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BEHAVIOUR OF BERYLLIUM-7 AND LEAD-210 TIME SERIES MEASURED IN SERBIA AND SLOVENIA OVER 1991-2015

Darko Sarvan[1], Dragana Todorović[2], Milica Rajačić[2], Jelena Krneta Nikolić[2], Vladimir Djurdjevic[3], Benjamin Zorko[4], Branko Vodenik[4], Denis Glavič Cindro[4], Jasmina Kožar Logar[4], Jelena Ajtić[1]

1 University of Belgrade, Faculty of Veterinary Medicine, Belgrade, Serbia
2 University of Belgrade, Vinča Institute of Nuclear Sciences, Belgrade, Serbia
3 University of Belgrade, Faculty of Physics, Belgrade, Serbia
4 Jožef Stefan Institute, Ljubljana, Slovenia

Cosmogenic beryllium-7 (Be-7) and a long-lived radon progeny lead-210 (Pb-210) are radionuclides commonly measured in the environmental radioactivity programmes. Although their production mechanisms and points of entry into the atmosphere differ, there is a strong interconnection between their behaviour since they are transported through the atmosphere attached to aerosols. Thus, their abundance is governed by the atmospheric processes and both are considered good tracers of air mass origin.

In this paper, we use the Be-7and Pb-210 specific activities measured in Serbia and Slovenia to investigate the degree of their similarities across a distance of about 500 km. Specifically, in an attempt to distinguish major influencing mechanisms, we apply factor analysis to the radionuclides' measurements conducted over 1991–2015 in Belgrade, Serbia, and Ljubljana and Krško, both in Slovenia. The factor analysis also includes the following meteorological parameters at each sampling site: temperature, cloud cover, relative humidity, precipitation and atmospheric pressure (not available at the Krško site).

The results of the factor analysis show that the communalities of only two factors are already larger than 0.5 for most of the variables. The exceptions are the atmospheric pressure in Belgrade and precipitation in both Belgrade and Ljubljana. The factor loadings of two factors show that: 1) the Be-7 specific activity, temperature, cloud cover and relative humidity are encompassed by factor 1 in all the sites; while 2) the Pb-210 specific activity is described by factor 2 together with atmospheric pressure in Belgrade and Ljubljana, but with precipitation in Krško (where atmospheric pressure is not available). These results imply that the Be-7 and Pb-210 are under different dominant underlying mechanisms.

Over the investigated 24 years, both the Be-7 and Pb-210 measurements across the three sites show a very good agreement in the measurement ranges and overall means. However, a closer examination of the differences in the data time series reveal an exception to this general agreement – during 2005–2012, there is a pronounced increase in radionuclides' concentrations in Ljubljana and Krško, relative to Belgrade. Therefore, factor analysis is also performed for this shorter time period. The obtained factor loadings show a change in the influence of the major two factors. Compared to 1991–2015, the influence of factor 2 on Be-7 increases in Belgrade and decreases in Ljubljana. On the other hand, an influence of factor 1 on Pb-210 decreases in Belgrade, but increases in Ljubljana and Krško. These opposing changes might explain the relatively high differences in the radionuclides' concentrations seen over 2005–2012.

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