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The Concentration of Selected Cosmogenic and Anthropogenic Radionuclides in the Ground Layer of the Atmosphere (Polar and Mid-Latitudes Regions)

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Abstract : The most important source of atmospheric radioactivity are radionuclides generated as a result of the impact of primary and secondary cosmic radiation, with the nuclei of nitrogen oxygen and carbon in the upper troposphere and lower stratosphere. This creates about thirty radioisotopes of more than twenty elements. For organisms, the four of them are most important: ^{3}H, ^{7}Be, ^{22}Na, ^{14}C. The natural radionuclides, which are present in Earth crust, also settle on dust and particles of water vapor. By this means, the derivatives of uranium and thorium, and long-life 40K get into the air. ^{137}Cs is the most widespread isotope, that is implemented by humans into the environment. To determine the concentration of radionuclides in the atmosphere, high volume air samplers were used, where the aerosol collection took place on a special filter fabric (Petrianov filter tissue FPP-15-1.5). In 2002 the high volume air sampler AZA-1000 was installed at the Polish Polar Observatory of the Polish Academy of Science in Hornsund, Spitsbergen (77°00'N, 15°33'E), designed to operate in all weather conditions of the cold polar region. Since 1991 (with short breaks) the ASS-500 air sampler has been working, which is located in Swider at the Kalinowski Geophysical Observatory of Geophysics Institute of the Polish Academy of Science (52°07'N, 21°15'E). The following results of radionuclides concentrations were obtained from both stations using gamma spectroscopy analysis: ^{7}Be, ^{137}Cs, ^{134}Cs, ^{210}Pb, ^{40}K. For gamma spectroscopy analysis HPGe (High Purity Germanium) detector were used. These data were compared with each other. The preliminary results gave evidence that radioactivity measured in aerosols is not proportional to the amount of dust for both studied regions. Furthermore, the results indicate annual variability (seasonal fluctuations) as well as a decrease in the average activity of ^{7}Be with increasing latitude. The content of ^{7}Be in surface air also indicates the relationship with solar activity cycles.

Keywords : aerosols, air filters, atmospheric beryllium, environmental radionuclides, gamma spectroscopy, mid-latitude regions radionuclides, polar regions radionuclides, solar cycles
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