**Recording of whistlers and high-altitude discharges during Bezymyanniy and Shiveluch volcano eruptions**

Malkin E. I., Cherneva N.V., Kazakov E. A., Shevtsov B. M.

Institute of Cosmophysical Research and Radio Wave Propagation (IKIR FEB RAS), Paratunka, Russia

Continuous monitoring of natural electromagnetic radiation in VLF range by a VLF direction finder, which records signals of electric and magnetic components of the electromagnetic field and determines the direction of radiation arrival in real time, made it possible to create a long-term data base of lightning activity on Kamchatka peninsula. Statistical analysis of the obtained data base was carried out to detect whistler generation sources using the data of the Automatic Whistler Detector and Analyzer Network and the World Wide Lightning Location Network. Different electromagnetic signals were recorded during the analysis of the strongest eruptions of Bezymyanniy and Shiveluch volcanoes, observed in 2023, from the corresponding azimuths along the direction to the active volcanoes. The time range, selected for the analysis, is determined by a large number of recorded pulses. For example, the total number of strokes during Shiveluch volcano eruption reached 26101 pulses. In the general data flow, signals of whistler type were detected. Analysis of their disperse characteristics showed the presence of initiating atmospherics that, in its turn, indicates so called long whistlers. Two-hop whistlers were identified by dispersion coefficient, which corresponded to the double passage of the signal from Kamchatka to Australia and back. The heights of the electric discharges were determined by means of interferograms of direct and reflected from the ionosphere radiofrequency atmospherics. The high-altitude distribution of an electric discharge is obtained, the penetration of which into the ionosphere is responsible for the generation of whistlers. The characteristics of volcanic electrical discharges and whistlers can be used to estimate the height of an explosive eruption.

The work was supported by IKIR FEB RAS State Task (subject registration No.124012300245-2).