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Dependence of Cerebral-Cortex Activation in Women on Environmental Factors

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Abstract—The investigation of female physiological reactions to different meteorological conditions and space weather is relevant, since there are little experimental findings in this field. The purpose of this work is to determine how the level of cerebral-cortex activity in women depends on the meteorological and cosmophysical parameters of weather and space processes. We studied electroencephalograms (EEGs) recorded at rest in the sitting position and with eyes closed. We performed four series of measurements of brain bioelectrical activity from February to June 2013. We found that the level of cortical activity recorded by EEG changed significantly during these 6 months. Significant differences were detected between the cortical activity and the parameters of weather and space processes; namely, an increase in the air temperature and a decrease in the wind speed and cosmic-ray energy result in a decrease in the activity rate of the right occipital lobe.

Keywords: environmental factors, electroencephalogram, cerebral-cortex activation

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INTRODUCTION

The dynamics of environmental factors are usually not taken into consideration in psychological and psychophysiological studies, although they have a significant effect on qualitative and quantitative data, thus questioning the reproducibility of conditions and results. The cerebral cortex provides mental performance, consciousness, and the interactions between an organism and environment; it also takes part in the adaptation to fluctuations in environmental conditions by selectively changing the level of activity.

A number of studies have been performed concerning the effect of space processes (Doronin et al., 1998; Karpin and Kostryukova, 2004; Pobachenko, 2007; Tsygankov, Grigor'ev, 2009; Kanunikov et al., 2010; Khodanovich et al, 2011; Khasnulin et al., 2011; Mulligan, Persinger, 2012; Khorseva, 2013) and weather conditions (Soroko et al., 2009; Kholmansky, 2009; Gudinova and Akimova, 2010; Vodolazhskaia et al., 2010; Vodolazhskiĭ and Vodolazhskaia, 2013) on the spectra electroencephalograms (EEG).

For example, I.E. Kanunikov et al. found that the changes in Earth's magnetic field correlate positively with the parameters of spatial synchronization of the right temporal leads in EEG; the authors suppose that this is the result of adaptation to the stress caused by the changes in geomagnetic activity.

According to K.V. Tsygankov and P.E. Grigor'ev, the activity of the left hemisphere is dominant as a result of interplanetary magnetic field polarity (both in the range of days and years), while the activity of the right hemisphere increases in the years of maximal geophysical storminess.

M.G. Vodolazhskaia et al. used the method of electroencephalography to prove that the cerebral processes are highly sensitive to wind, temperature, atmospheric pressure, and humidity (Vodolazhskaia et al., 2010).

According to the results of our study, an increase in the solar activity rate leads to a decrease in the level of color perception and in cognitive-task performance in young women. The weather and space factors that had greatest effect on cognitive performance were the solar magnetic field (SMF), wind speed, and solar cosmic rays (Pavlov and Kamenskaya, 2013a).

According to S.P. Smyshlyaev and P.A. Blakidnaya et al., there is certain evidence that heliogeophysical and meteorological factors are related. The elevation of solar activity from minimal to maximal during the 11-year-long cycle leads to an increase in air temperature, cloud cover, wind speed, and the parameters of atmospheric photochemical processes of ozone formation (Smyshlyaev et al., 2005; Blakidnaya et al., 2010).

Thus, our study is relevant, since there are little experimental data on the physiological reactions of the human organism to various weather and cosmic factors; the interpretation of such data is difficult due to the complex relationships between solar and Earth processes and the effects of deep-space radiation is poorly studied.

We chose young women as subjects because a more detailed study of the effects of environmental factors on neurophysiological processes in women of reproductive age is needed for the protection and promotion of health in the next generation.

Both men and women with meteotropic reactions have marked cardiovascular dysfunction; however, in women these changes are more pronounced (Grigoruk and Katyuchin, 2004; Solov'ev et al., 2014).

The purpose of this work is to determine how the level of cerebral-cortex activity in women depends on the meteorological and cosmophysical parameters of weather and space processes. We analyzed the data basing on a tradition that dates back to the studies of A.L. Chizhevsky (1976): each of the studied cosmophysical parameters and physiological reactions caused by them is investigated during several periods of time.

MATERIALS AND METHODS

The main method used in this study is a comparison of the intensity of different environmental factors (meteorological and space processes) and the level of cerebral-cortex activity. The cerebral-cortex activity was measured by its electrophysiological reactions (EEG desynchronization rate). As early as in the middle of the 200th century, G. Megun and G. Moruzzi Fokina, et al., 2007 found that the elevation of cortical and subcortical activity results in an increase of EEG desynchronization rate, i.e., higher frequency and lower amplitude of the main EEG rhythms. Thus, the level of desynchronization is a physiological marker of cortical activity.

The subjects were ten female students of the Herzen State Pedagogical University of Russia; the students were young adults (according to the classification of the International Conference on Age Classification, which took place in Moscow in 1965), i.e., 23–34 years old (25.9 ± 3.5 years). This age group was chosen since this is the most stable age period in the life of women. All the subjects were right-handed.

We performed four series of measurements of brain bioelectrical activity during the following time periods: from February 19 to March 5, 2013 (series 1); from March 5 to March 29, 2013 (series 2); from April 25 to May 20, 2013 (series 3); and from May 22 to June 11, 2013 (series 4). These time periods are suitable for measurements since they include a half of the annual cycle (a half-cycle) of meteorological and space processes, which contains both maximal and minimal values of the parameters. The EEGs were recorded in different days of a period, once per each of the subjects. The total number of analyzed EEGs is 40; thus, the time distribution of measurements was even during the whole period of study.

The EEGs were recorded during 5 min at rest in the sitting position and with eyes closed. We used an Encephalan-EEGR-19/26 electroencephalograph, Mini modification (Medicom MTD, Russia). Four pairs of electrodes were placed symmetrically on the points of the right and left hemispheres according to the standard 10–20 system (F3, F4, C3, C4, P3, P4, O1, and O2). The reference electrodes (A1 and A2) were placed behind the ears near the mastoid processes. Grounding electrodes were placed on Fz position. The resistance was 10–30 kΩ. We used the Encephalan program (professional version, 2012) to identify and remove all oculomotor, muscular and electrocardiographic artifacts, spikes, and sharp waves.

The spectrum parameters were determined in the following frequency ranges: delta-1 (D1) = 0.50–2.0 Hz, delta-2 (D2) = 2.0–4.0 Hz, theta (T) = 4.0–8.0 Hz, alpha (A) = 8.0–13.0 Hz, beta-1 (B1) = 13.0–24.0 Hz, and beta-2 (B2) = 24.0–35.0 Hz. We analyzed the power spectra using the relative power (RP) values in the main bands of each lead (%); then we z-normalized the RP values calculated by the following equation:

$$x' = (x - x_{\mathrm{m}})/y, \tag{1}$$

where x' is the normalized value of power, x is the value of RP, x_{m} is the arithmetic mean of RP in the group of 10 subjects, and y is the standard deviation. The level of EEG desynchronization in each of the leads was estimated on a five-point scale. The dominance of normalized RP values in D1 range was scored 0 points; in D2 range, 1 point; in T range, 2 points; in A range, 3 points; in B1 range, 4 points; and in B2 range, 5 points (Mukhin et al., 2011).

The levels of desynchronization in each of the leads were then matched with 7 geocosmic and 14 regional (St. Petersburg) meteorological indices. The values of geocosmic indices are available online at the site of the National Geophysical Data Center (NOAA): SMF (the average daily force of solar magnetic field, μT), SsN (SunSpot Number), F10.7fl (the average monthly flow of solar radiation at a frequency pf 2800 MHz), CR (the energy of cosmic rays per hour of universal time, MeV), Dst (the storminess of the geomagnetic field per hour of universal time, nT), A_{p} (the average monthly index of geomagnetic activity, nT), and A_{e} (the index of auroral electrojet per hour of universal time, nT). We used the meteorological indices available on the websites http://www.pogodaiklimat.ru and http://www.pogoda.by for each of the days of the period of study. Time (time of measurements), Wind (wind speed, m/s), Shows (horizontal visibility, m), T (air temperature measured at a height of 2 m above earth surface, °C), Td (dew point, °C), F (relative humidity, %) T_{e} (effective temperature, °C), T_{es} (solar effective temperature, °C), P (atmospheric pressure at

Table 1. Dynamics of meteorological and geocosmic indices in the period of study

Series	T	Clouds	Shows	Wind	CR	SsN	F10.7fl	A_p
Series 1	–3.2	7.7	8800	2.6	9170.4	42.1	105.8	5.8
Series 2	–2.8	6.5	8000	2.6	9202.5	57.9	111.2	9.0
Series 3	13.5	7.5	10000	1.9	8972.3	75.6	128.2	7.5
Series 4	19.5	6.2	10000	2.2	8722.4	70.8	125.0	10.9

For the explanation of abbreviations here and in Tables 2 and 3, see Materials and Methods.

the sea level, GPa), P_0 (atmospheric pressure at the level of the weather station, GPa), T_{min} (minimal daily temperature °C), T_{max} (maximal daily temperature °C), T_{amp} (the maximal amplitude of daily temperature values), and Clouds (cloud cover, points).

For the statistical analysis of data, we used the mean values and standard deviations. The relationships between the parameters were measured by Spearman correlation analysis and regression analysis. The statistical significance of results was estimated with the use of the following criteria: correlation coefficient r with a suitable significance level ($p \leq 0.05$; $p \leq 0.01$), scattergrams created for the visual analysis of the representativeness of found correlations, coefficient of determination R^2, and F-test and the calculation of a suitable significance level ($p \leq 0.05$; $p \leq 0.01$) by ANOVA for proving the effect of independent variables (weather and geocosmic indices) on dependent variables (the levels of EEG desynchronization) in simple and multiple regression analysis.

In order to determine the most significant correlations between the EEG parameters and weather and geocosmic indices, which vary linearly during the studied half-year period, we used the method of principal component analysis (factor analysis) with factor rotation by the Equamax method.

RESULTS

Statistically significant correlation was observed between some of the weather and geocosmic indices and the level of EEG desynchronization. These indices varied within a wide range during the studied half-year period. According to the data presented in Table 1, the air temperature and horizontal visibility increase from series 1 to series 4, while the cloud cover and wind speed decrease. The geocosmic parameters also changed: the energy of cosmic rays decreased from winter to summer, while the parameters of solar activity (SunSpot Number and the flow of solar radiation) increased. In response to an increase in solar activity from series 1 to series 4, the index of geomagnetic activity A_p also increased.

The correlation analysis showed that there are a number of correlations between the levels of EEG desynchronization in the main leads and the values of meteorological and geocosmic indices.

During the first series of measurements (February–March 2013), negative correlations were found between the level of desynchronization in the left occipital lead and the value of Shows ($r = -0.67$; $p \leq 0.05$) and Time ($r = -0.65$; $p \leq 0.05$) (Fig. 1). According to the results of simple regression analysis, the share of explained variance of the dependent variable (O1) is 55% for the correlation with Shows value ($F = 9.73$; $p \leq 0.01$) and 43% for the correlation with Time value ($F = 6.08$; $p \leq 0.05$).

The data suggest that the lower the value of horizontal visibility and the earlier the measurements are taken, the greater the level of desynchronization in the left occipital lead is (i.e., the higher the activation rate of the visual cortex in the left hemisphere is).

Negative correlation was observed between the value of Time and the level of desynchronization in the left parietal lead ($r = -0.65$; $p \leq 0.05$), which also proves that the activity of the left parietal lobe is higher in the morning and midday hours. The significance of this correlation is proved by 46% of explained variance of the dependent variable, i.e., the level of desynchronization in the left parietal lead ($F = 6.86$; $p \leq 0.05$).

Based on the functions of the left parietal lobe, we suppose that in the morning and midday hours the analysis of visual and auditory information by association areas is more effective. Speech performance involving the assessment of weight, shape, size, or surface texture perceived by skin receptors is also higher. Spatial orientation and the skill of georeferencing provided by interactions with the medial entorhinal cor-

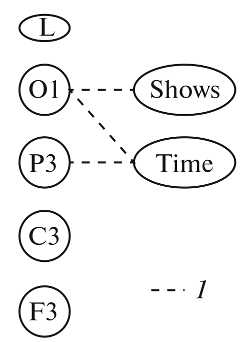

Fig. 1. Correlation pleiade of studied parameters in the first series of measurements. For the explanation of abbreviations here and in Figs. 2–4, see Materials and Methods. L is the group of leads in the left hemisphere; (*1*) $p \leq 0.05$.

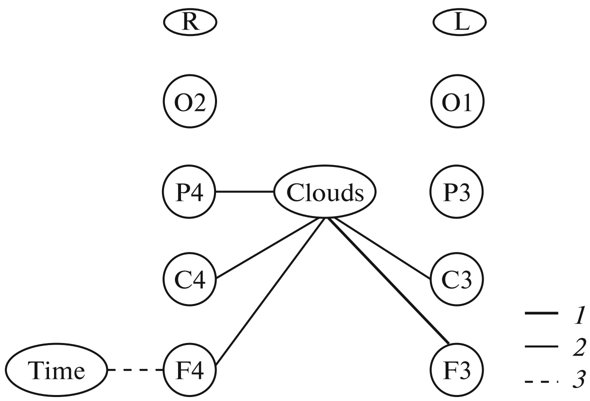

Fig. 2. Correlation pleiade of studied parameters in the second series of measurements. R and L are the groups of leads in the right and left hemispheres, respectively; (*1*) $p \leq 0.01$ and (*2*, *3*) $p \leq 0.05$.

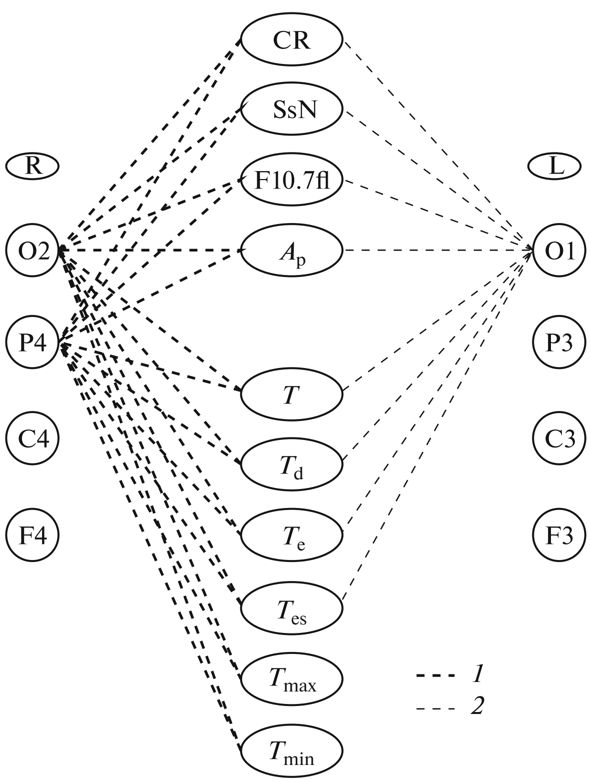

Fig. 3. Correlation pleiade of studied parameters in the third series of measurements. (*1*) $p \leq 0.01$; (*2*) $p \leq 0.05$.

tex, which is the center of navigation, is more effective (Agadzhanyan et al., 2005; Sargolini et al., 2006).

During the second series of measurements (March 2013), a number of strong positive correlations were found between the values of Clouds and the level of desynchronization in both of the frontal lobes (right: $r = 0.74$, $p \leq 0.05$; left: $r = 0.81$, $p \leq 0.05$) and in both central leads (right: $r = 0.76$, $p \leq 0.05$; left: $r = 0.71$, $p \leq 0.05$) (Fig. 2). Moreover, the level of desynchronization in the right parietal lead also correlates positively with the value of Clouds ($r = 0.67$, $p \leq 0.05$). The effect of the Clouds parameter on the level of desynchronization in listed leads is proved by F values obtained in ANOVA tests and a significant share of explained variance of dependent variables, i.e., the levels of desynchronization (42 to 61%).

We suppose that the low level of cloud cover leads to a decrease in the total level of desynchronization in frontal and central leads; the reduction of desynchronization starts in the left frontal lobe.

Thus, the low level of cloud cover during the second series of measurements (as compared with the first and third series) can reduce the activity of the association areas of the left frontal lobe, which can lead to a decrease in the efficiency of the formation of complex behavioral acts based on all sensory signals in response to environmental factors.

Statistically significant negative correlations were found between the level of desynchronization in the right frontal lead and the value of the Time parameter ($r = -0.68$; $p \leq 0.05$); the share of explained variance is 51% ($F = 8.37$; $p \leq 0.05$).

The measurements were taken from 12:00 to 19:00 MSK. In other words, the level of desynchronization in the right frontal lobe is higher in the morning; then it decreases, which leads to a lower efficiency of cognitive task performance.

During the third series of measurements (April–May 2013), a number of strong negative correlations were found between the level of desynchronization in the right occipital lead and the values of CR ($R^2 = 0.58$), SsN ($R^2 = 0.71$), F10.7fl ($R^2 = 0.71$), and A_p ($R^2 = 0.71$), as well as temperature indices T ($R^2 = 0.73$), T_d ($R^2 = 0.58$), T_e ($R^2 = 0.70$), T_{es} ($R^2 = 0.52$), T_{max} ($R^2 = 0.67$), and T_{min} ($R^2 = 0.72$) ($p \leq 0.01$; R^2 is the coefficient of determination of dependent variables, i.e., the level of EEG desynchronization; Fig. 3).

Strong correlations were also found between the level of desynchronization in the right parietal lead and the following indices: T ($R^2 = 0.70$), T_d ($R^2 = 0.59$), T_e ($R^2 = 0.69$), T_{es} ($R^2 = 0.48$), T_{max} ($R^2 = 0.64$) and T_{min} ($R^2 = 0.70$), CR ($R^2 = 0.50$), SsN ($R^2 = 0.68$), F10.7fl ($R^2 = 0.68$), A_p ($R^2 = 0.68$) ($p \leq 0.01$). It remarkable that most of the coefficients of determination are higher than 0.50, which means that the meteorological and cosmic factors have a significant effect on the level of desynchronization in the right occipital and parietal lobes. Moreover, the same negative correlations (although with lower level of significance; $p \leq 0.05$) were found between all listed indices and the level of desynchronization in the left occipital lead (the share of explained variance is around 52%).

The results suggest that the higher the air temperature, the index of geomagnetic activity, the sunspot number, the flow of solar radiation, and the energy of cosmic rays (solar) are, the lower the activity rate of both occipital lobes (mainly the right one) is.

During the fourth series of measurements (May to June 2013), a number of strong negative correlations were found between the level of desynchronization in the right frontal lead and the values of SsN ($r = -0.77$; $p \leq 0.01$) and F10.7fl ($r = -0.77$; $p \leq 0.01$); at the same time, the level of desynchronization in the right frontal lead correlated positively with the index of geomagnetic activity A_p ($r = -0.77$; $p \leq 0.01$) (Fig. 4).

The same negative correlations (although with a lower level of significance ($p \leq 0.05$) were found between all listed indices and the level of desynchronization in the right central lead; The share of explained variance of dependent values (desynchronization in F4 and C4 leads) was 61 ($p \leq 0.01$) and 47% ($p \leq 0.05$), respectively. Thus, an increase in the level of desynchronization in the right frontal and central leads results from an increase in geomagnetic activity. Elevated solar activity leads to a decrease in the level of desynchronization (i.e., the level of cortical activity) in the association area of the right frontal lobe.

According to the results of factor analysis, the relationships of desynchronization levels, meteorological parameters, and geocosmic leads have a five-factor structure. The Kaiser–Meyer–Olkin measure of sampling adequacy is 0.51; Bartlett's sphericity coefficient is <0.01. Accordingly, factor analysis is suitable for this population. Remarkably, the factor analysis was used for the whole series of measurements; thus, the amount of data was increased and the share of explained variance was higher (71%).

The first of the factors, which was the most important, may be called physiologic–cosmometerorological; the parameters with maximal factor weight were temperature parameters T_d (0.83), T_e (0.78), T (0.76), CR (–0.72), Wind (–0.67) and the level of desynchronization in the right occipital lead O2 (–0.63) (Table 2).

Thus, the higher the air temperature and the lower the wind speed and the energy of cosmic rays, the lower the level of desynchronization in the right occipital lead is, i.e., the level of activity of the right occipital association areas.

The third of the factors is also remarkable. It may be called the electroencephalogaphic factor, and it contains all the EEG parameters of the following leads: F3 (0.81), C3 (0.80), F4 (0.74), C4 (0.70), and O1 (0.34). Such correlations indicate that all the parameters of EEG desynchronization can be physiologically related, since the cerebral cortex is affected by nonspecific stimulating and inhibitory signaling systems.

Factors 2, 4, and 5 contain meteorological and geocosmic indices and describe the effect of geophysical processes on weather parameters; however, this study is not aimed at the detailed analysis of such effects.

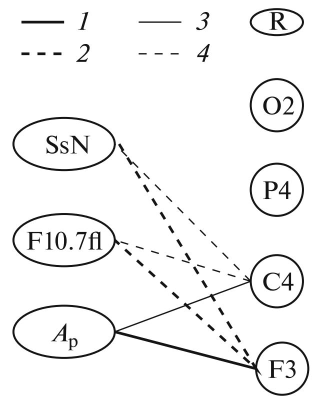

Fig. 4. Correlation pleiade of studied parameters in the fourth series of measurements. (*1*, *2*) $p \leq 0.01$; (*3*, *4*) $p \leq 0.05$.

DISCUSSION

We found that many of the meteorological and geocosmic factors affect the level of cortical activation in different ways depending on the series of measurements, i.e., on the seasonal dynamics of weather and geophysical processes. This conclusion corresponds with the data of V.N. Shepovalnikov and S.I. Soroko (1992), who supposed that the human body is more affected by the fluctuations of environmental factors than by their absolute values.

For example, In February and March 2013, the activity of visual cortex in the left hemisphere was higher in the morning hours and at lower visibility. This may result from the fact that lower amount of light increases the difficulty of visual perception.

In March 2013 (series 2), the cloud cover was lower; i.e., the amount of sun light was higher, which caused a decrease in the activity of the association areas of the left frontal lobe. Such an effect may result from mental and emotional fatigue and decreased efficiency of cognitive performance.

In April and May 2013 (series 3), the air temperature and solar activity (as well as, probably, geomagnetic activity) increased, which led to a decrease in the activity of occipital lobes (mainly the right one). These factors have a pronounced effect on the activity of the right occipital lobes, which is proven by the high values of explained variance obtained from linear regression models (Table 3). The deactivation of the right occipital cortex in this period was indicated by the shift of EEG power spectra to D1 and T frequency ranges. According to the data of L.A. Dikaya (2010), the activity of parietal and occipital cortex and the coherence of theta rhythm in these lobes increase when composing music. The author suggests that such effect results from the activation of attention processes, recognition of emotional images in memory, and heuristic search for new images and solutions related to some emo-

Table 2. Results of factor analysis

Indices	Factors				
	1	2	3	4	5
T_d	**0.832**	0.348	0.050	0.000	0.202
T_e	**0.779**	0.309	0.021	0.394	0.230
T	**0.758**	0.302	0.044	0.407	0.234
CR	**–0.719**	–0.374	–0.027	–0.161	–0.253
Wind	**–0.668**	0.068	0.280	–0.144	–0.295
O2	**–0.631**	0.026	0.269	0.050	0.258
P_0	–0.073	**–0.956**	–0.024	–0.040	–0.037
P	–0.077	**–0.956**	–0.024	–0.041	–0.037
SsN	0.456	**0.725**	–0.261	0.137	0.144
F10.7fl	0.595	**0.628**	–0.256	0.042	0.184
T_{amp}	0.183	–0.509	–0.144	0.488	0.075
F3	0.117	0.162	**0.813**	–0.297	–0.141
C3	0.002	0.055	**0.799**	–0.323	–0.121
F4	–0.082	–0.142	**0.740**	0.169	–0.075
C4	–0.104	–0.126	**0.695**	0.151	0.145
O1	–0.323	0.182	**0.338**	0.060	0.312
F	–0.113	–0.070	0.057	**–0.899**	–0.140
Clouds	0.021	0.014	0.032	**–0.854**	–0.037
A_p	0.386	0.433	0.136	0.542	–0.225
Dst	0.072	0.018	–0.184	–0.097	**–0.834**
Time	0.083	0.186	–0.177	0.112	**0.582**
SMF	–0.255	0.120	0.144	0.300	**–0.580**
Shows	0.442	0.025	–0.059	0.209	**0.550**

The table gives the values of factor weight for each of the factors.

Table 3. Results of simple regression analysis of the third series of measurements

Leads (dependent variables)	Indices (independent variables)	Coefficient of determination (R^2)	Simple linear regression equation
O2	SsN	0.71	O2 = –0.508(SsN) + 40.375
O2	F10.7fl	0.71	O2 = –0.508(F10.7fl) + 67.092
O2	A_p	0.71	O2 = –0.640(A_p) + 6.8
O2	T	0.73	O2 = –0.256(T) + 5.456

tional experience; our previous study proves this suggestion (Pavlov and Kamenskaya, 2014).

Multiple regression analysis showed that the activity of the right occipital lobe in April and May 2013 was most of all affected by air temperature, the flow of solar radiation at a frequency of 2800 MHz, and the energy of cosmic rays. The explained variance of desynchronization leveling the right occipital lead was 93% ($F = 25.79$; $p \leq 0.001$). The equation of multiple regression takes the following form:

$$\mathrm{O2} = 1.384(\mathrm{F10.7fl}) + 0.01(\mathrm{CR}) - 0.691(\mathrm{T}) - 259.677.$$

In May and June 2013 (series 4), an increase in geomagnetic activity (which was probably the result of its seasonal dynamics) led to an increase in the activity of the frontal and central leads of the right hemisphere; at the same time, an increase in solar activity resulted in a decrease in the activity of the association areas of the right frontal lobe. These data generally correspond with the conclusion of D.R. Belov et al. that the correlation between the geomagnetic activity and EEG spectra are especially significant in the frontal and central leads (Belov et al., 1998).

The right hemisphere is more sensitive to the influence of geomagnetic and solar activity. This corresponds with the literature data on the activation of the right hemisphere in response to intense environmental exposure. K.V. Tsygankov and P.E. Grigor'ev (2009) found that the right hemisphere is more sensitive to solar activity and the atmospheric infrasound.

Thus, changes in the geophysical parameters of weather and space processes lead to the activation of the cortex of the right hemisphere; the changes in solar activity and in the geomagnetic field have different effects.

An increase in the number of sunspots and the flow of solar radiation inhibits the activity of the right prefrontal cortex, which can result in a decrease in cognitive performance. This is proved by the data obtained by A.A. Konradov and A.I. Mikhailov: these authors observed a significant decrease in the reaction time and the energy potential in response to increased solar activity (Konradov et al., 2004; Mikhailov et al., 2004). In another study it was proved that an increase in solar activity leads to increased anxiety and lower stress tolerance (Kameneva et al., 2014). We have found that an increase in solar activity resulted in greater sensory-motor reaction time, a lower rate of task performance, a lower efficiency of digit recognition in color background, and the reduction of adaptation resources (Pavlov and Kamenskaya, 2013b).

According to the result of factor analysis, the higher the air temperature and the lower the wind speed and the energy of cosmic rays, the lower the level of desynchronization in the right occipital lead and the level of activation of the right occipital lobe are. Thus, more favorable weather and geocosmic conditions provide a lower level of activation of the right occipital lobe. This conclusion is proved by the study of V.P. Leutin and E.I. Nikolaeva (2008), who observed the activation of the left hemisphere under usual favorable conditions, and by the study of E. Motta (Motta et al., 2011), who observed a decrease in the frequency of epileptiform activity and epileptic seizures in the summer period, which is a more suitable period for recovering the adaptation resources of the body than spring or winter.

Our findings show that the dynamics of weather and geocosmic factors during a half-year-long period have different local effects on the activity of cerebral cortex in women in young adulthood. The occipital cortex of the right hemisphere is most sensitive to the influence of these factors. No effect of weather conditions on the arousal reaction was observed; this is proved by the composition of the third factor determined in the factor analysis, which contained only the parameters of EEG desynchronization and no meteorological or geocosmic indices.

CONCLUSIONS

We can conclude that the correlations found between the level of EEG desynchronization and environmental factors prove that these factors have both direct and indirect effects on the processes of cortical activation.

The level of cortical activity is higher in the conditions of lower visibility and in the morning or midday hours; low cloud cover, higher air temperature and solar activity, lower wind speed, and lower energy of cosmic rays are associated with cortical deactivation. The effect of geomagnetic activity is multidirectional: its elevation increases the activity of occipital lobes and decreases the activity of the right frontal lobe.

The solar magnetic field, the indices of auroral electrojet and geomagnetic storminess, and the values of air humidity and atmospheric pressure do not correlate with the level of cortical activity.

This is a pilot study, and the correlations found can hold completely only for given period of time and can only be typical of the given age and sex. Further research in other age and sex groups is needed. In addition, it could be helpful to estimate the influence of weather and geocosmic factors during a long-term psychophysiological and electrophysiological study in order to verify these data under consistent conditions.

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