ATMOSPHERIC FLUXES OF RADIONUCLIDES ON MONTHLY TIME -SCALE IN MALAGA (SPAIN)

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ABSTRACT.- Bulk atmospheric deposition of gamma radionuclides (^{7}Be, ^{210}Pb and ^{40}K) has been measured at Málaga (4º 28′ 80″ W; 36º 43′ 40″ N) at a coastal Mediterranean station in the south of Spain, from January 2005 through December 2012 for monthly periods

INTRODUCTION Berylium-7 is one of the radionuclide produced by spallation reactions of cosmic rays with light atmospheric nuclei.^{7}Be rapidly associates primarily with submicron-sized aerosol particles. Lead-210 which is one of the natural radionuclide of the ^{238}U decay series is widely used as a tracer. ^{210}Pb depositional pattern gave us information on continental aerosols in lower troposphere. These two radionuclides with their different sources and therefore are useful to understand the mechanisms of aerosol removal from the atmosphere. These radionuclides have been measured routinely in many places of the word in order to study the description of environmental processes such as aerosol transit and residence times in the troposphere and aerosol deposition velocities. ^{40}K is found in most types of soil and can easily be transported by re-suspended material. Potassium is an important constituent of fertile soil and is an essential nutrient for plant growth and in the human diet. This nuclide has been previously associated with the arrival of coarse re-suspended material (PM10, particulate matter with diameter below 10 µm) from the African continent (Hernández et al., 2005).

MATERIAL AND METHODS.- The sampling site is one of the environmental radioactivity monitoring network stations operate by the Spanish Nuclear Security Council (CSN). The sampling point was located above the ground, on the roof of the Faculty of Sciences, University of Málaga.

Monthly precipitation and dry fallout samples were routinely collected using a steel tray 1m^2 in area as a collecting system and polyethylene vessels of 50 l capacity for rainwater samples reservoirs. Measurements by gamma spectrometry were performed to determine the ^{7}Be, ^{210}Pb and ^{40}K activities of the samples using an intrinsic REGe detector. The peak analysis of ^{7}Be (I= 10.52 %, 477.7 keV), ^{210}Pb (I = 4%, 45 keV) and ^{40}K (I = 11%, 1460.8 keV) was done using GENIE 2000 peak analysis software. The counting time was 172800s.

RESULTS.- Table 1 summarises the main statistical variables calculated for the measured gamma emitting radionuclides (^{7}Be, ^{210}Pb and ^{40}K) in Bq/l over the whole sampling period.

	^{7}Be	^{210}Pb	^{40}K
Average	2,66	0.41	0.23
Geometric mean	2.19	0.34	0.18
Standard deviation	1.70	0.24	0.15
Coeff. of variation	63.9 %	58.7%	68.0%
Minimum	0.6	0.05	0.02
Maximum	8.3	1.32	0.84

The results from fluxes of ^{7}Be, ^{210}Pb and ^{40}K were correlated with five parameters: rainfall amount, rainfall duration, number of dry days and number of wet days. The next table provides the correlation coefficients between the fluxes and the mentioned parameters.

	Flux ^{7}Be	Flux ^{210}Pb	Flux ^{40}K
Precipitation (mm)	0.84	0.89	0.66
Duration of precipitation (min)	0.7,	0.82	0.59
Number of dry days	-0.45	-0.63	0.55
Number of wet days	0.51	0.68	0.61

The depositions of ^{7}Be and ^{210}Pb were well correlated with the amount of precipitation . Such relations have been commonly observed and explained by the fact that rainfall constitutes the major depositional pathway of these radionuclides. As previously observed, correlation of rainfall with ^{210}Pb seems better than with ^{7}Be (Caillet el al., 2001) likely due to a relatively greater contribution of ^{210}Pb from dry deposition.

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