Changing the Electric Field before Winter Precipitation

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ABSTRACT: The effect of decrease of an electric field in the front of precipitation was observed. If the radar data shows the appearance of the precipitation zone which is located at a distance of 80 km or more then electric field decreases. This happens only for precipitation which are moving to the point of observation. If the precipitation will go past the point of observation electric field changes slightly. The increase of the field coincides with the start of precipitation. The effect of 4 - 12 hours decrease of the electric field in front of snowfall was detected in 17 cases from 39 cases of precipitation.

INTRODUCTION

Pprecipitation particles (drops, snowflakes, snow pellets, hail) often carry the charges, which leads to changes in the electric field at the location of precipitation. However, charges of precipitation particles can not change the electric field at a distance of 80 km or more from the cloud. The reduction of the electric field at large distances from the region of precipitation has been found in the experiments. It can not explan in the framework of the known theoretical models. That paper describes the experimental data that were obtained at the scientific testing ground of the Central Aerological Observatory in the Moscow region.

DECRIPTION OF EXPERIMENTAL EQUIPMENT

The study of the electric field variation has been produced in the Central Aerological Observatory (CAO), Dolgoprudy, Moscow Region, where meteorological radar is installed. The electric field sensors (EFS-2/50) which were developed in the CAO produce measurement of the electric field. The detector of precipitation (RIO) was developed to record the instantaneous intensity of precipitation. RIO operates in the infrared range and allows to record the beginning and ending of precipitation to the nearest minute and measure the intensity of solid and liquid precipitation with an accuracy of ± 50%. Exterior view of devices and an example of recording data is shown is shown in Figure 1.

Figure 1.Exterior view of devices (EFS-2/50 (left) and RIO) and an example of recording data.

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Specifications and description of EFS-2/50 is given in [1]. The sensors showd good metrological characteristics. The drift of zero for the observation period from November to March did not exceed 5 V / m One of the sensors has been fitted with a device for checking the slope inclination measuring characteristics of EFS-2/50, which has changed the control ± 10% for months . It should be noted that the plates of the sensors during the measuring were oriented downwards, rather than upwards as usual. By simultaneous observations from the standard oriented sensor was determined reduction factor equal to the selected mode of installation 3.2 ± 20%. The selected arrangement of sensors allowed to provide long-term performance of the sensors in an unattended mode. Service of one of the sensors has been made only during the flowering trees and poplar fluff that caused deposits on the leading edge of the rotating grounded plate.

Scientific testing ground is equipped by S-band weather radar. It can detect precipitation at distance 300 Km. Archived radar data were used to analyze. On the figure 2 comparison between radar data, electric field and intensity of precipitationfor1 January 2013 year is shown.

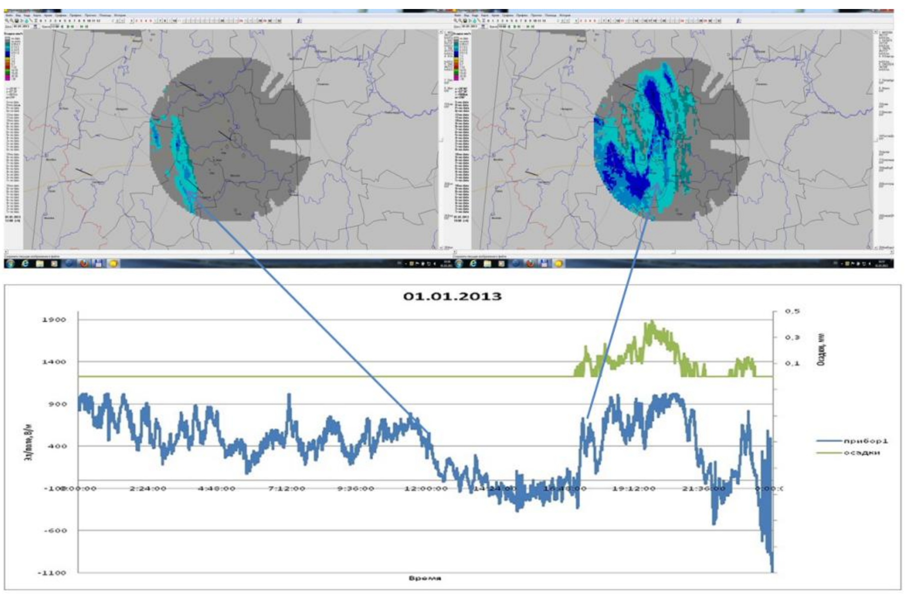

Fig.2. Data of meteorological radar, RIO and EFS-2/50 01.0.0213. On the upper position the map of weather radar reflectivity at the time of reduction of the electric field (left) and the moment of increase of the electric field (right). Arrows indicate those points on the graph of the electric field. The green line shows a graph of precipitation according to RIO (mm/h). The blue curve is the electric field without reduction coefficient (raw data - V/m).

The analysis of data has discovered effect of decrease of an electric field in the front of precipitation. If the radar data shows the appearance of the precipitation zone which located at a distance of 80 km or more then electric field decreases. This happens only for precipitation which are moving to the point of observation. If the precipitation will go past the point of observation electric field changes slightly. The increase of the field coincides with the start of precipitation. The effect of 4 - 12 hours decrease of the electric field in front of snowfall was detected in 17 cases from 39 cases of precipitation of varying intensity on 01.12.12 to 03.03.13. In 3 cases the effect was observed, and there was no snow. In the 13 cases present masking effect by the electric field from precipitation. In 6 cases the change of electric field and snowfall were weak. According to the upper-air observations in the timing of the field reduction marked the passage of atmospheric fronts over the point of observation. However, the fronts without precipitation did not cause a similar effect.

Thus the physical effects which lead to a change at electric field is not specified yet. The electric field is determined by the sum of the electric field of the Earth and the charges in the atmosphere. The observed effect may be due to the generation of charges in the cloud tops during the formation of precipitates, or changing the position of the existing charges in the atmosphere. The answer may be obtained by measuring the vertical electric field profile in the atmosphere

CONCLUSIONS

The results of these studies can be used to predict the falling of winter precipitation. In comparison with the radar data, this method has a large uncertainty in the determination of the time of precipitation, however, in the lack of weather radar its use can be justified.

REFERENCES

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