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INTRODUCTION. ⁷Be and ²¹⁰Pb are radionuclides which have been measured routinely in many places in order to study the description of environmental processes such as aerosol transit and residence times in the troposphere, aerosol deposition velocities and aerosol trapping by ground vegetation. ⁷Be is one of the radionuclide produced by spallation reactions of cosmic rays with light atmospheric nuclei and rapidly associates primarily with submicron-sized aerosol particles. ²¹⁰Pb is a natural radionuclide of the ²³⁸U series which is widely used as a tracer and its depositional pattern and give information on continental aerosols in lower troposphere. Therefore, these two radionuclides with their different sources are useful to understand the mechanisms of aerosol removal from the atmosphere. ⁴⁰K is also a natural radionuclide and has been associated with the arrival of coarse re-suspended material from the Africa continent. The bulk atmospheric deposition of ⁷Be, ²¹⁰Pb and ⁴⁰K has been measured at Málaga, south-eastern Spain from January 2005 to December 2014, on monthly basis.

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 is located above the ground, on the roof of the Faculty of Sciences (24 m.a.s.l.), University of Málaga (4°28'80" W; 36°43'40" N). Monthly precipitation and dry fallout samples were routinely collected on a monthly basis using a steel tray 1m² in area as a collecting system and polyethylene vessels of 25L capacity for rainwater samples reservoirs. Measurements by gamma spectrometry were performed to determine the ⁷Be, ²¹⁰Pb and ⁴⁰K activities of the samples using an intrinsic REGe detector.

RESULTS AND DISCUSSION

The results from specific activities (in Bq/L) of ⁷Be, ²¹⁰Pb and ⁴⁰K were analyzed to derive the statistical estimates characterizing the distributions. **Table 1** provides: Number of cases (N), arithmetic mean (AM), geometric mean (GM), standard deviation (SD), maximum and minimum values, the coefficient of variation (CV) and Skewness(GI).

Table 1. Summary statistics of the activity concentrations of the radionuclides

	N	AM	GM	SD	MAX	MIN	CV (%)	GI
⁷ Be	120	2.5	2.1	1.6	8.30	0.29	64	4.9
²¹⁰ Pb	120	0.39	0.32	0.23	1.32	0.05	60	6,4
⁴⁰ K	62	0.20	0.17	0.15	0.84	0.02	72	6,5

The specific activity of ⁷Be exhibit their maximum values in spring (**Fig. 1**). The higher values of ⁷Be can be due to the rapid exchange of aerosols between stratosphere and troposphere by contraction of tropopause in the spring season.

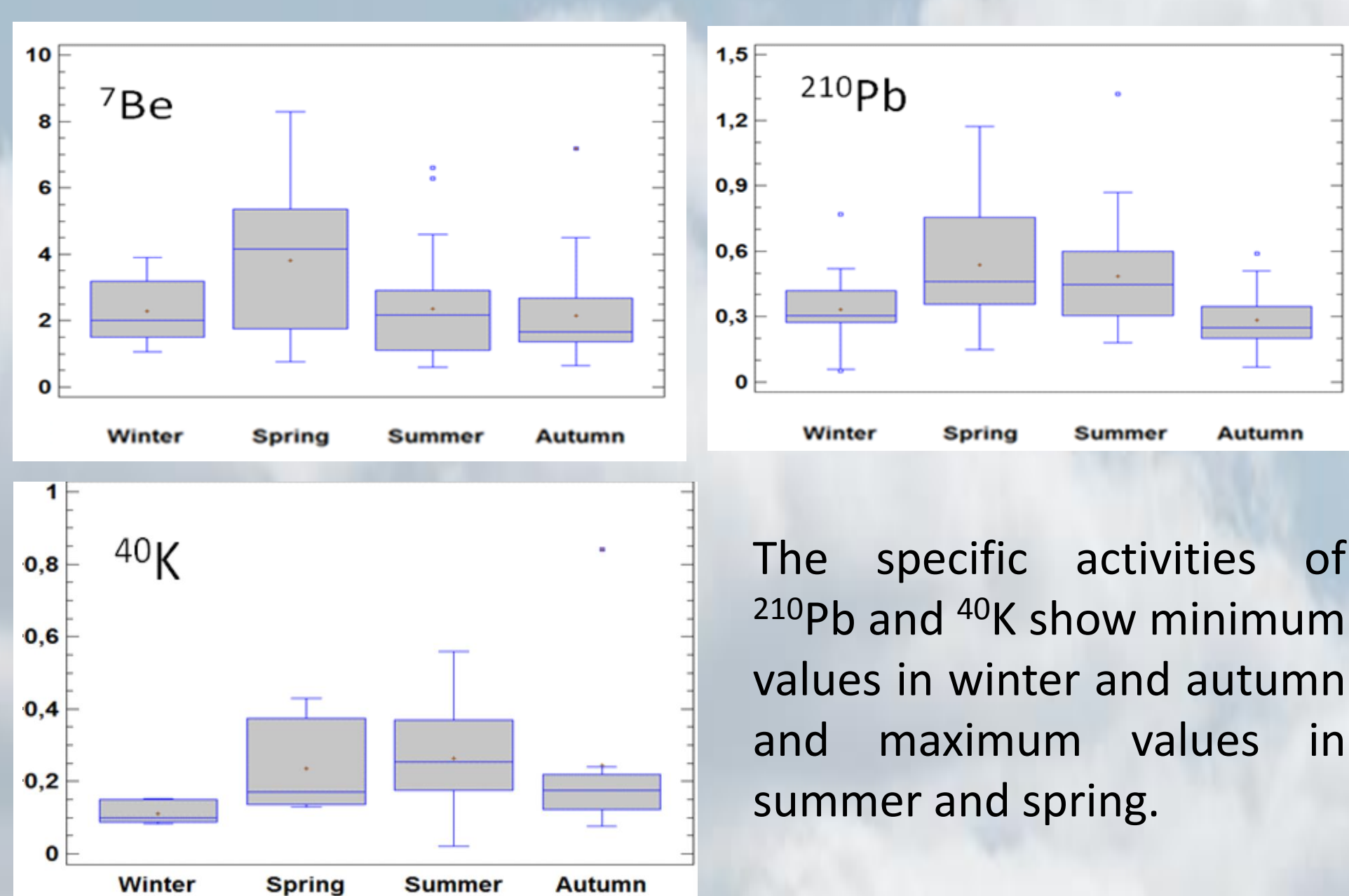


Fig. 1.-Seasonal variation of specific activities of ⁷Be, ²¹⁰Pb and ⁴⁰K

Taking into account the local orography and meteorological features in Málaga, with strong rain events followed by long dry periods, different parameters have been considered to study their influence on the concentrations of these radionuclides: number of dust intrusions (days) from Africa, rainfall amount (mm), rainfall duration, atmospheric pressure number of dry days and number of wet days. Best significant correlations found are shown in **Fig. 2**.

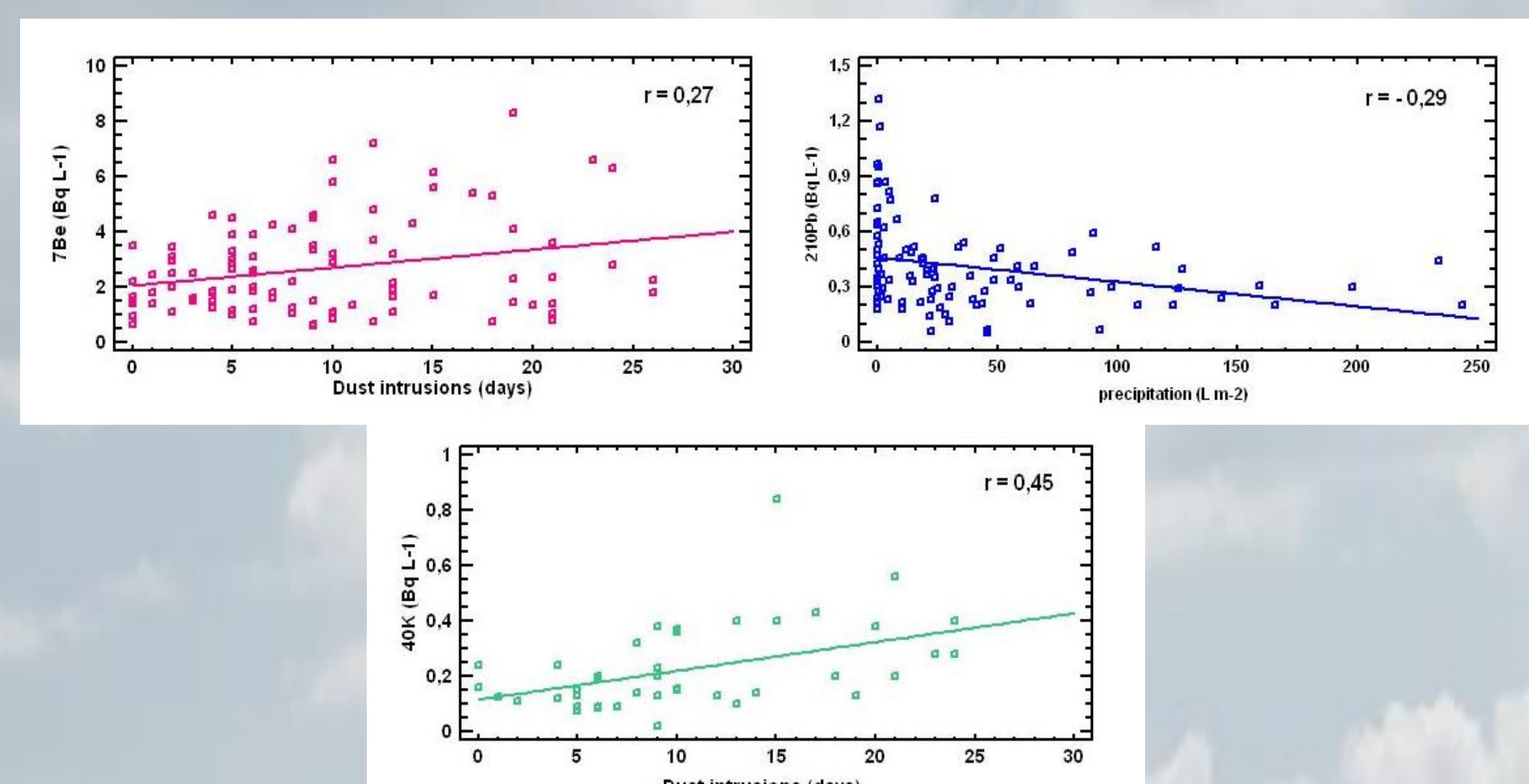


Fig. 2.- Scatter plots of radionuclides concentrations and some factors

The next three figures show the monthly variations in the deposition fluxes (in Bq/m²) of ⁷Be, ²¹⁰Pb and ⁴⁰K (**Fig. 3**). The lowest values were observed from June to September and the highest values from October to April. Correlation study was also carried out (**Table 3**).

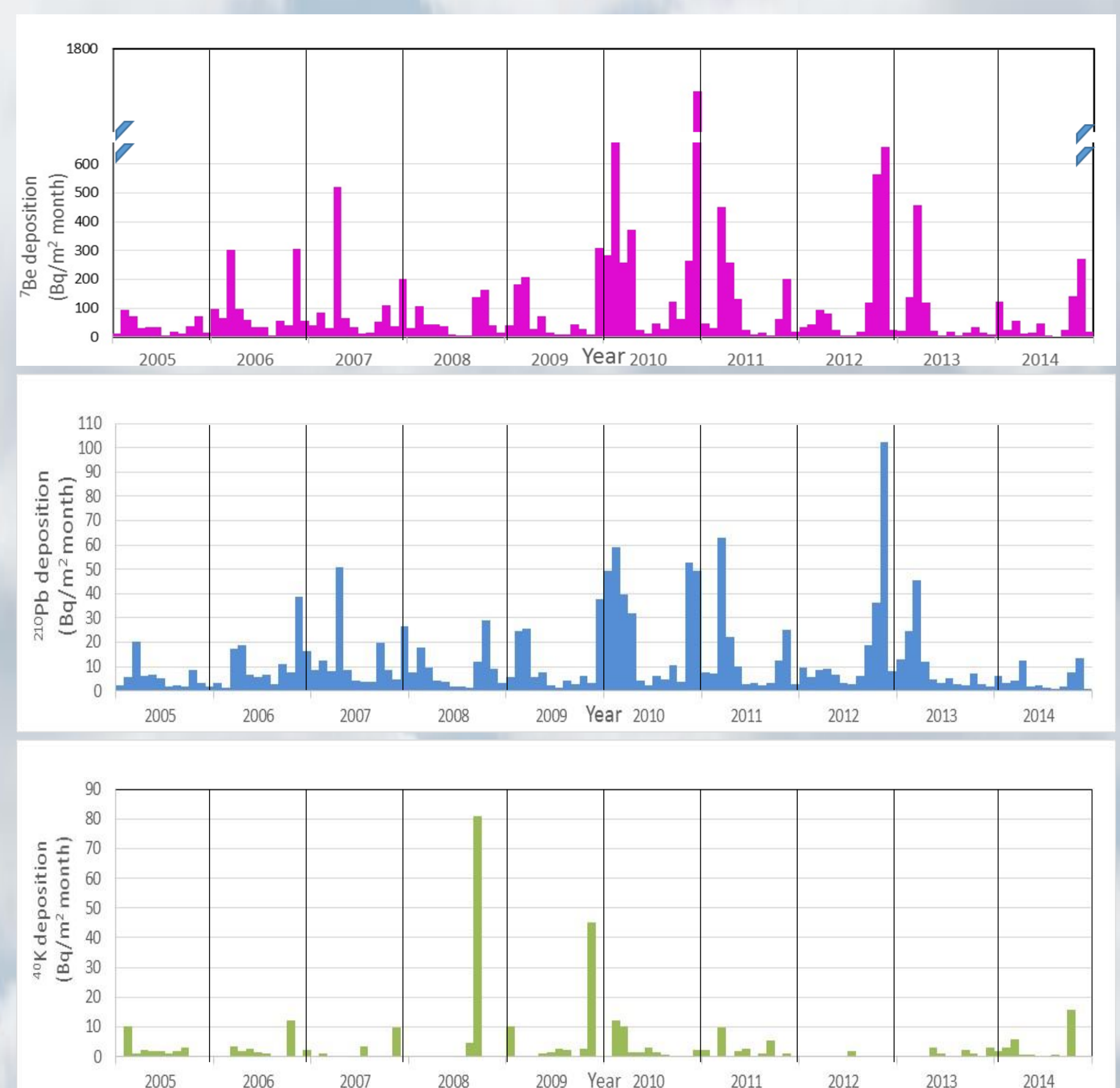


Fig.3. Depositional fluxes of the three radionuclides during the ten years under study.

Table 3.- Linear correlation coefficient between the depositional fluxes and different precipitation parameters.

	⁷ Be	²¹⁰ Pb	⁴⁰ K
Rainfall amount	0.86	0.87	0.66
Rainfall duration	0.85	0.89	0.60
Number of dry days	-0.68	-0.69	-0.52
Number of intrusions	-0.15	-0,13	-0,03
Relative humidity air	0.60	0.65	0.43
Temperature air	-0.41	-0.45	-0.21

The ⁷Be, ²¹⁰Pb and ⁴⁰K depositions are significantly correlated with the rainfall amount, rainfall duration, number of dry days and humidity air. Such relations have been commonly observed and explained by the fact that rainfall constitutes the major depositional pathway of these radionuclides.

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