

# Bachelor Course Geophysics - SS 2022

## Electrics

In this exercise you perform measurements of vertical electrical sounding (VES) and electrical profiling using 4-point arrays. You will perform VES measurements at two different sites, one site close to the assumed boundary of the former waste disposal site, the other in the undisturbed natural area of Neckar valley. Your first goal will be to use the VES data to detect the boundary of the waste disposal site. A secondary goal is to compare the profiles from measurements taken in opposite directions. Additionally, spontaneous potential (SP) measurements are demonstrated.

The location for this exercise is at a former waste disposal site, located close to Neckar River near the village of Kilchberg half-way from Tübingen to Rottenburg (see map).

**Groups will meet at the GUZ at either 8:00 or 13:00 and drive together to the field site.**

### Measurements in the field:

For the measurements you need: resistivity instrument (SYSCAL R1), multimeter, unpolarizable (2-3) and metal (ca. 10) electrodes, large set of cables (long and short; at least 3 cable drums), 2 measuring tapes of 50-100 m length, hammer, writing materials.

#### 1) **Comparison:**

- Compare metal electrodes and non-polarizable electrodes: observe the voltage after contacting the electrodes to the ground (measure with a multimeter).

#### 2) **Collect VES Data:**

- At both sites you will measure with a Schlumberger array and a 3-Pole array (half-Schlumberger). You will perform two 3-Pole measurements in opposite directions. Therefore, a total of 3 surveys at each site.
- For AB/2 and OA/OB (electrode positions) use the following spacings: 1.5, 2, 3, 4, 5.5, 7, 8.5, 10, 13, 17, 22, 28, 36 m. The spacing for MN will be 1 m (only increase this in case the voltage is too low).
- You will need to note the measurements as they are made in the field. You should organize your data into a table, as well as plot the data by hand simultaneously (log values of spacing vs. apparent resistivity). The plot helps to ensure that measurements are successful and problems can be noticed and corrected immediately.

#### 3) **Collect Profiling Data:**

You will use two different electrode arrays for profiling. For each array, take measurements at 1m point distances. The length of the profile should be ca. 30 m.

- Perform profiling measurements across the assumed boundary of the former waste disposal site using a Pole-Pole array. You need to measure the profile with 3 different spacings of AM: 1 m, 5 m, 25 m.

- Perform profiling measurements across the assumed boundary of the former waste disposal site using a Wenner array. You need to measure the profile with  $a = 5 \text{ m}$ .

### Writing your GROUP REPORT:

- Introduction: Lay out the goal of this report (e.g., phrased as a question) and provide general context required for the reader to understand the following sections. Introduce the exercise task(s) and the field site, and include a figure of the survey area.
- Methods: Explain the core geophysical principles, the instruments used, related uncertainties, and processing strategies. Outline the expectations (expected answers to the questions you are trying to solve: how many layers do you expect to find, what kinds of resistivities are expected, what is the depth of investigation) based on the geophysical theory and available site information (geology of the area).
- Results: Exclusively summarize the findings of the survey including informative figures:
  - A comparison of the metal electrodes vs the non-polarizable electrodes, in particular concerning their use for SP measurements.
  - Plot the VES results in a common  $\rho_a$ -diagram (Schlumberger and 3-Pole results in the same diagram).
  - Plot the 4 measured profiling results in one diagram. Locate the boundary of the former waste disposal site from the measured curves.

\*This section can be comparatively short as all interpretation is in the discussion section.

- Discussions:
  - Discuss the differences between the different types of electrodes and usefulness in different situations.
  - Discuss the VES results concerning the question “can we do a 1-D modeling?”
  - Discuss the differences/similarities between 3-pole results in opposite directions. Explain what you see.
  - Do the layer models align with what you expected for the undisturbed ground structure of the Neckar valley (approximate resistivities and depths of layer boundaries? investigation depth of the VES measurements?)
  - Do the layer models align with what you expected for the waste disposal site (approximate resistivities and depths of layer boundaries? investigation depth of the VES measurements?)
  - From the measured curves of the 4 measured profiling results, can you accurately estimate the boundary of the former waste disposal site? Explain the reason for differences of these curves.
- Conclusions: Reiterate the original motivation from the introduction and then provide take-away messages that are synthesized from the results and related discussions. This is often the most-read section, so highlight the most important points from your experiment.

**\* Submit as a zip archive including a pdf of your report and your data (e.g., as ASCII text file) on Ilias. Mention all group members and matrikelnumber on the report.**

**Submit your report the latest two weeks after the measurements**