



Radon anomalies in the northern Upper Rhine Graben (Germany) as result of recent geodynamic processes

Special Session: Radon and Geology

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Department G1 basic geological information

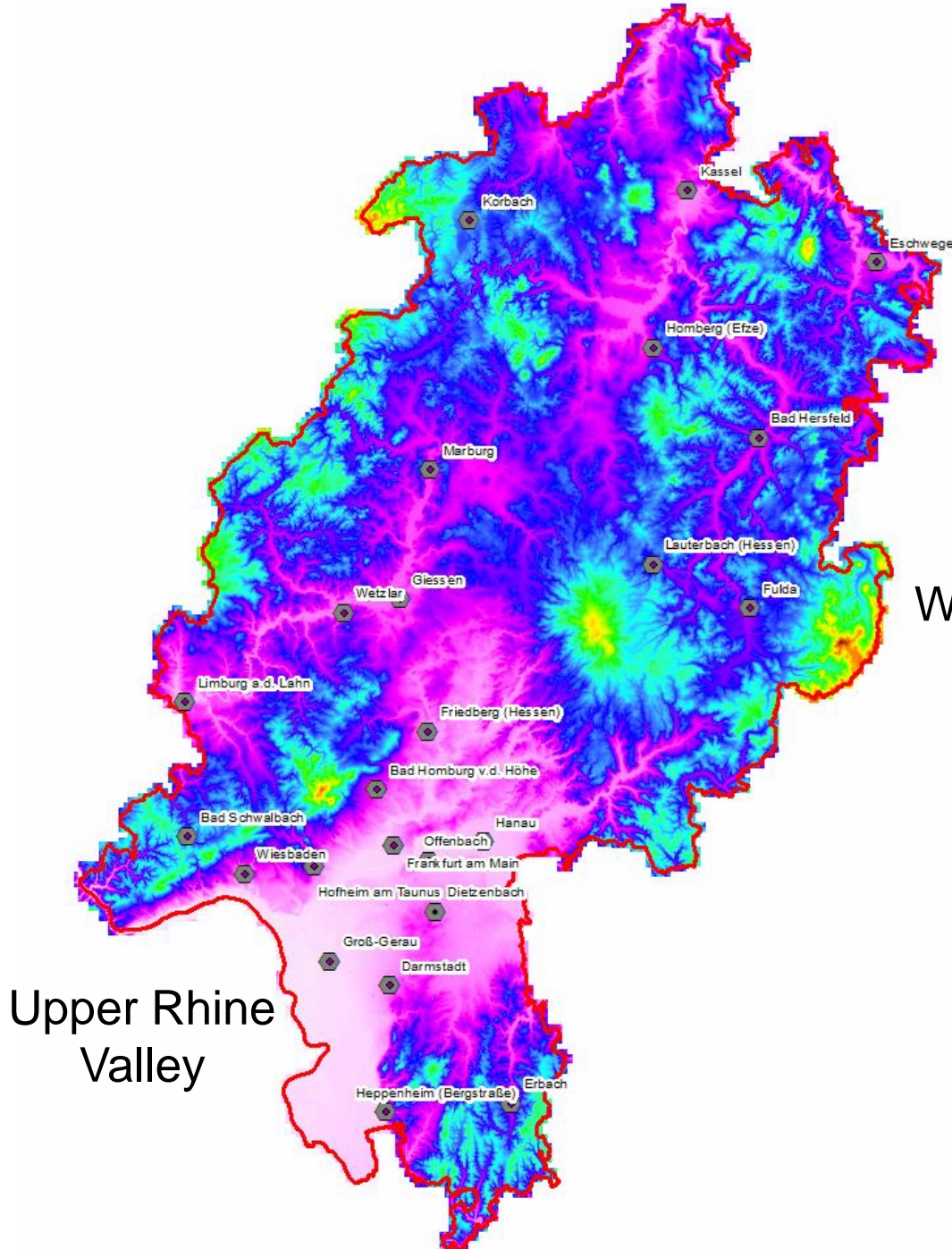




Location federal state of Hesse

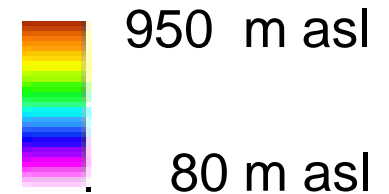
(wikipedia)

Hesse - Geography

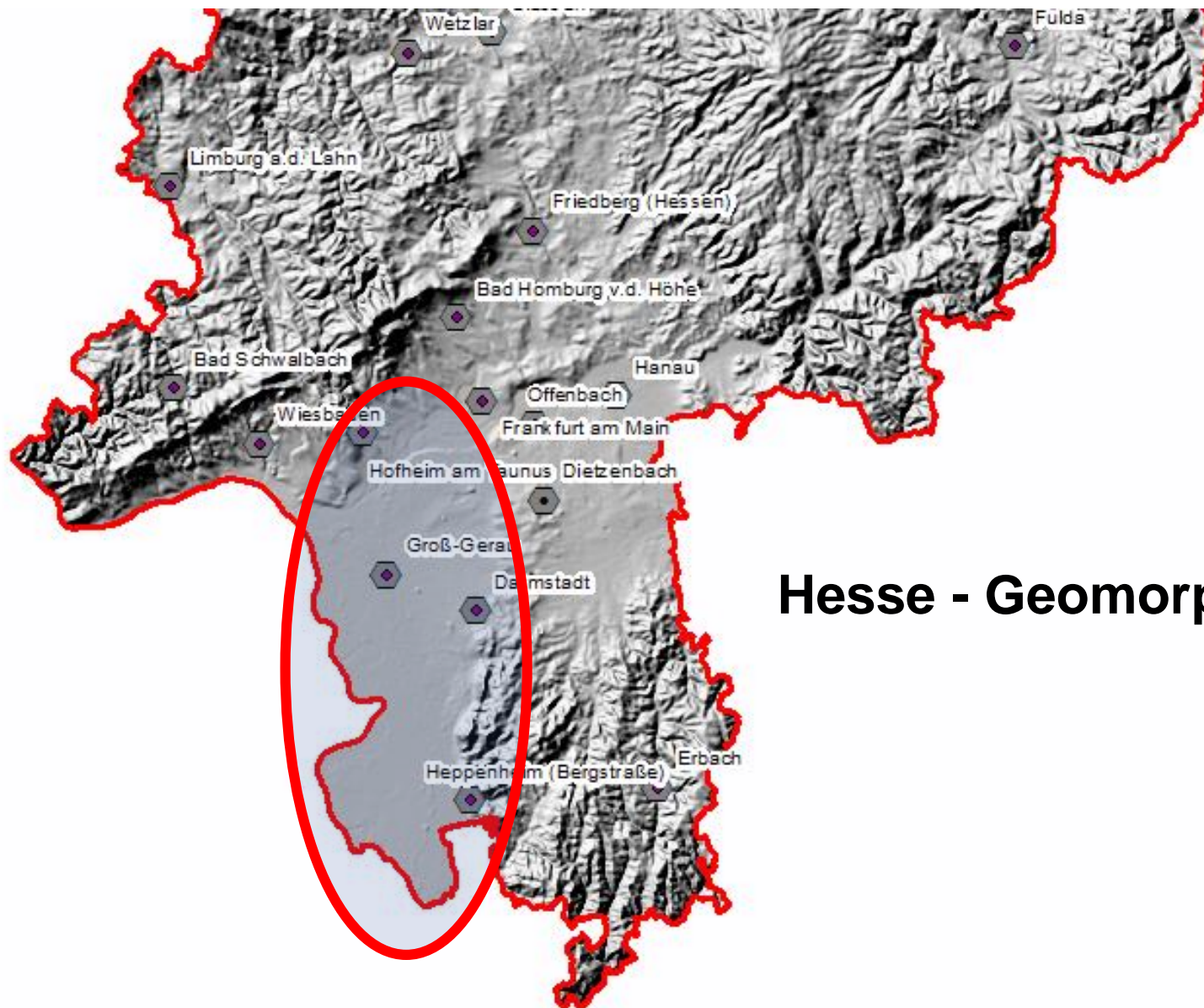


Wasserkuppe

elevation

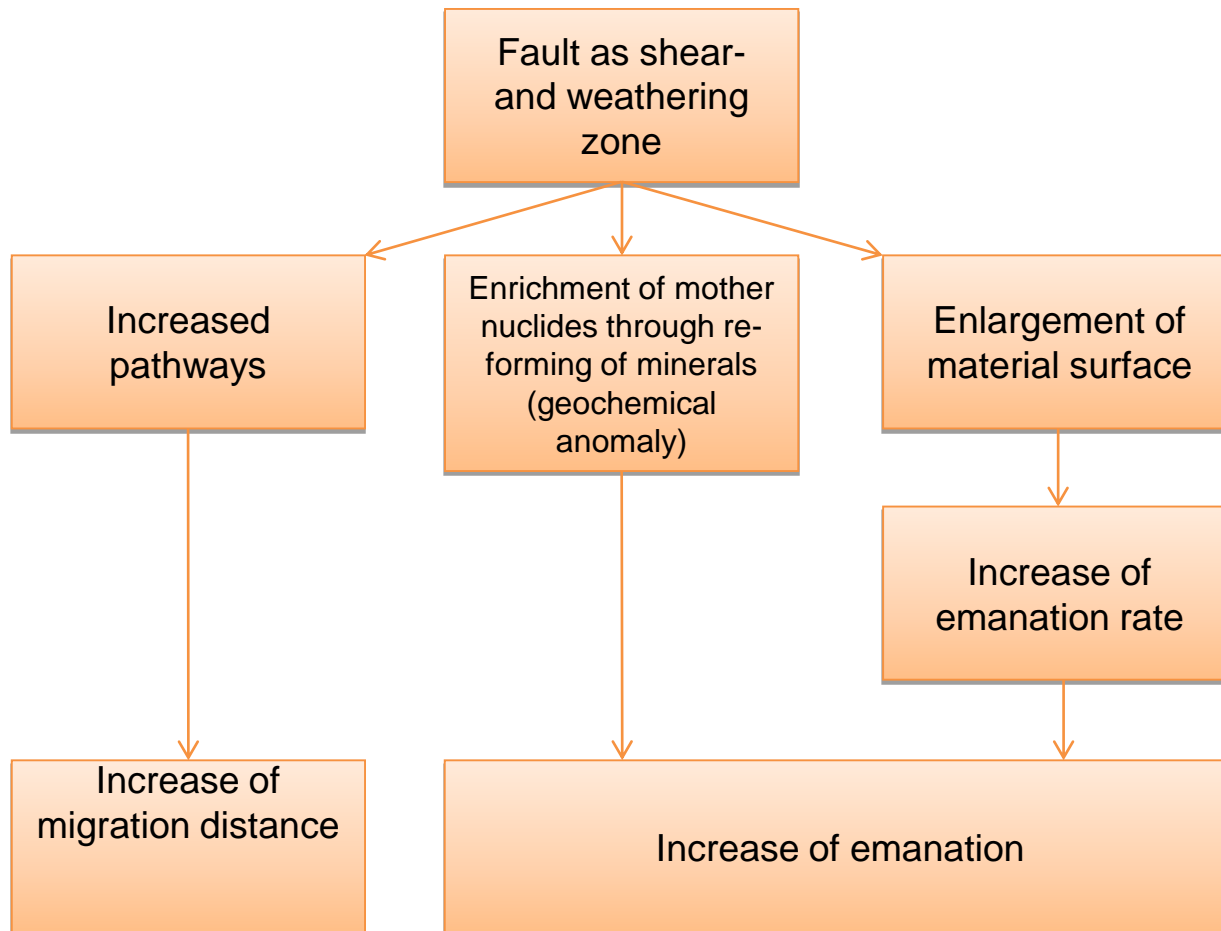


Upper Rhine Valley

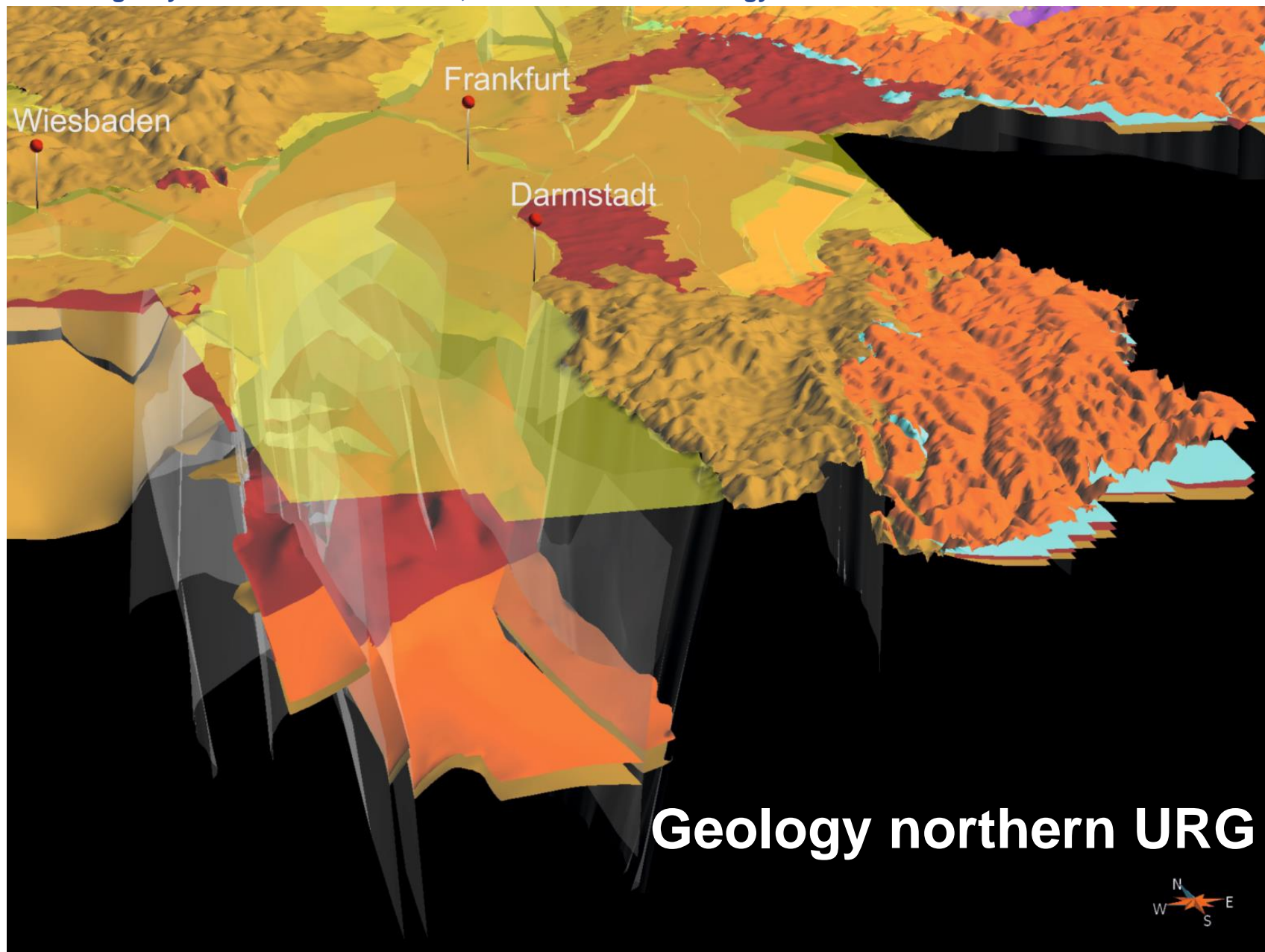


Hesse - Geomorphology

Assumption 1: Measured radon concentrations are dependent on tectonic inventory acting as migration paths

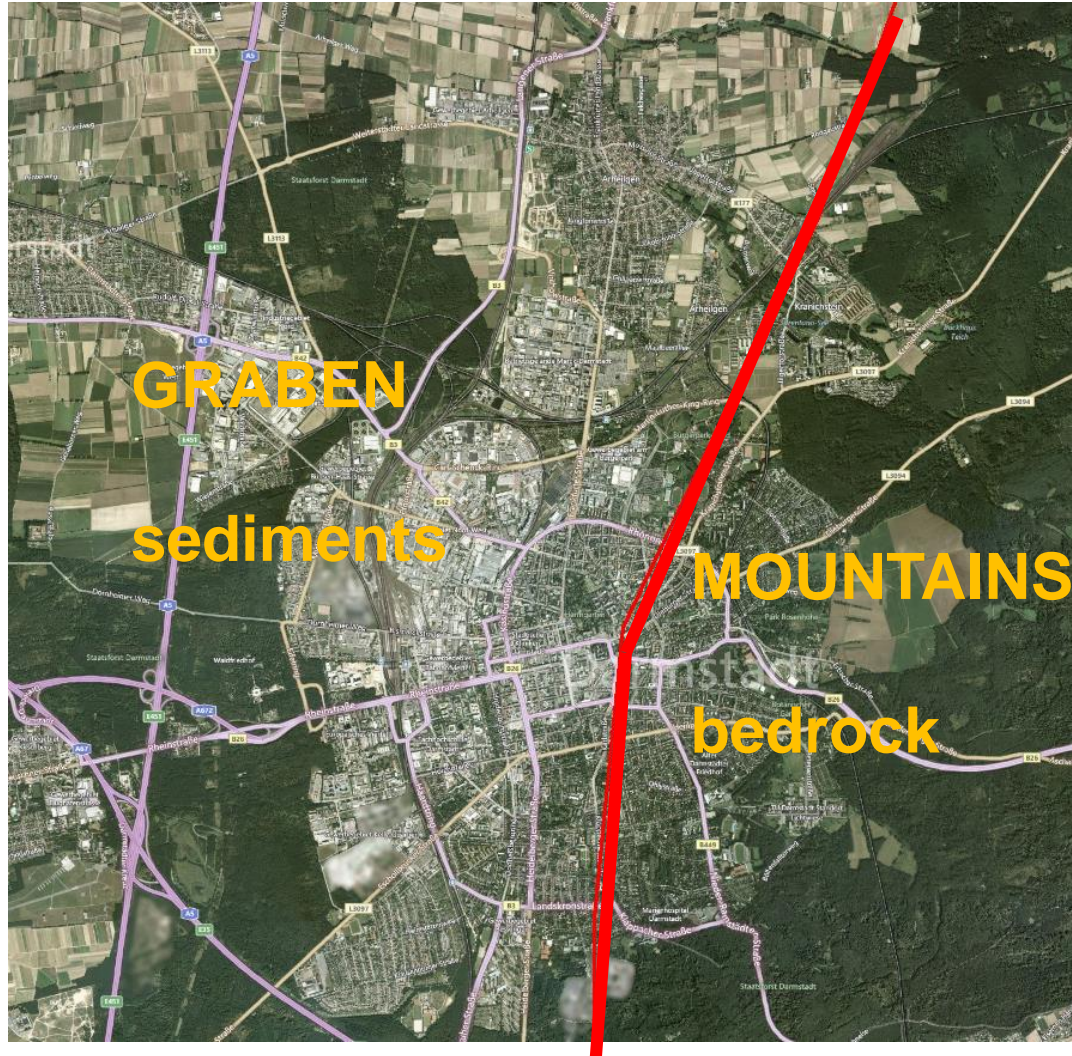


(Wewior 2012)



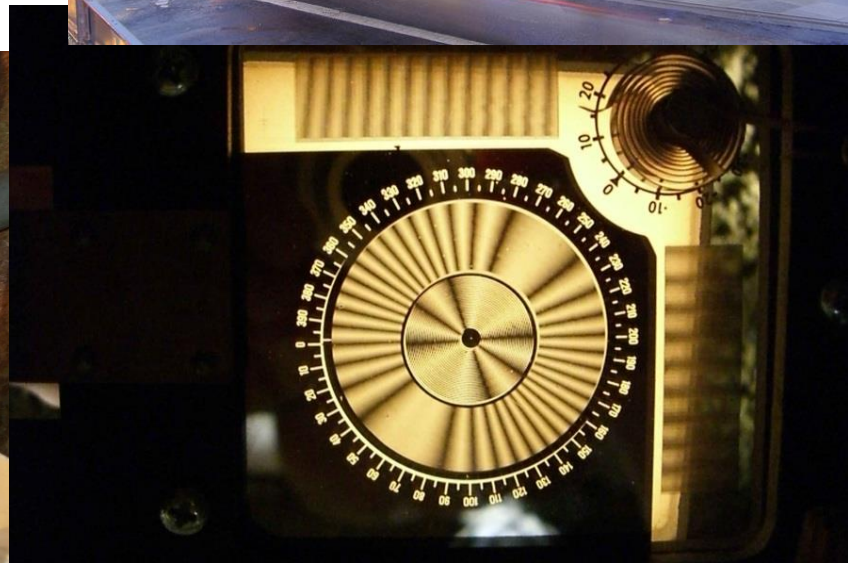
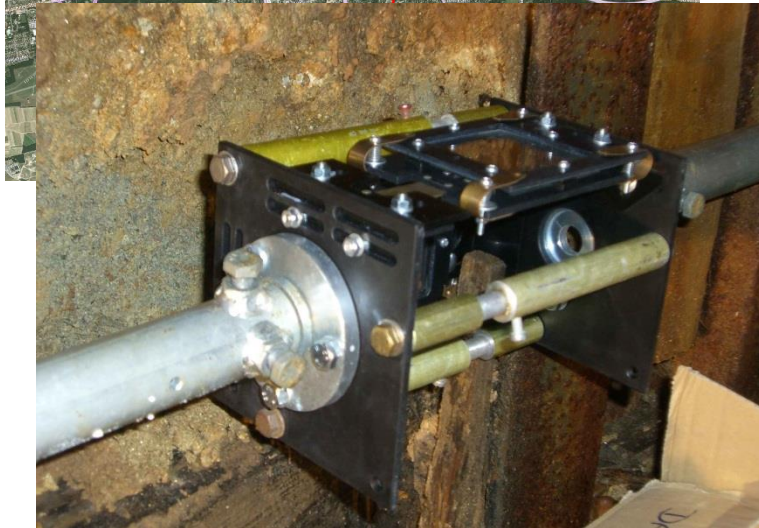
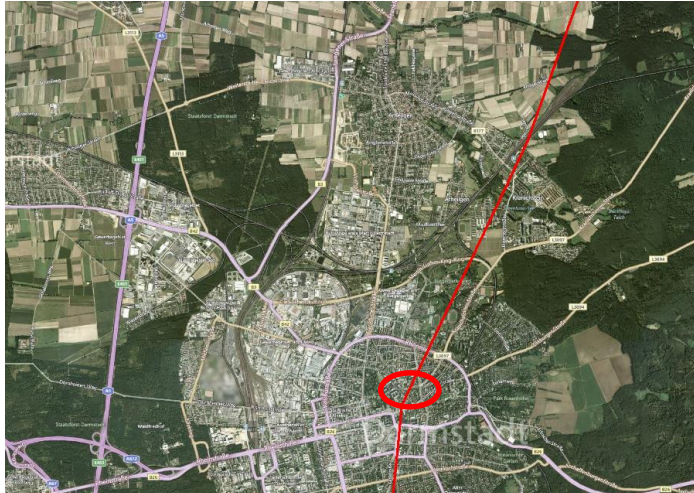
Geology northern URG

Geodynamics in Darmstadt

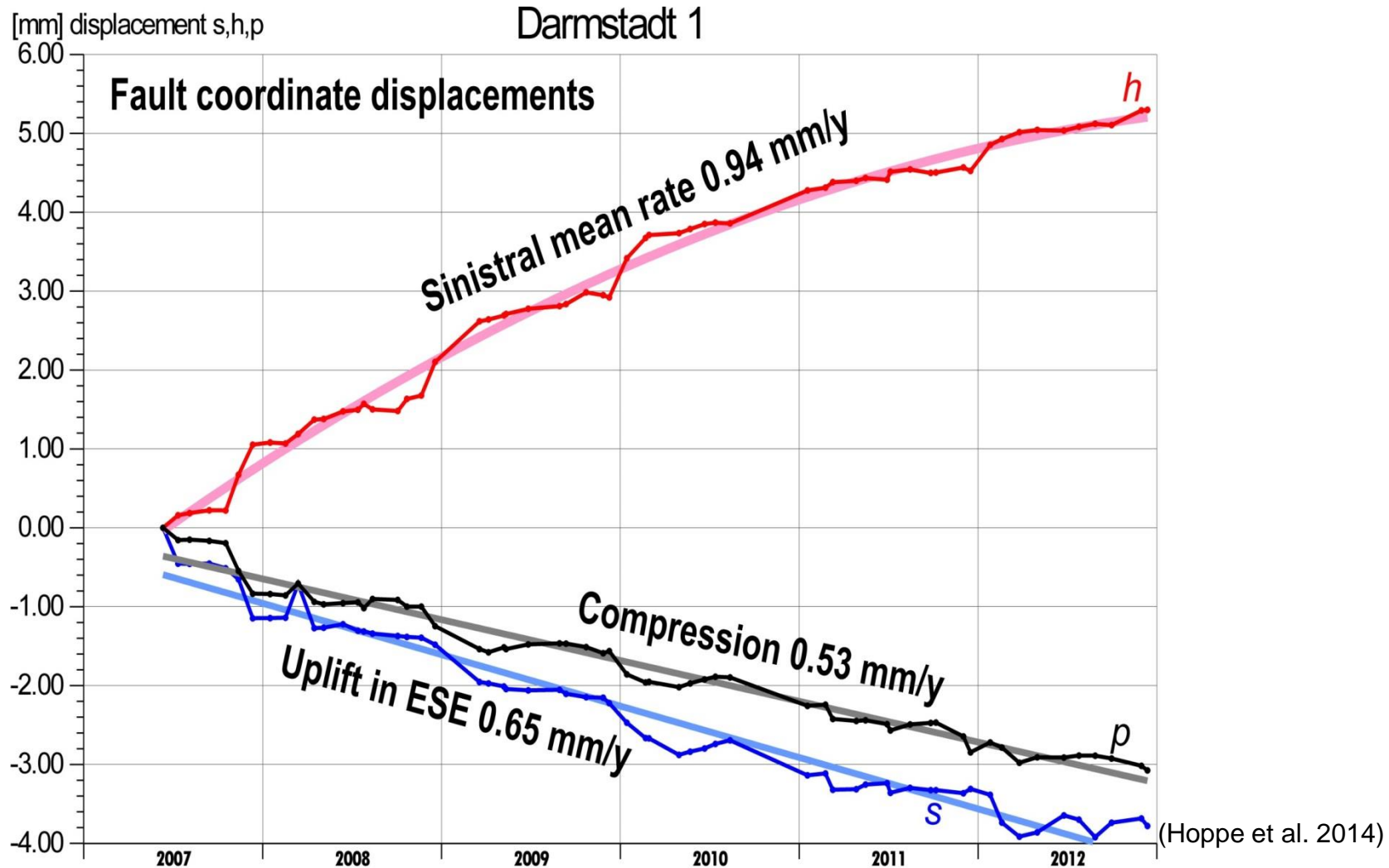


(Bing Maps)

Geodynamics in Darmstadt

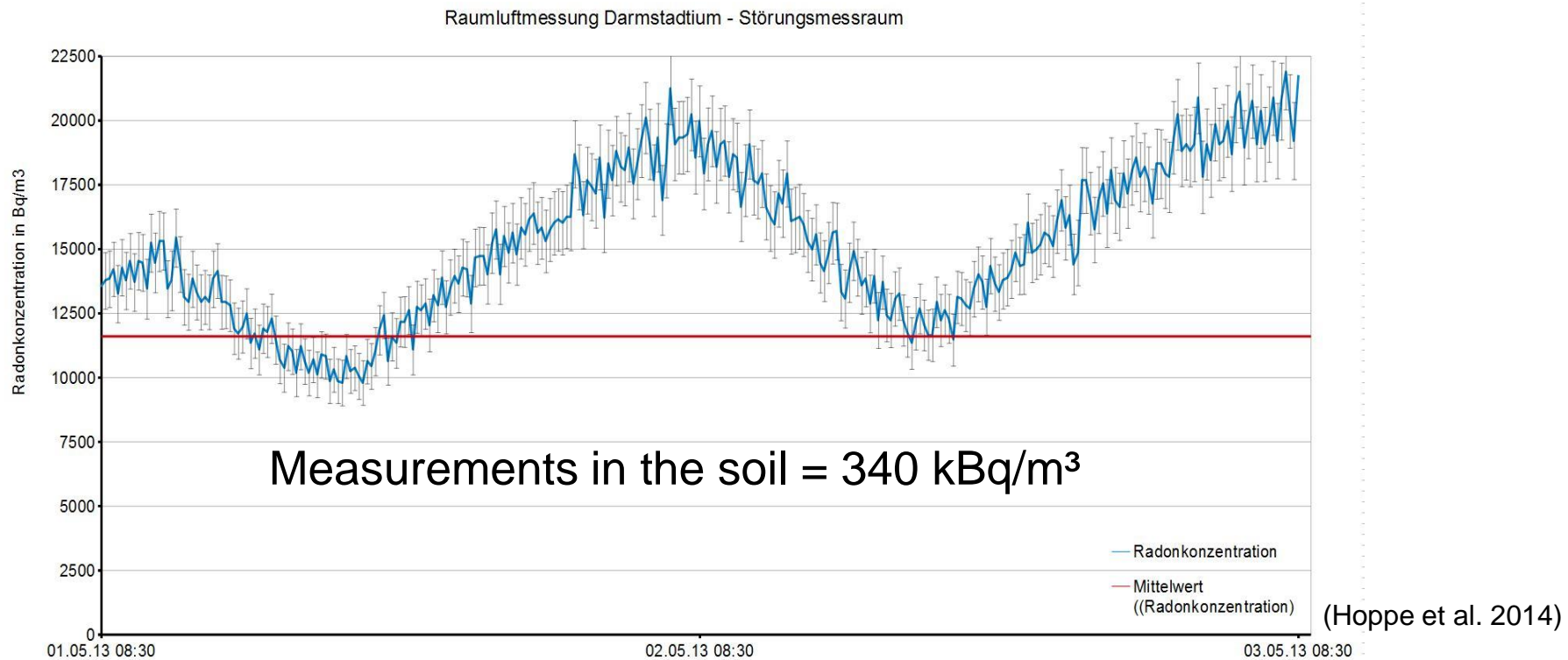


Geodynamics in Darmstadt



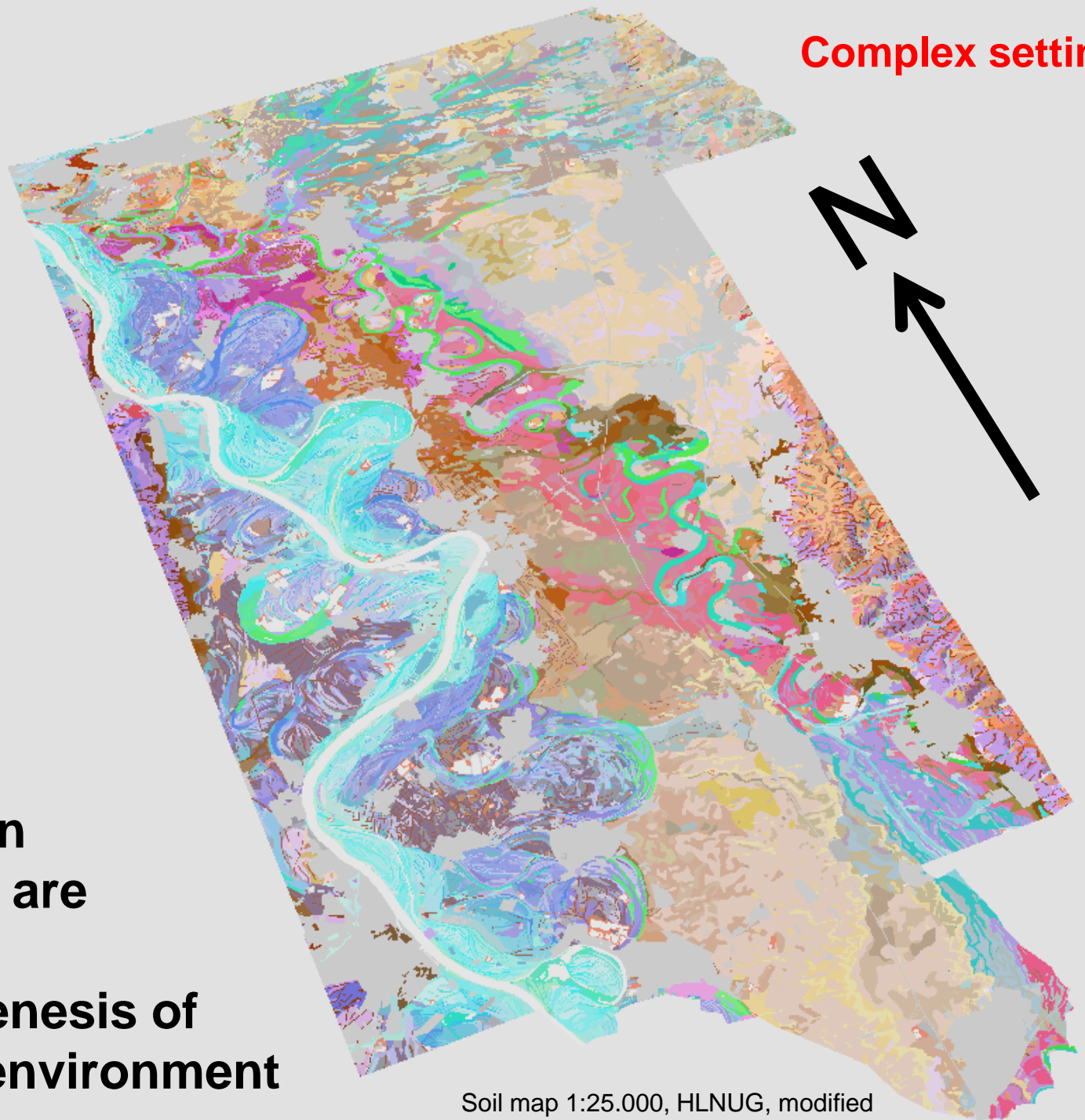
Radon measurements eastern master fault

| Location | Max. value Bq/m ³ | Av. value Bq/m ³ |
|-------------------------|------------------------------|-----------------------------|
| Front of the fault | 21.888 | 11.607 |
| Room right beside fault | 9.865 | 6.081 |
| Entrance hall | 187 | 15 |



Assumption 2

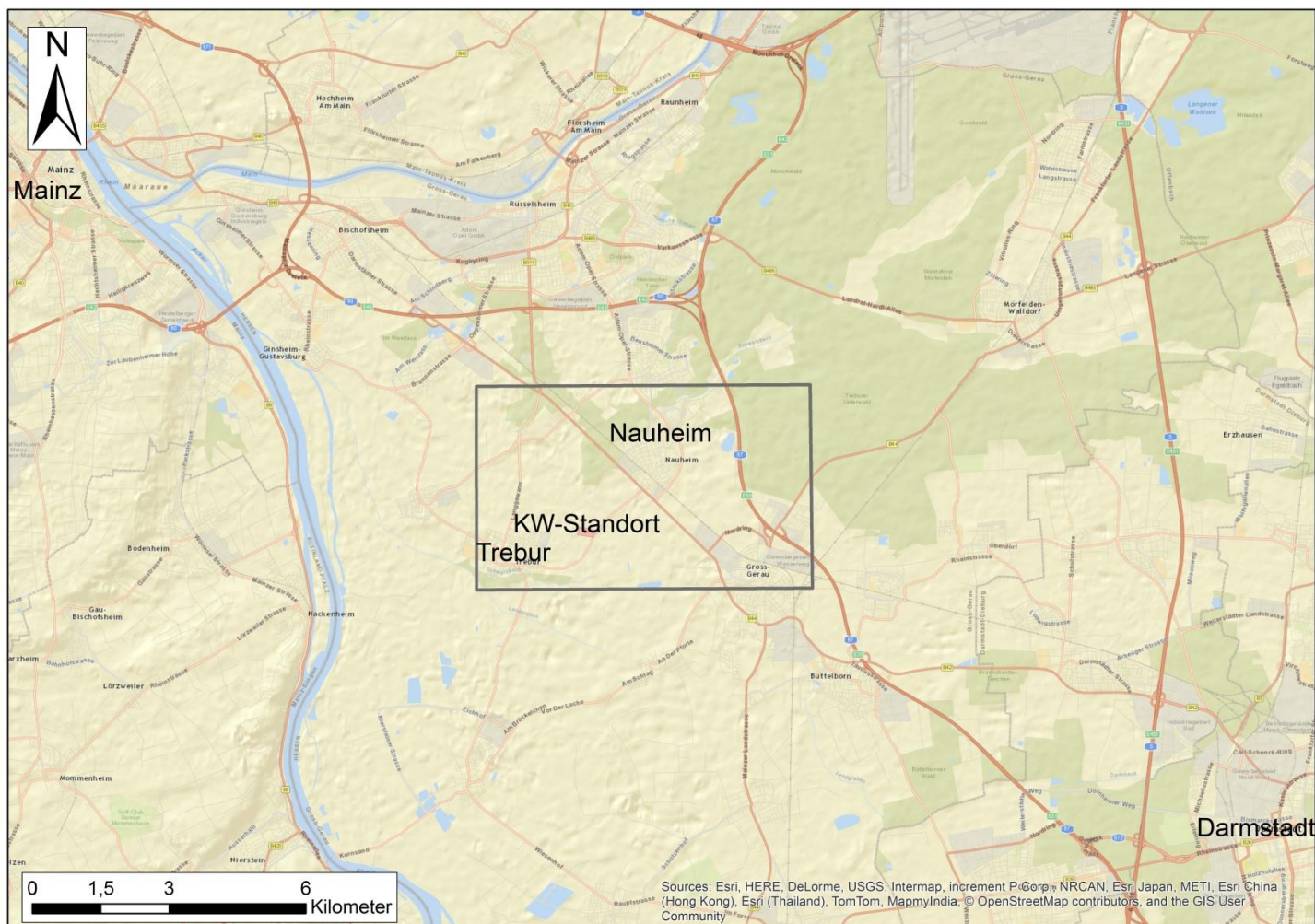
Complex setting



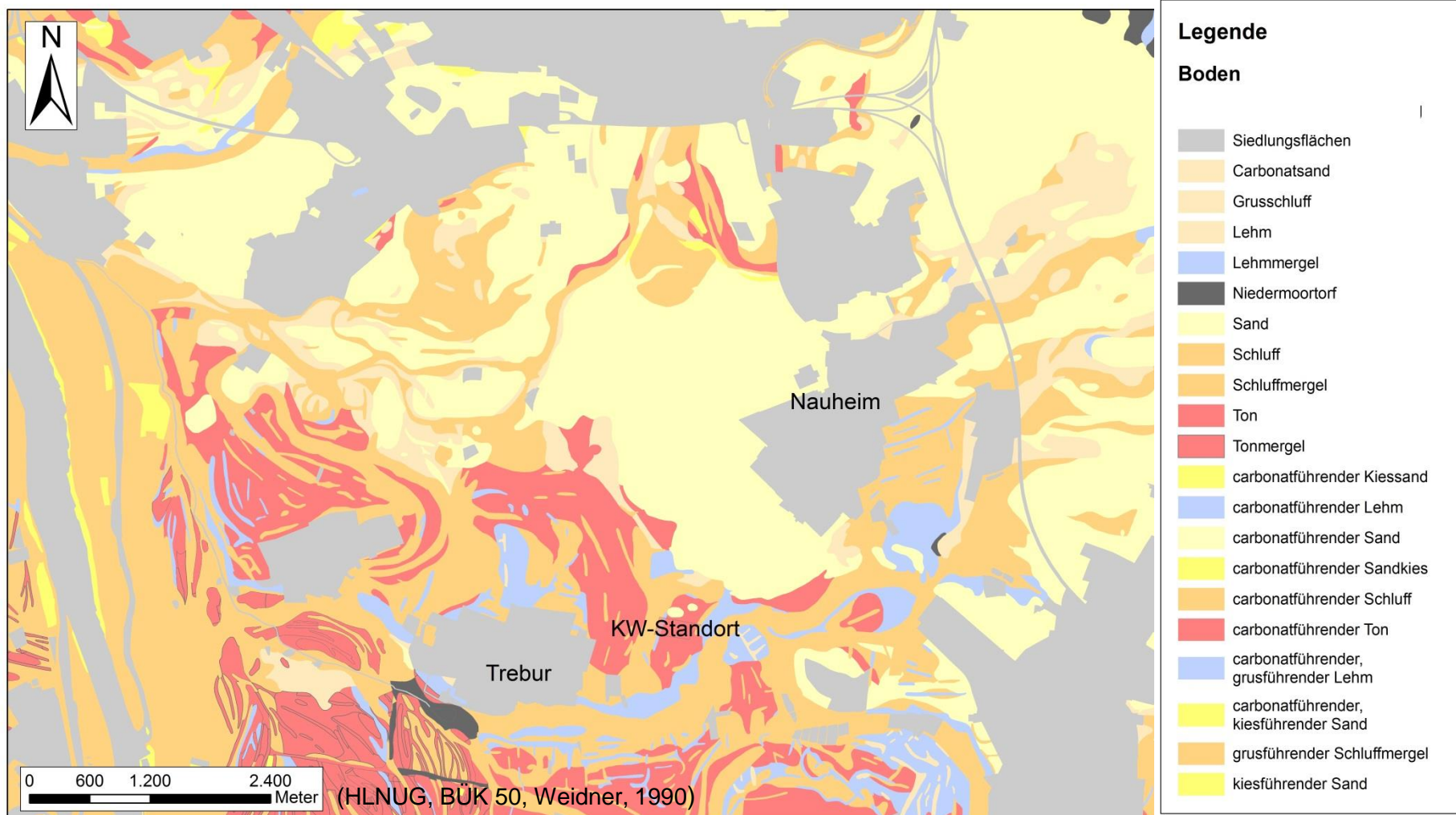
Measured radon concentrations are dependent on composition/genesis of measurement environment

Soil map 1:25.000, HLNUG, modified

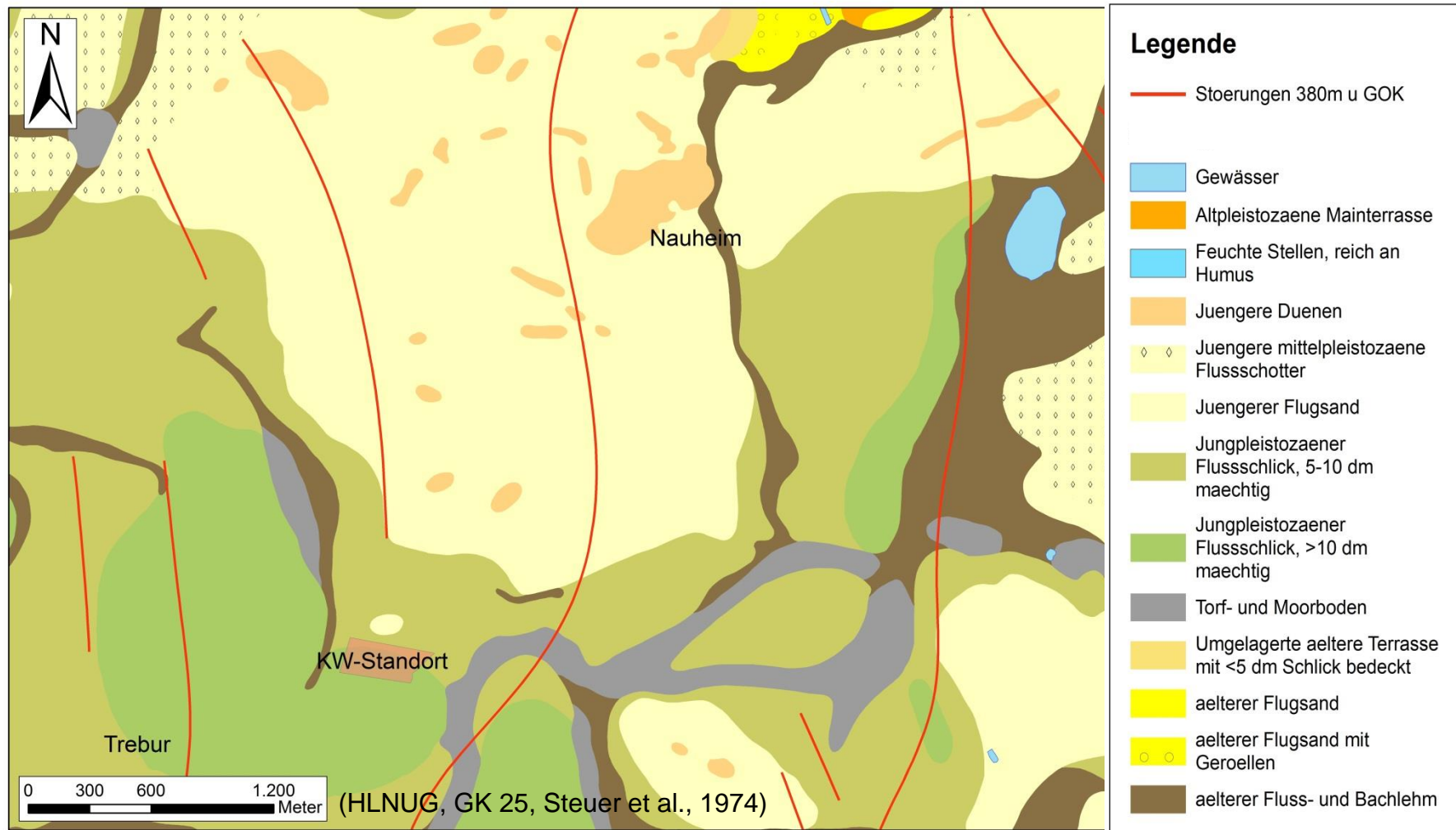
Measurements northern URG



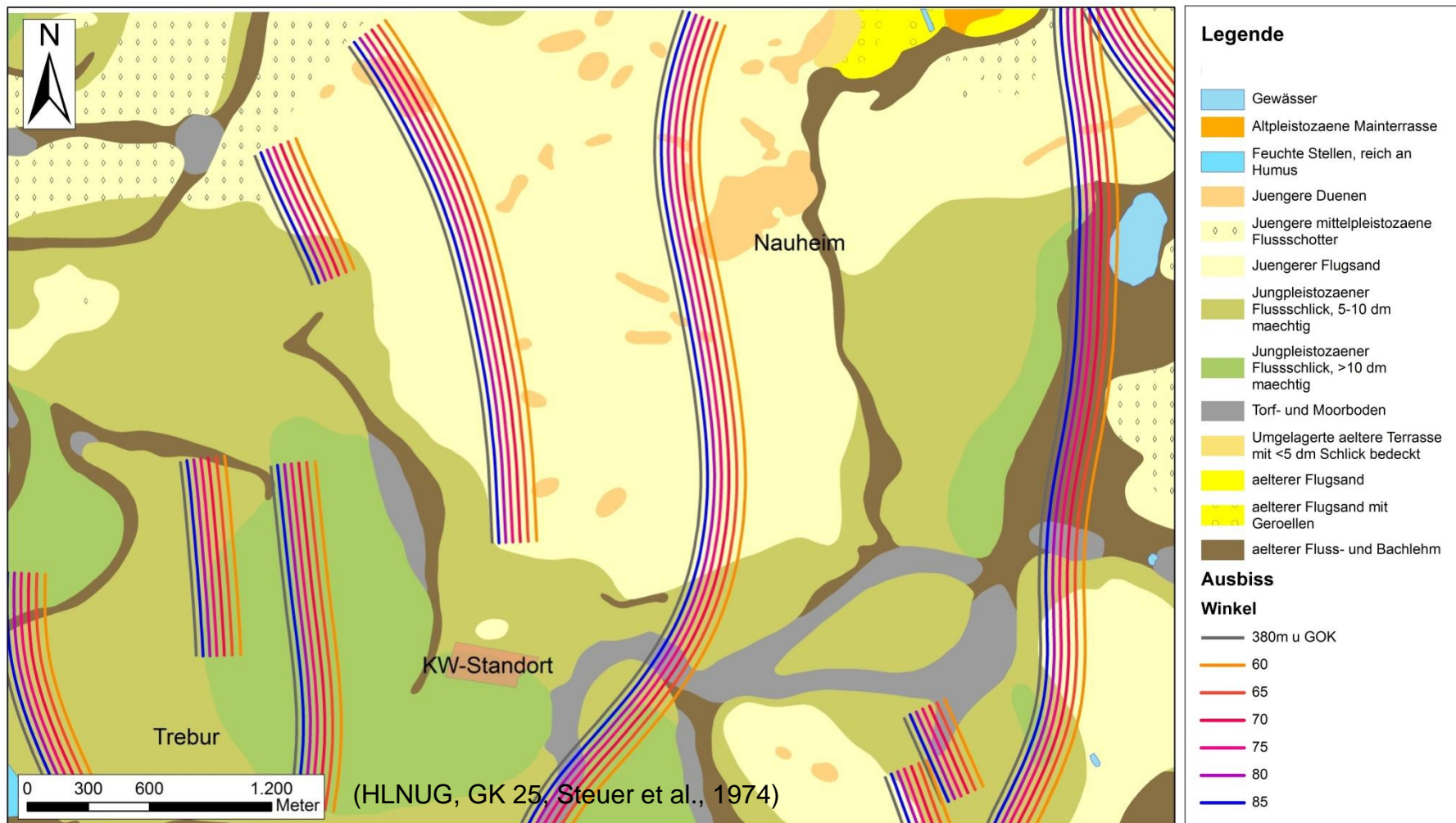
Soils



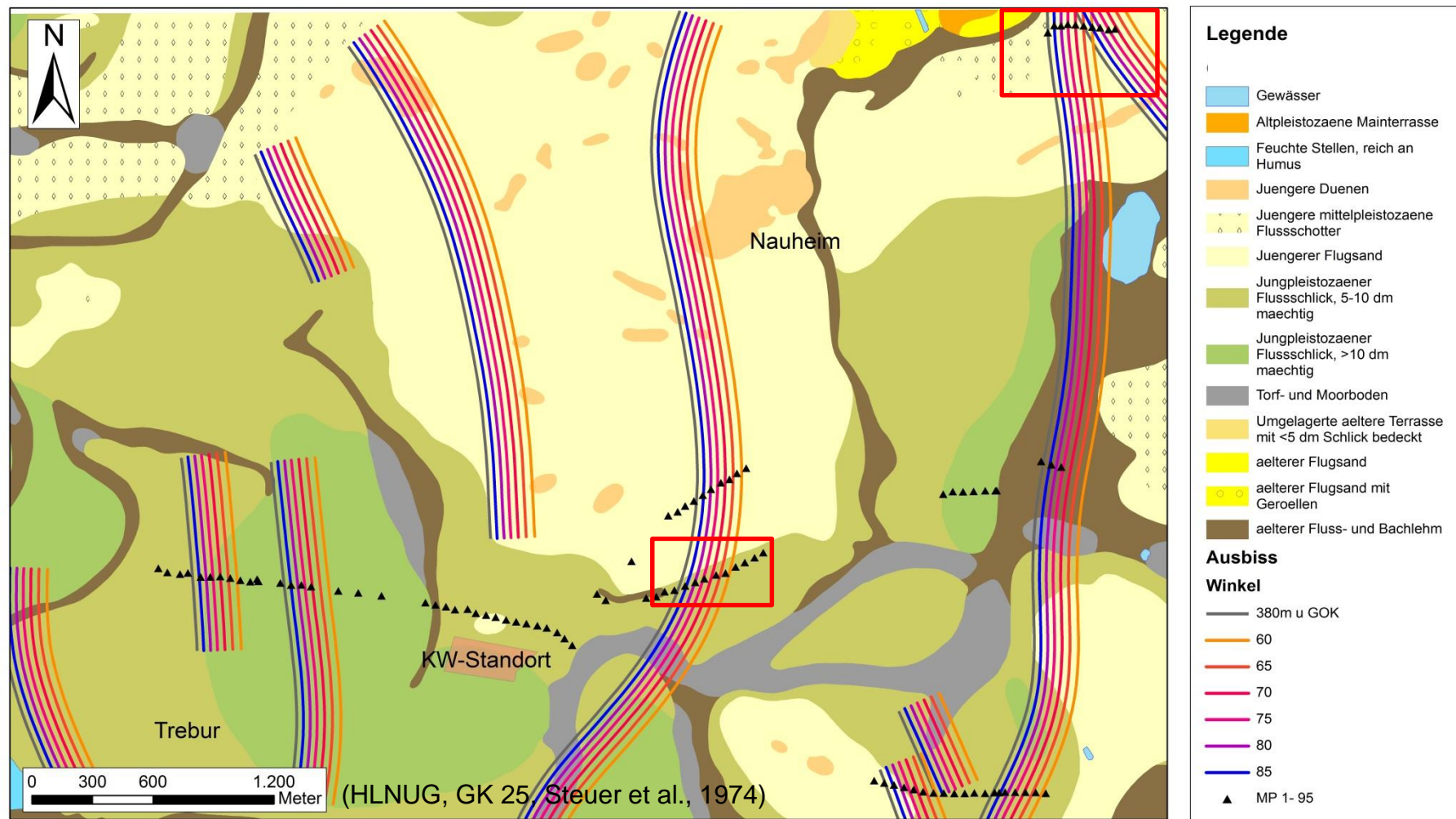
Geology



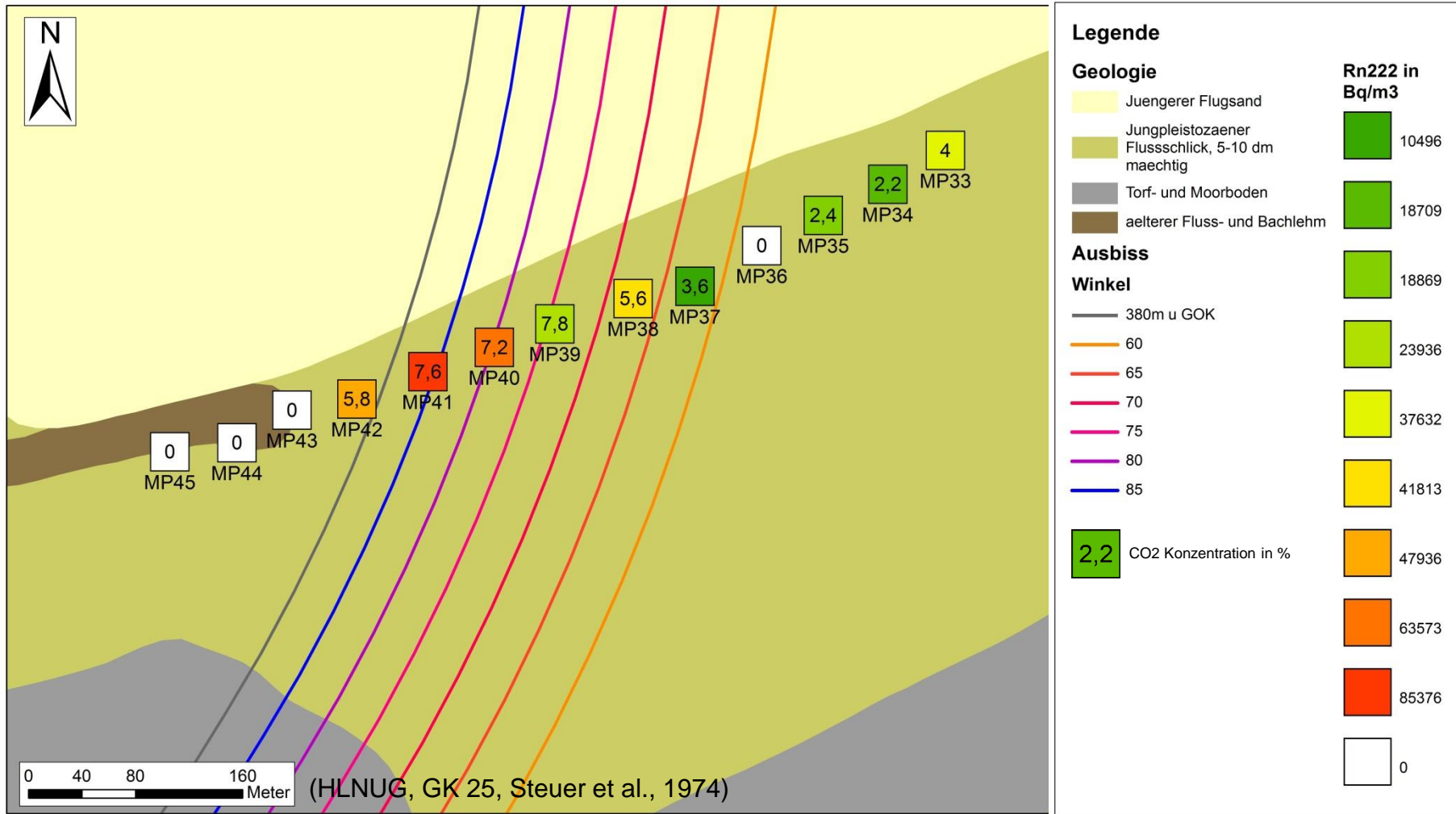
Projected faults



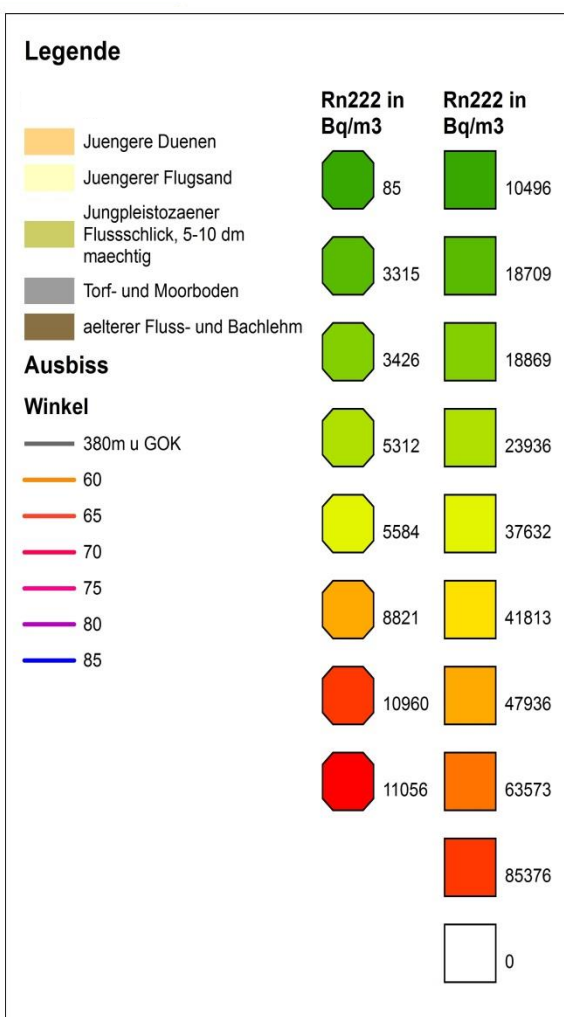
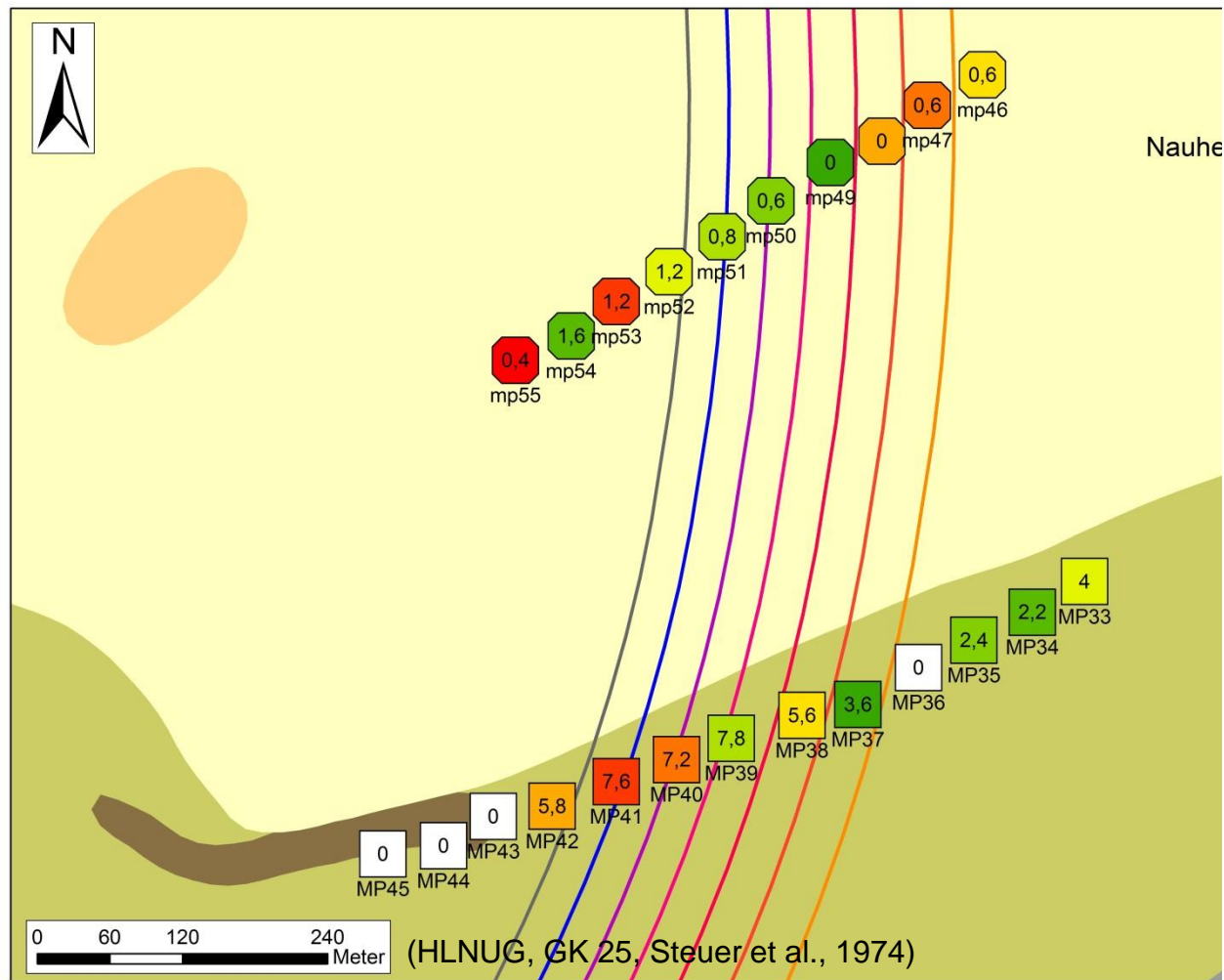
Measurement profiles



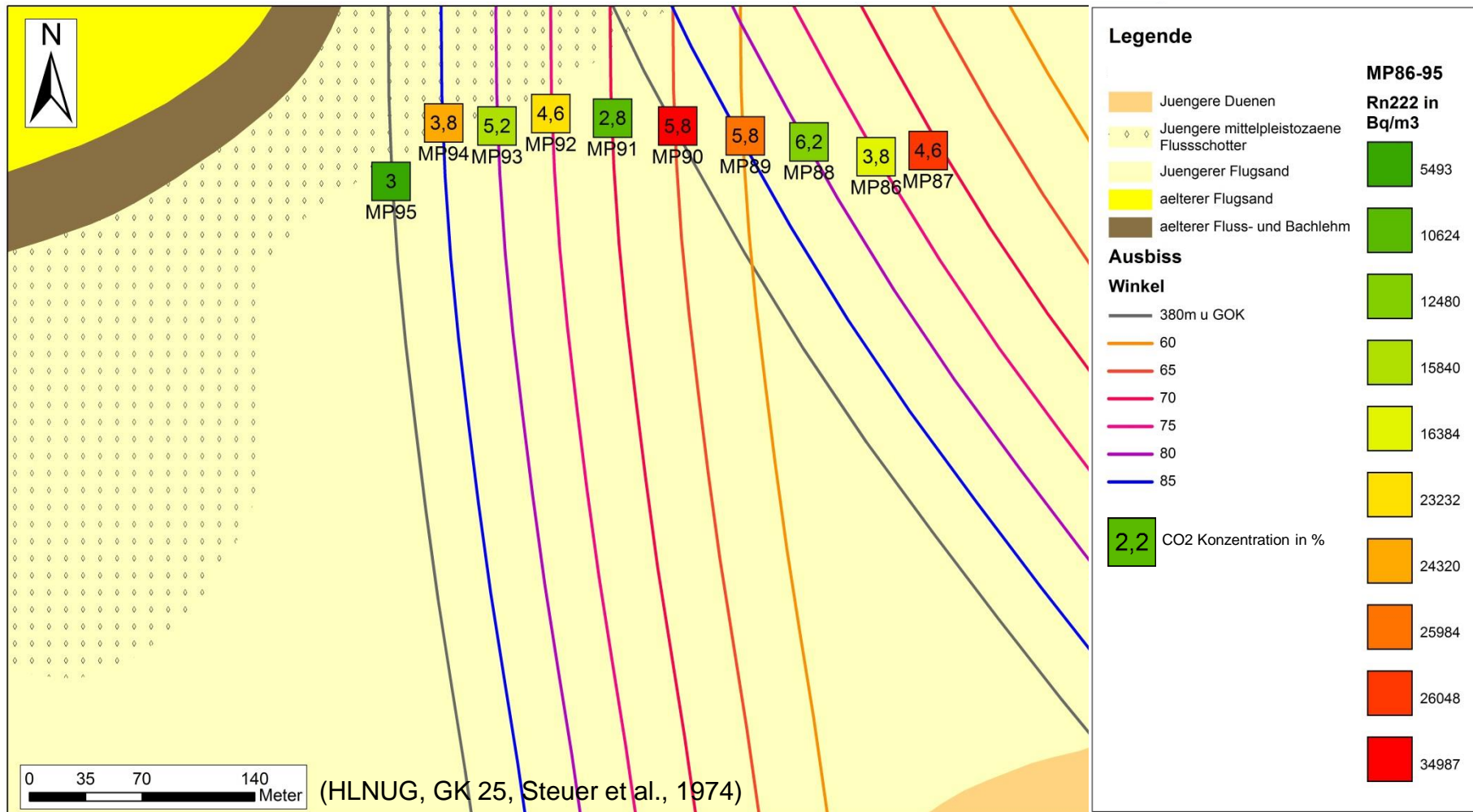
Measurements in clayey soil



Measurements in sand



Measurements in sand



Lessons learned

- Trend of increased radon concentrations in fault zones
- Significant dependency between radon concentration and soil type:
small grain size + low permeability = higher radon concentrations
- Trend of increased CO₂ concentrations in faults zones
- No dependency between CO₂ and soil type apparent

Conclusion

- Radon concentrations need to be set in context with composition/genesis of measurement environment and tectonic inventory

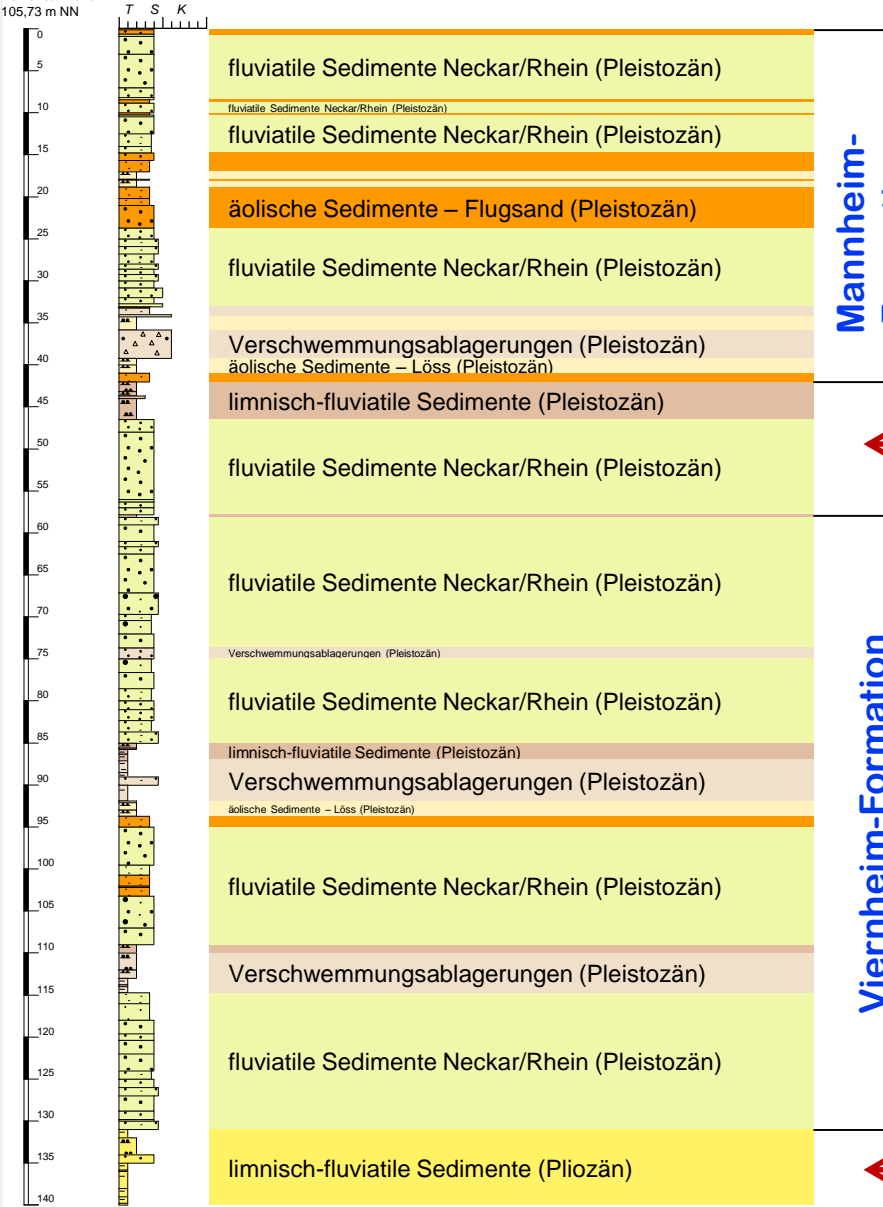
Challenge

- Composition/genesis of measurement environment varies a lot in x,y and z
- Tectonic inventory needs to be assessed in terms of
 - > spatial extent and
 - > activity

heterogenous deposits

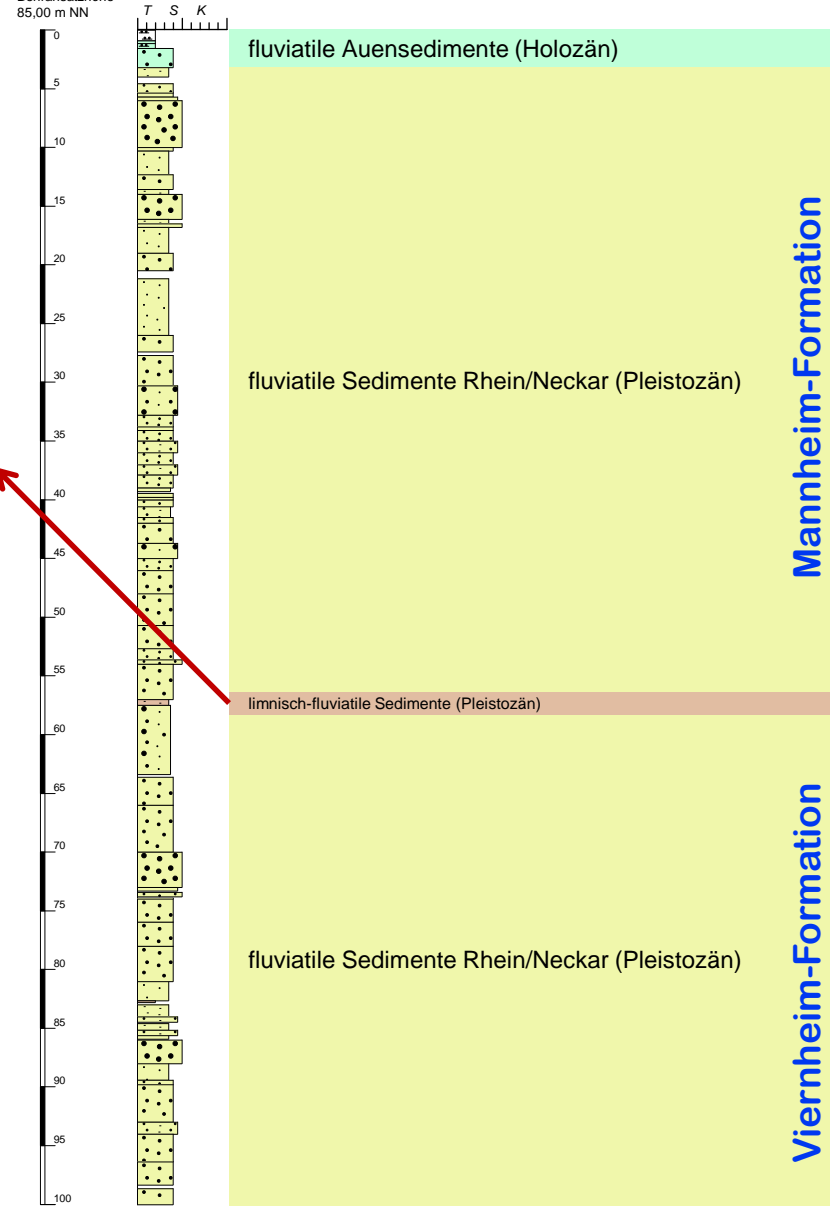
9063 WW Pfungstadt GWM 1.3 SWP-PF-H03

Bohransatzhöhe
105,73 m NN



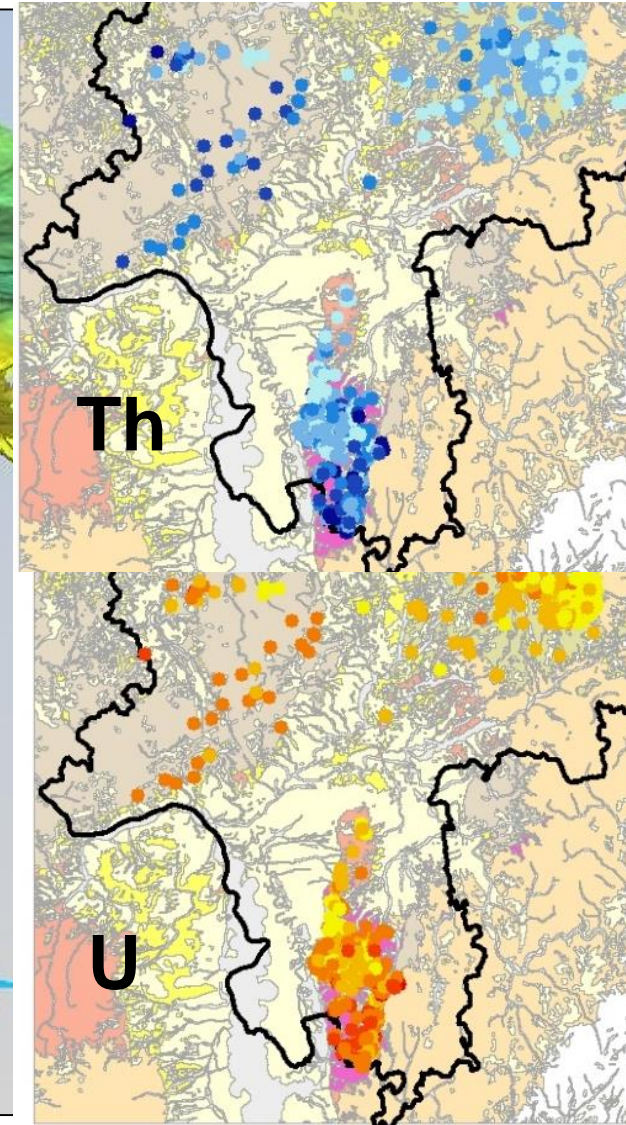
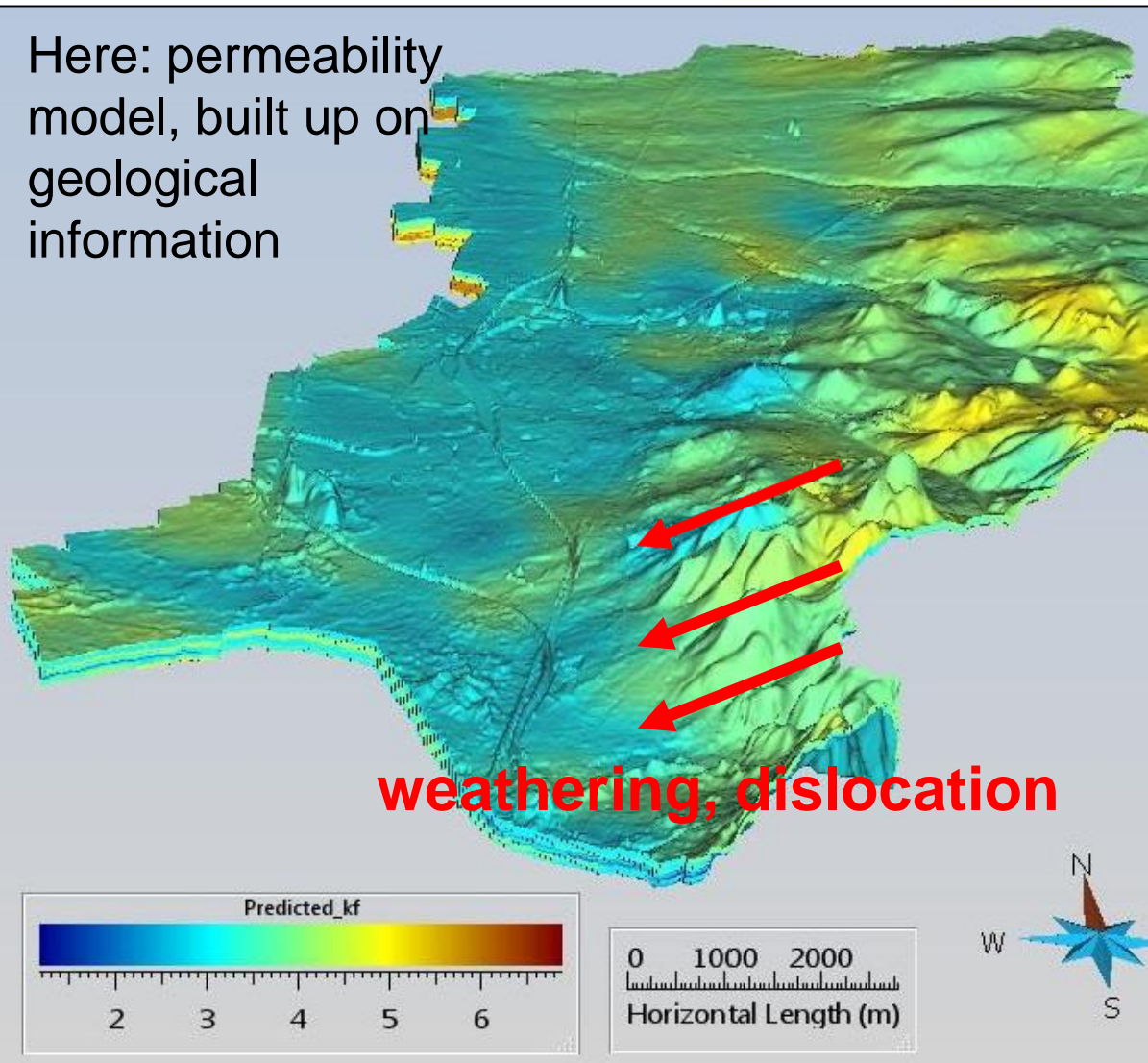
9016 FB Geinsheim BK 1

Bohransatzhöhe
85,00 m NN

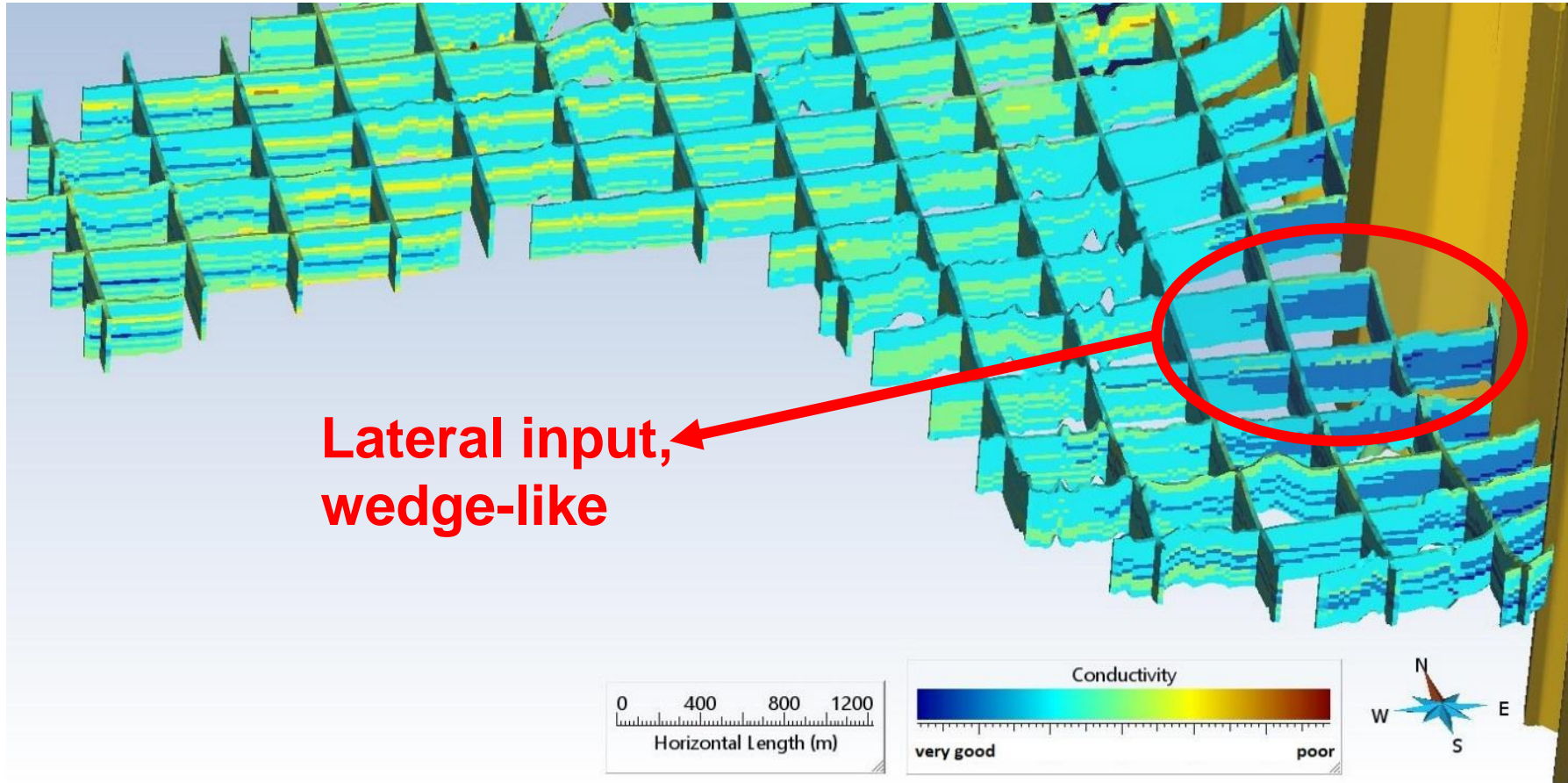


Approach: considering geological 3D-models

Here: permeability model, built up on geological information

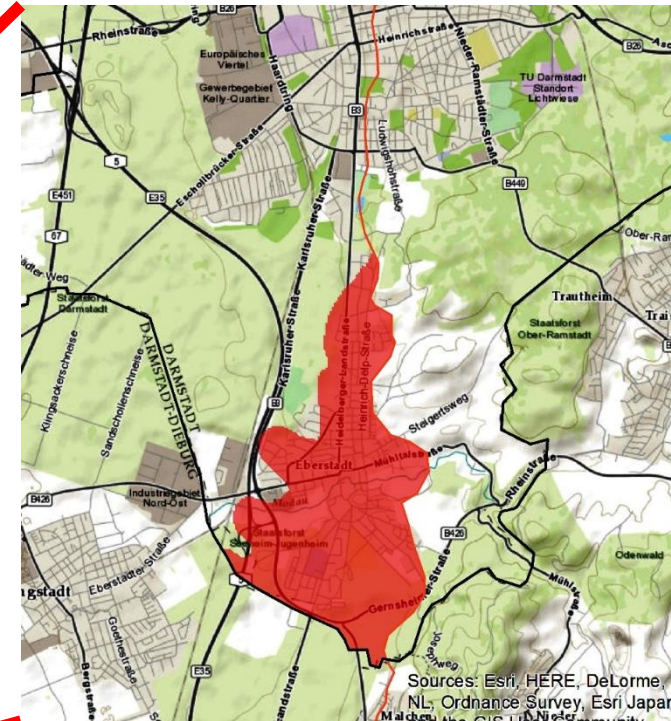
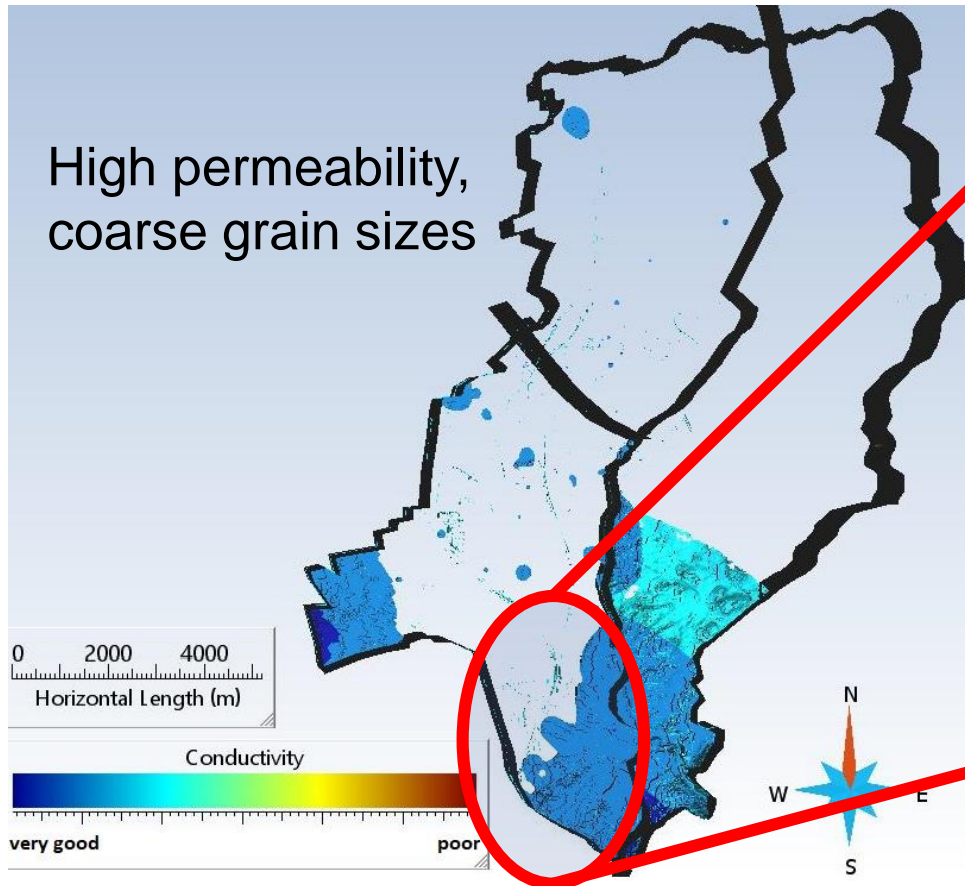


Approach: considering geological 3D-models



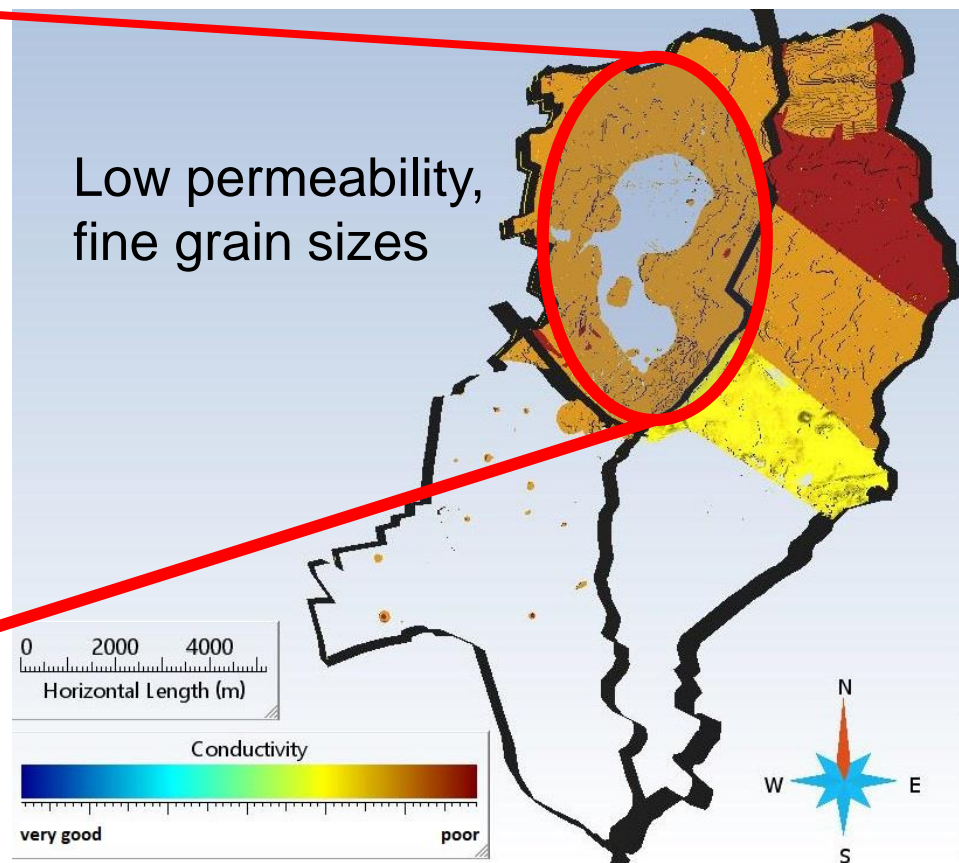
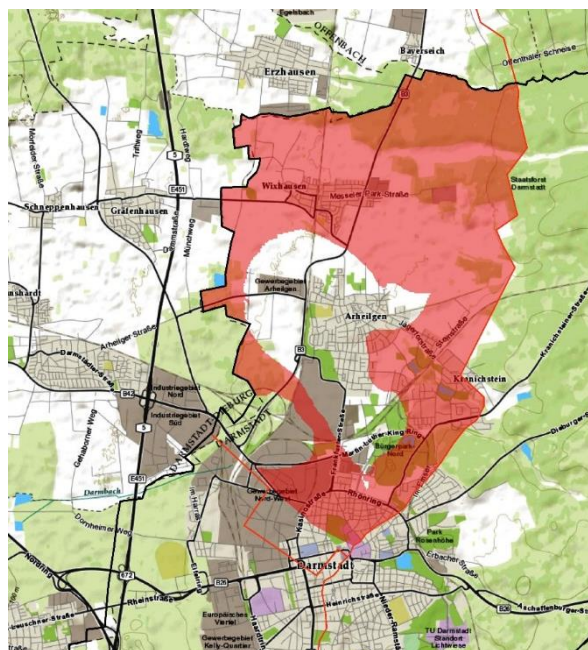
Fence diagram showing homogeneity regions in terms of permeability

Approach: considering geological 3D-models



Dislocated weathered granodiorite (Grus)

Approach: considering geological 3D-models



Mudflows from the graben shoulders

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3D-models now are the basis for radon measurements – leading to more reliable and systematic radon maps, here the first radon map for an urban area in the federal state.

stay tuned

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