Properties of depositional fluxes of radionuclides at Málaga (coastal mediterranean station)

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The activity concentrations of ^{7}Be, ^{210}Pb and ^{40}K were measured in Málaga, Southeastern Spain (36°43′40″N; 4°28′8″W) in aerosols, precipitation and dry fallout continuously and systematically for eleven years. At the same sampling point, aerosols were collected weekly on filters and monthly precipitation sampling was carried out to study deposition. The deposition of radionuclides on the ground represents an important factor in environmental radioactivity monitoring. To predict the long-term radiological consequences of an accidental deposition of the radionuclides to the ground, it is a prerequisite to know the environmental long-term behaviour of these radionuclides and a relatively large number of values is required for statistically meaningful conclusions. ^{7}Be and ^{210}Pb are highly particle active and they are easily scavenged by aerosols. Little attention is paid to ^{40}K in airborne materials. Its origin is lithogenic and is mainly originated from the suspension of soil. ^{40}K is found in most types of soil and can easily be transported by re-suspended material. This nuclide has been previously associated with the arrival of coarse re-suspended material from the African continent.

The specific activities of ^{7}Be, ^{210}Pb and ^{40}K in bulk deposition varied from 0.30 to 8.3 Bq L^{-1} (mean = 2.6 Bq L^{-1}), 0.05 to 1.3 Bq L^{-1} (mean = 0.39 Bq L^{-1}) and 0.02 to 0.84 Bq L^{-} (mean= 0.20 Bq L^{-1}) , respectively. The temporal variations of radionuclides exhibit similar seasonal behaviour with low values in winter-autumn months and maximum values in spring-summer months. The time variations of the different radionuclides concentrations have been discussed in relation to various meteorological factors and the mean values have been compared to those published in recent literature for other sites located at different latitudes. Bulk depositional fluxes of ^{7}Be, ^{210}Pb and ^{40}K have been evaluated for period of measurements. Bulk depositional fluxes of ^{7}Be , ^{210}Pb and ^{40}K varied between 3 and 1776 Bq m^{-2} $month^{-1}$ (annual mean = 1250 Bq m^{-2} $year^{-1}$), 0.9 to 102 Bq m^{-2} $year^{-1}$ (annual mean = 140 Bq m^{-2} $year^{-1}$ and 0 to 81 Bq m^{-2} $year^{-1}$ (annual mean = 65 Bq m^{-2} $year^{-1}$). Data on the atmospheric depositions of radionuclides in Málaga show that the seasonal variation is not uniform from year to year and the amount of rainfall controls mainly the depositional fluxes.

The specific activities of ^{7}Be and ^{210}Pb in bulk deposition samples showed a similar seasonal trend variation to that of the atmospheric aerosol concentrations. Using the concentrations of ^{7}Be , ^{210}Pb, in air and their depositional fluxes, the deposition velocities of aerosols and washout ratios were calculated. The mean deposition velocity of ^{7}Be and ^{210}Pb over the eleven-year period is approximately 1 cm s^{-1} for both radionuclides and the corresponding washout ratios are 840 and 1190, respectively. The results showed a prevailing influence of amount of rainfall for deposition velocities and other factors such as TSP, the number of rainy days and the number of dry days for washout ratios. A comparison of our measurements and other data obtained at different locations in the world was also made.