RADON LEVELS IN OUTDOOR AIR AND SOIL GAS RELATED TO GEOLOGY OF SLOVENIA

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Two main directions of radon investigations in Slovenia

Radiation protection

- **Radon in living and working environment**

Concentrations of radon and its short lived decay products in the attached and unattached form, equilibrium factor, non-radioactive aerosols, meteorological conditions (*T*, *P*, *RH*), identification of radon sources, mitigations, radon mapping

- **Radon dosimetry**

Optimization of methodology for dose calculations

Radon transport

- **Radon anomalies in soil gas and thermal water related to earthquakes and activity of tectonic faults**

Continuous monitoring of radon in soil gas and thermal water

- **Spatial and temporal variations of Rn in soil gas**
- **Low level radon areas**

Radon measurements in outdoor air and in seawater profiles

Radon measurements in outdoor air and in soil gas

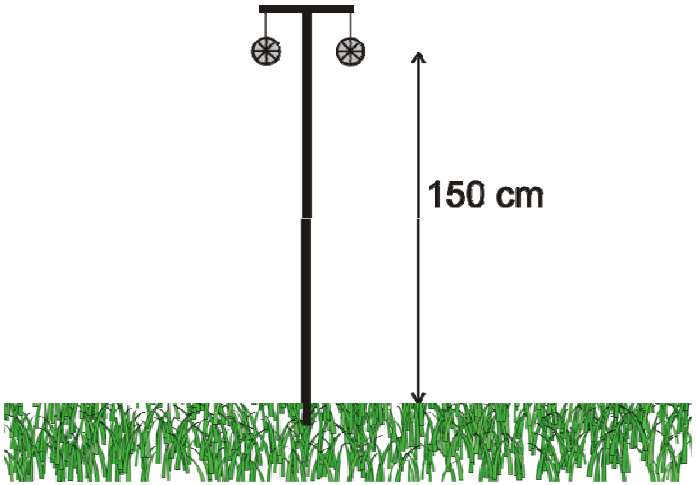
Outdoor air

- 60 measurement points have been selected over the entire country (mostly at the meteorological stations within the national network) where long-term permanent national radioactivity monitoring (gamma dose rate with thermoluminescent dosimeters) is being carried out
- in nearby dwellings radon concentration in indoor air at the same 60 points was measured

Soil gas

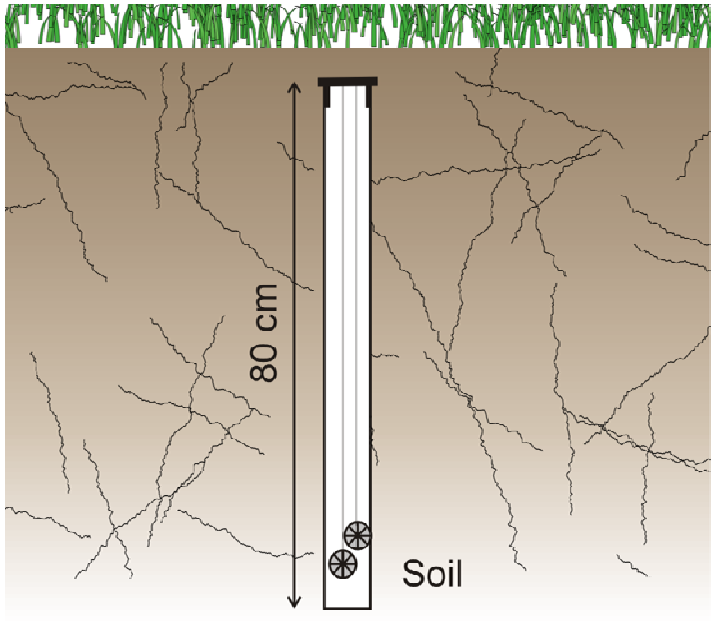
- at the same 60 measurement points
- additional 72 measuring points on radon risk areas

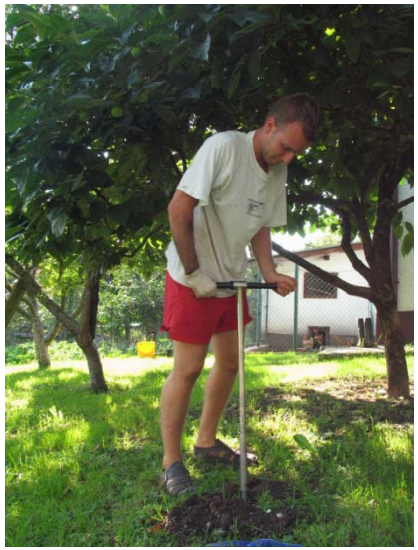
Radon measurements in outdoor air



Nuclear track detectors based on a CR-39 foil (Radonlab, Norway) were exposed in pairs for 3−5 months in Summer 2005 and Spring – Summer 2007.

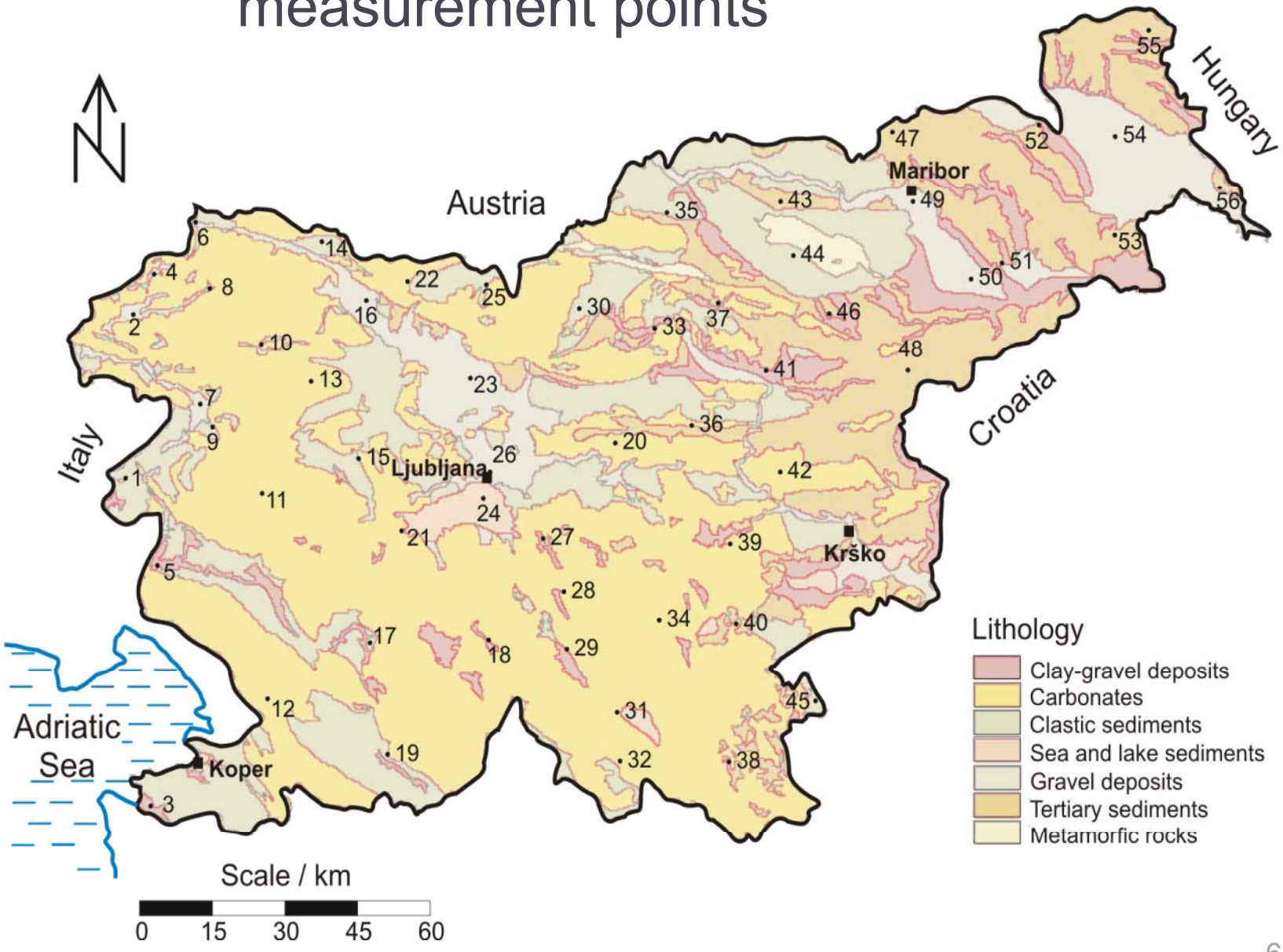
Radon measurements in soil gas



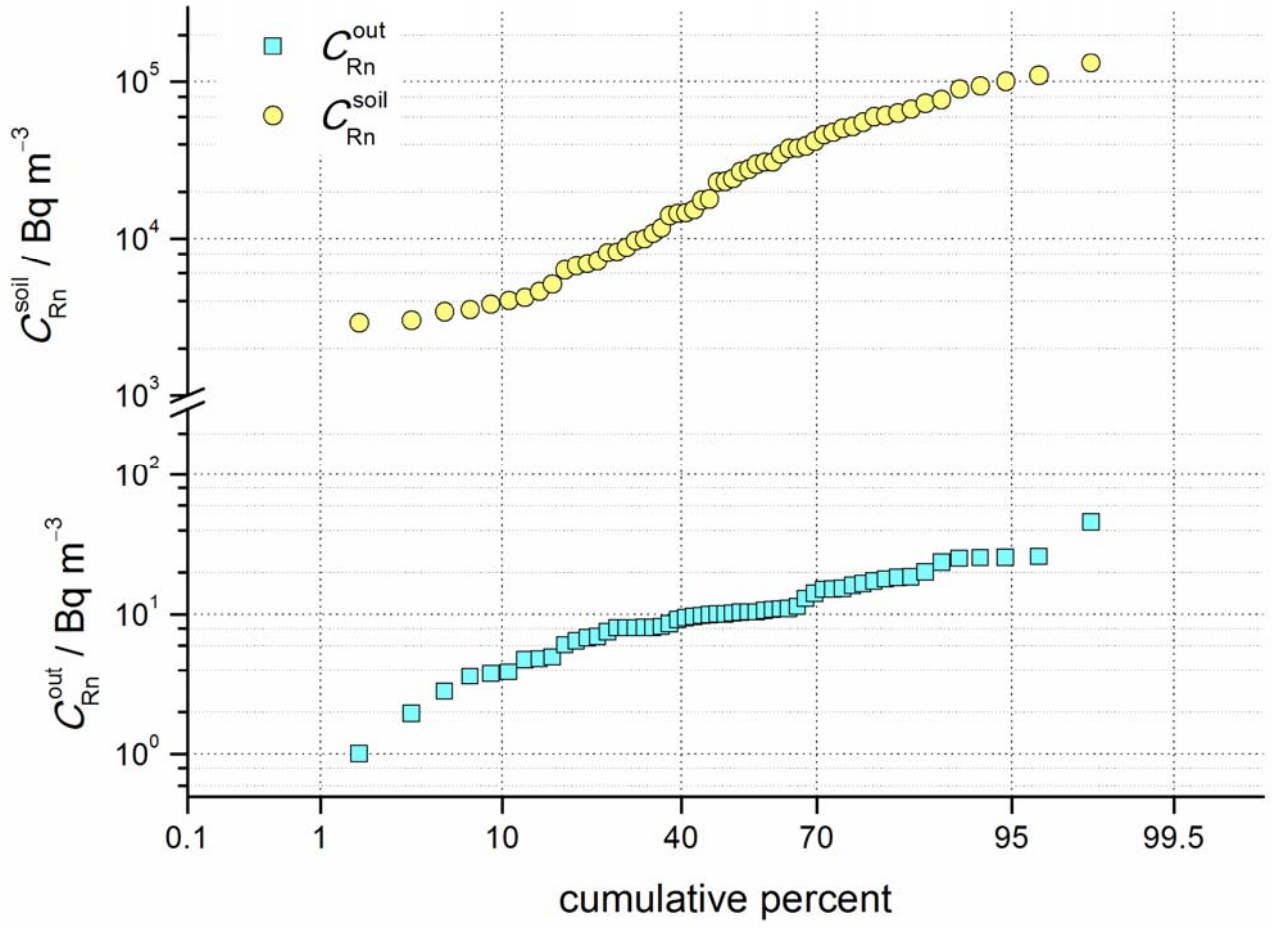


Nuclear track detectors (Radonlab, Norway) were exposed in pairs for 4−7 days in August 2007 and Nuclear track detectors (IFJ-PAN, Kraków, Poland) for 2−3 weeks in August 2008.

Lithology map of Slovenia with measurement points



Lognormal distribution of radon concentration in outdoor air and in soil gas



C_{Rn}^{soil}

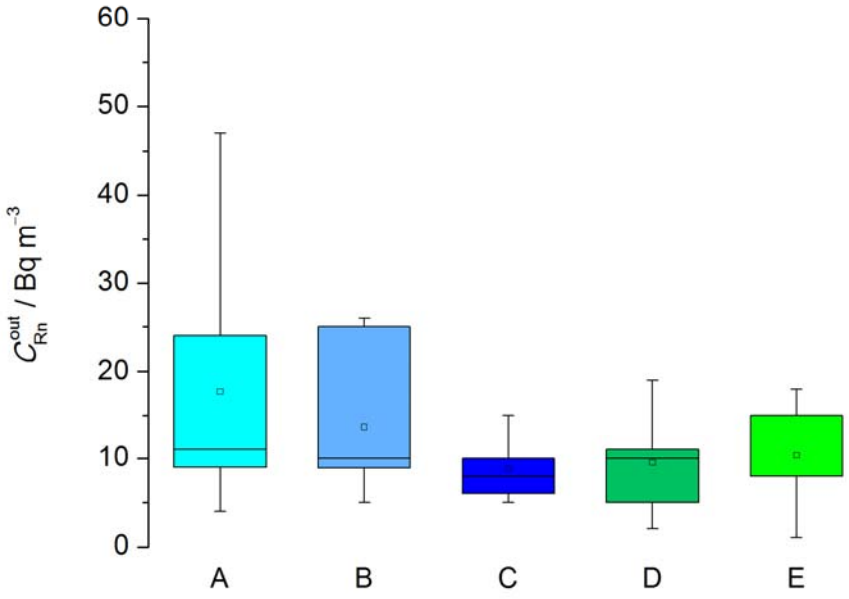
GM=20.7 kBq m^{-3}

C_{Rn}^{out}

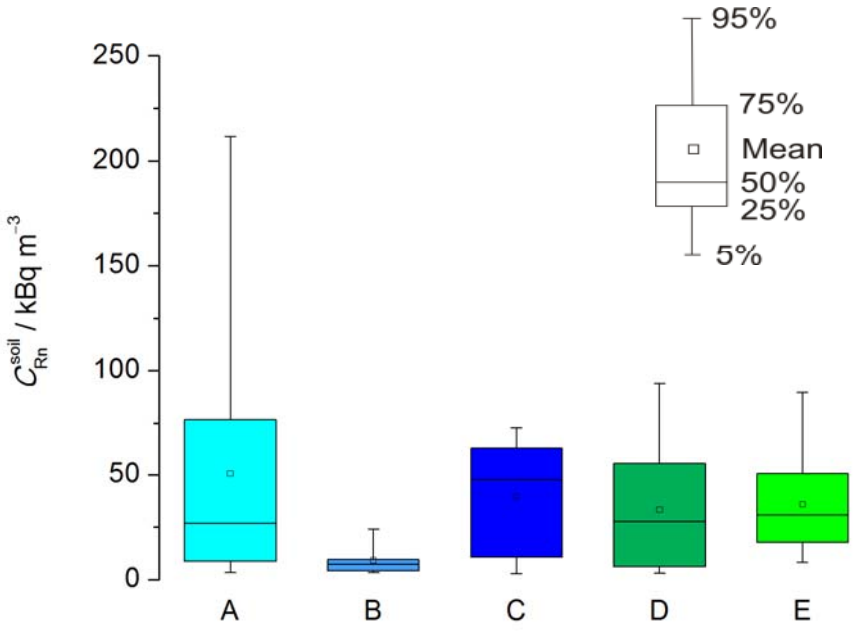
GM=10.0 Bq m^{-3}

Box & whisker plots of radon concentrations

outdoor air

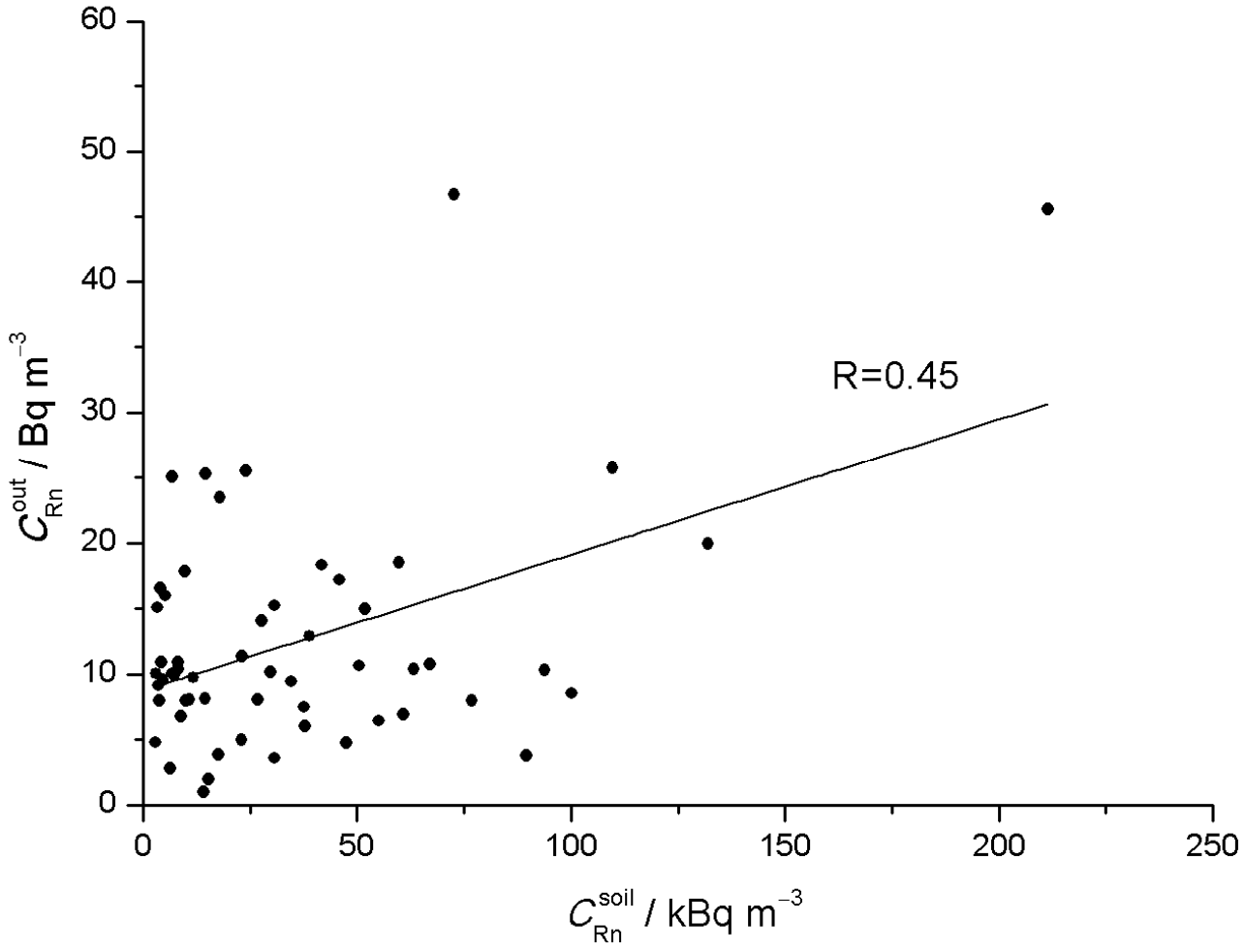


soil gas



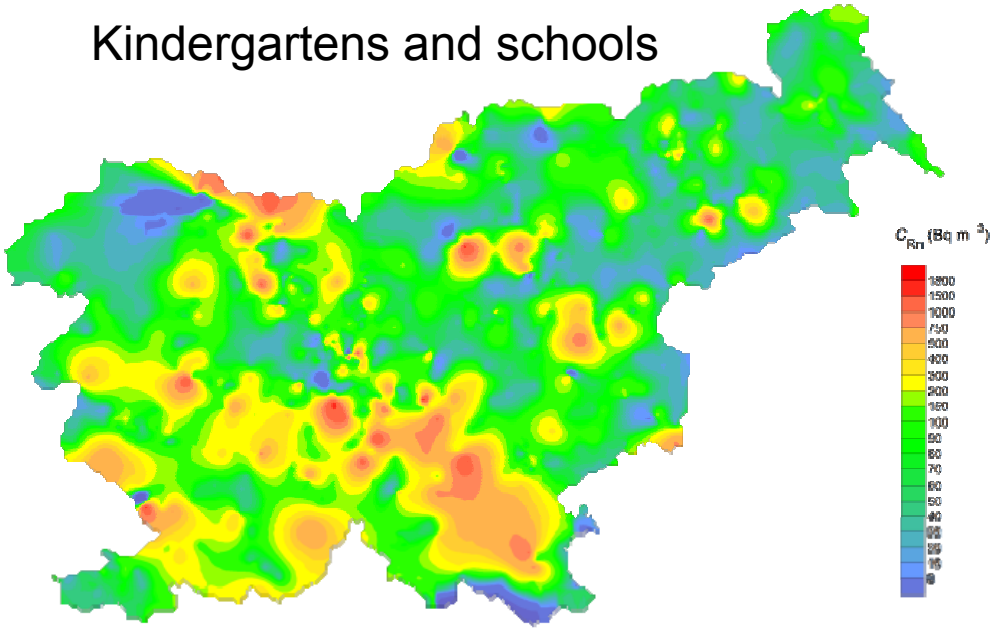
Lithological units: A – carbonates, B – clastic sediments, C – clay-gravel deposits, D – gravel deposits and E – Tertiary sediments

Correlation between radon concentration in outdoor air and in soil gas

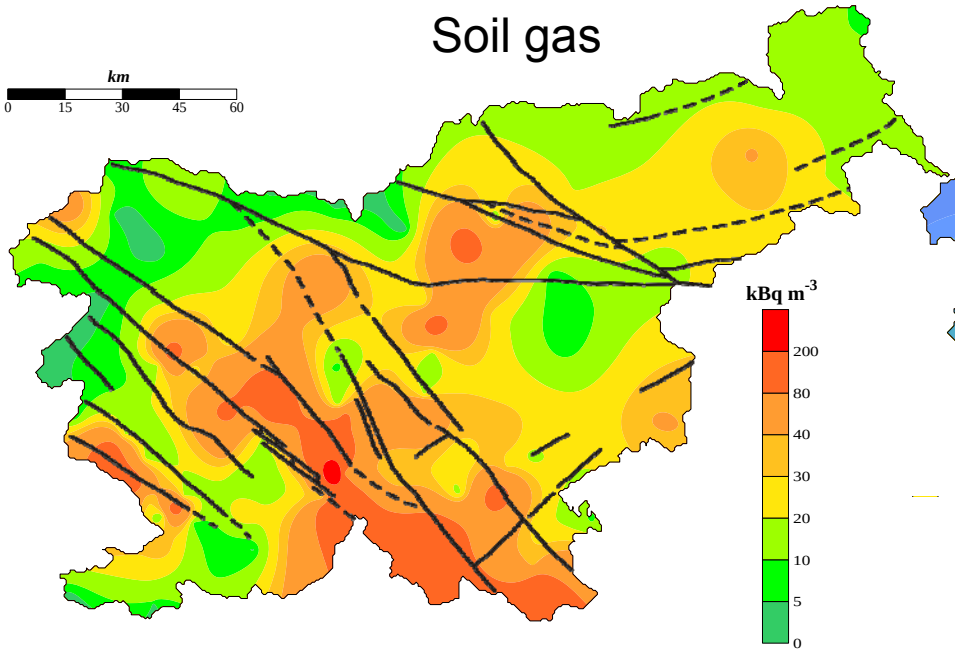


Radon maps

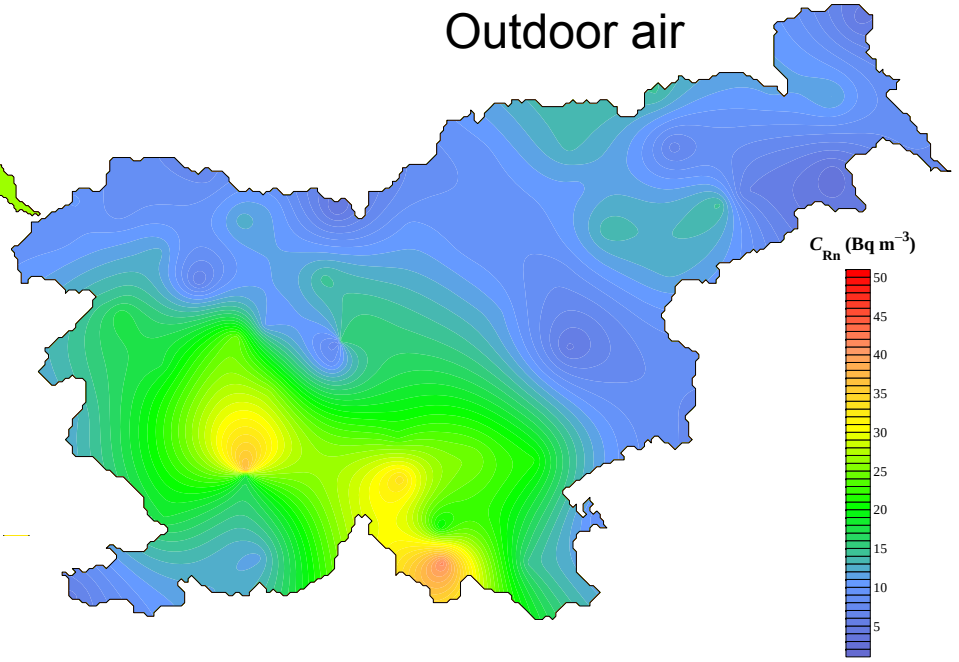
Kindergartens and schools



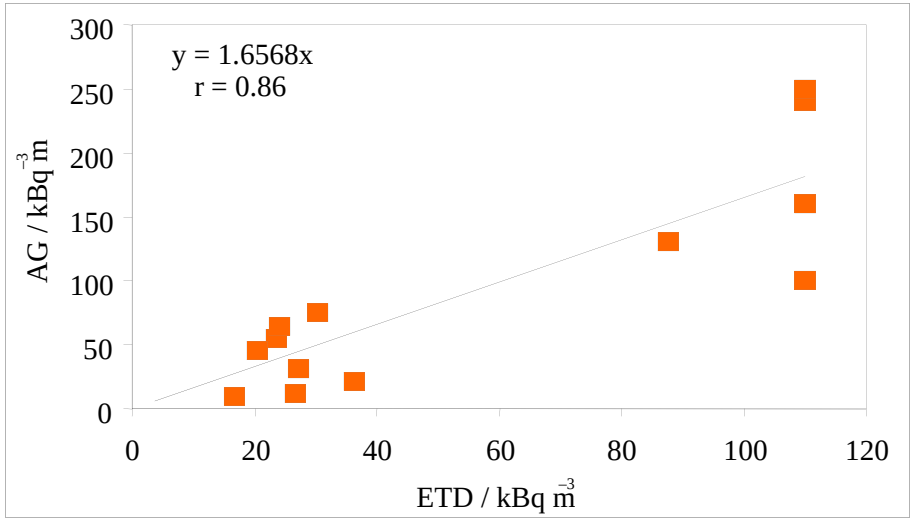
Soil gas

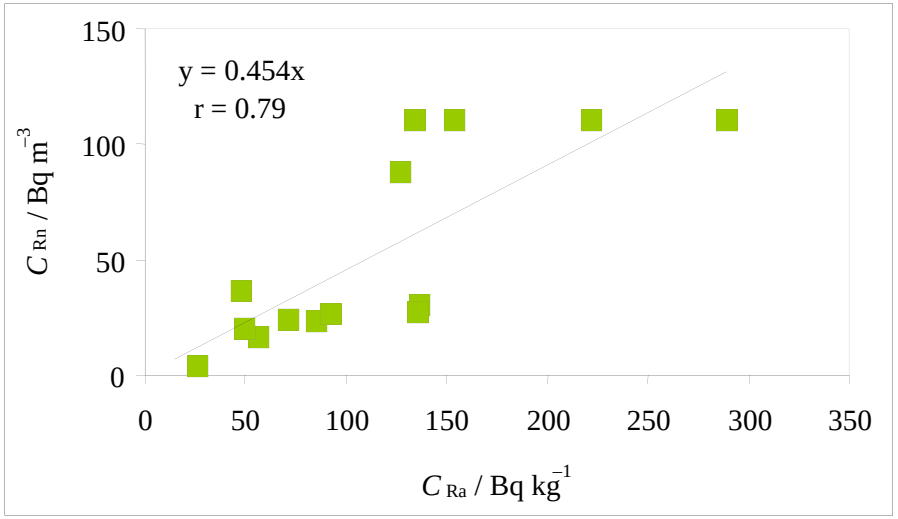


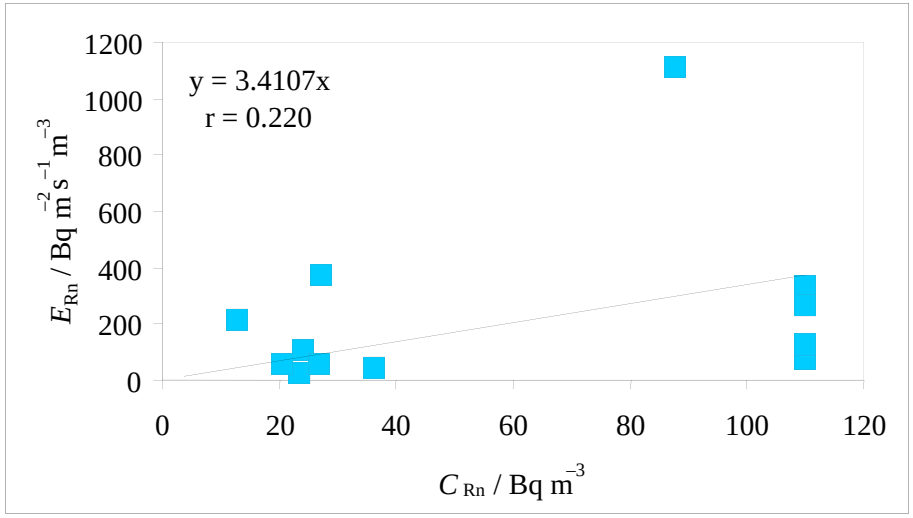
Outdoor air

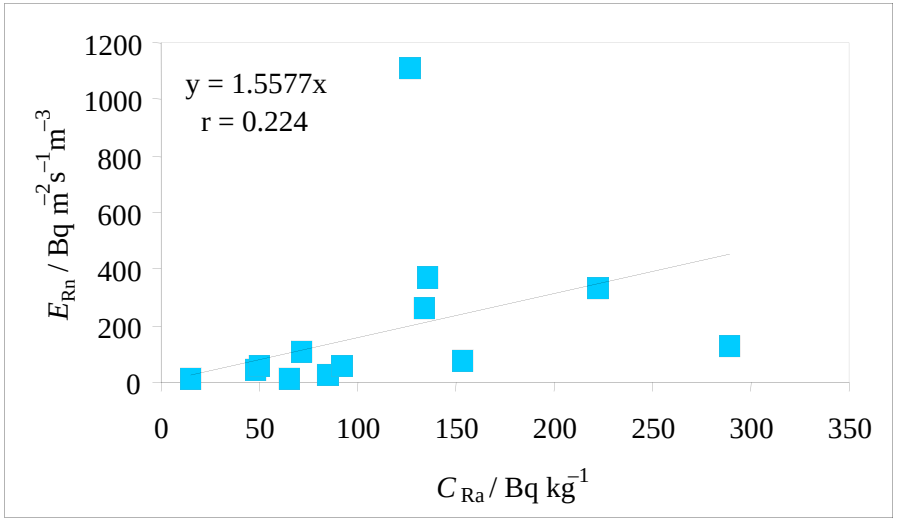


Radon in soil gas: correlations









CONCLUSIONS

- The widest ranges and highest radon concentrations in both outdoor air and soil gas have been found on carbonates in western and southern part of the country.

- Elevated values in outdoor air and soil gas have been also found in close proximity to the tectonic faults.

- A moderate correlation between radon concentration in outdoor air and soil gas has been observed.

- In order to upgrade the preliminary map of radon in soil gas, a more dense grid of measurement points should be used – which will presumably be done in the future.