Geophysical Research Abstracts
Vol. 21, EGU2019-17995, 2019
EGU General Assembly 2019

Testing theoretical and empirical models for soil gas radon and soil air permeability determination: comparison with field measurements

Silvana Beltrán Torres (1), Katalin Zsuzsanna Szabó (2,3), and Csaba Szabó (1)

(1) Eötvös Loránd University, Lithosphere Fluid Research Lab Institute of Geography and Earth Sciences, Budapest, Hungary (silvana.beltran@ttk.elte.hu), (2) Department of Chemistry, Institute of Environmental Science, Szent István University, Gödöllő, Hungary , (3) Nuclear Security Department, Centre for Energy Research, Hungarian Academy of Sciences, Budapest, Hungary

Terrestrial radiation is the most important source of natural radioactivity we are exposed to. Hence, it has a high importance to define the role of physical and chemical soil properties on geogenic radon, especially, in areas nearby settlements. The goals of the study are twofold 1) to test the usability of several theoretical/empirical models for soil gas radon concentration and permeability by comparison with the same parameters measured in the field, and 2) to test the usability of the wide range of the soil geochemical and physical properties as independent input parameters into predictive natural radioactivity models.
This study was performed in the western side of Velence Hills in Hungary, near Pákozd settlement, in a 0.8 km2 downhill meadow area that belongs to re-deposited slope debris on the Velence granite formation. In situ measurements of soil gas radon activity concentration and soil gas permeability were compared with the correspondent values obtained by applying theoretical and empirical models. These models use the laboratory measured radium/uranium content, radon emanation coefficient and soil physical properties, for instance, dry bulk density, porosity, arithmetic, geometric mean particle diameter and water content of soil samples. Effects of additional geochemical properties such as clay mineral, organic matter and carbonate content were also studied. Field measurements and soil sampling were carried out in three replicates at 30 randomly selected sites. The values of soil gas radon concentration obtained from the predictive models are numerically different, however they are significantly correlated (r=0.6, p=0,001). These differences correspond to the contribution of the underlying rock that are not considered in the predictive models and the interference of thoron in the field measurements. Therefore, rock properties were included into the models (Ra-226 content, emanation), and the thoron interference was corrected by thoron differentiated field measurements. Consequently, the differences in the measured and predicted values are significantly reduced, thus the predictive power of the modified model for soil gas radon concentration increases. Regarding to the soil gas permeability, the calculated values were significantly greater than the measured and no correlation was found between them. For these reasons, modifications were performed and the accuracy of the predictive model was improved considerably. Soil gas radon and calculated geogenic radon potential is decreasing with the higher amount of sand and increasing with the higher amount of silt and clay, since the radioactive element bearing heavy minerals can be find below the sand fraction.