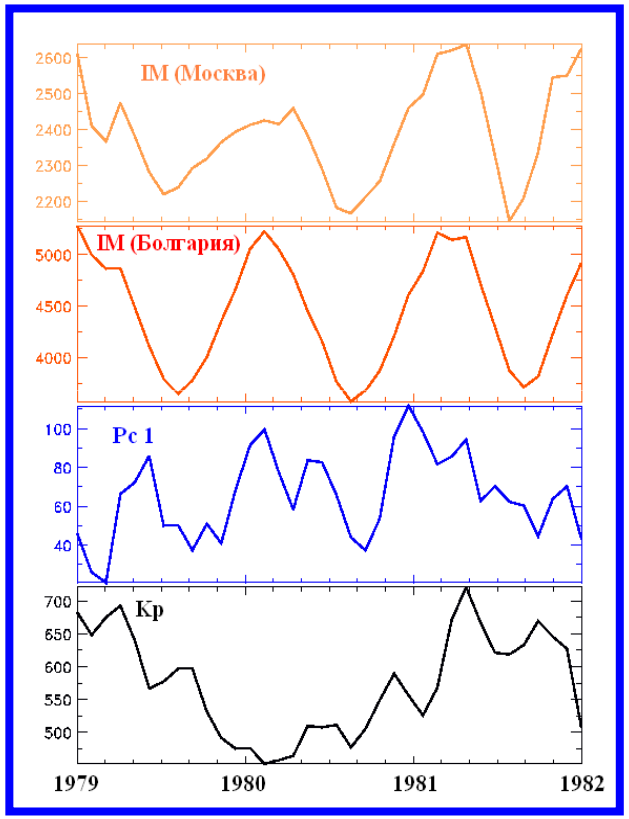


Fig.1. The number of infarction (MI) and magnetic activity (Kp)

Infarction mortality, solar (Wp) and geomagnetic (Kp) activity and Pc1 geomagnetic pulsations

Fig.2





There is no agreement between the medical data and geomagnetic activity (Kp)

Very good correlation between Moscow and Bulgaria data is seen as well as with Pc1 pulsation

The comparison the normalized simultaneous seasonal variations of the death from infarction in Bulgaria [Ivanova et al., 2002] and emergency medical calls for infarction in Yakutsk.

One can see that In Bulgaria (low latitudes), the maximum of infarction death was in winter, however, in Yakutsk (subauroral latitudes) there were several maxima coincided with increase of geomagnetic activity.

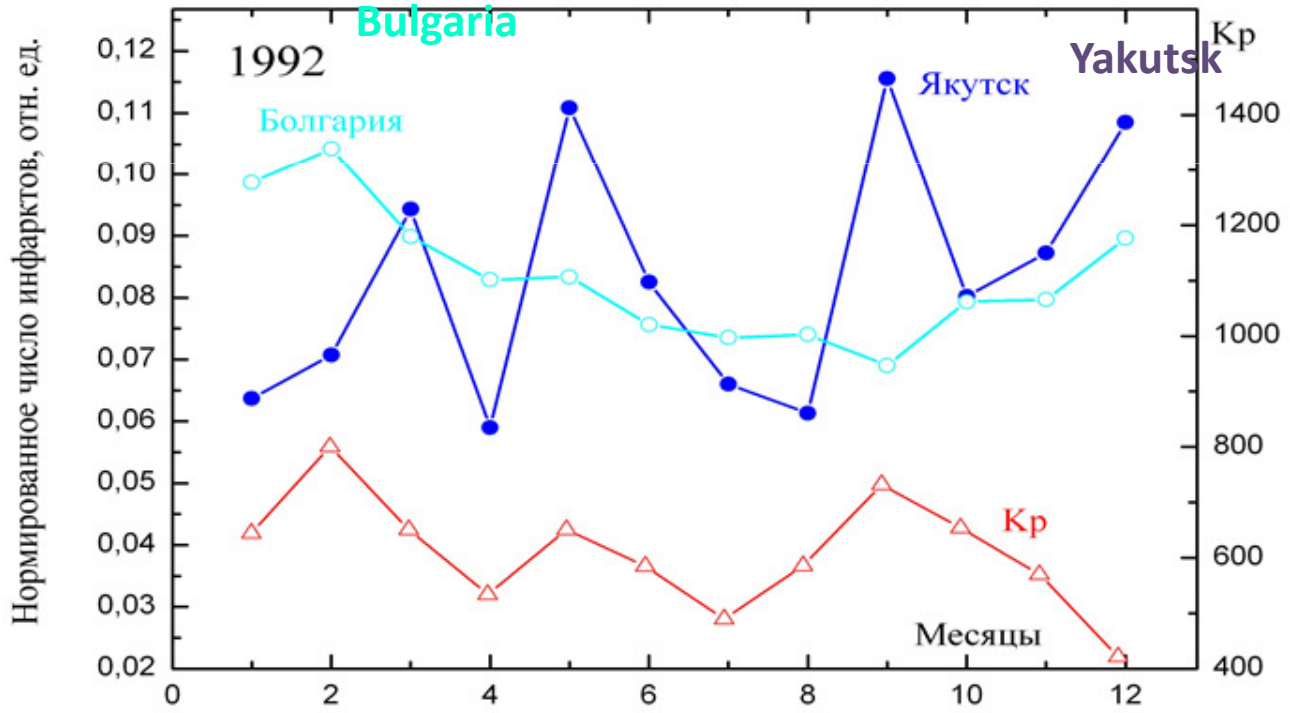


Fig. 3 Сопоставление одновременных медицинских данных - общей смертности от ИМ в Болгарии в 1992 г., числа вызовов СМП в г.Якутске по поводу ИМ и Кр-индекса

Discussion

It is known, that with increasing planetary magnetic activity, the substorms shift from auroral to subauroral latitudes (Yakutsk).
The substorms could be important factors to medical study because they are typically accompanied by intensive Pi1 geomagnetic pulsations at the similar to Pc1 periods which could be biotropic . Note, Pi1 pulsations are decayed very quickly with latitude decreasing and practically do not observed at low latitudes as Bulgaria.
A typical substorm and simultaneous Pi1 pulsations are shown in Fig. 4.

One possible reason of the infarction seasonal effects could be the seasonal variations of the pineal gland hormone (melatonin) production which suppressing was observed during geomagnetic storms (e.g. Rapoport et al, 1995). The melatonin is well known as a multifunctional key regulator of the circadian rhythms.

One of the negative important factor could be the Pc1 and Pi1 geomagnetic pulsations at frequencies comparable with the human heart beat. Due to that, these pulsations can affect a human cardiovascular system.

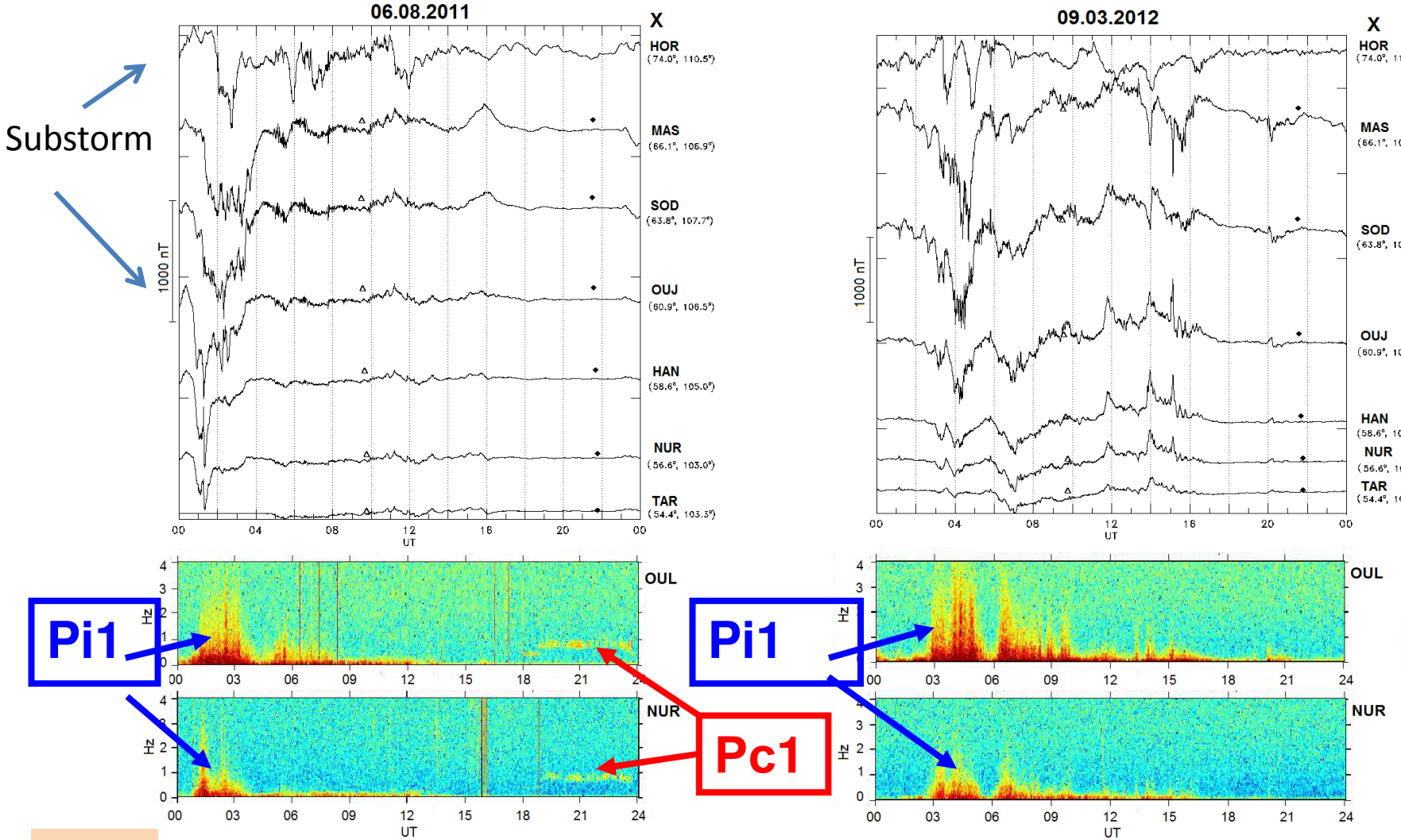


Fig. 4. **Two examples of Pi1 geomagnetic pulsations during substorms**

In is seen that during substorm, strong Pi1 pulsations are observes also at subauroral latitudes (here, OUL and NUR stations located at the same geomagnetic latitude as Yakutsk). The Pi1 spectrum is wider than Pc1, but includes the same frequency range.

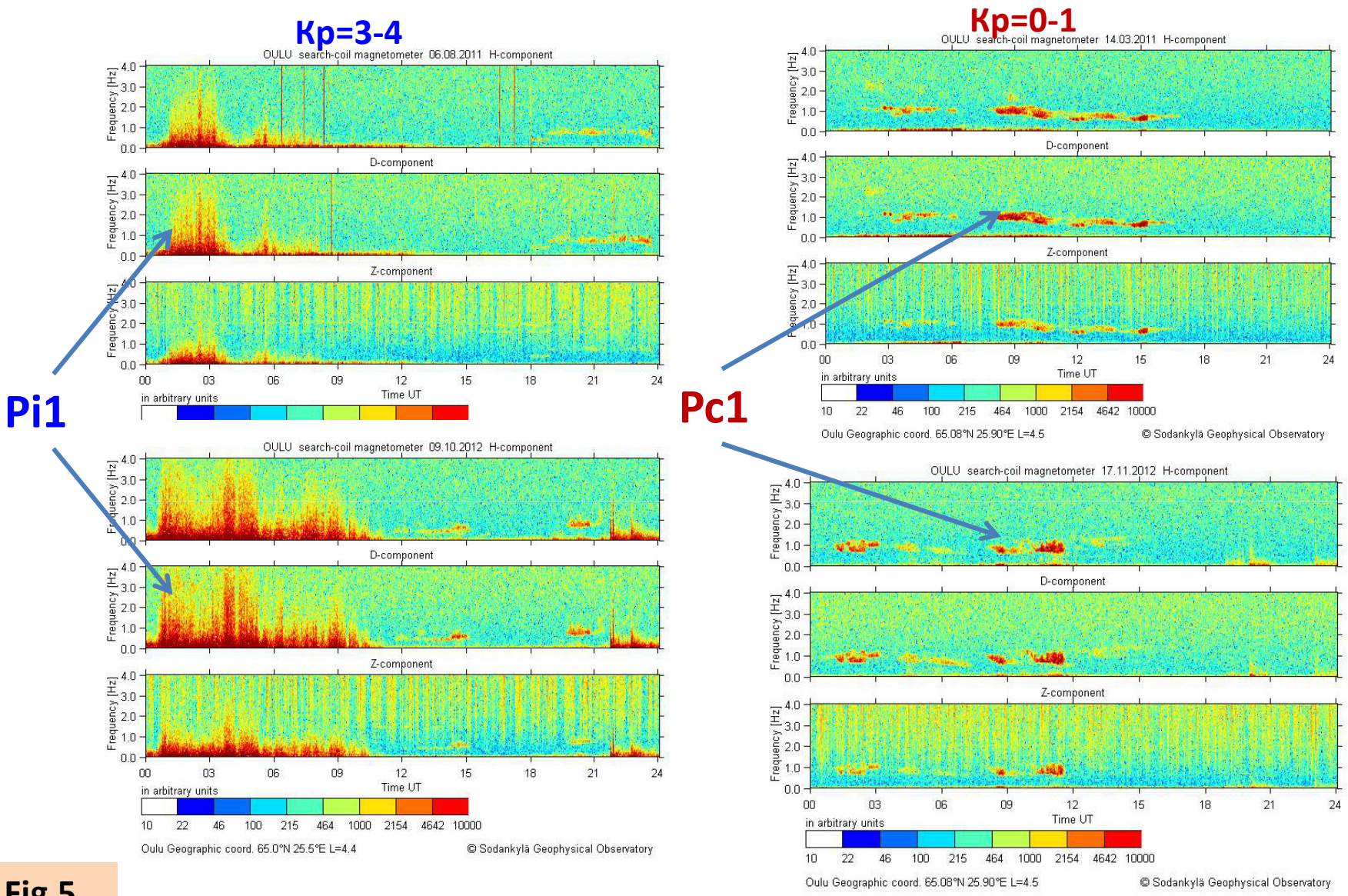


Fig.5

Typically , in subauroral latitudes (Yakutsk), the strong Pi1 geomagnetic pulsations are observed during the magnetic disturbed periods (Kp =3-4) and Pc1 pulsations during quiet time (Kp=0-1).

Summary

A comparison of seasonal distribution of infarction at subauroral latitudes (Yakutsk) with the simultaneous seasonal change of infarction deaths at low latitudes (Bulgaria) showed their significant difference.

In Bulgaria, the maximum of infarctions was registered in winter, however, in Yakutsk there are several maxima coinciding with significant increases of geomagnetic activity.

We assume that at subauroral latitudes, a great role in aggravations of infarctions plays the enhancement of local geomagnetic activity, namely, the night magnetospheric substorms, always accompanied by irregular geomagnetic Pi1 pulsations with similar to Pc1 periods (0.5–5.0) Hz.

The irregular Pi1 pulsations can be biotropic, as well as quasi-sinusoidal geomagnetic Pc1 pulsations.