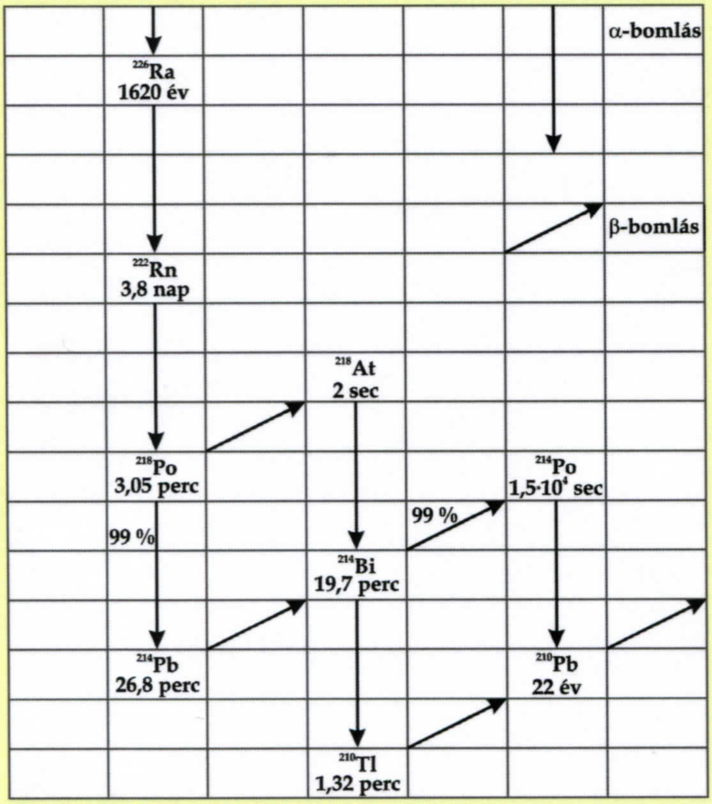
VI. Magyar Radon Fórum

A Radon a Környezetben Nemzetközi Workshop

Veszprém

2011.



Pannon Egyetemi Kiadó

VI. Magyar Radon Fórum

A Konferencia Rendezői

Pannon Egyetem Radiokémiai és Radioökológiai Intézet
Radioökológiai Tisztaságért Társadalmi Szervezet
Magyar Biofizikai Társaság Radioökológiai Szakcsoport

Elnök: Somlai János
Titkár: Kovács Tibor

A kiadvány szerkesztőbizottsága:
Kovács Tibor, Somlai János, Szabó Csaba

VI.

Magyar Radon Fórum

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TARTALOMJEGYZÉK

A VI. Magyar Radon Fórum
és
A Radon a Környezetben Nemzetközi Workshop

PROGRAMFÜZET

Veszprém, 2011. május 16 - 17

2011. május 16. hétfő

13.00 ***Köszöntő, a konferencia megnyitása –*** *Dr. Rédey Ákos, a Pannon Egyetem Rektora*

Szekció elnökök: C. Cosma, Cs. Szabó

13.30 **A Radon Vita Folytatódik** (The Radon-Debate Continues) – Gy. Köteles

14.00 **Current Status of European Geogenic Map** – P. Bossew

14.20 **Geogenic Radon Potential Mapping in Hungary** – K. Szabó, Á. Horváth, Cs. Szabó

14.40 **Alternative SSNTD Based Radon Measurements** – T. Kovács, T. Ishikawa, Y. Omori, R. Mishra, A. Csordás, J. Somlai

15.00 ***Kávészünet***

Szekció elnökök: P. Bossew, T. Kovács

15.20 **On the Measurement of Thoron Activity Concentration With Etched Track Type Detectors; The Temporal Changes of Radon in Soil Gas** – I. Csige

15.40 **Seasonal Variation of Nano Aerosols in the Postojna Cave** – M. Smerajec, A. Gregorič, J. Vaupotič, I. Kobal

16.00 **Baita-Stei Radon Prone Area: New Indoor, Water and Soil Measurements** – C. Cosma, A. Dinu, R. Cs. Begy, T. Dicu, M. Moldovan, B. Papp, D. Nita, C. Candea, D. Fulea

16.20 **Diurnal Variation of Radon in the Underground Low-level Laboratory in Belgrade, Serbia** – V. Udovičić, A. Dragić, R. Banjanac, P. Kolarž, Z. S. Žunić

16.40 **Radiological Investigation of the Effects of the Red Mud Disaster** – T. Kovács, Z. Sas, J. Somlai, G. Szeiler

2011. május 17. kedd

09.20 **Köszöntő, a második nap nyitása –** *Dr. Varga Kálmán, a Radiokémiai és Radioökológiai Intézet Igazgatója*

Szekció elnökök: I. Csige, J. Somlai

09.30 **A Radoninhaláció Biofizikai Hatásainak Kvantitatív Leírása** – I. Balásházy

10.00 **Radonviszonyok a Markhot Ferenc Kórház Új Fürdőjében** – K. Nagy, E. Deák, Y. Kobayashi, N. Kávási, T. Kovács, I. Berhés, T. Bender, J. Vaupotič, S. Yoshinaga, H. Yonehara

10.20 **A Dohányzási Kockázat Befolyásolási Pontjai: Csökkenthető-e a Dohányosok Veszélyeztettsége?** – P. Herke

10.40 ***Kávészünet***

11.00 **Radon és Toron Tokaj-hegyaljai Borospincékben** – E. B. Búzás, I. Csige

11.20 **A Radon Szempontjából Kritikus Munkahelyek Vizsgálata az Egykori Mecseki Uránbánya Telephelyein** – J. Jónás, A. Várhegyi, J. Somlai, G. Szeiler, T. Kovács, N. Kávási

11.40 **Radon Mérések Magyarországi Borospincékben** – Z. Sas, I. Asztalos, J. Somlai, M. Förhécz, B. Kis, G. Szeiler, T. Kovács

Szekció elnökök: P. Bossew, D. Nikezic

12.00 ***Poszter szekció***

External Doses from Radon Progeny – V. M. Markovic, D. Krstic, D. Nikezic, N. Stevanovic

Radon Measurement in Water and Carbonated Water: Comparison Between Charcoal Adsorption and Lucas Cell (Luc 3A) Methods – D. Nita, C. Cosma

Measurements of Rn-222 and Ra-226 Content in Thermal- and Carbonated Spring Waters from Harghita and Bihor County, (Romania) – R. Cs. Begy, C. Cosma

Radon and Thoron Measurements Connected to Hungarian Adobe Houses – Zs. Szabó, Cs. Szabó, Á. Horváth

Radiation Hazard of Different Hungarian Building Materials – P. Völgyes, Zs. Szabó, J. Somlai, Cs. Szabó

Radon Emanation Fraction Measurements in Some Soils of Different Source Rocks from Hungary – D. Zachary, H. É. Nagy, Zs. Szabó, K. Zs. Szabó, Á. Horváth, Cs. Szabó

Natural Radioactivity in Turkish Spring of Rudas Spa (Természetes radioaktivitás a Rudas fürdő Török-forrásában) – Á. Freiler, Á. Horváth

Long-term Integrating Radon/thoron Measurements in a Dwelling, Case Study – Cs. Németh, T. Ishikawa, Y. Omori, G. Szeiler, T. Kovács

The change of radon activity concentration in Tapolca cave in the previous 4 years – N. Gál, J. Somlai, G. Szeiler, Z. Sas, T. Kovács, N. Kávási

Radon content of drinking water in Veszprém and in the surrounding settlements – T. Pallósi, J. Somlai, G. Szeiler, Z. Sas, I. Chirca, T. Kovács

Radon Emanation in Slovenian Soil Samples – R. Kardos, T. Bujtor, B. Máté, M. Horváth, J. Somlai, T. Kovács

Development a low level radon measurement system based on pulse shape discriminating NDI Detector – T. Kovács, B. Máté, A. Csordás, J. Somlai

12.45 *Ebéd*

Szekció elnökök: Z. Žunić, I. Balásházy

14.00 **Jacobi Room Model Parameters for Radon Progeny at Turbulent Airflow** – N. Stevanovic, V. M. Markovic, D. Nikezic

14.20 **Playing With Statistics of the Radon Topic** – P. Bossew

14.40 **Radon Levels and Dose Estimation Problems in Underground Manganese Mine in Hungary** – T. Vigh, T. Kovács, N. Kávási, J. Vaupotič, V. Jobbágy

15.00 **Radon Study in the Pálvölgy Cave (Budapest, Hungary)** – H. É. Nagy, Cs. Szabó, Á. Horváth, A. Kiss

15.20 *Kávészünet*

Szekció elnökök: D. Nikezic, K. Nagy

15.40 **Preliminary Indoor Thoron and Radon Measurements in North-Western Romania** – B. D. Burghele, B. Papp, Z. Horvath, C. Cosma

16.00 **Risk Assessment of Radon in Soil, in Baita-Stei Uranium Area (Romania)** – B. Papp, C. Cosma

16.20 **Radiological Investigation of Hungarian Clays (Used in Brick Factories)** – Z. Sas, J. Somlai, V. Jobbágy, G. Szeiler, T. Kovács

16.40 *A konferencia zárása*

DIURNAL VARIATION OF RADON AND AIR-IONS CONCENTRATIONS IN THE UNDERGROUND LOW-LEVEL LABORATORY IN BELGRADE, SERBIA

Udovičić Vladimir [1], Dragić Aleksandar [1], Banjanac Radomir [1], Kolarž Predrag[1], Žunić S. Zora [2]

[1]*Institute of Physics, Belgrade, Serbia*
[2]*Institute of Nuclear Sciences "Vinča", ECE LAB, Belgrade, Serbia*

Abstract

The underground low-level laboratory in Belgrade, Serbia exists for fourteen years, with the continuous monitoring of the radon concentration carried out during this period. The radon time series analysis based on the short-term measurements has shown that there are two periodicity at 1 day and 1 year. Besides the fact that the laboratory has the system for radon reduction, there is significant one day period which is the main subject of this work. It has been shown that the radon behavior in the underground low-level laboratory in Belgrade has the similar characteristics as in the other underground environment (caves, mines, boreholes…).

Introduction

The Low-Background Laboratory for Nuclear Physics at the Institute of Physics in Belgrade is a shallow underground laboratory. The laboratory was built in the loamy loess cliff on the bank of the river Danube with the overburden of 12 m of soil. The experiments and routine measurements in the underground Low-Background Laboratory for Nuclear Physics require low levels of radon concentration with minimum temporal variations [(1)]. Unfortunately, in the underground environments radon level has extremely high values (up to several $kBqm^{-3}$) and temporal variations, especially the daily amplitude might be very intensive. The radon behavior in such specific environments is the subject of intensive research. This is confirmed by a number of scientific articles published in a few last years [(2, 3, 4, 5, 6)]. The underground low-level laboratory in Belgrade, Serbia exists for fourteen years, with the continuous monitoring of the radon concentration carried out during this period. The radon time series analysis based on the short-term measurements has shown that there are two periodicity at 1 day and 1 year. Besides the fact that the laboratory has the system for radon reduction [(7)], there is significant one day period which is the main subject of this work. The physical origin of the obtained daily variation in the underground laboratory is not straightforward. The daily variability shows a weak correlation with the difference of external and internal temperature. Also, in this work we present the simultaneous measurements of the atmospheric fast ions and indoor radon concentration in the ground and underground low-level laboratory.

Experimental methods

The all experiments are performed in the underground low-level laboratory in Belgrade. The laboratory is located on the right bank of river Danube in the Belgrade borough of Zemun, on the grounds of the Institute of Physics. The ground level part of the laboratory (GLL) is situated at the foot of the vertical loess cliff, which is about 10 meters high. The underground part of the laboratory (UL), of the useful area of 45 m^2, is dug into the foot of the cliff and is accessible from the GLL via the 10 meters long horizontal corridor, which serves also as a pressure buffer for a slight overpressure in the UL (*Figure 1*).

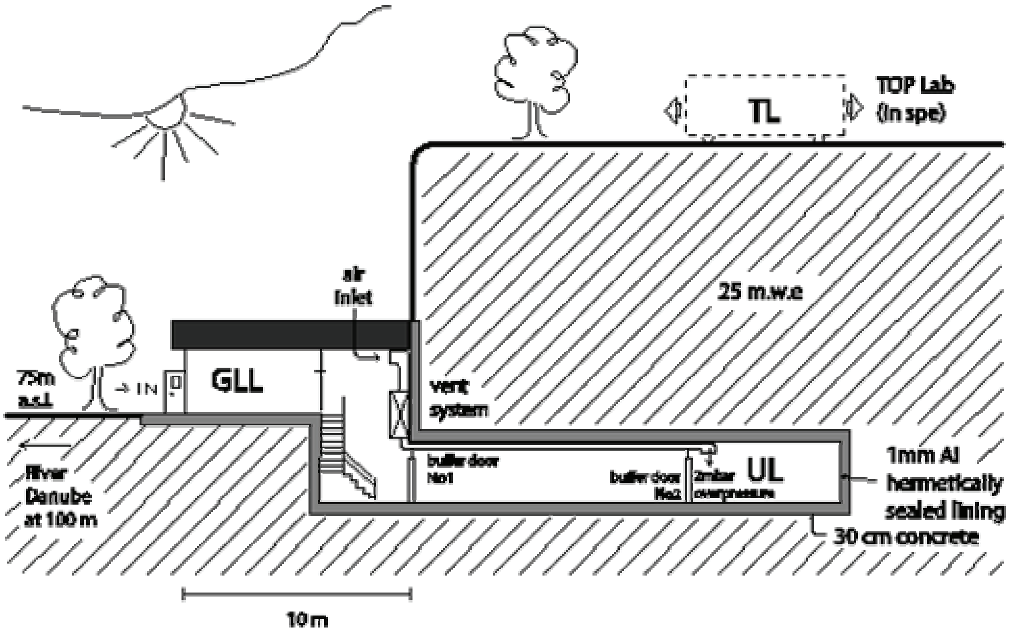

Figure 1: Cross section of the Low-level and CR Laboratory at IOP, Belgrade, 44°49'N, 20°28'E, vertical rigidity cutoff 5.3 GV

The underground low-level laboratory in Belgrade, Serbia exists for fourteen years, with the continuous monitoring of the radon concentration carried out during this period. The special designed system for radon reduction is consist of three stage: a) The active area of the laboratory is completely lined up with aluminium foil of 1 mm thickness, which is hermetically sealed with a silicon sealant to minimize the diffusion of radon from surrounding soil and concrete used for construction, b) the laboratory is continuously ventilated with fresh air, filtered through one rough filter for dust elimination followed by the battery of coarse and fine charcoal active filters and c) the parameters of the ventilation system are adjusted to give an overpressure of about 2 mbar over the atmospheric pressure. The radon monitor is used to investigate the temporal variations in the radon concentrations. For this type of short-term measurements the SN1029 radon monitor was used (manufactured by the Sun Nuclear Corporation, NRSB approval-code 31822). The device consists of two diffused junction photodiodes as a radon detector, and is furnished with sensors for temperature, barometric pressure and relative humidity. The user can set the measurement intervals from 30 min to 24 h. The radon monitor device records radon and atmospheric parameters readings every 2 h in the UL. The data are stored in the internal memory of the device and then transferred to the personal computer. The data obtained from the radon monitor for the temporal variations of the radon concentrations over a long period of time enable the study of the short-term periodical variations. The series taken during period of three years were spectrally analyzed by the Lomb-Scargle periodogram method (8).

Aspirated Gerdien condenser is widely utilized instrument for the air-ion concentrations and mobility measurements. Cylindrical Detector of Air-Ions (CDI-06) is made in the Institute of Physics, Belgrade (9) (*Figure 2*). It is fully automated portable instrument with ability to alternatively measure concentrations of positive and negative air-ions, temperature (T), pressure (P) and relative humidity (RH).

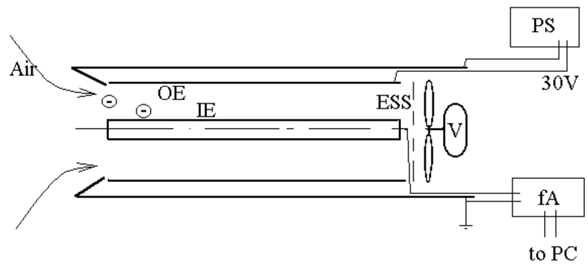

Figure 2: Cylindrical Detector of Air-Ions (CDI-06)

Results and discussion

The descriptive statistics on the raw radon data are shown (*Table 1*). The radon data from radon monitor device SN1029 for the period of three years are spectrally analyzed. Lomb-Scargle periodogram analysis method has been used in spectral analysis of radon time series. The advantage of Lomb-Scargle method is well known statistical interpretation of peridogram. The results of spectral analysis of the raw radon data are presented (*Figure 3*).

Table 1: Descriptive statistics on the raw radon data

	Mean	Standard deviation	Minimum	Median	Maximum
Radon concentration (Bqm^{-3})	13.50	9.75	0	12.4	75

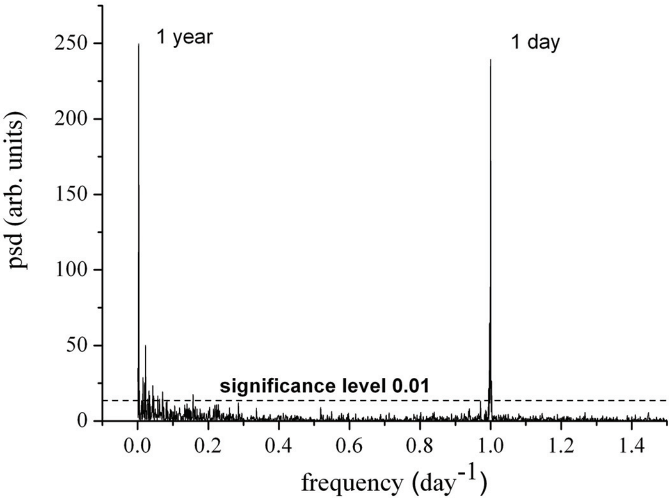

Figure 3: Lomb-Scargle periodogram for a measurement period of three years with time sampling of two hours

It is obvious that the Lomb-Scargle periodogram shows very clean peak at 1 day and 1 year period. In the long term a clear seasonal variation of the radon concentration (monthly average) is obtained (*Figure 4*).

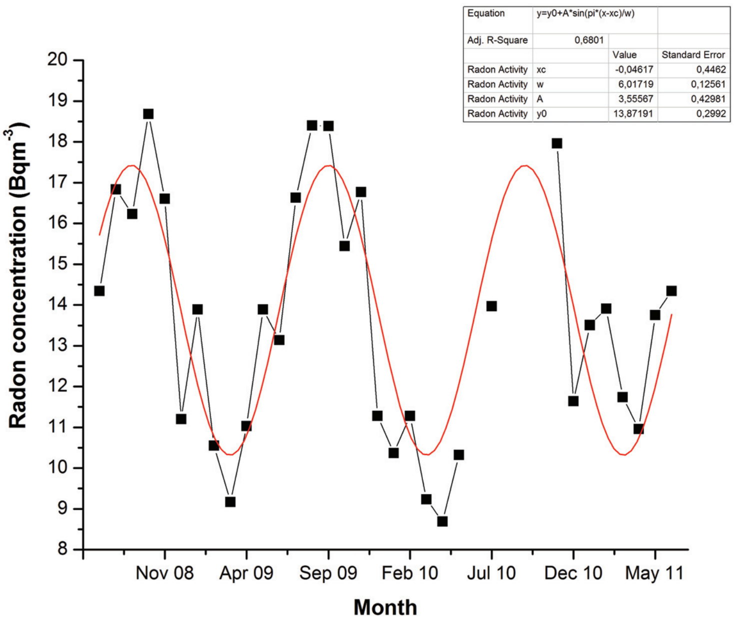

Figure 4: Seasonal variation of the radon concentration (monthly average)

Special attention is made to the daily radon variability in the UL in Belgrade. Many authors are found that the daily variation in the radon concentration in the underground environments mainly depend on the difference of the outside atmospheric temperature and the internal temperature inside underground spaces [2, 4]. The obtained results for one calendar year are presented (*Figure 5*).

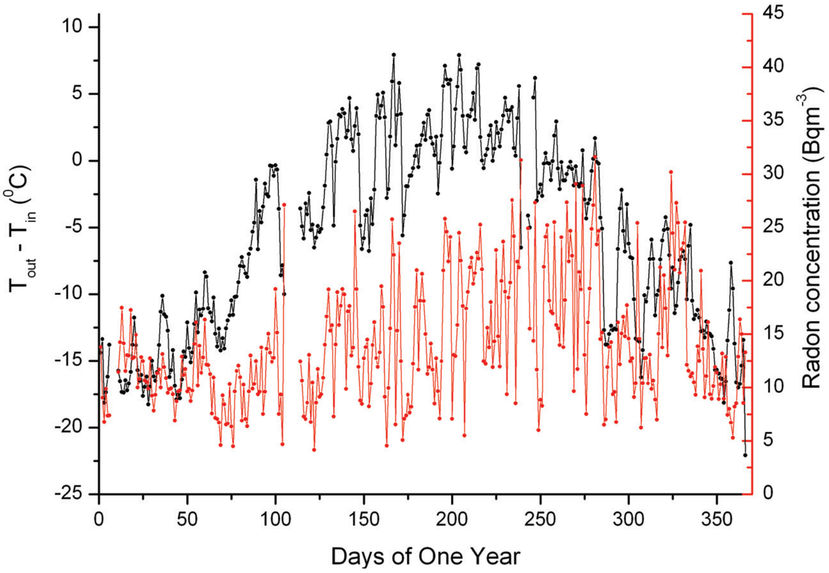

Figure 5: Radon concentration (red line) in the UL versus the difference of the outside atmospheric temperature and the internal temperature inside UL (black line) for one calendar year. The Pearson correlation coefficient between radon concentration and the difference of external and internal temperature is 0.18

It is obvious that there exist a weak correlation between radon concentration and the difference of external and internal temperature. The Pearson correlation coefficient between radon concentration and the difference of external and internal temperature is 0.18. Also, the time series show that there are two different seasons according to the gradient of the temperature. One is winter time (from December to the June) with low values of the radon concentration and the second one is summer time (from June to November) when radon values rich the maximum.

Also, in this work we present the simultaneous measurements of the atmospheric fast ions and indoor radon concentration in the GLL and UL. Air-ions and radon are important constituents of the air which can affect the human health. On the other hand, radon is the main source of the air-ions in the lower troposphere and variation of air-ion concentrations is attributed to changes of the radon activity [10]. The short-term simultaneous measurements of the atmospheric fast ions and indoor radon concentration in the GLL and UL are shown (*Figure 6*) and (*Figure 7*). The radon concentration <Rn> and positive air-ions <Nions>+ are average over all measurements interval.

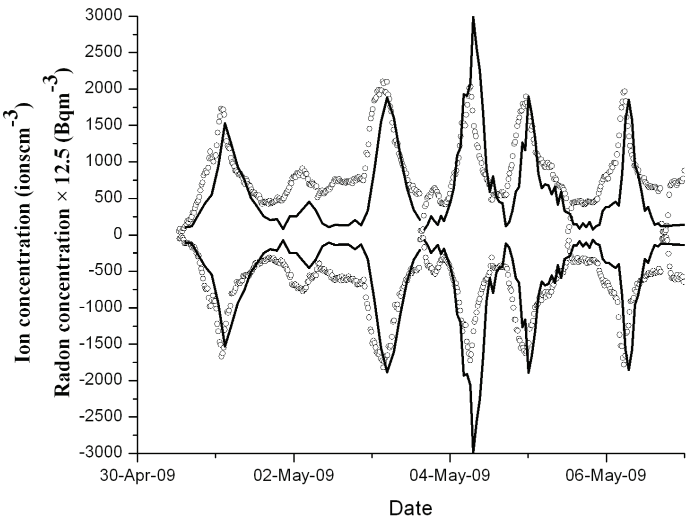

Figure 6: Radon concentration (circle) versus atmospheric fast ions in the GLL (black line), r = 0.66, <Rn> = 54 Bqm^{-3}, <Nions>+ = 840 $ionscm^{-3}$

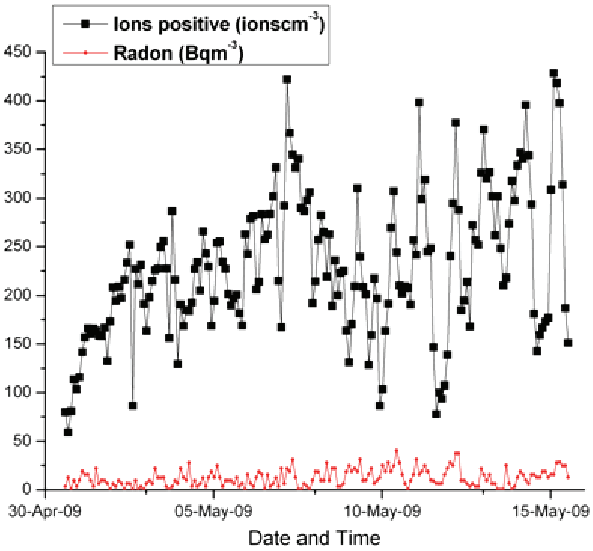

Figure 7: Radon concentration (red line) versus atmospheric fast ions in the UL (black line), r = 0.17, <Rn> = 12 Bqm^{-3}, <Nions>+ = 227 $ionscm^{-3}$

It is clear that the Pearson correlation coefficient r is decreased in the UL compared with the r value obtained in the GLL.

Conclusions

It has been shown that the radon behavior in the underground low-level laboratory in Belgrade has the similar characteristics as in the other underground environment (caves, mines, boreholes…) because it has the same source and the places are complete surrounded with the soil. It is also not quite understood the influence of the meteorological parameters on the radon variability. In this work we tried to point out the correlation between daily radon variation and the difference of external and internal temperature in the UL. The further theoretical and experimental research work is necessary to explain physical mechanisms by which the temperature gradient is correlated with radon variations in the underground environments.

Acknowledgments

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