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Hillslope characterization in terms of geophysical units based on the joint interpretation of electrical resistivity and seismic velocity data

Tatiana Feskova^{1,2}, Peter Dietrich^{1,2}

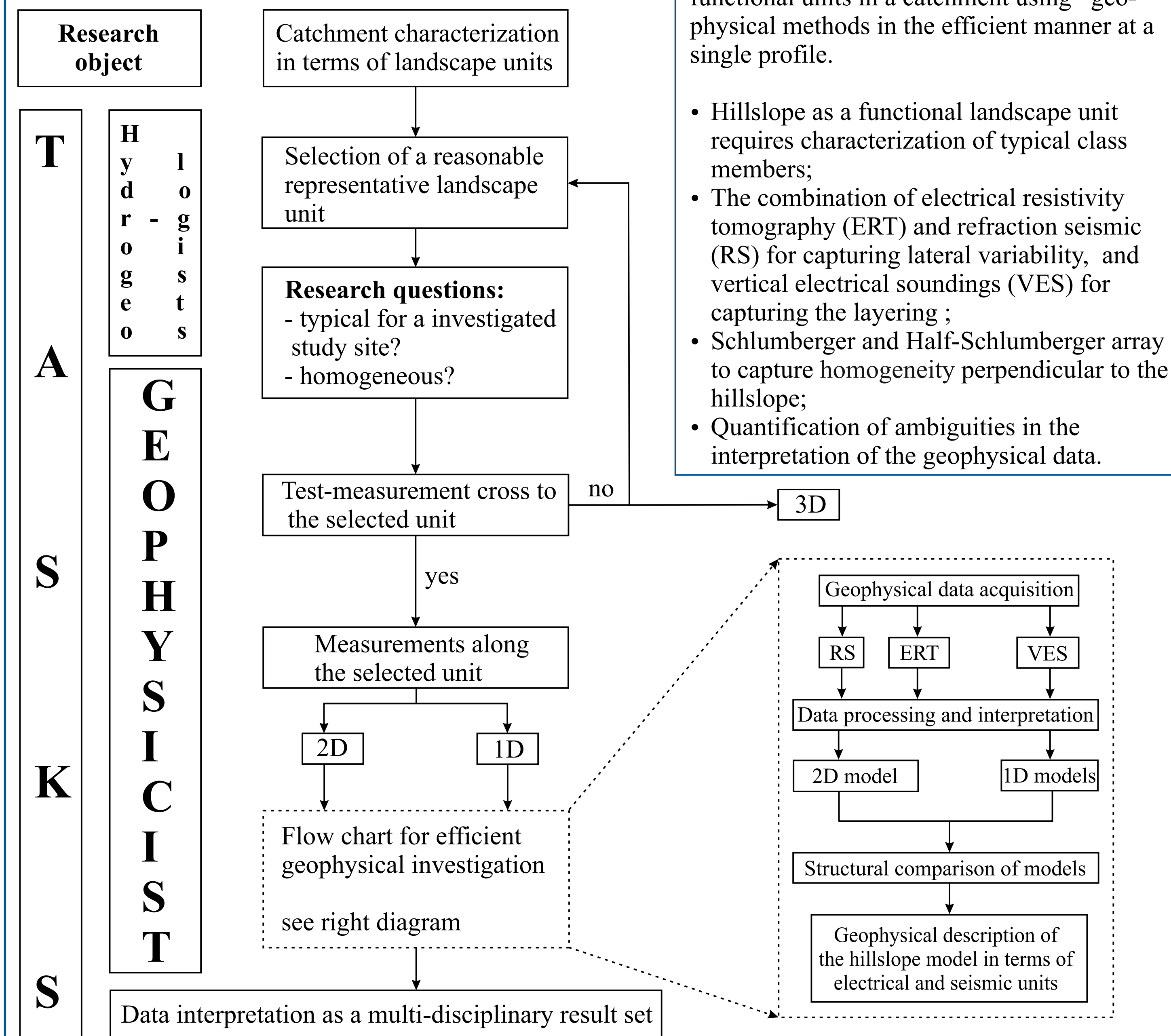
1. Helmholtz-Centre for Environmental Research – UFZ, Department Monitoring and Exploration Technologies, Leipzig, Germany
2. Eberhard Karls University of Tübingen, Department of Geosciences, Tübingen, Germany



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Introduction & Research philosophy



Selected representative landscape unit: A hillslope in the Weierbach catchment

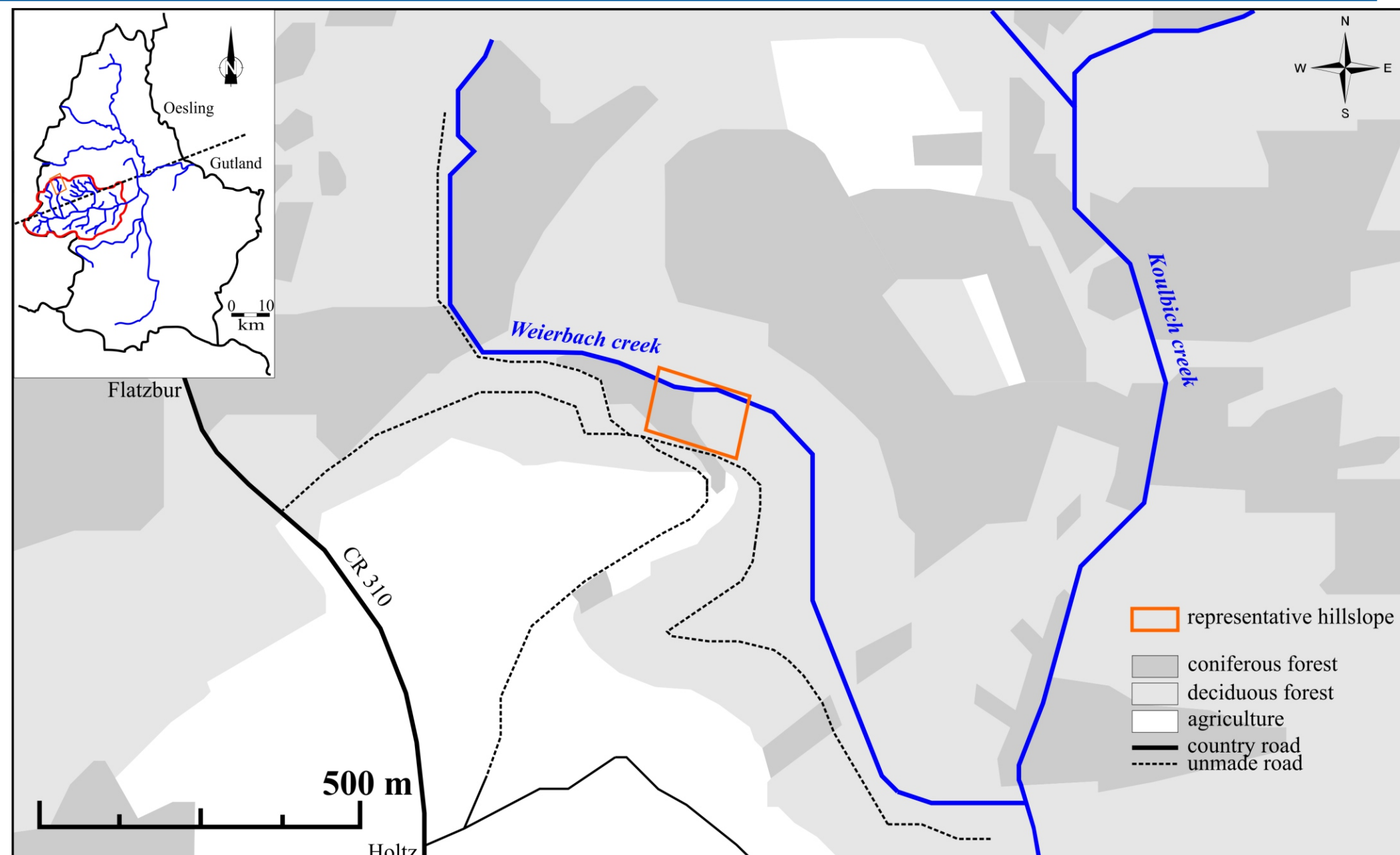
The test site is located in the north-west part of the Attert Baisn that lies in the contact zone between schistous Ardennes massif (Oesling) and the sedimentary Paris Basin (Gutland) in the mid-west of Grand-Duchy of Luxembourg.

Catchment parameters:

- an area of 0.7 km²;
- V-shaped valley;
- valley slopes are mainly forested (ca. 84%);
- plateau surface is used by agriculture (ca. 13%).

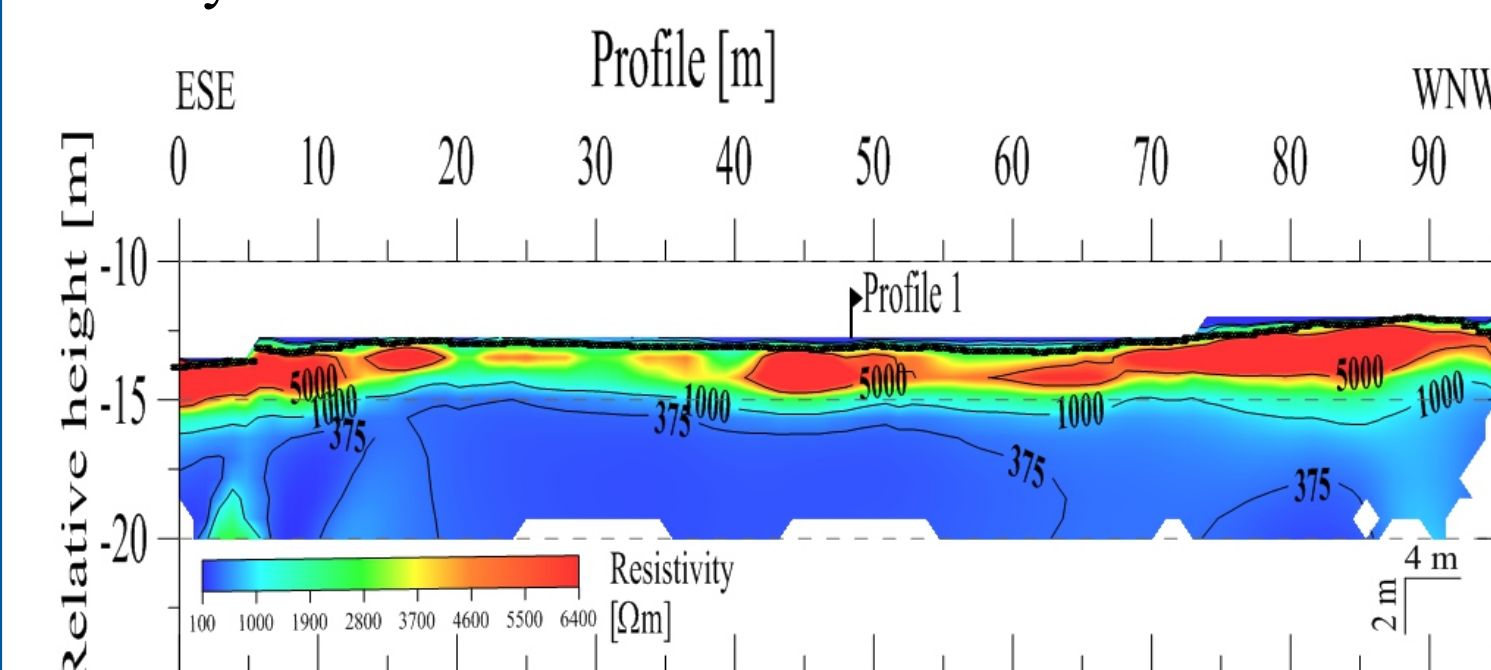
The outcrop representing the general geological sequence of study area:

- soil surficial horizon;
- periglacial deposits;
- fractured schist;
- compact schist.



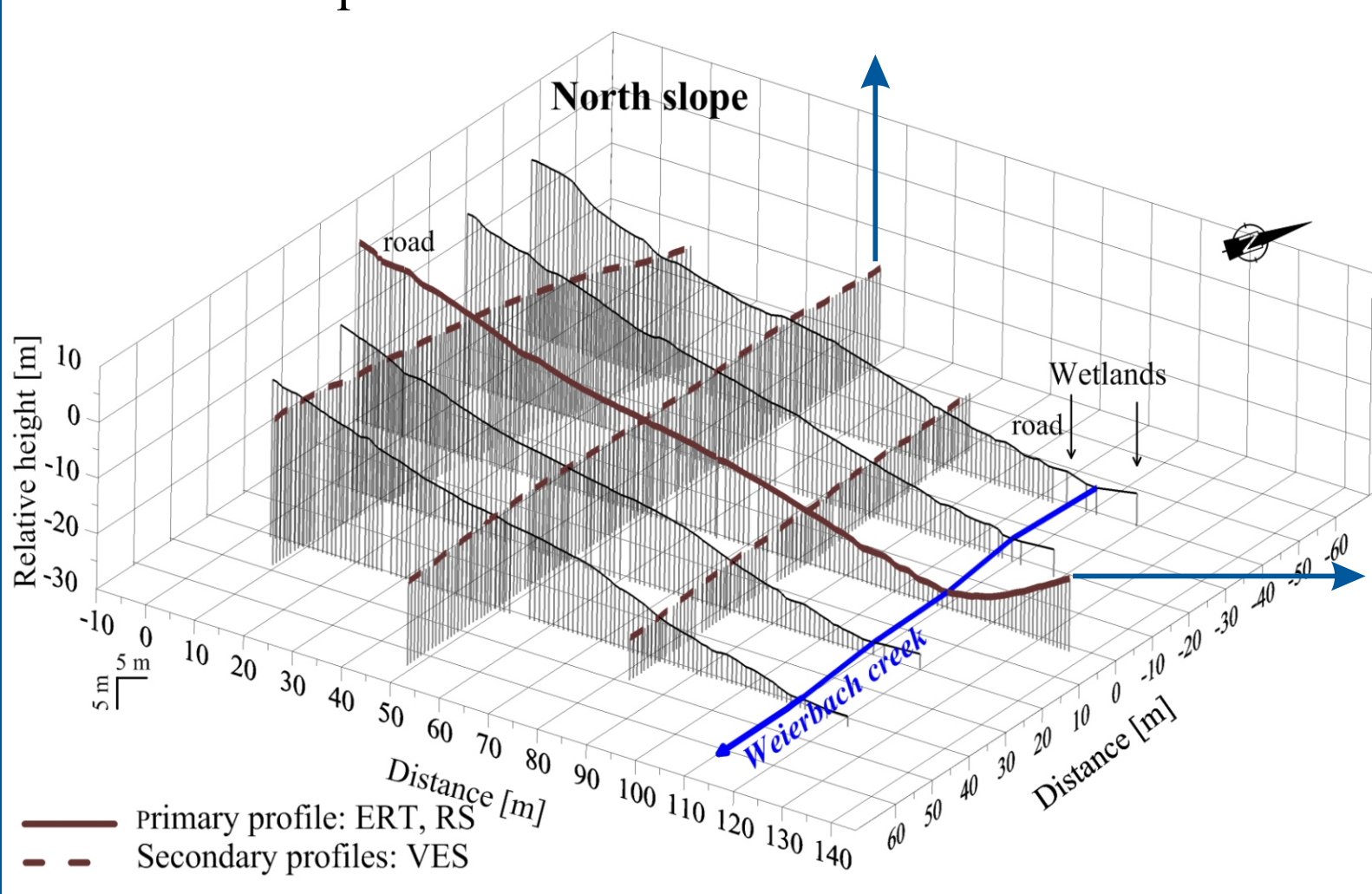
Results of Geophysicist's tasks

Pre-investigation cross to the hillslope using ERT to check the representation and homogeneity of the selected hillslope directly in the field.



- ☺ Typical for investigated area
- ☺ Homogeneous: horizontal layering and nearly lateral invariable

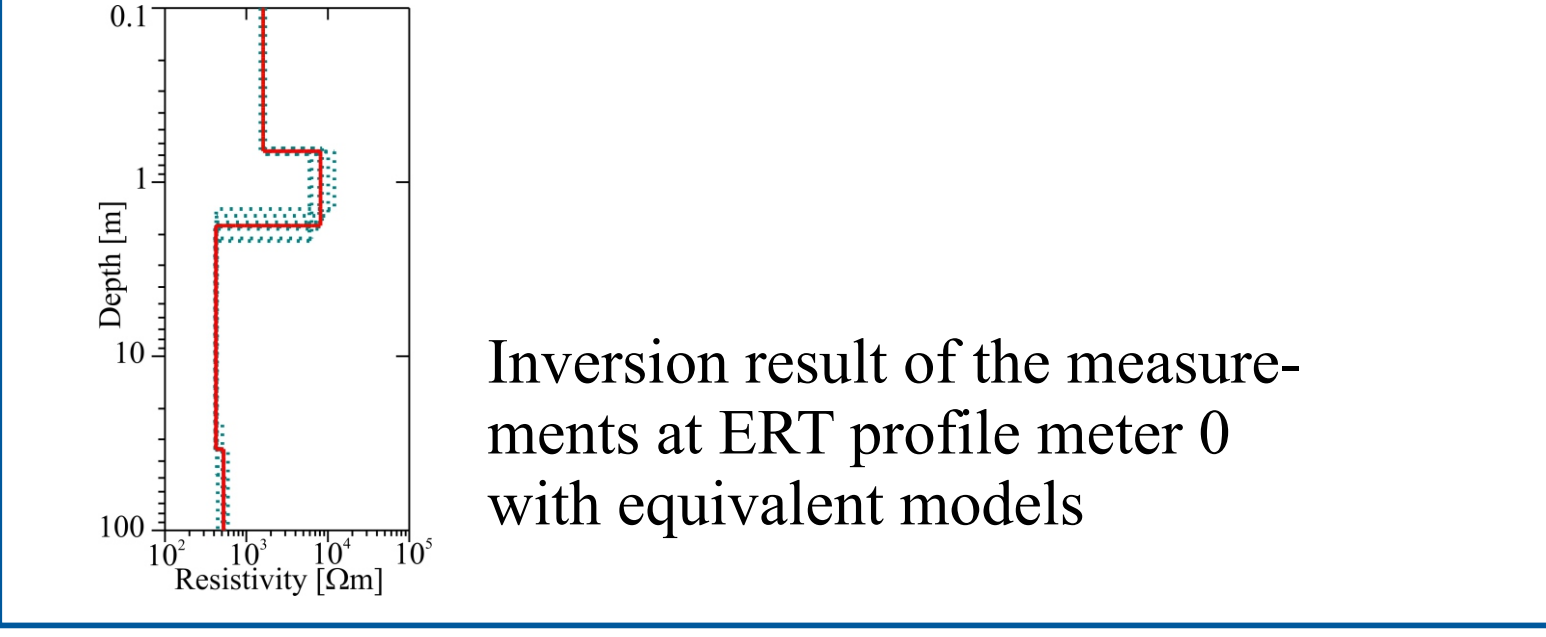
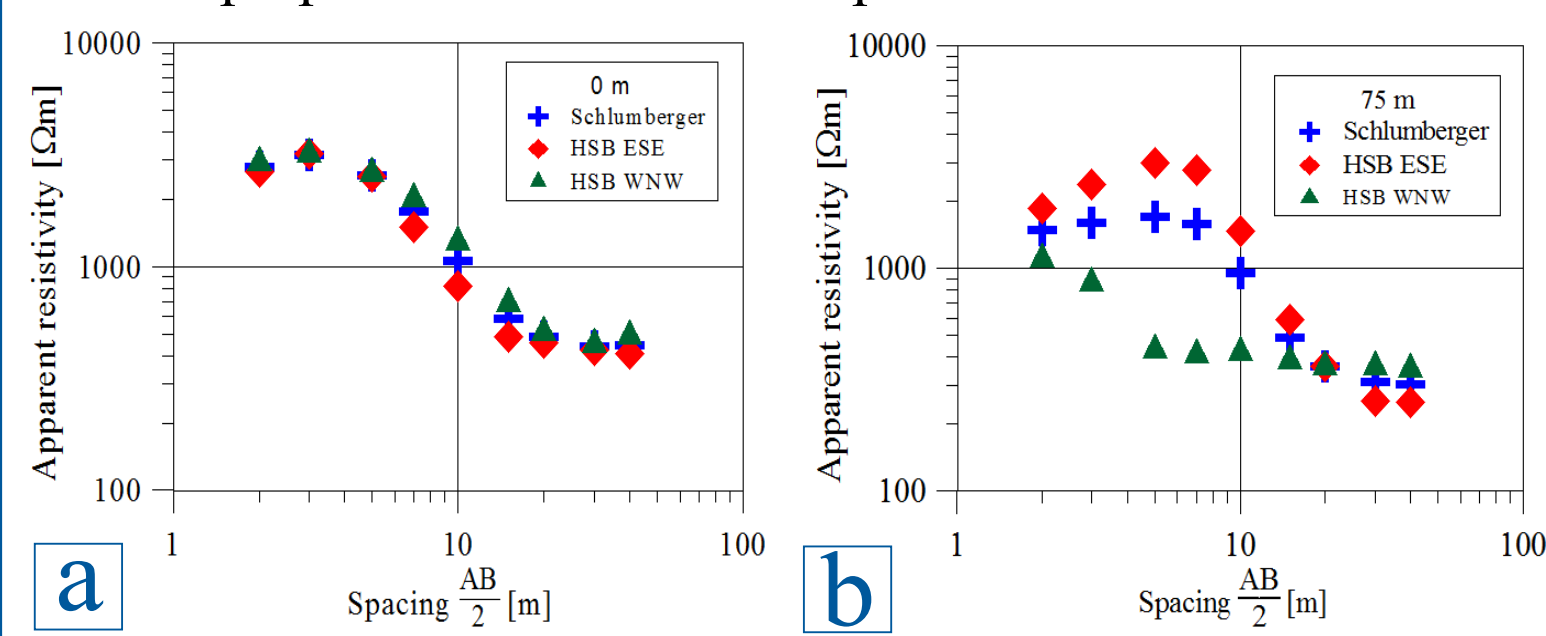
Digital elevation model of the selected hillslope with measuring layout to combine geoelectrical and refraction seismic techniques.



Sounding curves of measurements with Schlumberger and Half-Schlumberger arrays at ERT profile meter:

(a) 0 m presenting an example for lateral homogeneity perpendicular to the ERT profile;

(b) 75 m presenting an example for lateral heterogeneity perpendicular to the ERT profile.

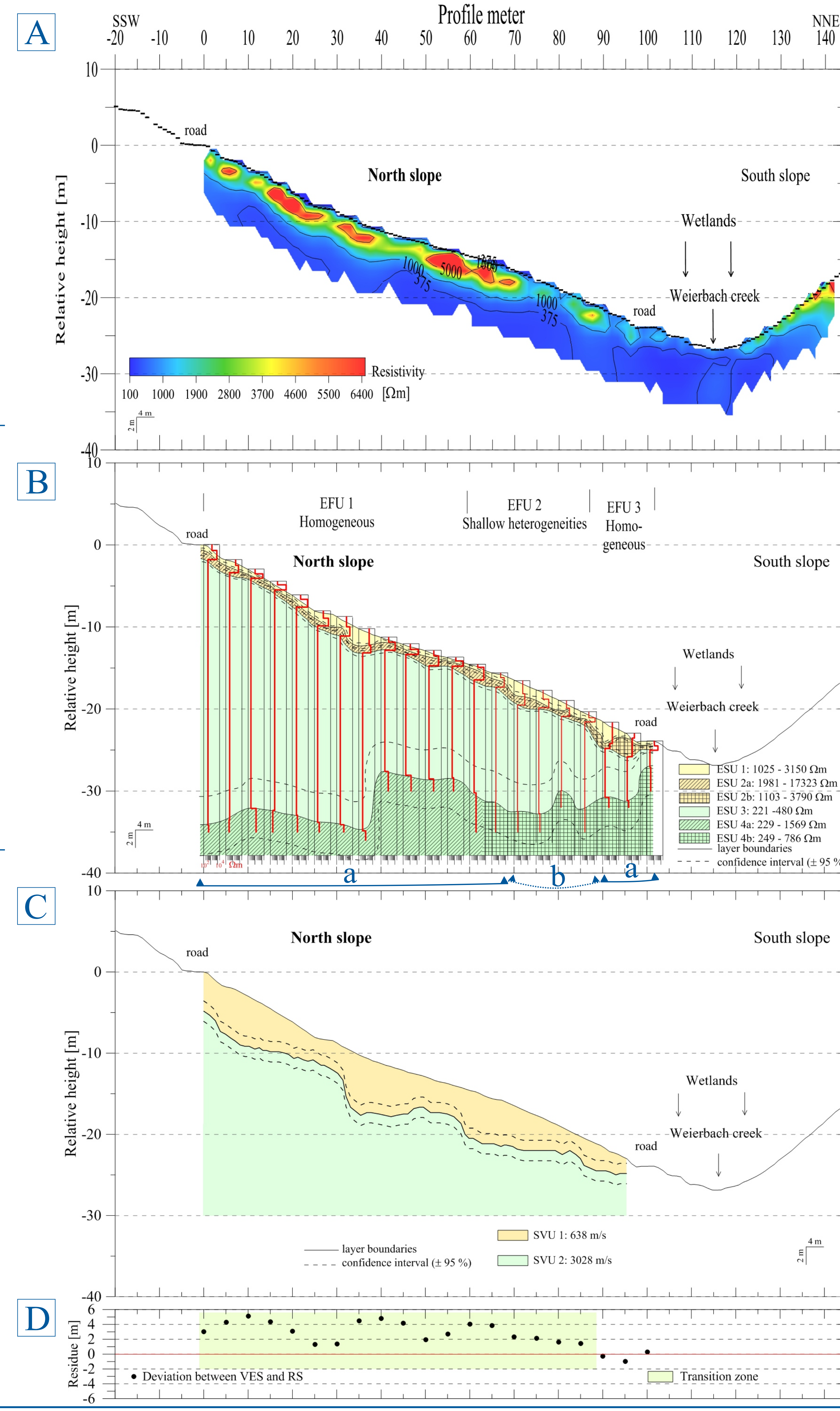


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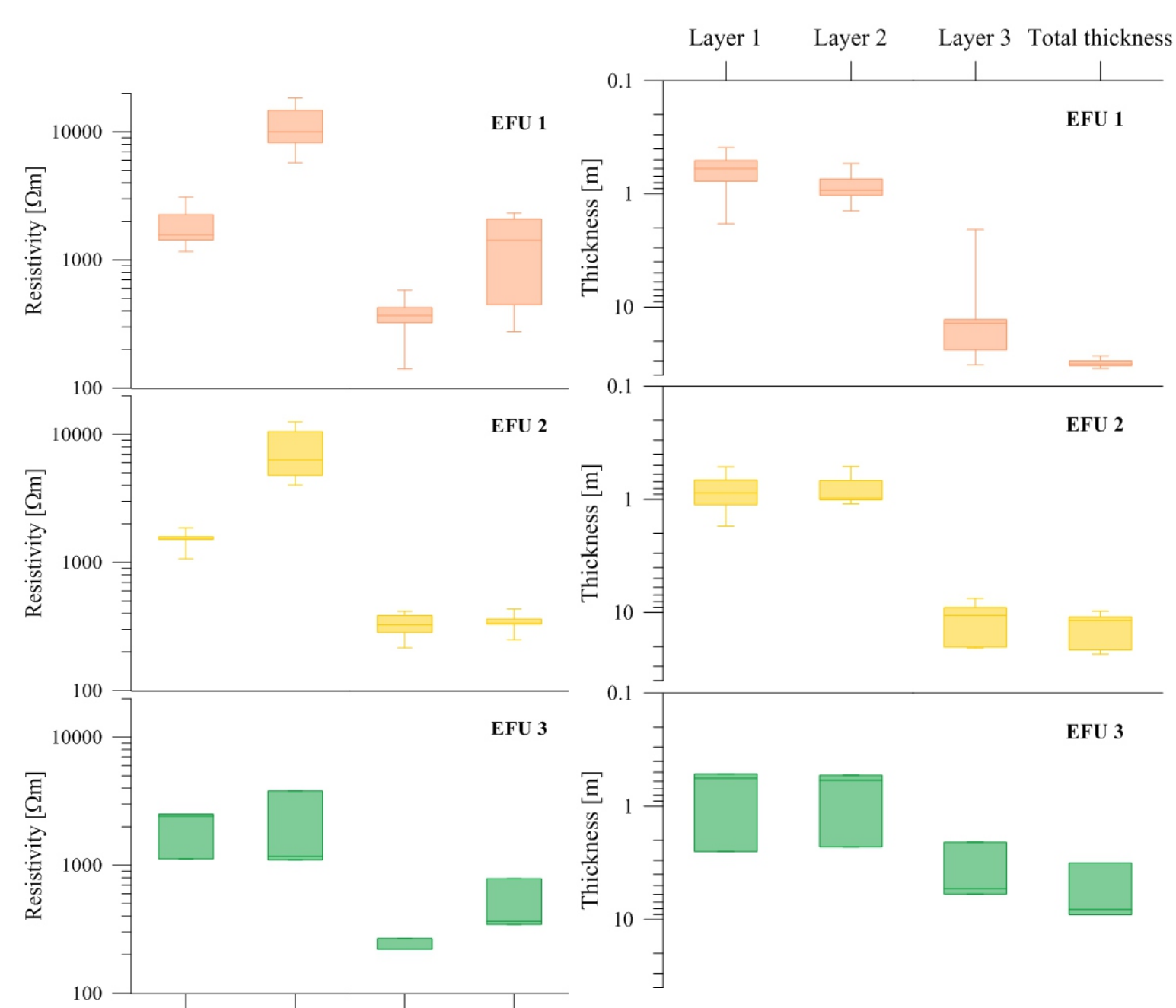


Geophysical investigation along the selected hillslope:

Two-dimensional hillslope subsurface model in terms of:

- Geo-electrical investigation using ERT slope profile (A) perpendicular to the Weierbach creek and VES-spreading (B) parallel oriented to the Weierbach creek in terms of electrical stratigraphic units (ESU's). The VES results for locations with lateral homogeneity perpendicular to the ERT profile are drawn with bold lines (a);
- Refraction seismic investigation (C) in terms of seismic velocity units (SVU's).

Difference between VES and RS hillslope subsurface models (D) is ca. 2.6 m and is designated to a transition zone between periglacial deposits and fractured schist.



Box-whisker plots of resistivity (left graph) and thickness (right graph) distribution downhill as well as over the width of the investigated hillslope in terms of elementary functional units (EFU's).

Conclusions

- ☞ Identification of three significant hillslope areas along the investigated hillslope in terms of EFU's;
- ☞ Determination of electrical and seismic stratigraphic units (ESU's and SVU's) with respect to the lithology of the investigated study site;
- ☞ Resistivity and seismic velocity hillslope models complement well one other.

The suggested approach provides a successful geophysical investigation of the hillslope via combination of ERT, VES and RS in the efficient manner in contrast to the expensive 3D-measurements.



Contact:
Dipl.-Geophys. Tatiana Feskova | tatjana-lew@hotmail.de
tatiana.feskova@ufz.de | +49341/235-1827 | www.ufz.de
Helmholtz-Centre for Environmental Research - UFZ
Department Monitoring and Exploration Technologies (MET)
Permoserstrasse 15, 04318 Leipzig, Germany