Геомагнитная активность и осложнения родовой деятельности

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Abstract

- Present study attempts to relate the frequency of occurrence of delivery complications with parameters of global geomagnetic activity in the frequency range of Pc4-5 (10^{-3} - 10^{-2} Hz).
- Biological effects of geomagnetic pulsations were studied for myocardial infarction and Pc1 (1 Hz frequency) pulsations and neurological pathology and Pc3 ($1\text{-}5\cdot10^{-2}$ Hz) pulsations.
- For both meaningful correlations were found. We attribute the possible physical basis of these correlations to the frequency similarity of geomagnetic pulsations with and some quasi-periodical processes in human body, leading to resonance effects.
- Because of inverse-power type of the averaged spectra of natural ULF geomagnetic disturbances, pulsation amplitude at 10^{-3} Hz is 3-4 orders higher than at 1 Hz and it is natural to assume that long period ULF pulsations can influence periodical biological processes with similar periods. The periods of labor pains coincide with periods of Pc5 pulsations and here we check the assumption about the relation between the frequency of delivery complications and geomagnetic disturbances in Pc5 frequency range.

Introduction. Chizhevsky

The name of Alexandr Chizhevsky is known to everybody, his main idea about the influence of Solar activity on biological and social processes still meets contradictory opinions, but the main scielnific conclusions from his results are probably not realized yet by the scientidic community.
Here we give only some lessons from his studies (not only results, but also technique and approaches) which are important for our consideration

He was the first, who recognized, that the physical mechanism for the inter-relation between solar activity and biological objects is the geomagnetic activity.

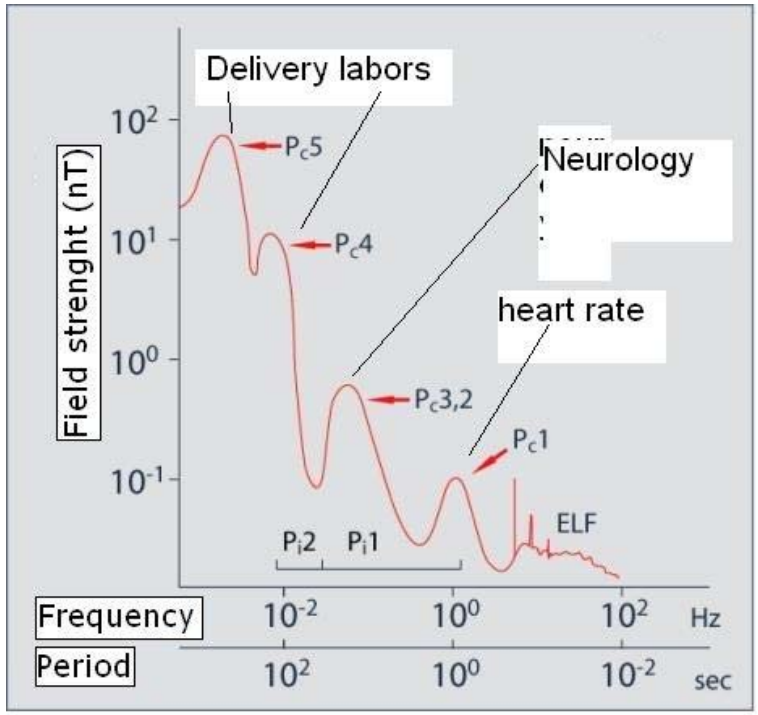
The accuracy of his statistical correlations and the choice of objects for them is still higher than in many up-to-date-studies, especially in similar spheres of knowkedge

One of his results, namely the evident dependence of mortality on solar cycle, statistically meaningful, but different in two cities at different latitudes confirms the importance of geomagnetic pulsations.

Ideas and Data Processing. Problems and contradictions

- Even now, the majority of statistical results are obtained on global geomegnetic (or even solar) indexes. E.g. Stoupel et al. (2002) studied correlations of mortality with R, AE, and Kp index. Maximal correlations at different time delays from solar cycles (11 year and 27-day) obtained in different studies, lied a basis for scepticism to Chizhevsky results.
- Moreover, a big number of inter-dependent factors leads to difficulty in interpretation of results of statistical studies. Mortality and infarction statistics was considered more intensively, that the other parameters, and we can mention the result by Kleimenova et al. (2001), who found a correlation with Pc1 (1 Hz) occurrence rate in infarctions. Summarizing, we can say that both 27-day and 11-year cyckes are clearly seen in different one-point biological parameters, but dependences vanish after gloval averaging, and the problem of correct statistical discrimination of influencing factors is a necessary step to understand possible physical relations

Geomagnetic pulsations



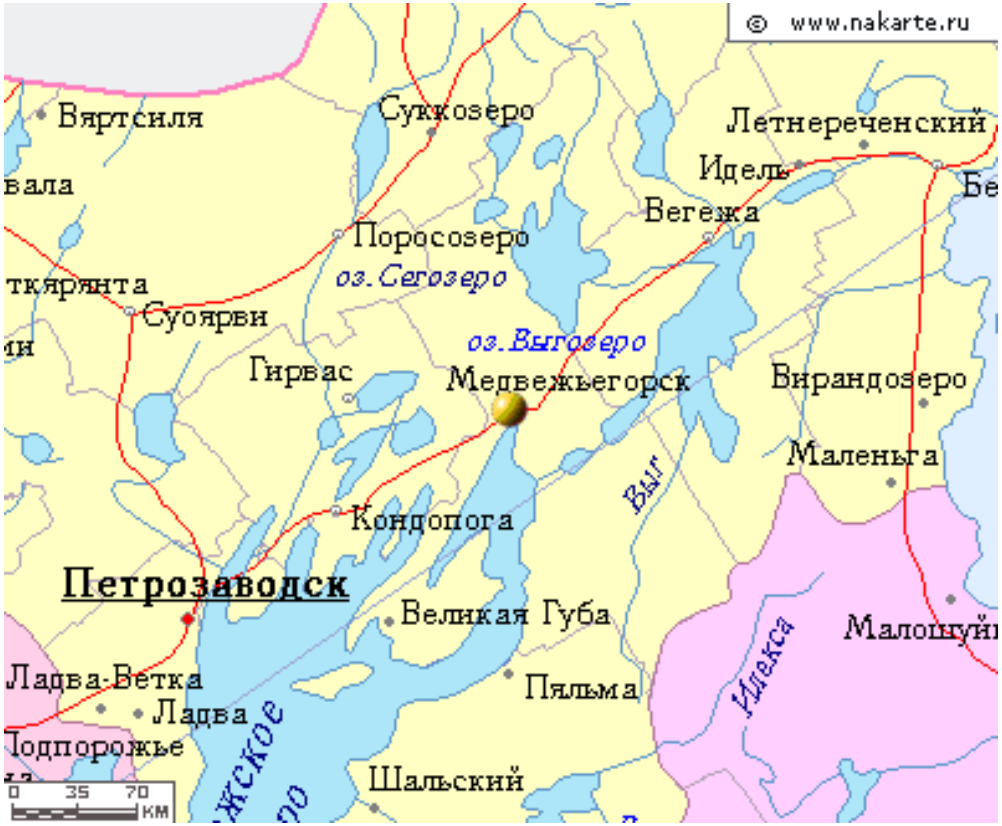
Pc5 – Pi3 – high correlation with global activity, auroral latitudes, high irregular amplitudes at nightime, regular – at morning and afternoon hours, large amplitudes, at disturned periods are seen at middle latitudes

Pc1 – middle and low latitudes, source – ionosphere and thunderstorms, specific seasonal variation, coinsident with infarction occurrence rate, IAR – nighttime, also auroral latitudes

Pc3 – middle latitudes, daytime, maximum at moderate global activity, mechanism for correlation - ???

Pc4 – sub-auroral latitudes, big amplitudes, weak correlation with geomagnetic activity, daytime, late delivery labor periods

Data



Geographic

Lat = 62°55‘N

Lon=34°27' E

CGM

Lat = 59.16

Lon= 111.83

L=3.83

Low industrial interfefernce

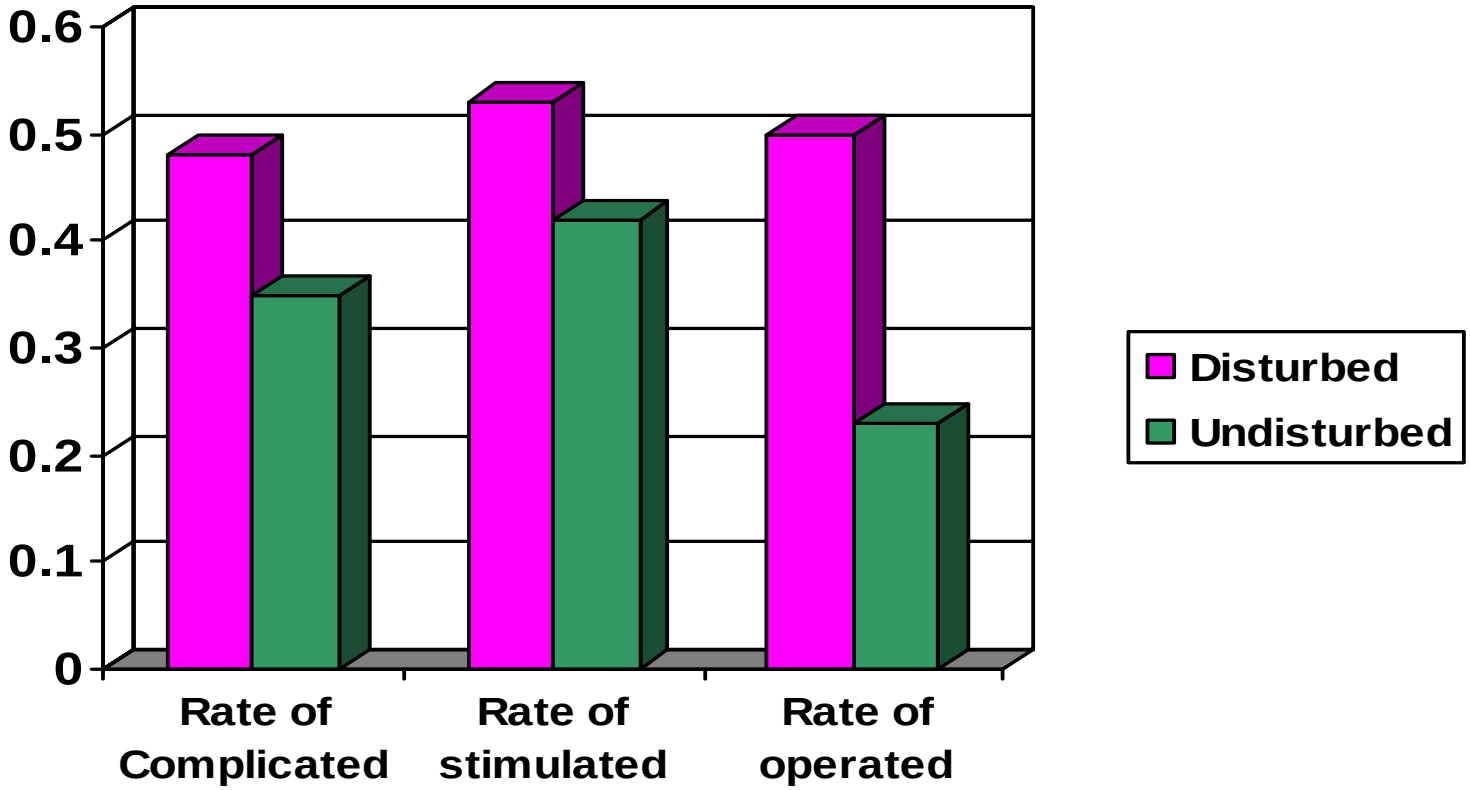
140 birth histories in 1999

Data Processing.

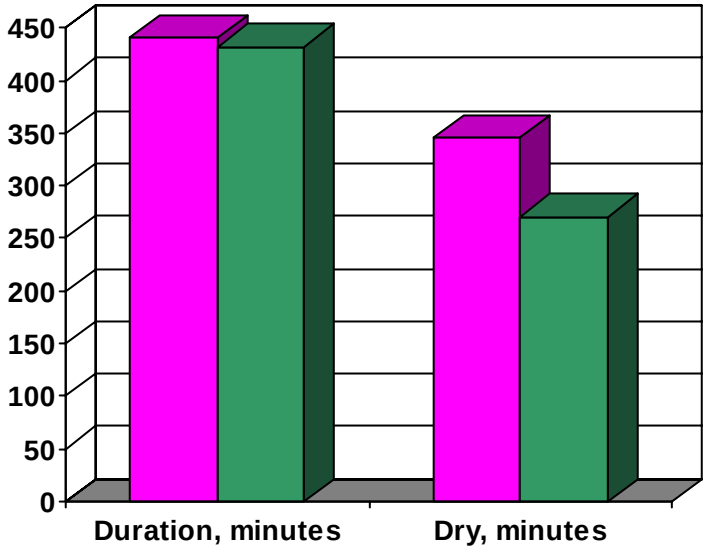
- 1. Main anthropometric parameters: age, height, weight, basin measurements;
- 2. Previous pregnancies, common and gynecological diseases, infections
- 3. Current pregnancy complications and percularities
- 4. Last delivery history: date, gestation, start, duration of main periods, complications, obstetric tactic
- 5. Parameters of a newborn: weight, length, Algar, health status.

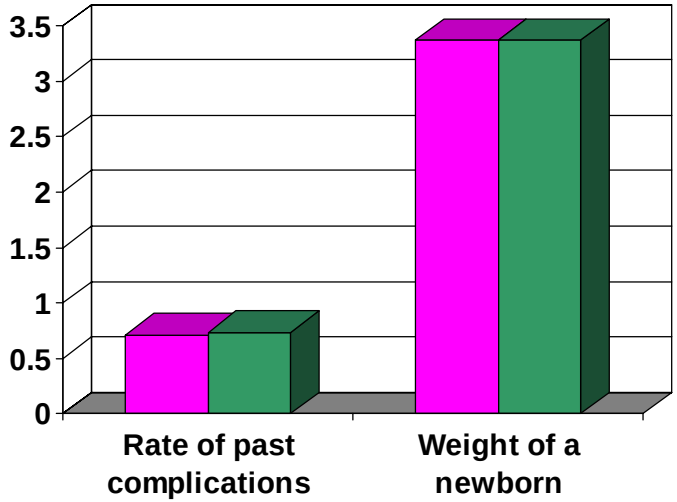
- All the days of births are divided into two groups with daily maximal Kp>3 and <3. The sets are almost equal, 69 and 40 cases, respectively. The majority of delivery histories have all the important information for each day.

Results. Magnetic activity and delivery complications



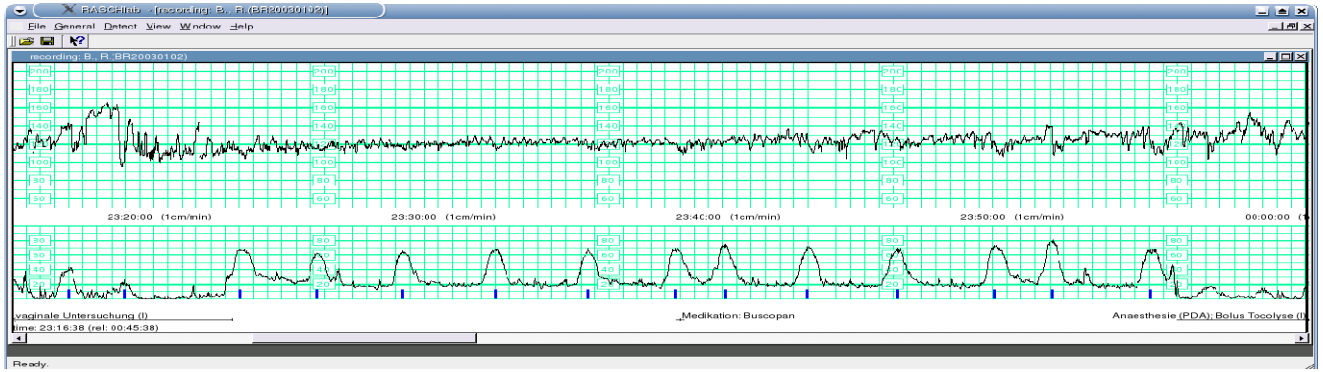
Two more diagrams





One of often complications is the early loss of amniotic fluid. This results in averagely longer dry period for disturbed days. The right diagram shows, that weight of newborns and rate of woman with different complications on the past are equal for both groups of days

Discussion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Anaesthesie (PDA); Bolus Tocolyse (I)
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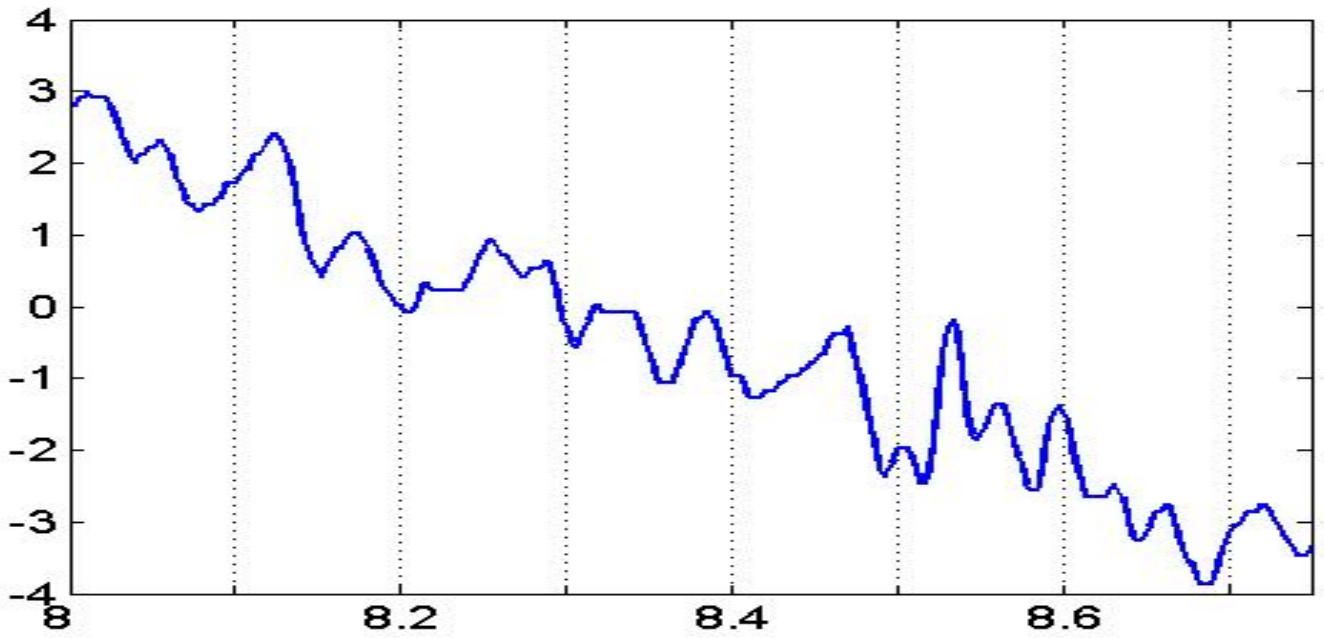
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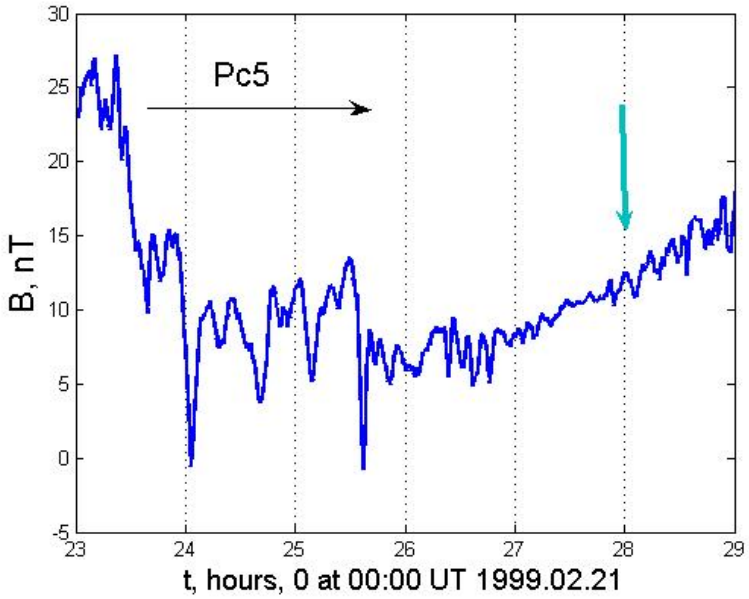
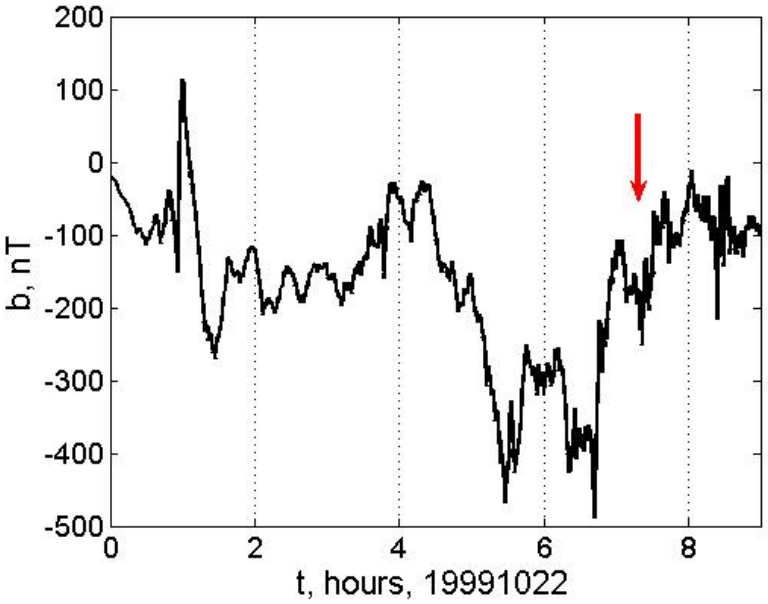
Examples





Typical pulsations in Pc4-5 range for moderately disturbes days, amplitudes are about 5-10 nT in Pc5 and 1-2 in Pc4 range

Great storm on October 22, 1999

Amplitudes are >100 nT at NUR (L=4) !!!

Some ideas about Physics

- At moderate disturbances no clear relation between pulsations' amplitude and frequency of delivery complications is found.
- At highly disturbed days, when big amplitudes are seen in all freauency ranges increase of complications occurrence rate is quiet cear.
- We associate this effect with the regulation mechanism od delivery processes. Physiological delivery requers very complicates and coorfinated regulation of power, frequency and direction of tension. The eigen-frequency of the process changes in a systematic way from 10-20 minutes to 1 minute. If an exterbal disturbance becomes comparable with the cerebral governing signal, the delivery labor is disordered.

Summary

- A positive correlation exists between geomagnetic activity and frequency of delivery complications;
- At the next step the detailed parameters of geomagnetic disturbances will be studied, but it is already clear that at least big geomagnetic storms are dangerous
- The seasonal variations of delivery complications, independently found by Karelian group with two maxima near equinox periods confirms this conclusion

- A bad prognosis for delivery process during big magnetic storms, if it is reproduced at more representative statistics, can make some corrections into obstetric management and even into family planning. A possibility and reasonability of field compensation is debatable.