Radon flux maps for the Slovak Republic based on several approaches and their experimental verification

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Worldwide interest in the naturally occurring radioactive gas ²²²Rn (radon) is primarily related to the possibility of its accumulation in enclosed spaces, which can pose a potential health hazard. Since one of the main sources of indoor radon is the soil, mapping the radon exhalation rate from the soil is of critical importance.

In this study, radon flux maps with a spatial resolution of 0.5 km × 0.5 km covering the territory of the Slovak Republic were created based on several approaches combining both theoretical and empirical models. The required input parameters include the measured concentrations of the radioactive elements ²³⁸U, ²³²Th and ⁴⁰K in the soil and ²²²Rn in the soil air, obtained from the Slovak geological map server. Another set of input parameters includes soil parameters such as soil porosity, radon emanation coefficient, dry bulk density of the soil and soil volumetric moisture, the representative values of which were determined from the granulometric fractions of sand, silt and clay in soil samples. The effective diffusion coefficient of radon, which is an important variable in determining the radon flux, was calculated using several semi-empirical relationships. This parameter is significantly affected by soil moisture, which is subject to high temporal and spatial variability. Soil moisture data were obtained from two online databases, the ERA-I/L and the GLDAS-Noah.

The created radon flux maps for the Slovak Republic were compared against radon fluxes determined experimentaly at several locations and also with existing European radon flux maps, for which different sets of input parameters were used.

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