Soil particle size distribution using the Integral Suspension Pressure method (ISP) and Gamma-Ray Spectrometry (GRS) techniques for soil texture mapping.

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INTRODUCTION

- Soil textural mapping is important for establishing sustainable resource management in agriculture as it controls soil hydraulic properties, water holding capacity, solute transport process, carbon sequestration and soil erosion (Muñoz-Rojas et al., 2017) .
- Traditional methods are labor-intensive and time-consuming, prompting the development of alternative techniques like the combination of Integral Suspension Pressure (ISP) method and Gamma-Ray Spectrometry (GRS).
- ISP method is based on Stoke's law (Durner and Iden, 2021), while GRS measures radionuclide concentration in the soil, both contributing to more efficient and accurate soil texture mapping.

STUDY AREA

The study area is the Hydrological Open-Air Laboratory (HOAL) in Petzenkirchen (Fig. 1) located in Lower Austria.

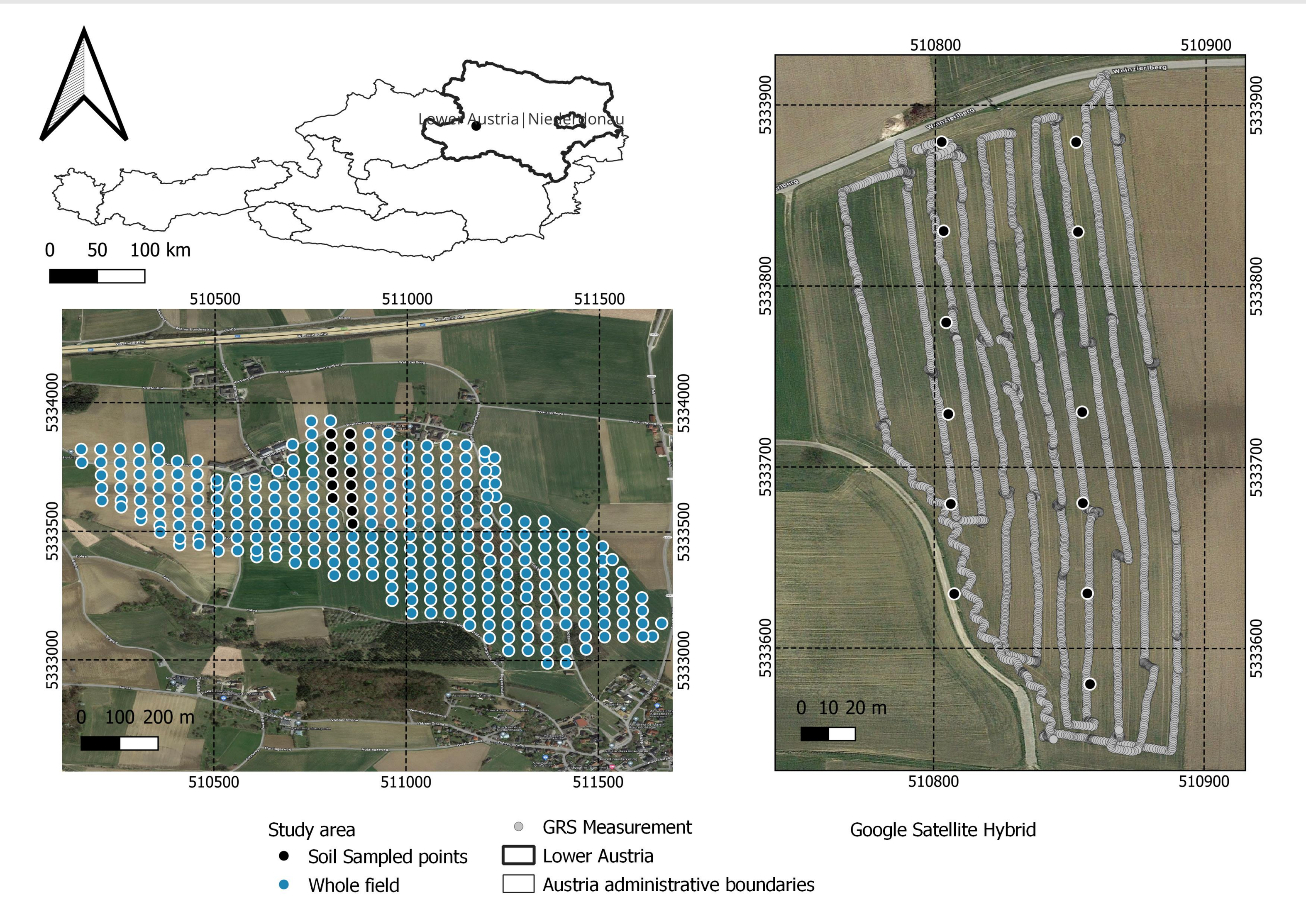

Figure 1. Study area at Hydrological Open-Air Laboratory (HOAL) in Petzenkirchen, Austria.

OBJECTIVES

- Assess changes in soil particle distribution over a period of a decade;
- Investigate the spatial distribution of radionuclide concentrations in the soil;
- Develop an integrated modelling approach using GRS data for soil textural mapping.

METHODOLOGY

Field work

Field soil sampling

GRS field measurements

Laboratory analysis

Laboratory analysis using ISP method

2023 and 2012 soil textural comparison

Data processing

Model development and mapping

Spatial data analysis using QGIS

Developed a Linear regression correlation model using R.

Soil particle size distribution (sand, silt and clay) using GRS data.

Figure 2. a. Laboratory soil texture analysis using ISP; b. GRS field measurement

RESULTS & DISCUSSION

Evaluating changes in soil particle distribution

- The soil particle size distribution in 2023 does not show significant difference from that determined in 2012 (Fig.3).
- This could be due to stable environmental conditions since 2012.

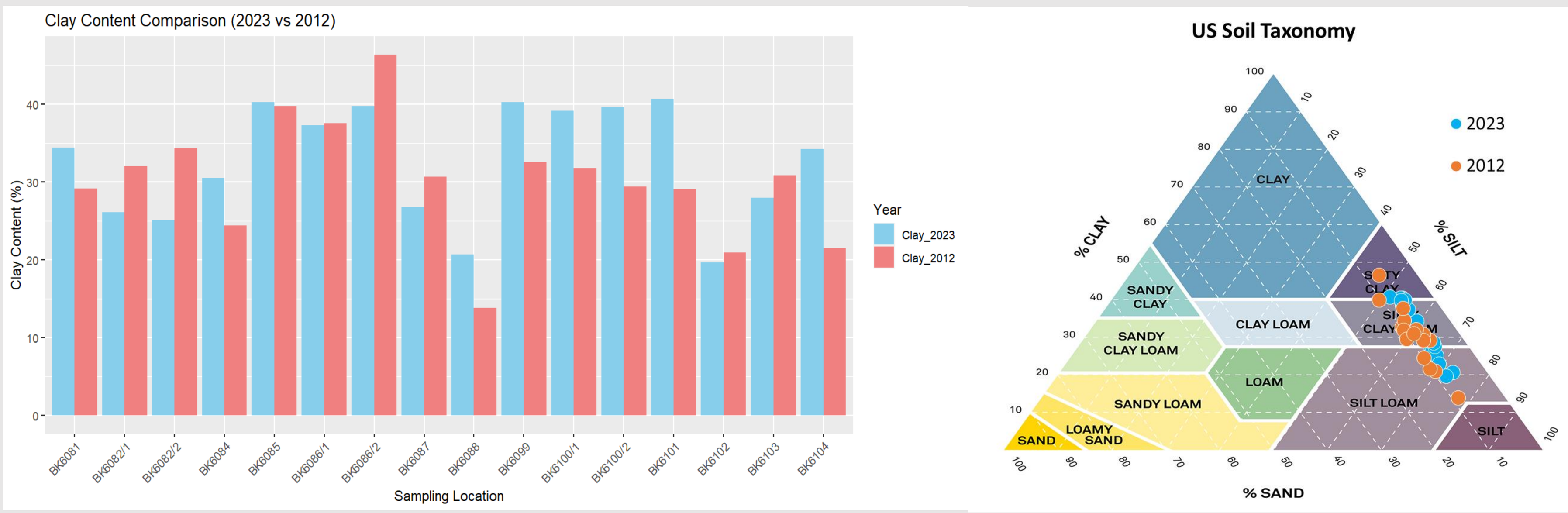

Figure 3. Comparison of Soil particle size distribution for 2023 and 2012.

Investigating the spatial distribution of radionuclide concentration

- ^{238}U and ^{232}Th show similar pattern different from ^{40}K (Fig. 4). ^{40}K is highly dependent on soil moisture thus the variation.

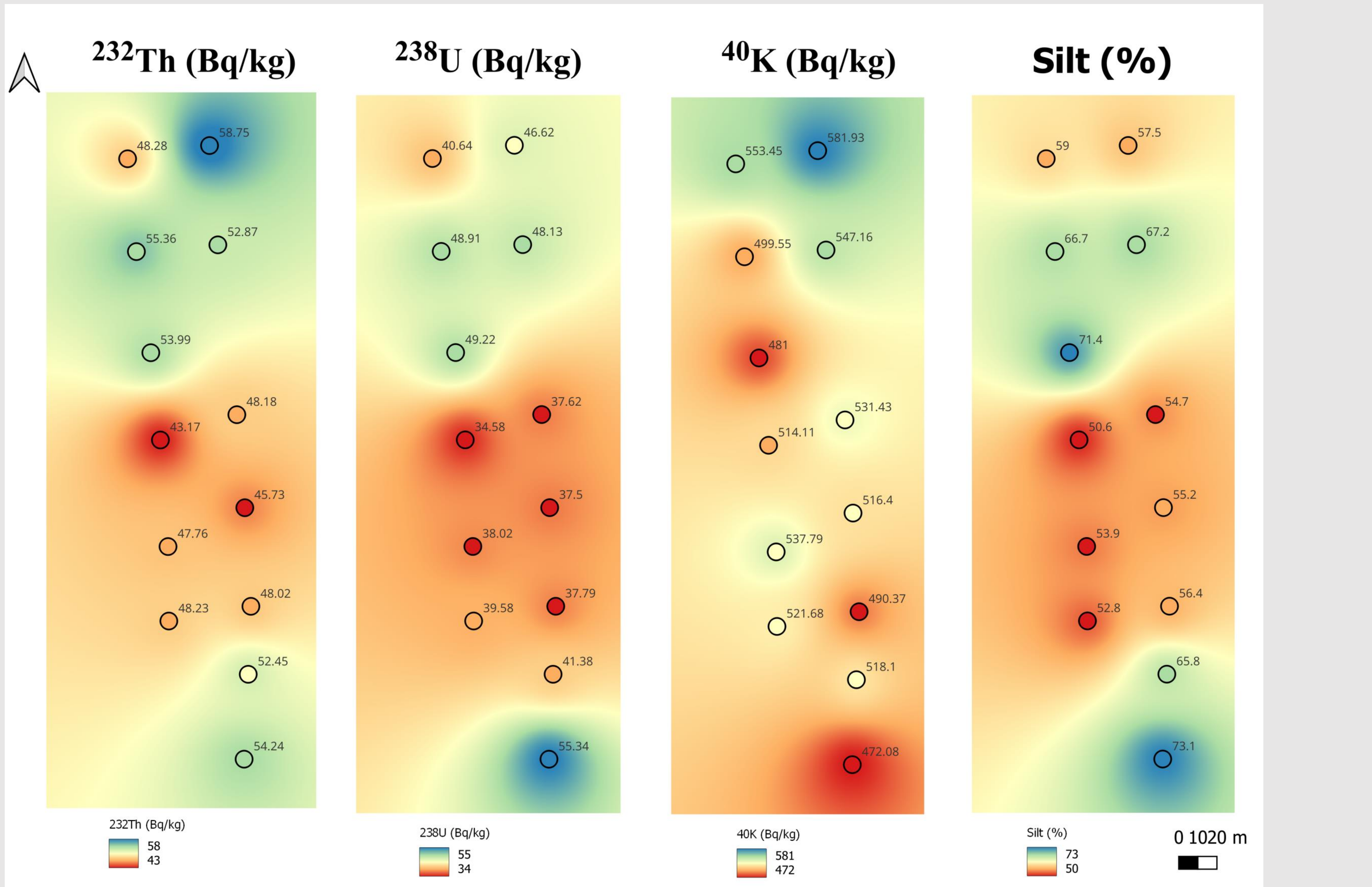

Figure 4. Comparing soil radionuclide concentrations measured with GRS vs silt concentration.

Integrated modelling approach

- The correlation between the radionuclides and sand doesn't show a good fit as compared to silt and clay (Fig. 5)

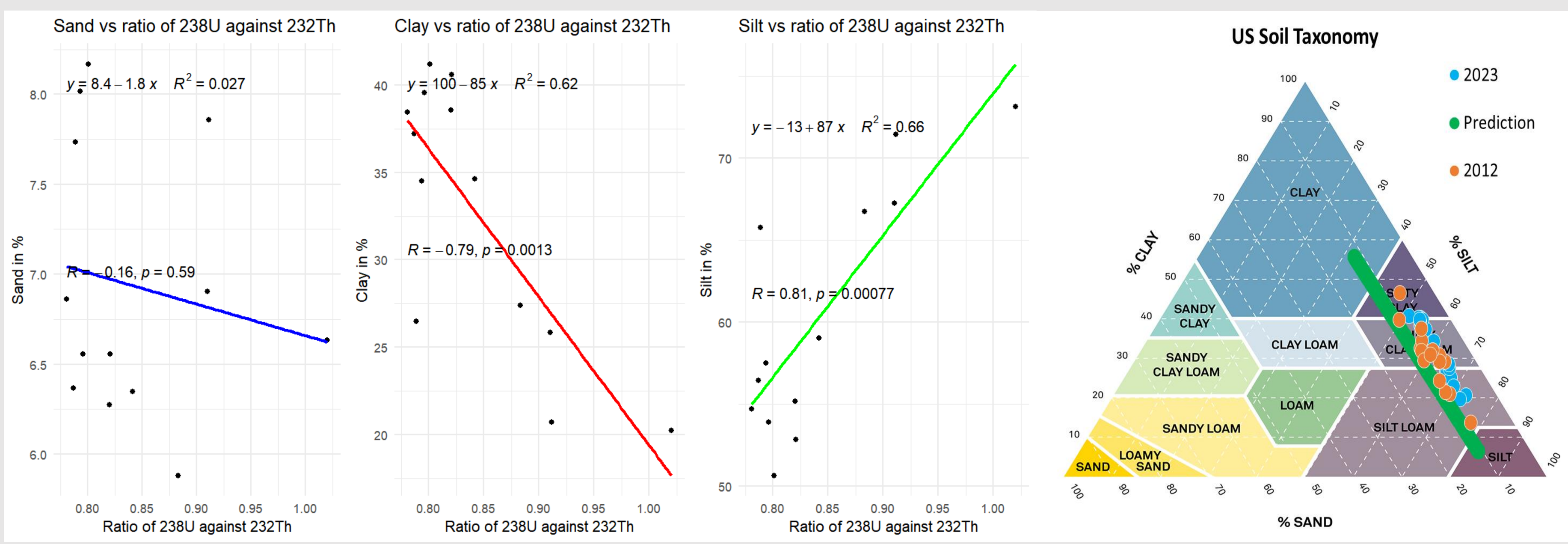

Figure 5. Correlation model results and soil textural classification based on model results.

CONCLUSION and RECOMMENDATIONS

- ^{40}K attenuation is influenced by soil moisture thus slightly differs from ^{238}U and ^{232}Th. Soil moisture could be included as independent variable during modelling;
- ^{238}U and ^{232}Th give a good correlation coefficient with silt and clay than sand;
- Soil texture in the study area ranges from silty loam to silty clay;
- More sampling should be done to have more data for model performance enhancement and validation.

REFERENCES

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