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Solar-Terrestrial Relations and Physics of Earthquake Precursors

Influence of heating experiments on parameters of Schumann resonances

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Abstract. Recently the significant increase in intensity of researches in the field of the fissile impact on geophysical processes in various environments is noted. Special attention is paid to a research of impact on an ionosphere of a potent short-wave radio emission of heating stands. Today experiments on change of an ionosphere are made generally at stands HAARP, EISCAT in Tromse (Norway). Within the Russian campaign (Tomsk) EISCAT/heating (AARI_HFOX) made from October 19 to October 30, 2016 experiments on impact on an ionosphere F-layer by the radiation potent HF. For assessment of impact of these experiments on geophysical processes mathematical methods carried out the analysis of change of the parameters of the Schumann resonances received on the basis of data from the station of constant observation of the Schumann resonances in the city of Tomsk, the Tomsk State University (Russia).

1 Introduction

Heating stands unlike traditional methods of diagnostics of an ionosphere give the chance to influence targeted natural ionospheric processes, and, perhaps, to operate these processes. Impact on an ionosphere by powerful Shortwave radiation leads to the fact that the ionosphere (F layer) is heated — in the field of a wave electrons of ionospheric plasma disperse, and disperse nonuniformly, so, the conduction changes and the periodic structure of ionospheric currents is created.

Besides the scientific results received in works with heating stands such as discovery of low-frequency radiation of ionospheric current systems (Getmantsev's effect), research of plasma instabilities, optical luminescence of the indignant area, is available also a possibility of applied application of these installations.

HAARP on Alaska and "EISCAT" heating stands in Norway technically are the most potent. These stands have the high effective power of radiation, a wide frequency range of "heating", a possibility of radiation in various modes, including the continuous, pulse and amplitude-modulated with a modulation frequency from extremely low-frequency to very low-frequency range, a possibility of scanning of a beam.

Schuman's resonance is called the phenomenon of formation of standing electromagnetic waves of low and ultralow frequencies between the Earth's surface and an

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ionosphere.

The Earth and its ionosphere are a huge spherical resonator which cavity is filled with the low conductivity environment. If the electromagnetic wave which arose in this environment after rounding of the globe coincides again with characteristic phase (enters a resonance), then it can exist long time.

Average monthly experimentally observed values of the most legibly expressed resonant frequencies make about 8, 14, 20, 26, 32 Hz. At higher frequencies resonances become almost imperceptible. For the main – the lower, most intensive spectrum line variations of a resonant frequency within 7-11 Hz are possible, but mostly within a day the dispersion of resonant frequencies usually lies in limits ± (0.1-0.2) Hz.

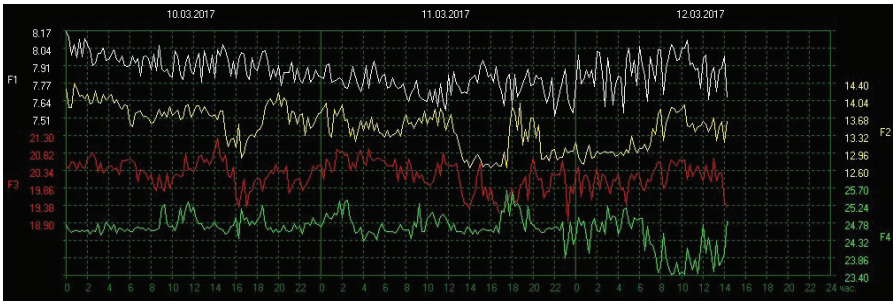

Fig. 1. Fragments of the relation of Schumann resonance`s frequencies on local time according to complex monitoring in Tomsk, local time is expressed in the Tomsk Summer Standard Time (TSST). TLDV =UTC+ 7 hours

The central frequencies of resonances are defined by wave guide parameters Earth - an ionosphere, namely height of the lower bound of D-layer and a profile of its conduction which, in turn, are defined by energy of the ionizing radiation of the Sun and the mesosphere. The size of cooperative energy of these radiations on the day party exceeds radiant energy on the night party, depending on position of the Sun on an ecliptic, by 200 - 700 times that involves the considerable difference of heights and profiles of conduction of D-layer.

Energy factor (q), as well as frequency, is the parameter of the frequency characteristic of the resonator Earth - ionosphere and also depends mainly on a profile of conduction of a D-layer.

Amplitude of a resonance is defined, first of all, by energy of a rating from the world storm centers which activity depends on their local time of day. On the other hand, energy in a point of reception is defined by its arrangement of rather these centers, namely: the azimuths influencing a ratio of amplitudes of horizontal components of the field; the remoteness defining attenuation owing to losses and owing to change of section of a wave guide; a phase in the point of reception defining change of amplitude according to a phase of a standing wave, and also parameters of local storm activity.

For these reasons amplitude of resonances cyclically changes with the daily period, but its value and the nature of change can differ for various points of observation at preservation of separate common regularities

Single-pass variations arise owing to single-pass impact on an ionosphere of the potent external factors changing parameters of its ionization. The splashes in solar space radiation which are result of solar flashes and splashes in galactic space radiation concern to those.

On the basis of the aforesaid it is possible to draw a conclusion that studying influence of experiments on heating of an ionosphere on parameters of Schumann resonances will

help to draw a conclusion on the nature of impact of such experiments on a geophysical situation, and also on activity of people.

2 Method of investigations

In October, 2016 we were given an opportunity to analyse and study this influence or to draw a conclusion on its absence. A number of experiments on studying of the phenomena in a F-layer of an ionosphere caused by an ionosphere rating potent HF - radiation was conducted to the period from October 19 to October 30 within the Russian campaign EISCAT/heating (AARI_HFOX).

Knowing the period and time of impact on an ionosphere, we can estimate change of parameters of the Shumann resonances at the corresponding time terms to draw a conclusion about influence of experiments at heating stands on a geophysical situation.

As the frequency and good quality of the Schumann resonances, are parameters of the frequency characteristic of the resonator Earth — an ionosphere, it is logical to assume that these parameters are not subject to influence of experiments on heating while amplitude of a resonance is defined by energy of a rating from the world storm centers, therefore is more subject to influence from the external phenomena.

For an assessment of a geophysical situation during an experiment data of complex monitoring in Tomsk, (data source — http://sosrff.tsu.ru/) are taken.

The data submitted on the website http://sosrff.tsu.ru/ are digitized and kept in the form of a sequence of data from 14 till October 29, this period includes a row of control days and days of carrying out an experiment.

For the analysis of influence the following technique, for each of components was chosen:

1) mean daily value of each parameter D is calculated

2) the expectation for daily values of each parameter M is calculated

3) M/D relation – the relative size of the interesting parameter is calculated.

The step 3 allows to receive the normalized values of parameter.

4) by imposing of schedules of original values of parameter and received on a step 3 relations, the visual assessment of nature of change of input data in the dates corresponding to days of carrying out experiments of EISCAT becomes.

3 Results of investigation and discussion

During the investigation it was detected the increasing of the absolute and relative amplitude of the component a1, a2, and a3 during the period is present from October 20 to October 29, that speaks about relation of value of these components of Schuman resonances on heating of an ionosphere.

The assumption made theoretically that the frequency and the energy factor are probably not subject to influence from experiments on an ionosphere rating potent HF - radiation, is also confirmed, results for one of components of frequency and energy factor of the Schuman resonances are given in figures.

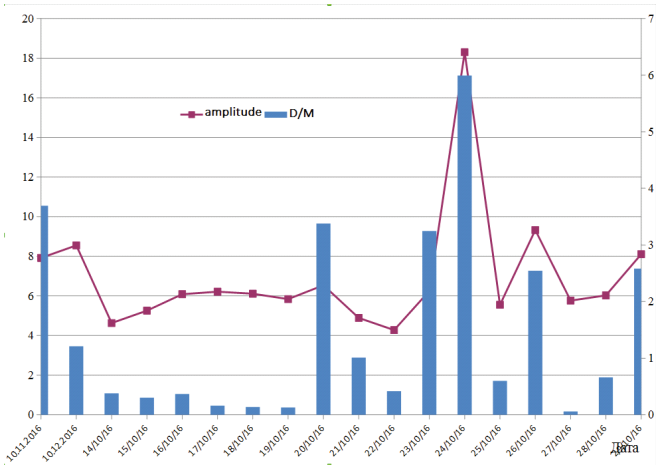

Fig.2. Result of the analysis for a component a1 of amplitude of the Schumann resonances.

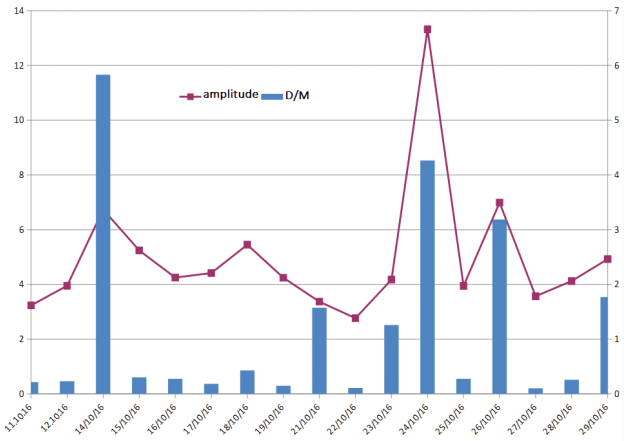

Fig. 3. Result of the analysis for a component a2 of amplitude of the Schumann resonances.

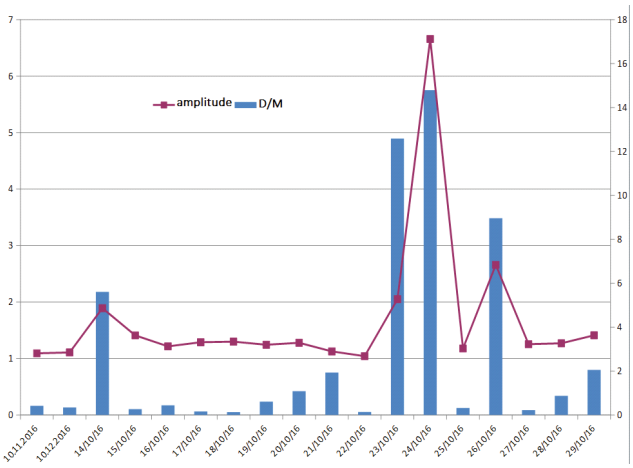

Fig. 4. Result of the analysis for a component a3 of amplitude of the Schumann resonances.

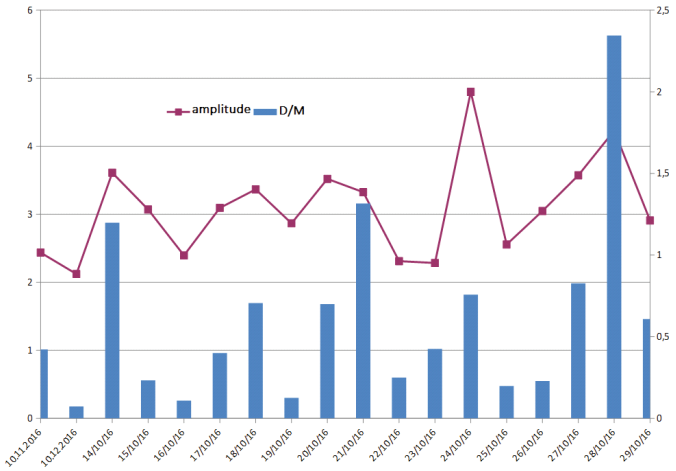

Fig. 5. Result of the analysis for a component a4 of amplitude of the Schumann resonances.

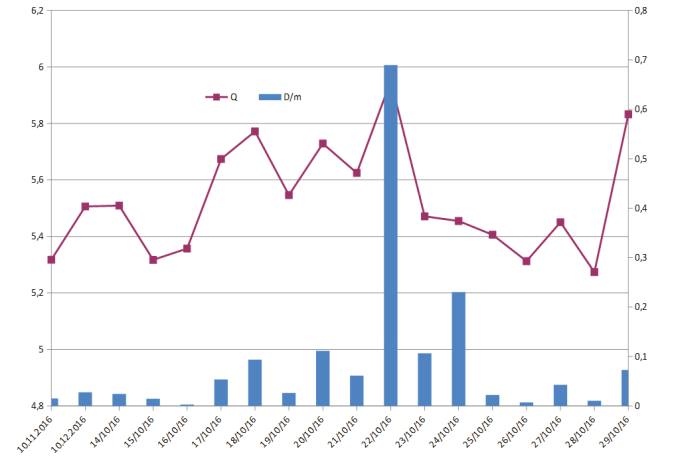

Fig. 6. Result of the analysis for a component q1 of energy factor of the Schumann resonances.

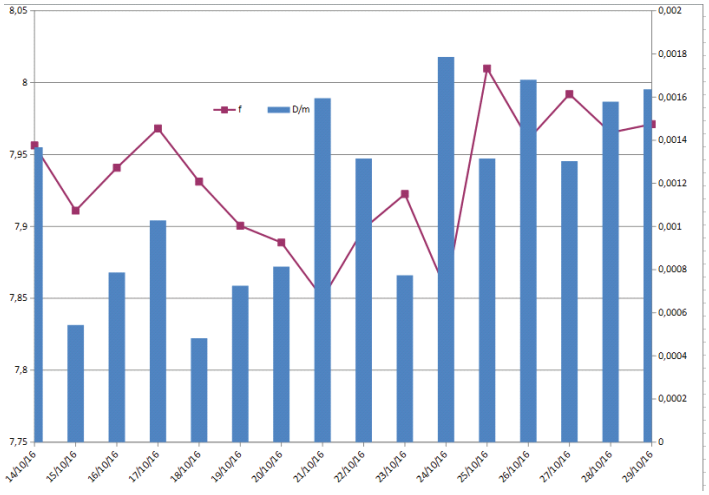

Fig. 7. Result of the analysis for a component f1 of frequency of the Schumann resonances.

4 Conclusions

In a number of the countries researches for the benefit of assessment of a possibility of simulated influence on natural geophysical processes are actively conducted now. Works are in the considered area at a stage of fundamental and search and conceptual researches.

The existing methods of the fissile impact on a geophysical situation, except for nuclear detonations, have much a smaller power engineering, than geophysical indignations of natural origin. For example, indignations of a magnetic field of Earth during magnetic storms in tens of times exceed what managed to be created by means of heating stands now. That is why the main idea by which foreign experts when developing new technologies of creation of geophysical weapon are guided is use of the resonance and trigger phenomena. It means activization of natural natural processes with a release of their big internal energy by means of much less potent impact on a geophysical situation.

Recently the significant increase in intensity of researches in the field of the fissile impact on geophysical processes in various environments is noted. The majority of these researches has the closed character. However at the modern level of development of technologies creation of the geophysical weapon capable to make global impact on the population and infrastructure of the states is represented improbable and also to estimate technical capability of development of perspective tools (weapon), the bound to simulated influence on an ionosphere (a magnetic field of Earth).

At the same time it is impossible to exclude that by analogy with the forecast of space weather during the conducted geophysical researches efficient methods of prediction of other anomalies and cataclysms can be developed. It is apparent that preliminary information on the forthcoming adverse geophysical situation can be used in the military purposes that speaks about relevance of a problem of geophysical ensuring activity of armed forces.

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