

CAESIUM-137 DISTRIBUTION IN THE SOIL IN A SEMI-NATURAL ECOSYSTEM IN GREECE

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EXTENDED ABSTRACT

The purpose of this work was to provide data showing the levels of Caesium-137 (¹³⁷Cs) in the region of Karpero in the prefecture of Grevena (Northern Greece), 11 years after the accident in Chernobyl nuclear power plant in Ukraine on April 26, 1986.

For this purpose, samples of undisturbed soil on a hill slope area were collected from three upper and three lower positions. The distance, on the slope, between upper and lower positions was about 50 m. The samples were in the form of cylindrical columns of a height of 10 cm. Each sample-column was divided to 10 slides (sub-samples) of 1 cm height each. After proper processing of the soil, the concentration of Caesium-137 in each sub-sample was determined with a system of measurement of gamma radiation spectrometry (Camberra). Furthermore, the type of soil (Vougioukos method), the organic matter content (Walkey-Black method) and the pH, were determined.

Statistical analysis (ANOVA test) was performed after transformation of the data according to Box-Cox method.

No difference was found in the concentration of ¹³⁷Cs between the upper and lower positions (F=0.834; p=0.382). This suggests that any statistically significant superficial mobility of radionuclides did not occur.

By calculating the profile areal inventory we estimated that the average level of ¹³⁷Cs in the studied area ranges from 20-35 kBq/m². The majority of the radiocaesium remains in the top few (2-5) centimeters of the soil. The distribution of the ¹³⁷Cs is well described by the exponential model. By fitting this model to each sample profile, the relaxation length, defined as the inverse of the rate of change of concentration of ¹³⁷Cs in the soil column, (i.e. 1/a), was calculated and was found to be 2.25 cm (95% C.I.: 1.5-3 cm). Several empirical models were used to fit the data. These models were compared between each other and they are further discussed.

The type of soil in the area under investigation was found to be clay with organic matter content 3.64% and pH 5.67. This type of the soil allows an irreversible absorption of the radionuclides in the colloids and fixation of them to the crystalloid grid of the clay minerals. This rather constant fixation explains the observed very slow mobility of the radionuclide. This is ecologically important and it is of high agronomic interest for Greece because a lot of cultivated areas have clay soils but also because the upper few centimetres of soil constitute the rhizosphere area of herbaceous species which suggests a chronic risk, the radionuclides to pass into the food chain.

Key words: Radionuclides; soil pollution, profile areal inventory, relaxation length.