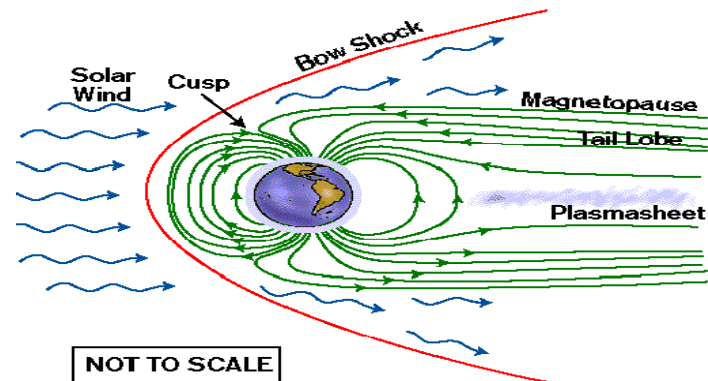


# ARE GEOMAGNETIC DISTURBANCES AND PULSATIONS REALLY HAZARDOUS?

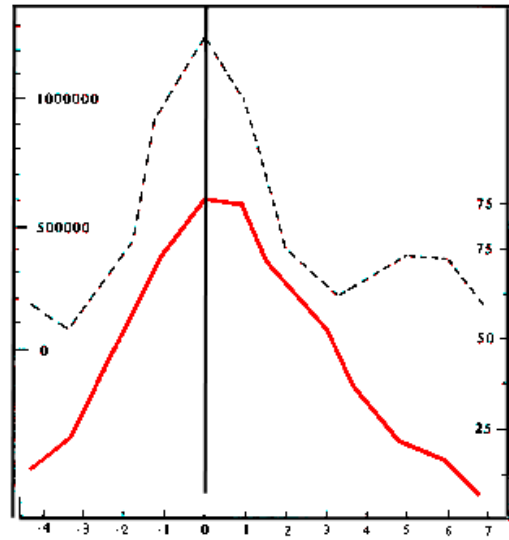
**Kleimenova N.G.**

*Institute of the Physics of the Earth, Russia*





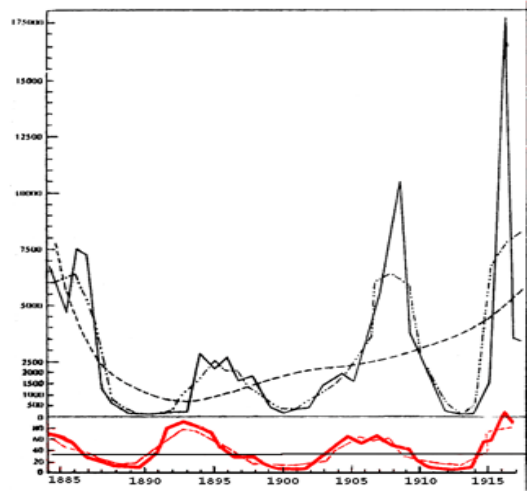
A.L. Chizhevsky  
(1897-1964 )-



Kva-

**Cholera**  
Russia 1823-1923

Solar activity



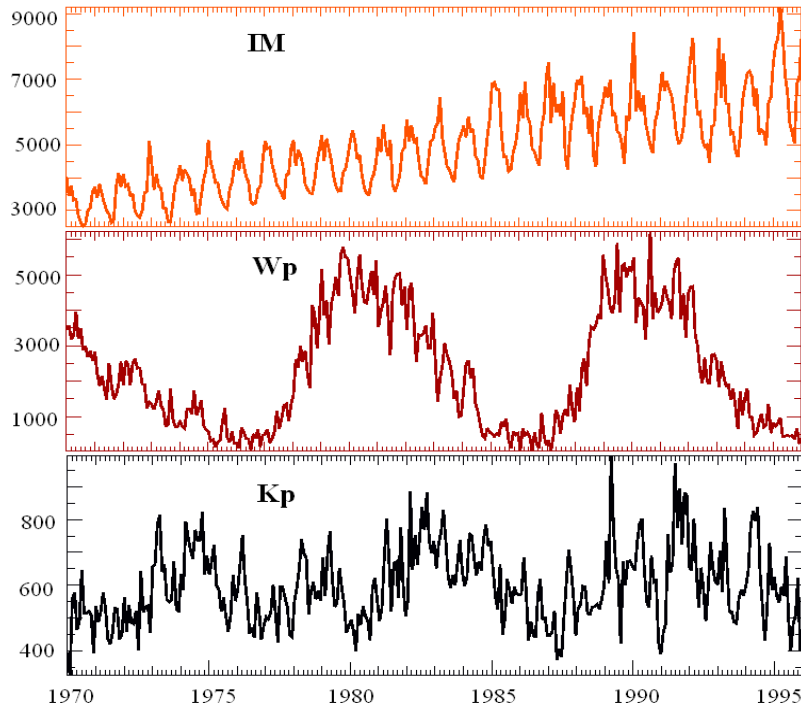
**Enteric fever**  
Moscow 1883-1915

Solar activity

## IMPORTANT NOTES

- 1. Very many authors presented a lot of evidences that geomagnetic disturbances could be one of the hazard factor for human organisms specially for patients with cardiovascular pathologies. **However, not every magnetic storm was bioeffective.**
- 2. The magnetite biomineralization and magnetoreception in organisms was found by J.L. Kirschvink.
- The main agent of the space weather influence on the biosphere is still unknown.

1970 - 1995

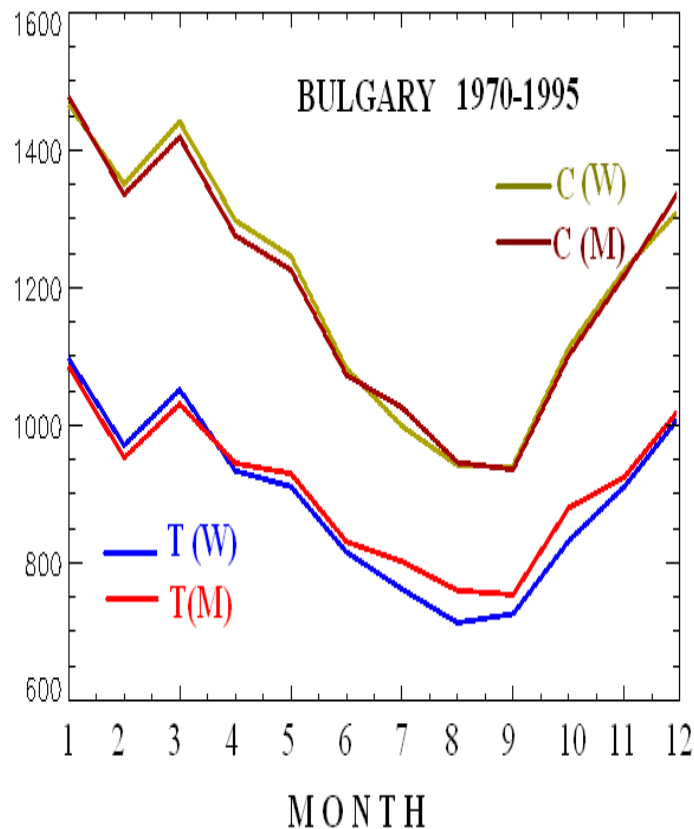


**The infarction mortality demonstrates the strong season quasi-periodicity with the winter maximum and the summer minimum.**

**The relationship between the solar and geomagnetic cycles activity and the human infarction mortality is absent.**

**Variations of the infarction mortality (Bulgaria) and solar (Wp) and geomagnetic activity (Kp) for period of 26 years data (1970-1995)**

## Seasonal variations of MI mortality



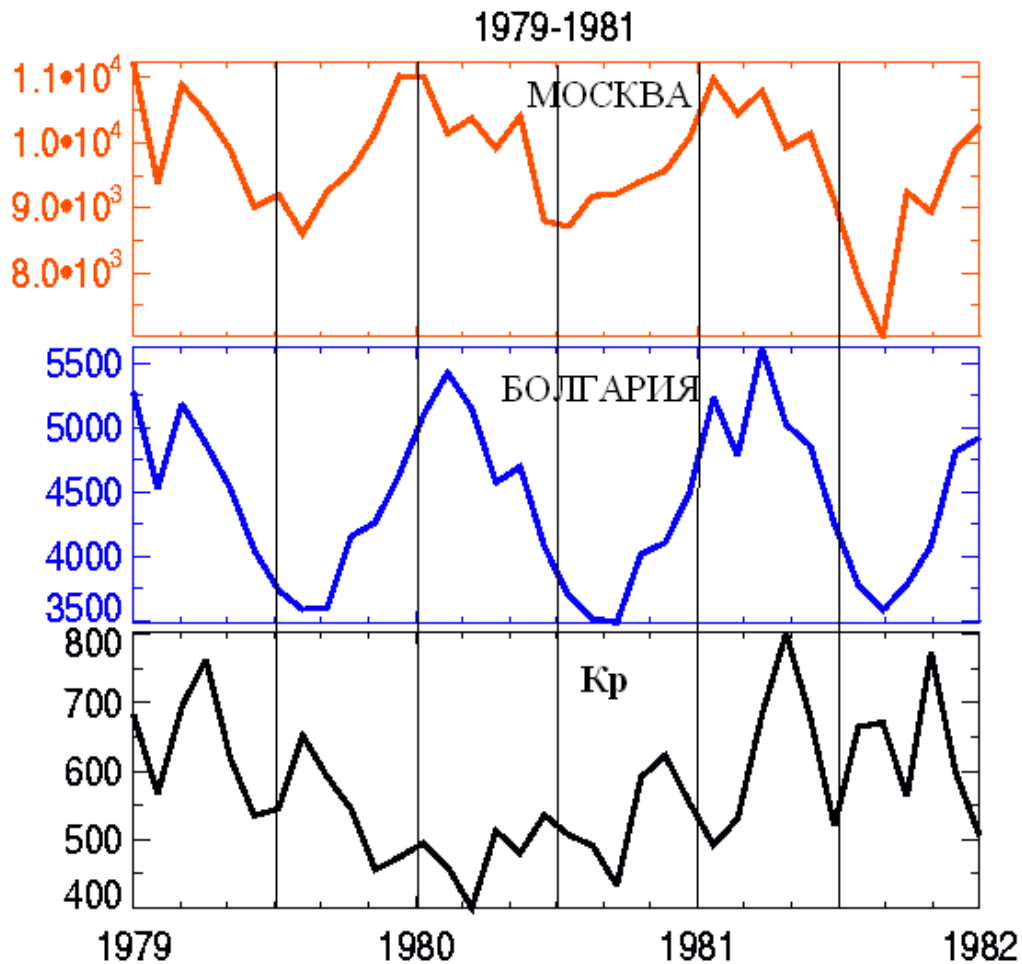
This analysis demonstrated strong season mortality variation with the profound **summer minima and winter maxima**.

However, it is well known that the maximum of **magnetic storm occurrence is attributes to equinox**, not to winter.

Thus, we suggest that a **biotropic efficacy of the magnetic storms may depend on the season**.

**Variations of the general infarction mortality in Bulgaria summarised for 16 years**

**(M - men, W – women, T – in towns, C - in the country)**



Very good correlation between **Moscow** and **Bulgaria** medical data ( $R=0.84$ ) is seen.

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

Monthly numbers of ambulance calls for three years (1979 – 1981) in **Moscow** of myocardial infarctions (85,700 cases) and the myocardial infarction mortality in **Bulgaria** and geomagnetic activity (monthly values of the Kp index)

# Infarction in Moscow and magnetic storms

- We analyzed 129 magnetic storms (1979-1982)
- **infarction (MI) increasing**
- Equinox – 75            56 (~75 %)
- Summer – 32            1 (~ 5 %)
- Winter – 22            21 (~95 %)
- Thus – only less than 5% of the summer magnetic storms and more than 95% of the winter storms showed the MI enhancement.
- As usually, the storm main phase was not accompanied by MI increasing. The most of MI storm increasing was observed during the recovery phase of magnetic storm.

# Geomagnetic pulsations

## Day (Pc)

T = 0.2-5.0 s (Pc 1)

T = 10 - 45 s (Pc 2-3)

T = 45 - 150 s (Pc 4)

T = 3-10 min (Pc 5)

)

## Night (Pi)

T = 1- 40 s (Pi1)

T = 40-120 s (Pi2)

T = 40-120 s (Pi2)

T > 2-3 min (Pi3)

We suggested that one of critical factors which affect a human cardiovascular system could be geomagnetic Pc1 pulsations having the frequency comparable with frequency of heart rate beatings



# Pc1 geomagnetic pulsations

**Frequency – 0.5 – 2.0 Hz**

**Amplitude – 10 – 100 pTл**

**Diurnal occurrence maximum – 00 - 06 MLT**

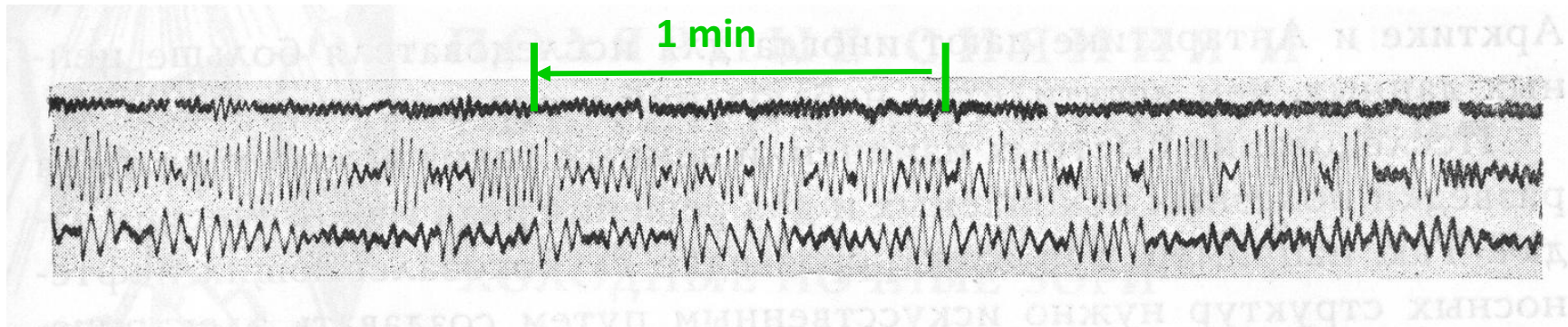
**Duration –from several minutes to several hours**

**Pc1 pulsations are typical for the recovery phase of magnetic storm**

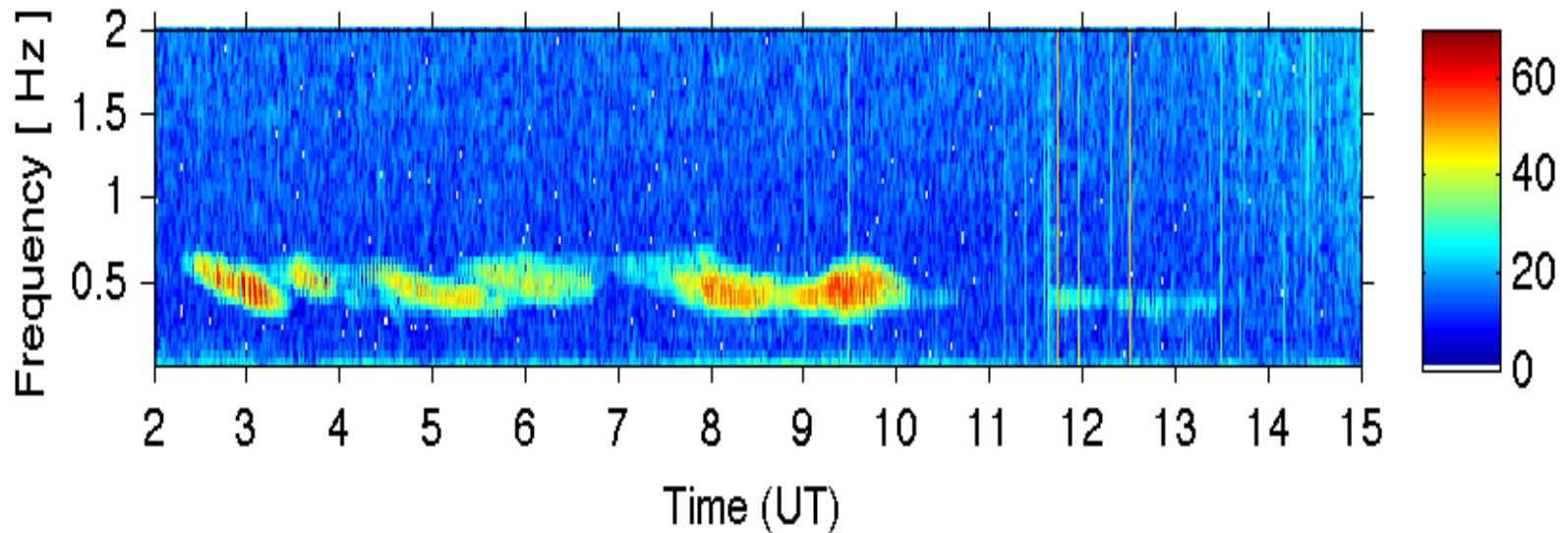
**A number of Pc1 occurrence increases in winter time**

Pc1

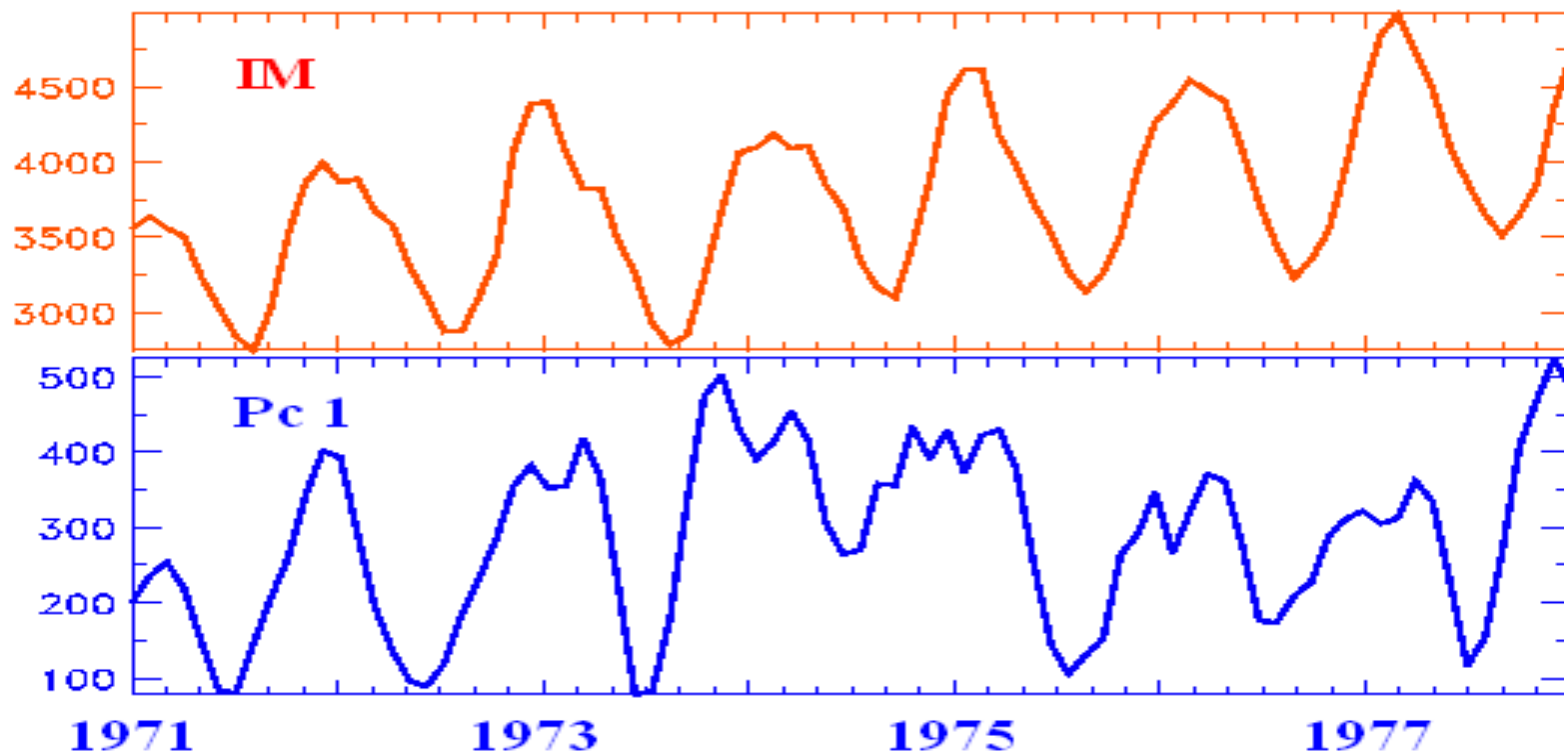
# An example of chart (paper) record of Pc1 geomagnetic pulsations



Sodankyla - 2006 06 13 - Total power

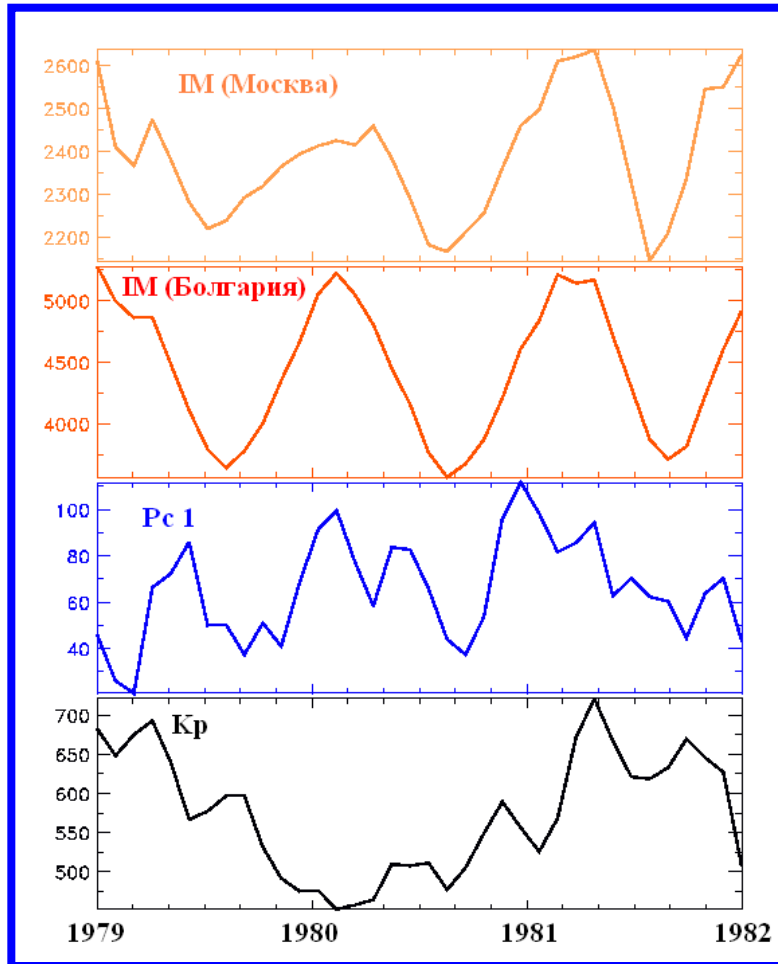


# Mortality from infarctions in Bulgaria (IM) and monthly duration of geomagnetic pulsations Pc1



The similar season variations of IM and Pc1 are seen.

# Infarctions (Moscow), mortality (Bulgaria), geomagnetic activity and Pc1 pulsations



**Very good correlation  
between Moscow and  
Bulgaria data ( $R=0.84$ ) is  
seen.**

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

# Anomalous large number of IM in Moscow and Pc 1

- Ambulance call data in Moscow in 1979-1981

- 85 000 infarctions

	1979	1980	1981
• Daily average (M)	77.2	76.5	81.2
• Standard deviation ( $\sigma$ )	15.8	13.8	16.7

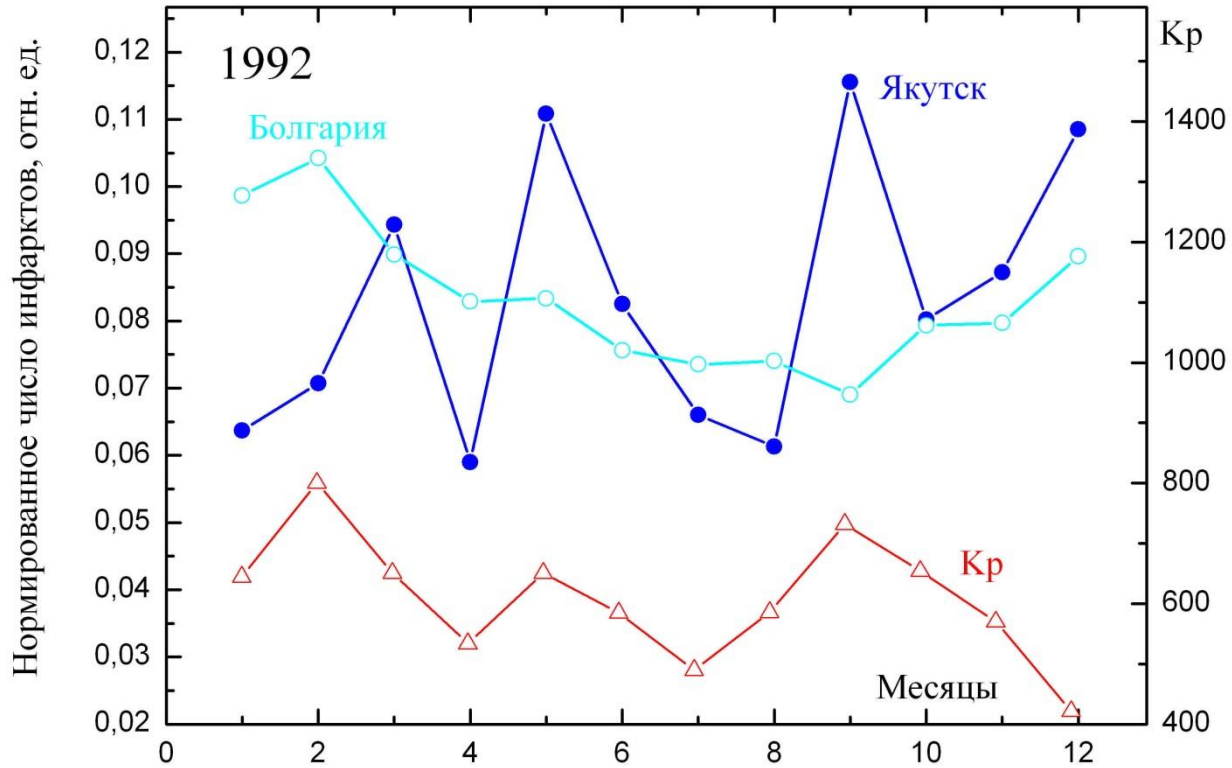
- Days with anomalous numbers of ambulance calls related to IM

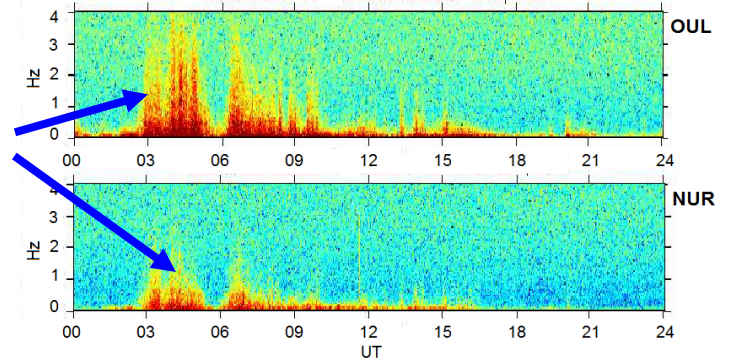
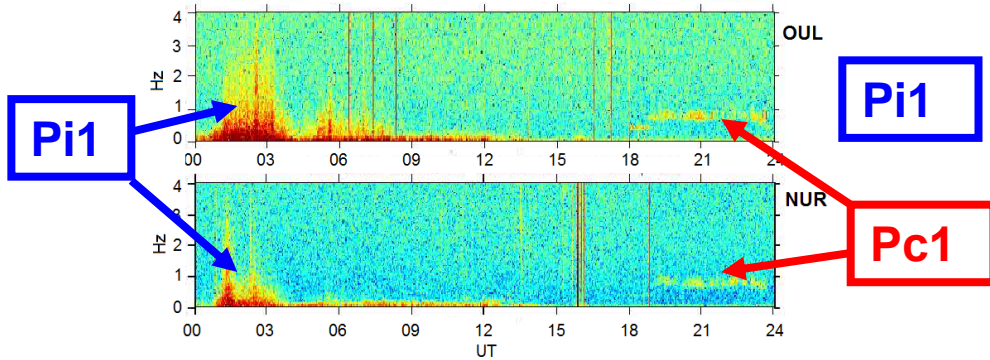
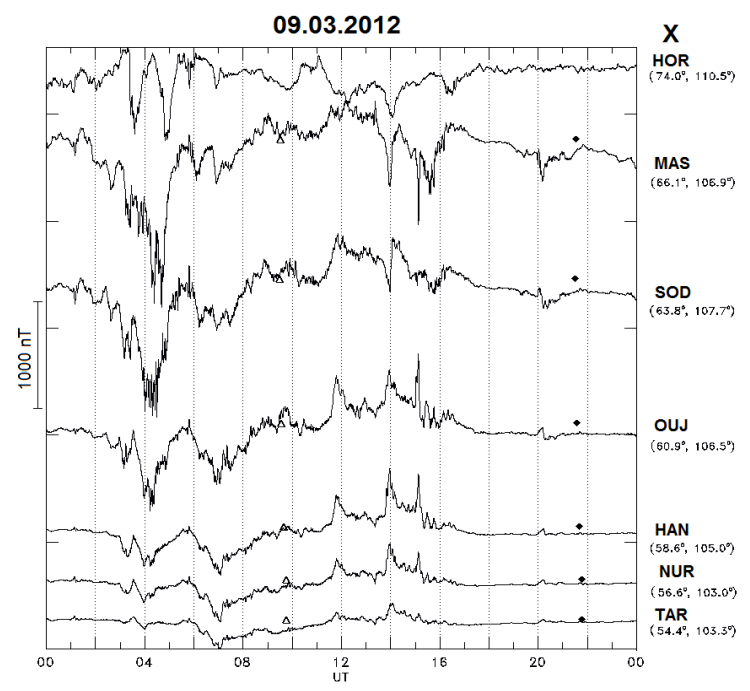
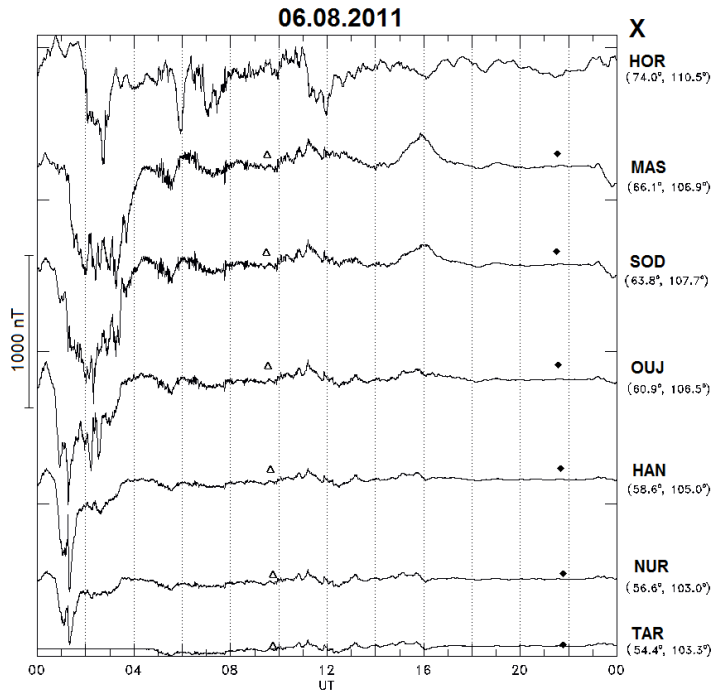
- A) More than 101 ambulance calls per day = 67

Days following by appearance of Pc1 among them = 46 (69%)

- B) Less than 46 ambulance calls per day = 20

Days following by appearance of Pc1 = 3 (15%)





Two examples of Pi1 geomagnetic pulsations during substorms

# MELATONIN

The melatonin is well known as a multifunctional key regulator of the circadian rhythms. In addition, the melatonin is an immune modulator and antioxidant for the cardio-vascular system, and the seasonal variations in its production play a critical role in the seasonal sharpening of various pathologies of the cardio-vascular system

**We suggest that sensitivity of human organism is violated during winter time due to instability related to the lack of luminosity and large production of melatonin.**



# Conclusion

1. The strong season variations of infarction at the middle latitudes with **winter maximum and summer minimum** does not coincided with season variation of solar and geomagnetic activity. The seasonal variations of myocardial infarctions at the middle latitudes (Moscow and Bulgaria) show a great similarity.
2. However, in the seasonal variations of the ambulance calls related to myocardial infarctions at subauroral latitudes (Yakutsk), there are the addition maxmima associated with geomagnetic activity maxmima.
3. We suggested that one of biotropic factors which affect a human cardio system could be geomagnetic Pc1 or Pi1 pulsations with the frequencies comparable with frequency of human heart rate beatings.
4. In summer even very strong magnetic storms and Pc1 pulsations appearance have no biotropic effects, while in the winter time even small and moderate magnetic storms became biotropic.
5. We suggest that sensitivity of human organism is violated during winter time due to instability related to the lack of luminosity and large production of pineal gland hormone – melatonin.



**THANK YOU FOR ATTENTION**