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Comparison of the beryllium-7, lead-210 and caesium-137 activity concentrations in the surface air along 45 °N in Serbia and Slovenia

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Activity concentrations of cosmogenic beryllium-7, terragenic lead-210 and artificial caesium-137 are closely observed within environmental radioactivity monitoring programmes in Serbia and Slovenia. In this study, we compare the temporal evolution and seasonal cycles of the radionuclides recorded over 1991–2015 in three locations: Belgrade (44.88333 °N; 20.583333 °E; 95 m a.s.l.), the capital of the Republic of Serbia; Krško (45.950414 °N; 15.512261 °E; 204 m a.s.l.), a town in eastern Slovenia, located ~400 km west of Belgrade; and Ljubljana (46.042356 °N; 14.487494 °E; 292 m a.s.l.), the capital of the Republic of Slovenia, located ~500 km west of Belgrade. The latitudes of these three sites differ only slightly, approximately by 1°.

The similarities between the data sets are evident from their measurement ranges and long-term means. For example, the recorded beryllium-7 activity concentrations fall within the ranges reported for different locations in Europe. In the lead-210 series, the observed values are similar to the activity concentrations reported for some neighbouring regions, but around twofold higher than in locations that are under a significant maritime influence, thus removed from this radionuclide's source. The activity concentrations of caesium-137 at all the sites are of the same order of magnitude and agree with the post-Chernobyl picture of the fall-out in Europe.

However, there are some noticeable differences in the seasonal cycles of these radionuclides at the investigated sites. For example, even though the beryllium-7 seasonal cycles in all the sites exhibit a spring/summer maximum and a winter minimum, the timing of the maximum recorded at the Slovenian sites is agreement with other Western European sites of similar latitude in contrast to the Belgrade site that shows an earlier occurrence of the maximum, more in line with European locations further north.

A possible explanation for the observed dissimilarities could lie in the differences of the meteorological patterns in the investigated sites. According to Köppen-Geiger climate classification, Krško and Ljubljana have Warm temperate fully humid climate with warm summers (Cfb), while Belgrade is characterised by Warm temperate fully humid climate with hot summers (Cfa). Belgrade is located deeper in the continental landmass, and its climate has more of midlatitude continental characteristics, in terms of higher summer temperature, more pronounced seasonal temperature amplitude, and lower precipitation, especially during summer months. These differences in climate affect the transport and removal of the radionuclides from the atmosphere and could lead to the observed dissimilarities. Still, a detailed analysis of the radionuclides' time series and their relation to the time series of the meteorological parameters is needed to better understand their interconnexion.

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