

Relationship between the concentration of radon directly measured in soil air and calculated after radium

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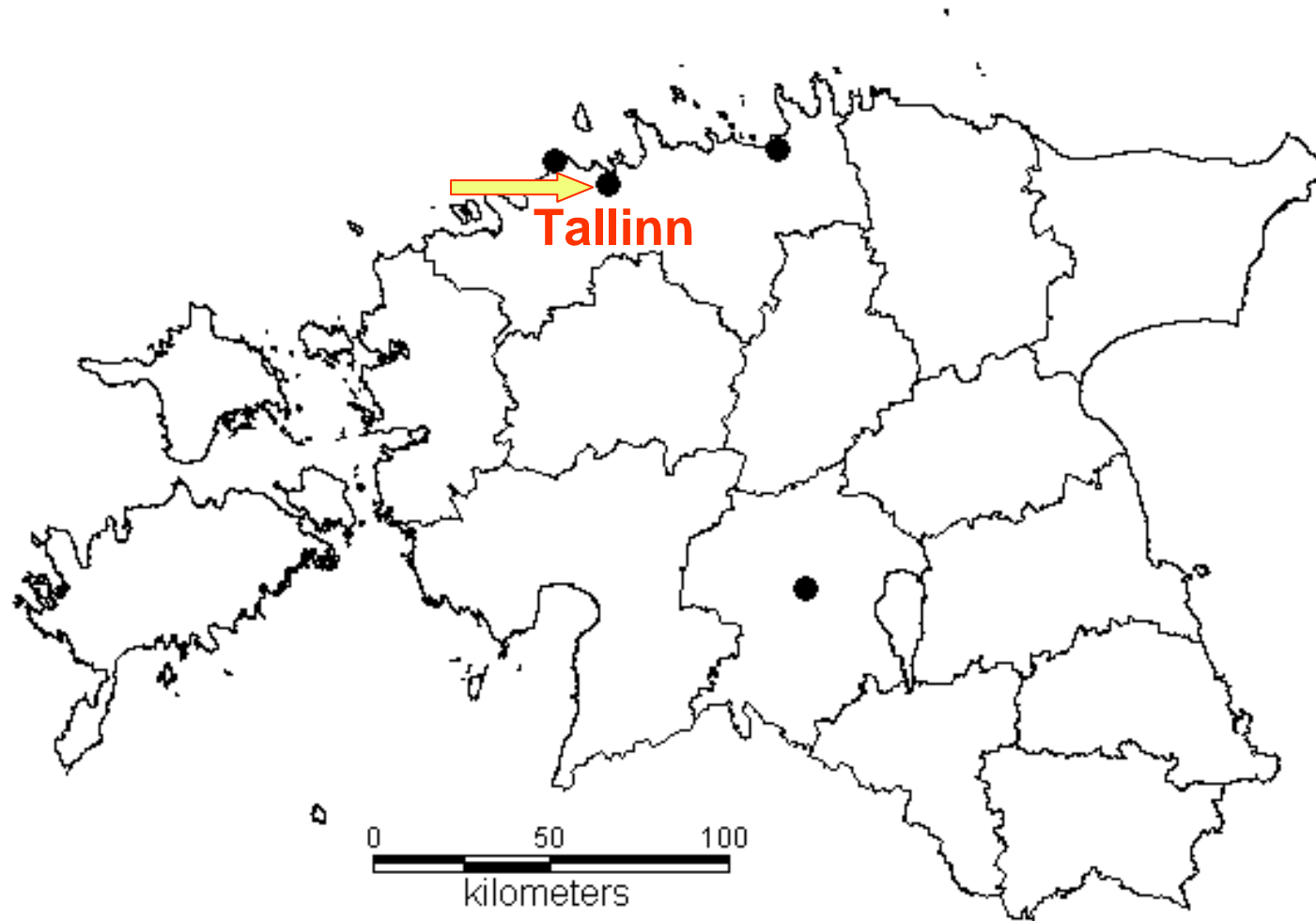


Introduction

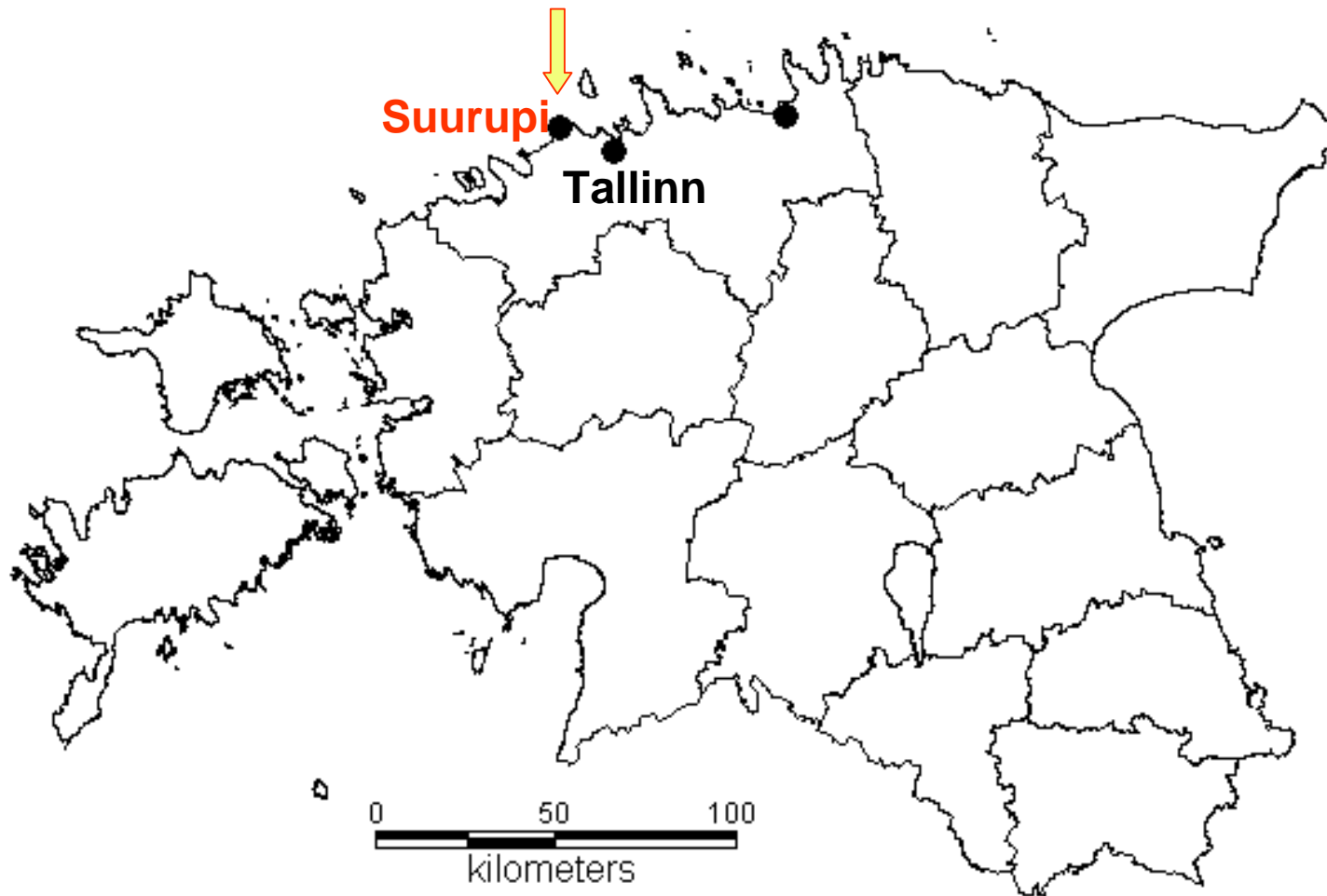
The major sources of Rn in Estonia are the following:

- **Dictyonema argillite** and **obolus sandstone** (phosphorite)
- **granitoidal material** rich in U, Th and K that has been transported from the outcrop areas of crystalline basement rocks by glaciers;
- some varieties of **Devonian sand-** and **siltstones** with elevated concentration of U.

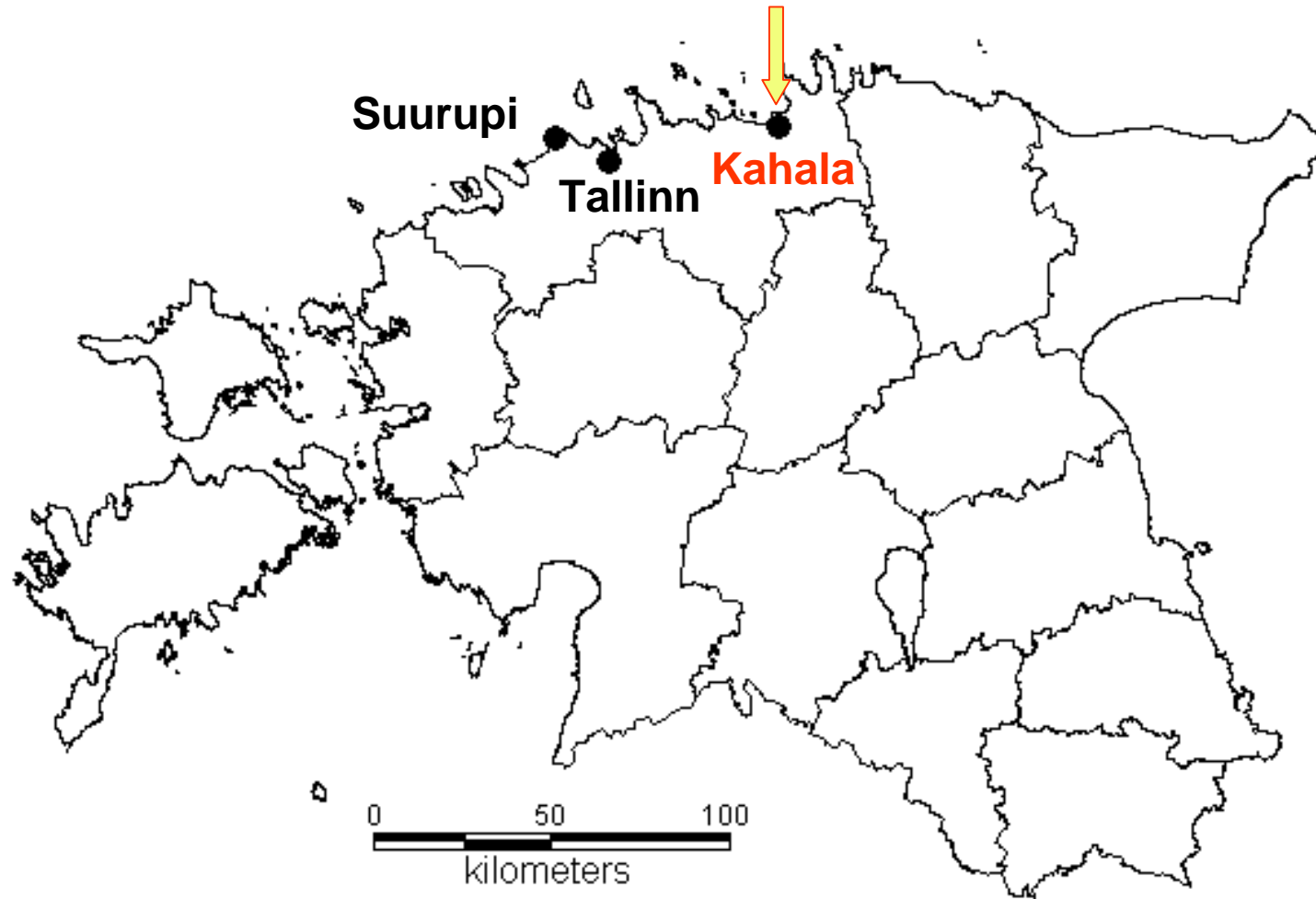
Location of Tallinn monitoring site



Location of Tallinn and Suurupi monitoring sites



Location of Tallinn, Suurupi and Kahala monitoring sites



Methods (1)

The concentration of eU in soil with gamma-spectrometer and the concentration of Rn in soil air with Markus 10 (RnM) were measured at depths:

- 0.3 m,
- 0.55 m and
- 0.8 m.



Methods (2)

Calculating RnG:

$$RnG = A \cdot e \cdot \bar{\rho} \cdot (1 - p) \cdot p^{-1} ,$$

where **RnG** – maximum activity concentration of Rn (kBq/m³);

A – activity concentration of Ra, (Bq/kg);

e – Rn emanation factor;

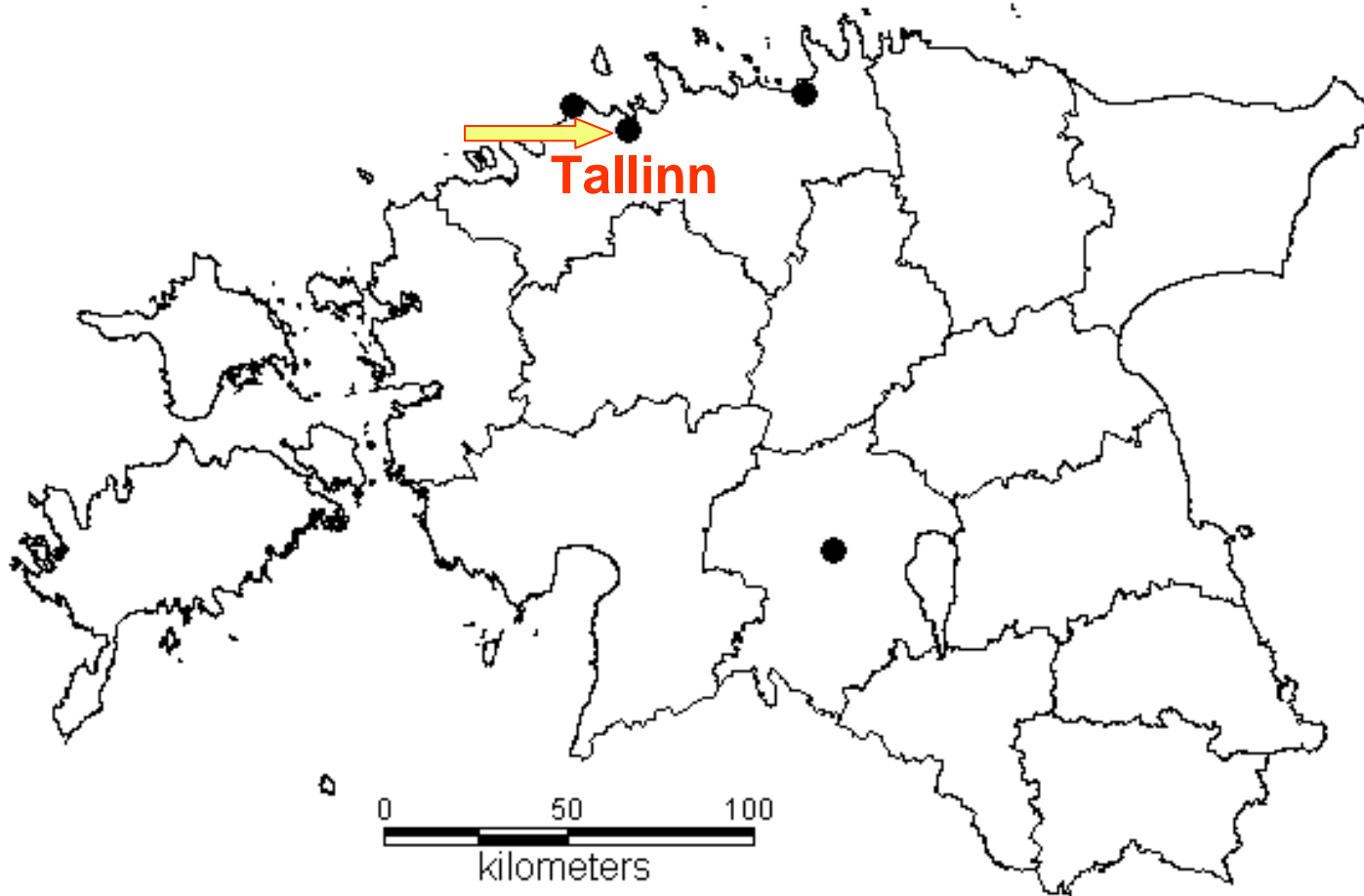
$\bar{\rho}$ – compact volume weight, for soils (kg/m³);

p – porosity (ratio pore volume/total volume).

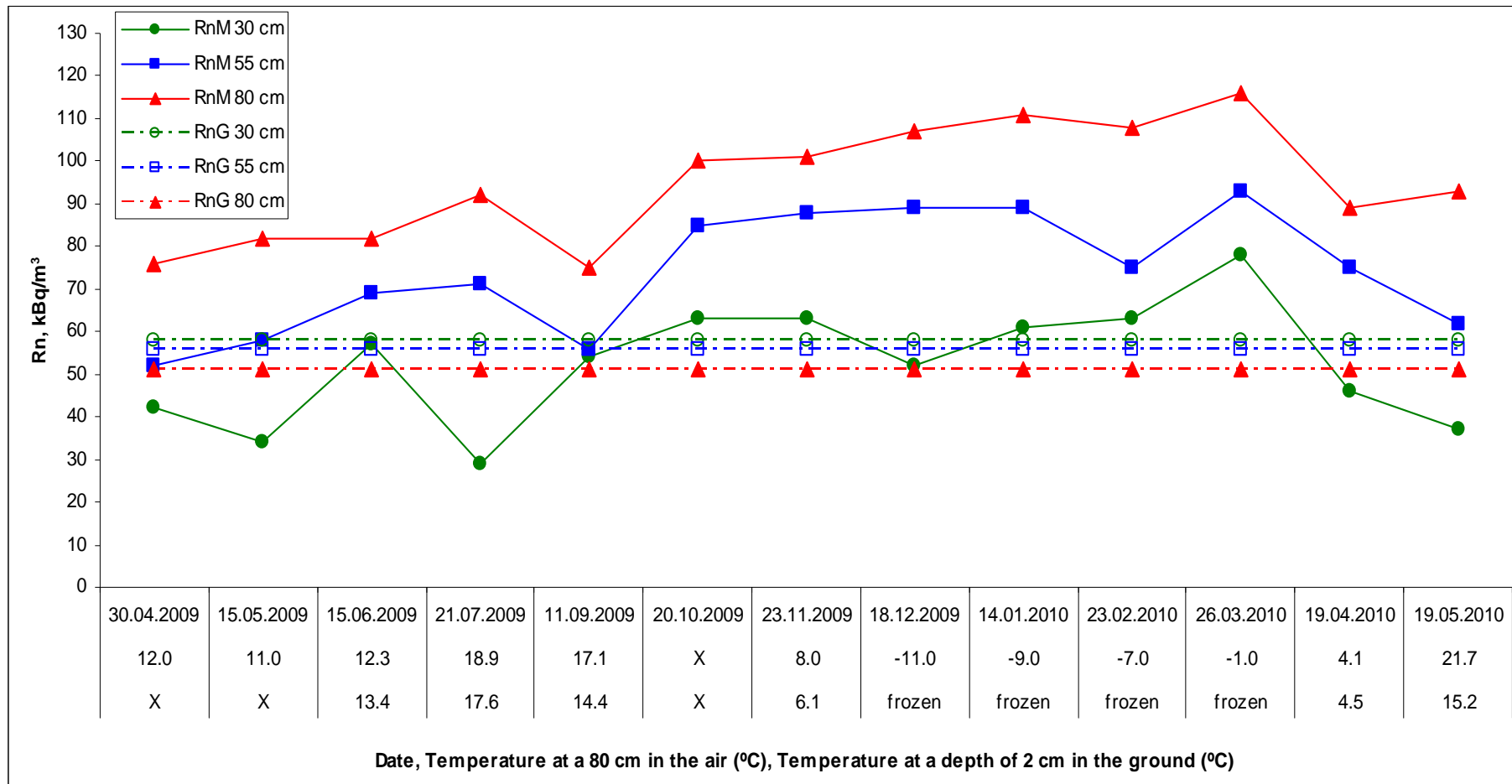
Results

Under normal circumstances the directly measured concentration of Rn in soil air is lower than the concentration calculated after eU in soil.

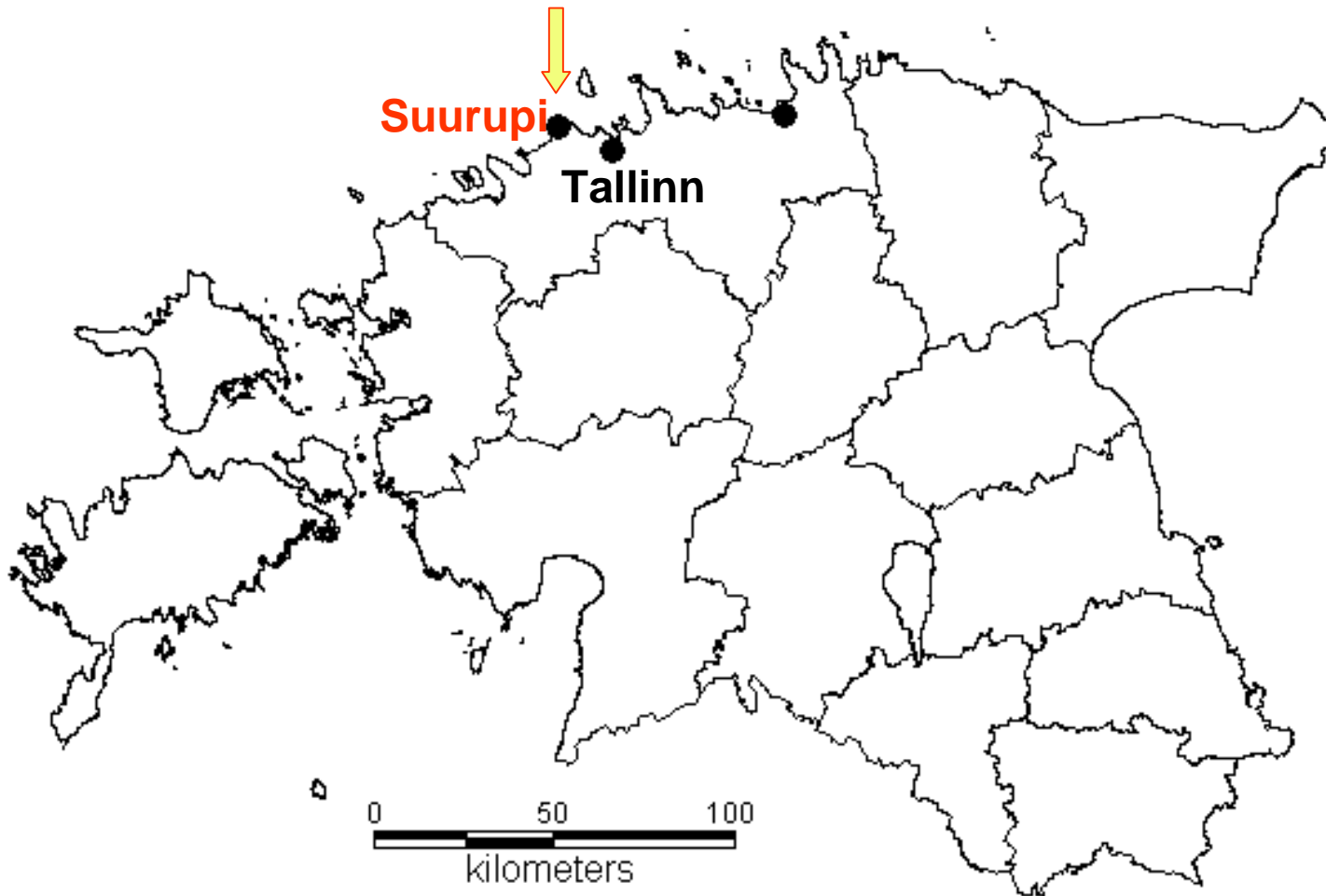
Location



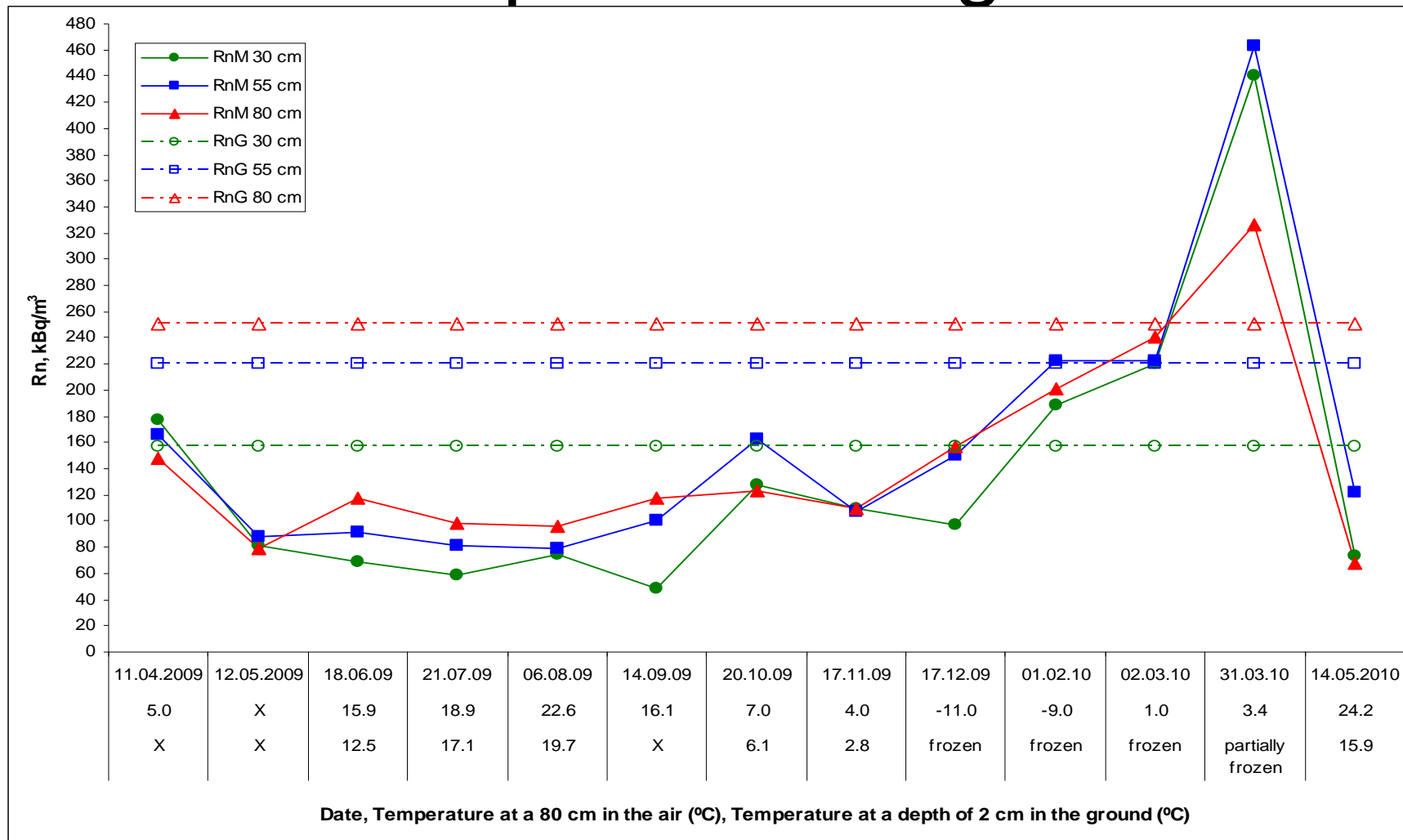
Time series of changes in Rn concentration in soil air of the Tallinn monitoring site



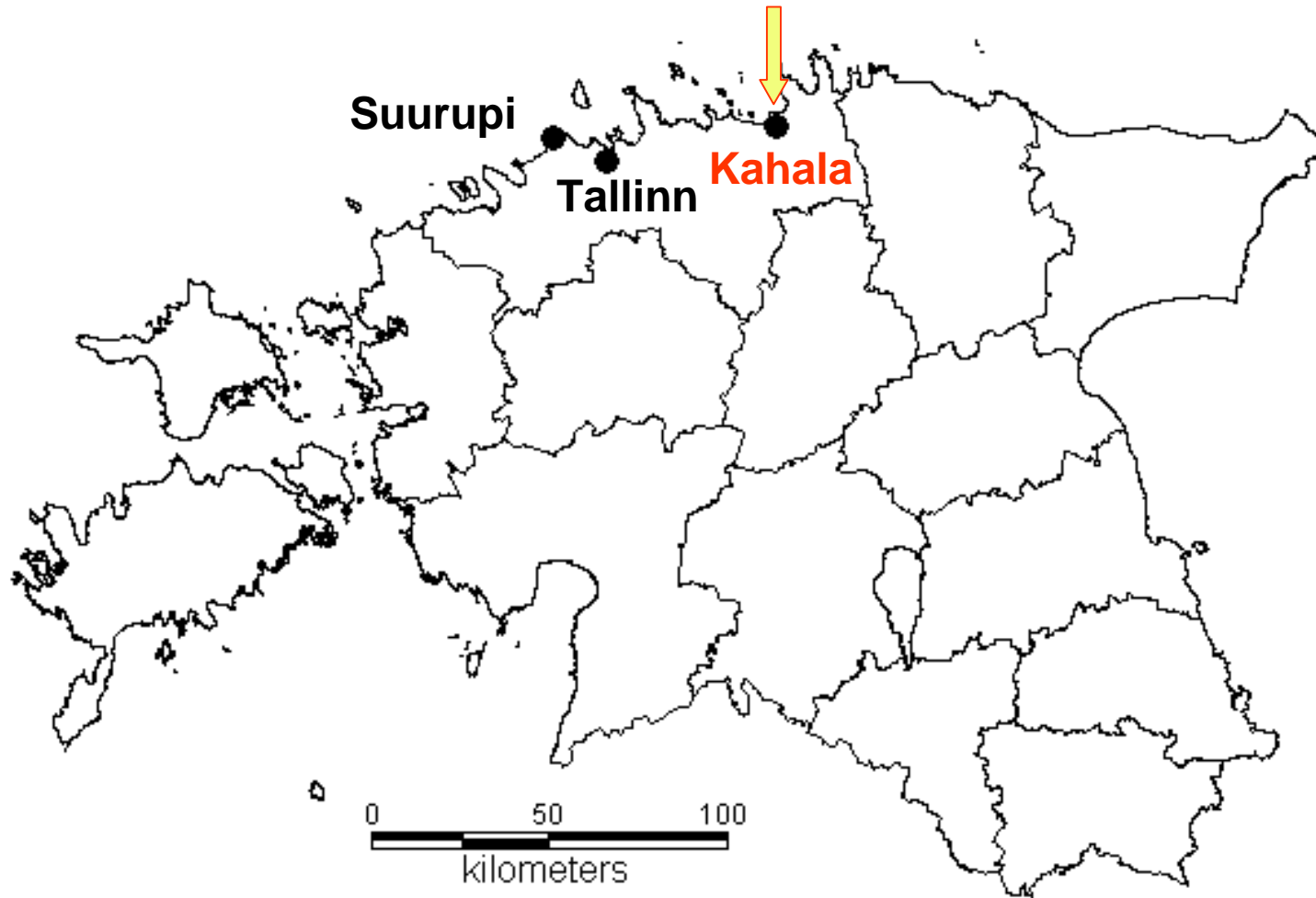
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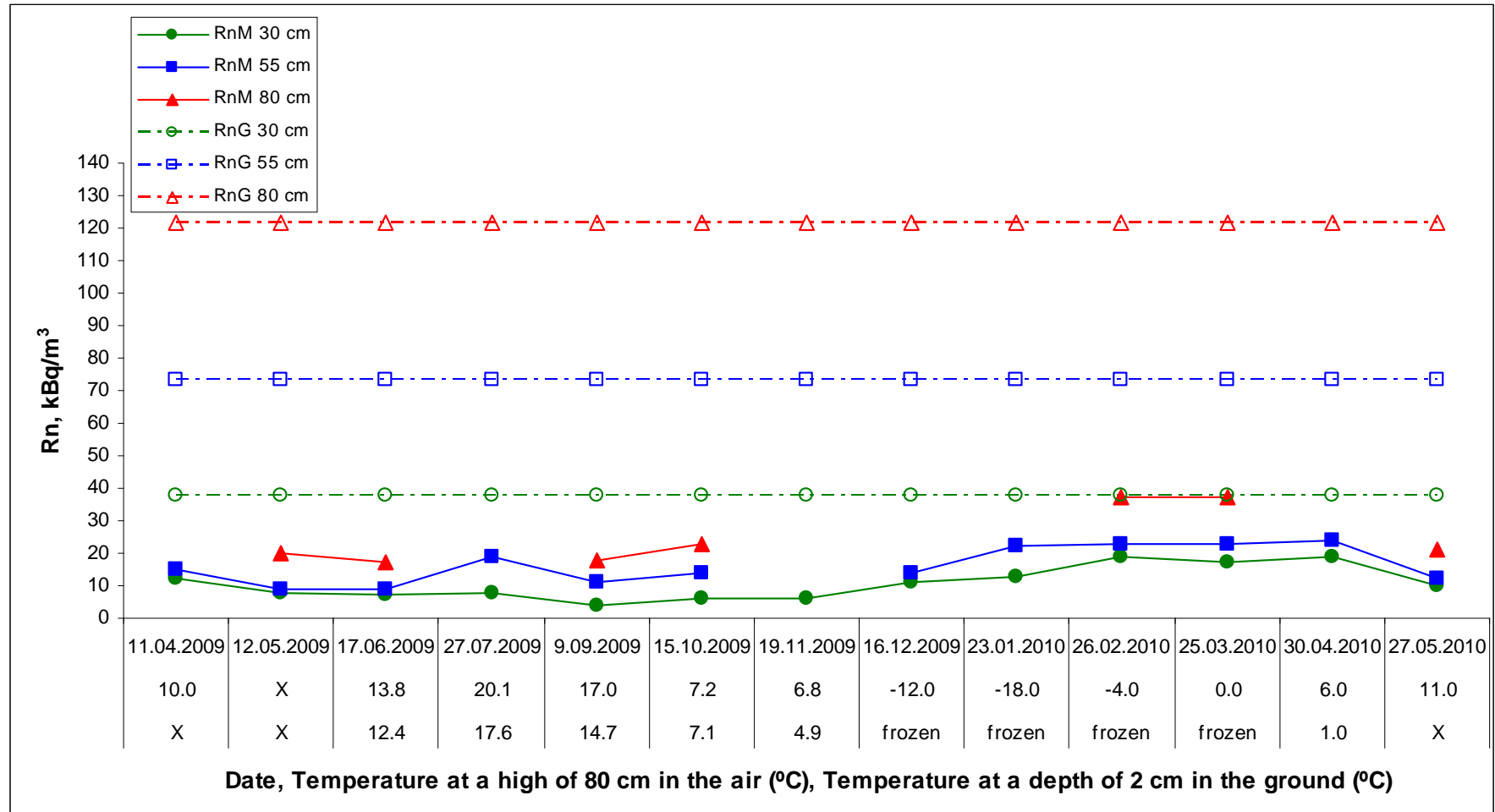
Time series of changes in Rn concentration in soil air of the Suurupi monitoring site



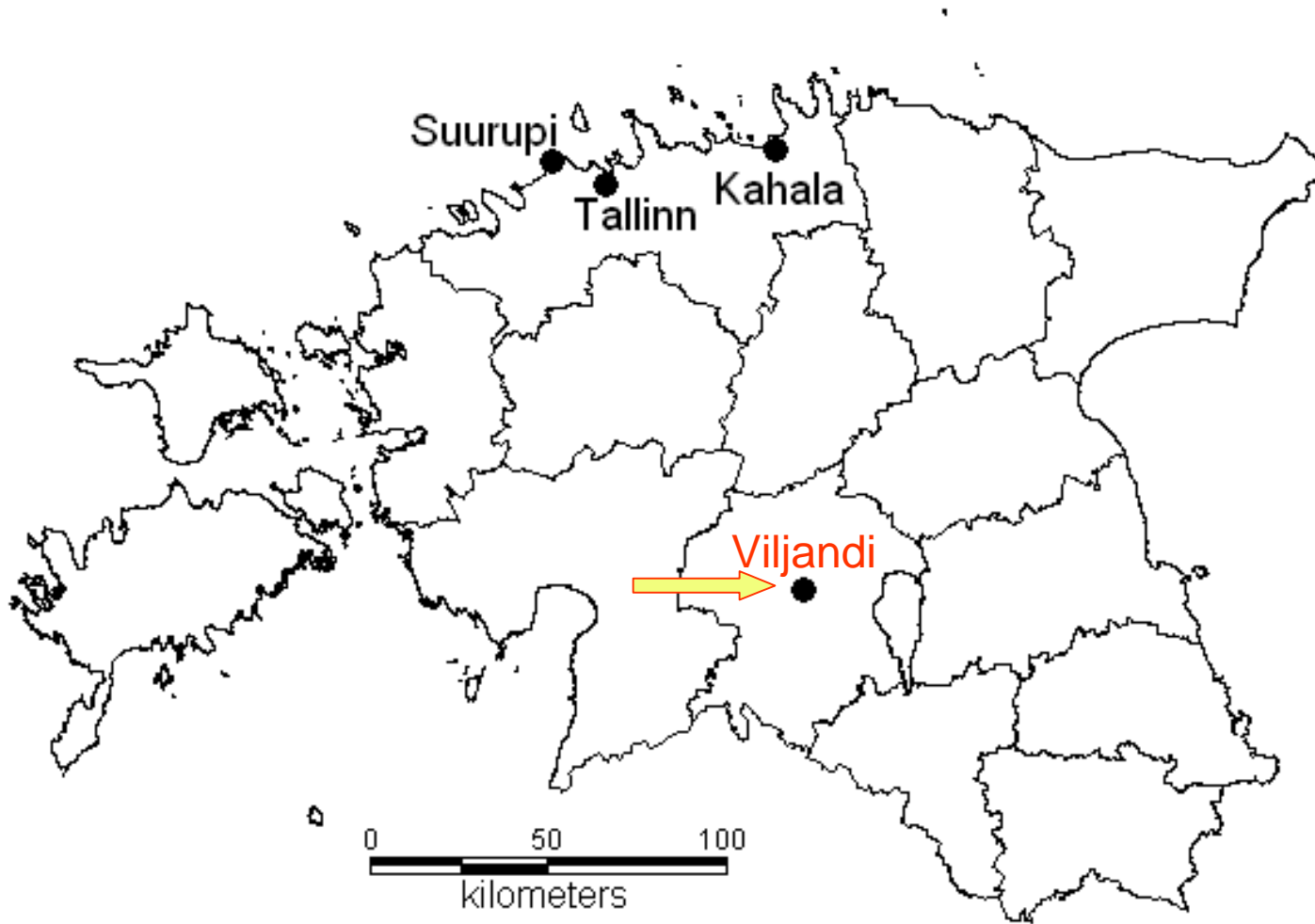
Location



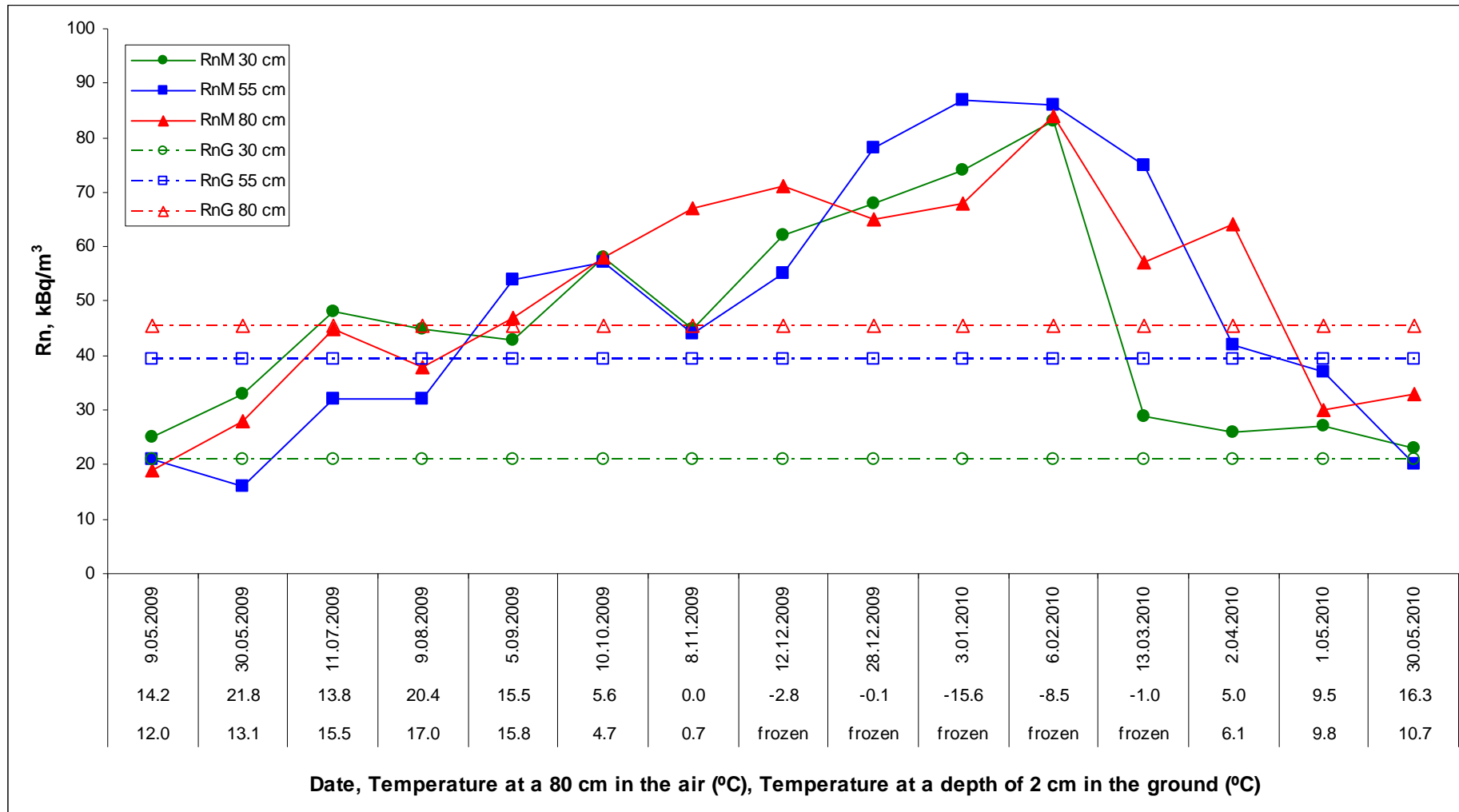
Time series of changes in Rn concentration in soil air of the Kahala monitoring site



Location



Time series of changes in Rn concentration in soil air of the Viljandi monitoring site



Conclusions (1)

- In all sites the concentration of RnM in soil air depends on the geological composition, time of measuring and precipitation.
- Decisive factor is the character of topsoil (humus horizon) covering the Quaternary deposits in a monitoring site, its moisture content and temperature during measuring.

Conclusions (2)

The actual level of Rn risk in Estonia can be assessed **only by parallel using of two methods:**

- 1) **gamma spectrometer** enables calculation of the concentration of Rn based on the concentration of Ra measured in soil;
- 2) the concentration of Rn measured in soil air by **emanometer Markus 10** allows assessing the inflow of Rn from deeper layers

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Thank you for your attention!