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ANALYSIS OF OUTDOOR ^{222}Rn AND ^{220}Rn CONCENTRATION MEASURED AT BACAU, ROMANIA: A DETERMINISTIC STUDY

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Abstract

During three years, 2011-2013, time series of ^{222}Rn (radon) and ^{220}Rn (thoron) progeny concentration measured at Bacau, Romania have been analyzed with different deterministic instruments in order to extract valuable information about their deterministic behavior. The time series of data were obtained within the framework of the monitoring program performed by the Environmental Radioactivity Monitoring Station, Bacau. Correlations with the deterministic nature of atmospheric temperature and pressure have been made. The results have been also compared with some previous measurements carried out for indoor radon concentration. In order to extract information about the chaotic characters of the radon/thoron concentration and environmental parameters time series, the Curve length method proposed by Higuchi, the generalized Hurst exponent, and Grassberger-Procaccia algorithm were used. The Higuchi method was chosen due to the fact that is a method capable to obtain stable values of the fractal dimension, even for small data time series. The generalized Hurst exponent may be used in order to extract fractal dimensions for medium time series, and Grassberger-Procaccia algorithm calculates the fractal dimensions directly from time series, the algorithm being simpler and faster than other classical measures derived from deterministic chaos theory.

Key words: environmental radioactivity, fractal dimensions, radon monitoring, time series

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