Multidimensional Interpretation of Controlled-Source Radio-Magnetotelluric (CSRMT) of a waste-site in Cologne, Germany

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SUMMARY

Radio-Magnetotelluric (RMT) method is based on measurements of the electromagnetic (EM) field using military and civilian radio transmitters broadcasting in a frequency range between 10 to 1000 kHz as the source. In order to reach to higher signal to noise ratio and a deeper penetration depth, CSRMT measurements are performed using a controlled-source in a wider frequency range of 1 to 1000 kHz.

We accomplished a dense CSRMT survey over a waste-site in Cologne, Germany. The site was used as sand and gravel pit from 1940s to the 1950s. Afterwards, it was filled with different kinds of wastes including household refuse, construction and industrial waste, cinder, tires, wood, plastic, military fences, etc. The aim of the CSRMT survey is to detect the boundary and the basement of the waste body and possibly any signature of contamination leakage to the deeper subsurface.

Two perpendicular transmitters, each 265 and 580 meters long, were set-up to obtain the full impedance tensor and the tipper elements. In order to validate the far-field condition, RMT measurements were also carried out with the transmitters switched off. The far-field data have been acquired in a total of 177 stations from thirteen profiles. The separation between the stations and the profiles was 10 and 30 m respectively.

The RMT and CSRMT data acquired in this field experiment, were processed and the corresponding apparent resistivity, phase and tipper were calculated. Here, we present and discuss the 2D and 3D inversion of the computed transfer functions.

In general, we image a high conductive waste body extending to a maximum depth of 15 m. The exploration depth is around 50 m in average. The waste body indicates an internal structuring and is well confined to the former pit area. Below the waste, sandy gravel is deposited.

Outside the waste the subsurface is highly resistive.

The CSRMT results, are in a good agreement with former DCR results that are obtained from the same region indicating the reliability of the data acquisition, processing and inversion.

Keywords: electromagnetic, CSRMT, inversion, conductivity, waste-site