

RADON ISOTOPES AS AN INDICATORS OF DYNAMIC ATMOSPHERIC PROCESSES

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The study of the behavior of radon isotopes in the surface atmosphere is a relevant task, since radon and thoron are excellent indicators of dynamic processes, such as the vertical and horizontal transfer of air masses, gas exchange in the lithosphere-atmosphere system (the Earth's breath). The behavior of radon isotopes is due to changes in weather conditions, the state of the atmosphere and the surface layer of the soil. Radon and thoron, unlike other tracer gases, are easy enough to measure. Moreover, due to the differences in the nuclear-physical properties of these isotopes, namely, the decay constants, radon and thoron, when measured together, they can carry information about the processes of different time scales. The above defined the purpose of this work - the study of the dynamics of radon and thoron in the surface atmosphere, the identification of patterns on different time scales from daily to annual.

Continuous monitoring of volumetric activity (VA) of radon, thoron and its decay products in the surface atmosphere was made from the end of 2016 in the Tomsk Observatory of Radioactivity and Ionizing Radiation using RTM2200 radon radiometer (Germany) installed 1 m from the earth's surface. RAD7 radiometer (USA) was used to study the vertical profile of VA of radon isotopes. Synchronous measurements of radon and thoron at different heights were made continuously with tact of 30 minutes. Analysis of the monitoring data revealed a number of regularities on the daily and annual scale and the main influencing factors. According to the results of the analysis, regularities were revealed in seasonal dynamics (Fig. 1). Seasonal trend for radon VA is expressed poorly. The minimum values are observed in the period of melting of snow cover. For thoron, a completely different behavior is characteristic - in winter, minimum values are observed, and in the warm period of the year - maximum.

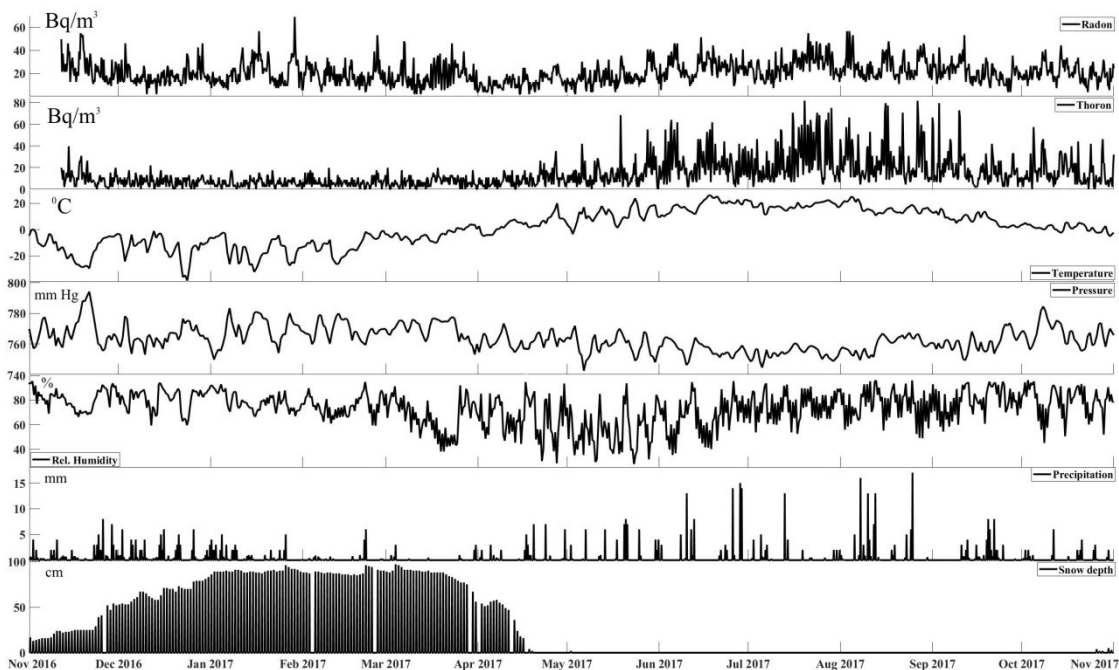


Fig.1. Dynamics of VA of radon isotopes and meteorological quantities

The diurnal variations of the VA of radon and thoron are much larger than the seasonal variations. The diurnal variations of radon and thoron volumetric activity are clearly expressed during periods without rain or snow. The maximum VA of radon is observed in the pre-dawn hours, when the atmosphere is the least mobile, and the minimum - in the daytime, when vertical mixing of air due to turbulent diffusion is maximal. The paper discusses the effect of various meteorological quantities on the magnitude and dynamics of radon isotopes, and a comparison with the results of other authors.