Evaluation of liquid deposit characteristics by variations of ionizing radiation background level

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Introduction. One of the main components of the atmospheric radiation background is soil radioactive gases and atmospheric radionuclides, which serve as excellent tracers of various atmospheric and geophysical processes.

Monitoring of the radiation background of the surface layer of the atmosphere has shown that its value is not constant and depends on various factors, such as the state of the atmosphere, the time of day, the season of the year and the geographical location of the region. An anomalous increase in the radiation background is observed when liquid precipitation falls. This phenomenon is explained by the processes of leaching of short-lived DPR of radon and toron from the atmosphere. Accordingly, the greater the intensity of rainfall, the more the dose rate increases.

The purpose of this work is to estimate the intensity of precipitation using radiation markers, which used the magnitude of the anomalous surge of the γ-radiation dose rate and the β-radiation flux density during precipitation. In the course of the study, the dependences of the γ-radiation dose rate and β-radiation flux density on meteorological parameters, such as the height of rain clouds, the density and turbulence of the atmosphere, were analyzed.

The simulation took into account the spatial (in the vertical direction) and temporal dynamics of the γ-radiation dose rate, generated by short-lived daughter decay products of radon and toron in the surface atmosphere, washed out to the surface of the earth during rainfall. When calculating the spatial distribution (in the vertical direction) of the volume activity of short-lived daughter decay products of radon and toron, the state of the atmosphere was taken into account.

As a result of assessing the contributions of individual atmospheric radionuclides to the total dose rate for various turbulent diffusion coefficients and the height of the lower edge of the rain clouds, the radionuclides were identified that make the main contribution to the total γ-background. Based on the measured γ-dose dose rate and β-radiation flux density, the calculated values and the dynamics of the rainfall intensity with experimental data were verified.

Conclusion. The good convergence of the calculated and experimental results indicates the possibility of using the parameters of the γ-radiation dose rate and the β-radiation flux density to estimate precipitation intensity.