Seasonal and annual course of aeroelectric field in Kamchatka

S. Smirnov

Institute of Cosmophysical Research and Radio Wave Propagation FEB RAS,
Kamchatka region, Russia, e-mail sergey@ikir.ru

ABSTRACT: The analysis of the seasonal and annual course of aeroelectric field of middle latitude observatory Paratunka [52^{0}58′ N, 158^{0}15′ E] in Kamchatka during 1997-2008 is carried out. The seasonal intervals of greatest and lowest values, stable from year to year, are observed. The change of annual course of aeroelectric field in near ground air at the observatory, that is in the active geodynamical region, is shown. The great positive course has changed for light negative one. It is possible connected either with the change of the intensity of radon emanation or volcanic activity in Kamchatka.

1. INTRODUCTION

Long-term continuous measurements of aeroelectric field (Ez) are of great significance in the study of the dynamics of atmospheric process. Annual courses at different observatories may be completely opposite and depend on local geophysical factors. Both positive [Harrison, 2006] and negative [Marcz and Harrison, 2003] trends were observed.

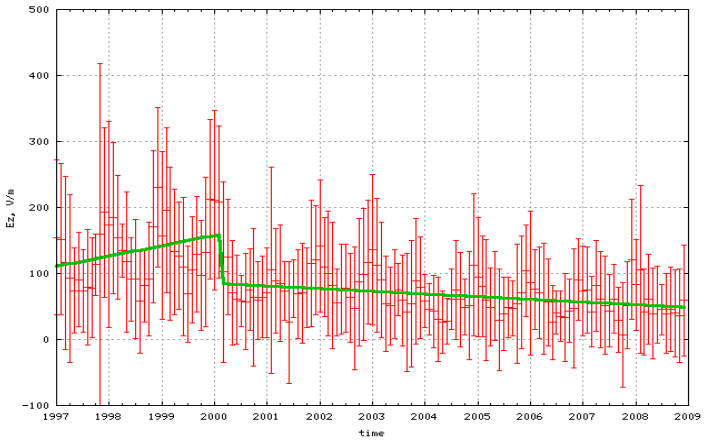

Fig. 1 Monthly average, dispersion and Ez annual course at “Paratunka” observatory

2. MEASUREMENT TECHNIQUES

The observations were carried out at mid-latitude observatories of the Eurasian continent. In Kamchatka the "Paratunka" observatory, IKIR FEB RAS, (λ=158,25°E; φ=52,9°N) is located in the South of Kamchatka peninsular, to the west from the Avacha Bay in a valley protected by ranges of small hills at the height of 50 m

above the sea level. "Pole-2" sensor was used to measure the electric field intensity; it was constructed in a Branch of Voeikov Main Geophysical Observatory, by Research Center of Remote Atmosphere Sounding. The sensor is installed in a field which is 200 m from the administration building at the height of 3 m; the area around it is cleaned from trees within the radius of 12 m.

3. MAIN RESULTS AND DISCUSSION

The field total variation at the station for the period 1997 to 2009 is shown in Fig.1.

The more detailed analysis of the annual course at "Paratunka" observatory showed the following. From January, 1997 to February, 2000 there was a positive course with the angular coefficient of +1.3; from March, 2000 to 2009 the course was negative with the angular coefficient of -0.3. Such a broken graph may be explained by the fact that the observatory is located in an active geodynamic region. The field variation may be influenced by several factors. One of them is the change of seismic mode. Fig.2 illustrates M/lg(R) values for strong seismic events in the vicinity of the observatory, where M - earthquake magnitude, and R - distance from the observatory to an epicenter. If this value is more than 3 the observatory is within the zone of earthquake effect. Such events could influence the mode of radio active gases (radon) discharge from the ground and, consequently, the ionization process in the near ground layer of the air.

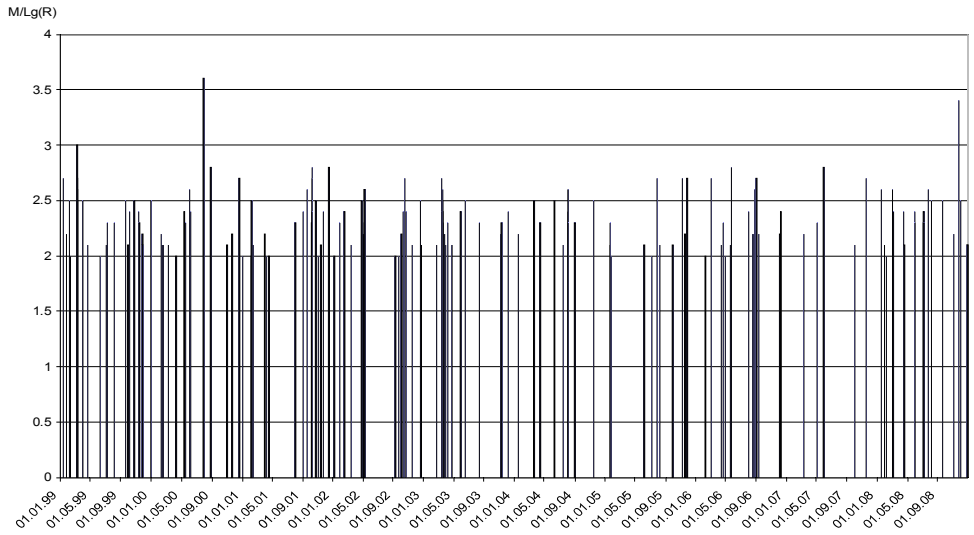

Fig.2. Graph of M/lg(R) values for strong seismic events near "Paratunka" observatory. M - earthquake magnitude, R - distance from the epicenter to the observatory.

Another important factor is the volcanic activity in Kamchatka. Volcano ash outbursts may affect the electric field state in the near ground air [Smirnov, 2008]. 29 active volcanoes are located in Kamchatka. The change of volcanic activity result in the change of heavy aerosol concentration in the air and, thus, air electroconductvity also becomes different. Fig.3 illustrates histograms of month distribution of Ez averages (1997-2009) (a) and of snow level (2008-2009) (b) at "Paratunka" observatory. Snow in the area of the observatory covers the ground from November to the end of May.

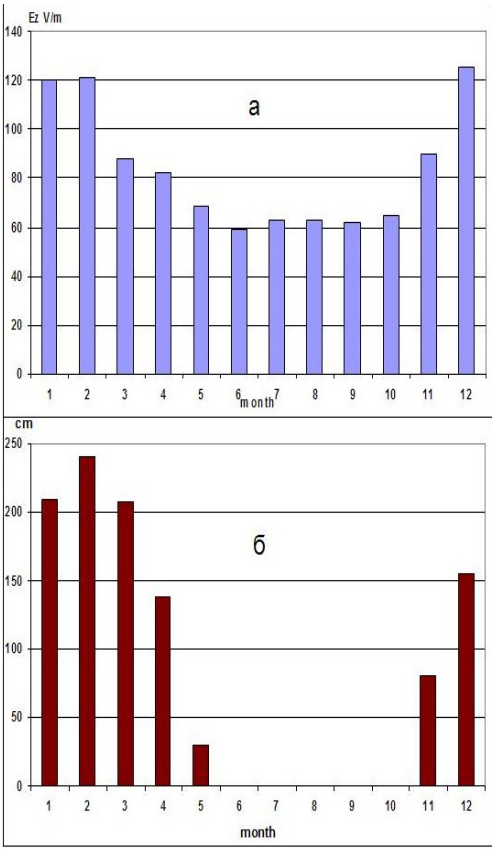

Fig. 3. Histograms of month distribution of Ez averages (1997-2009) (a) and of snow level (2008-2009) (b) at "Paratunka" observatory

4. CONCLUSIONS

In the result of continuous observations the analysis of quasi-stationary state and of the dynamics of atmospheric electric field at "Paratunka" observatory, IKIR FEB RAS, [52^{0}58' N, 158^{0}15' E] for the period 1998 to 2009 was performed. An important linear course of monthly averages of Ez field intensity located in the active geodynamic region in Kamchatka was discovered. A supposition was made that annual course of aeroelectric field may be affected by the modes of radioactive emanations from the ground and of volcanic activity due to ash outbursts into the atmosphere.

ACKNOWLEDGEMENTS

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