Geophysical surveys at the former camp site in Berlin-Blankenfelde

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Abstract
The study investigates a site of a former camp from the time of National Socialism in Berlin (Germany). After the second world war, the study area was also part of the former Berlin Wall complex. Two different radar array systems, an impulse and a step-frequency radar, were applied to the area and compared. Both radar arrays complement each other in their results and allow a differentiated data view. In connection with other sources, the former camp site Blankenfelde could be reconstructed in great detail.

Keywords
archaeogeophysics; archaeological prospection; Berlin-Blankenfelde; impulse radar; step-frequency radar

Introduction

For the archaeological prospection of structures hidden beneath the subsurface, geophysical methods are essential. Besides the broadly applied magnetics systems, especially the ground penetrating radar (GPR) methodology offers an extensive three-dimensional view into the depth. In this study, two different GPR techniques, impulse radar and step-frequency radar, are applied and compared on an area of about three hectares for the investigation of archaeological structures from the time of National Socialism.

The area under investigation is a site of a former camp in Blankenfelde, an urban quarter in the district of Pankow of the city Berlin (Fig. 1). From 1941 to 1945, it was used as a camp for sick forced laborers from Eastern Europe, who were unable to work (Runder Tisch 2012).

The local authorities initiated the erection of a memorial at the former camp site. The project is promoted and scientifically accompanied by the "Museum Pankow".

Materials and methods

To detect the foundations and remains that are still hidden in the subsurface, a magnetometer survey was conducted first, followed by GPR surveys using both an impulse radar and a step-frequency radar.

A distinction is made between different GPR systems, which differ in signal form and, therefore, in data acquisition in general. The most widely used GPR methodology is the impulse radar. Another approach is the step-frequency radar, which is also called a continuous-wave radar (Jol 2009).

In contrast to an impulse radar, which transmits short impulses into the subsurface and records reflections in the time domain, a step-frequency radar transmits sine waves with increasing frequency. Thus, phases and amplitudes of various frequencies can be recorded in the frequency domain. Fast Fourier Transformation displays these in the time domain (3D-Radar 2018).

For the impulse radar measurements, the pulseEKKO system from the manufacturer Sensors & Software Inc. from Canada with 250 MHz antennas consisting of four transmitting and receiving antennas was used (Meyer et al. 2021).

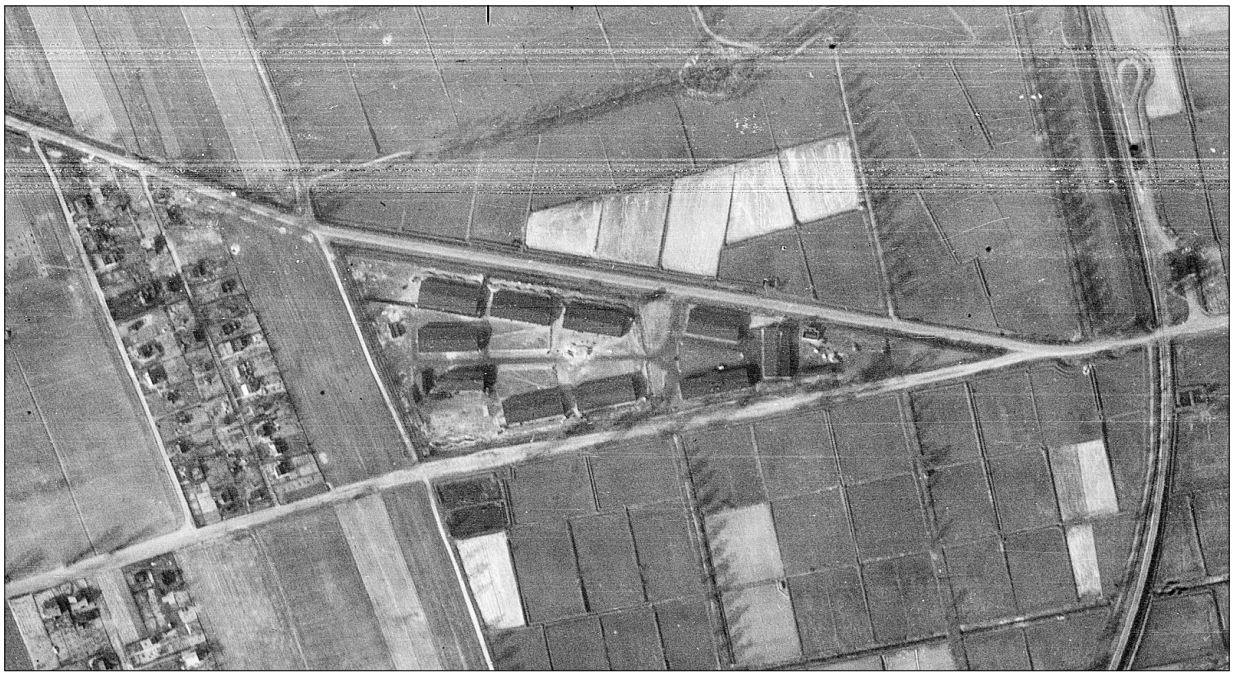

Fig. 1: Aerial photo from April 1945 of the former camp site in Berlin-Blankenfelde (Berliner Luftbildarchiv 1945).

Fig. 2: Results of the GPR measurements with a depth of 2.00 – 2.25 m for the impulse radar (left) and about 2.12 m for the step-frequency radar (right). Timeslices are shown as general view (bottom) and detail section (top). Low reflection amplitudes are shown in white, high ones in black.

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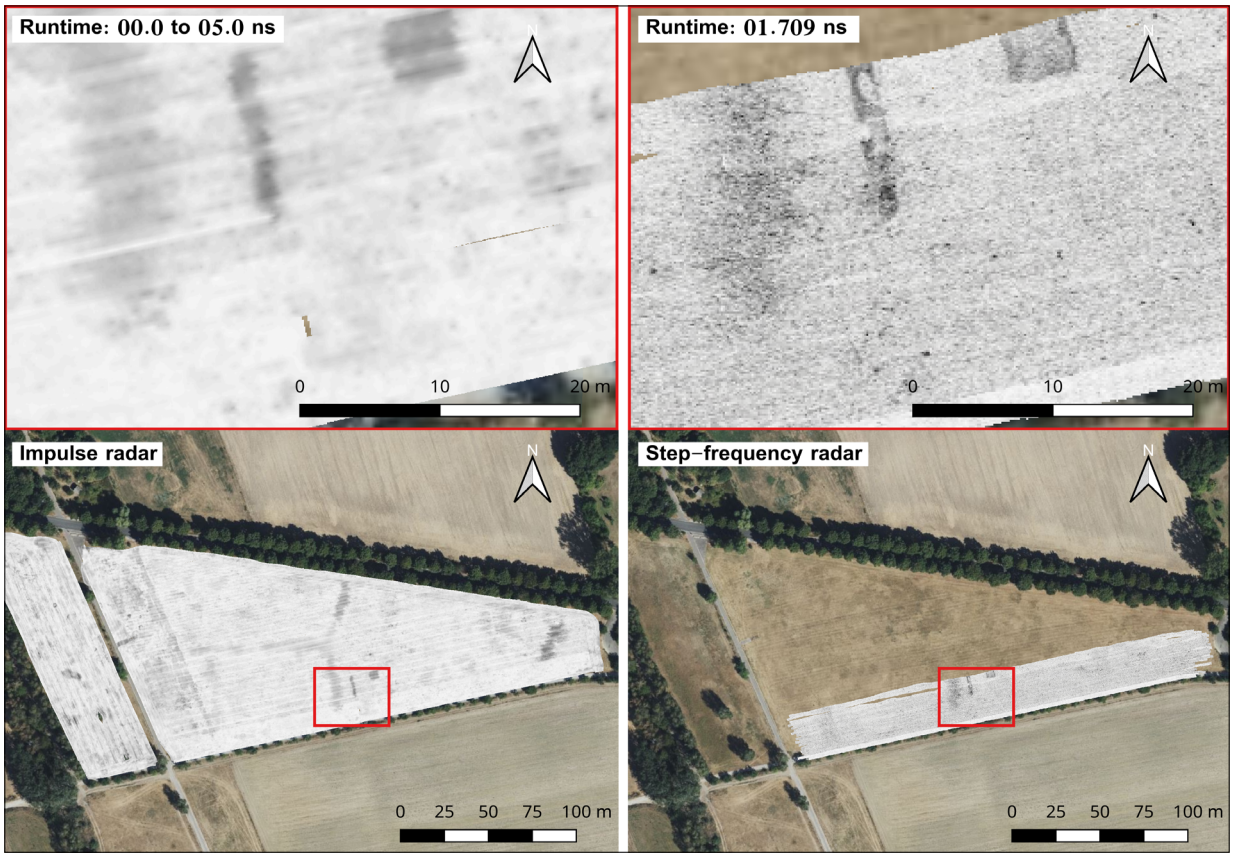

Fig. 3: Results of the GPR measurements with a depth of 0.00 - 0.25 m for the impulse radar (left) and about 0.09 m for the step-frequency radar (right). Timeslices are shown as general view (bottom) and detail section (top). Low reflection amplitudes are shown in white, high ones in black.

In contrast, the step-frequency radar array from the manufacturer Kontur (formerly 3D-Radar, Norway) covers low-frequency ranges from 200 MHz to high-frequency ranges of 3 GHz (3D-Radar 2018).

Results

Due to the low-frequency antennas of the impulse radar, larger structures can be resolved very well down to depths of 2.25 meters (Fig. 2). On the one hand, smaller remains in the near-surface area can be resolved only poorly if at all with such low frequencies. On the other hand, the step-frequency radar can more clearly resolve this depth range of 0-0.5 meters in some details since much higher frequencies are used (Meyer et al. 2021) (Fig. 3).

Discussion

Based on historical sources and several aerial photographs, various structures can be referred to as the former camp. Among them are remains of walls or foundations, traces of paths, pits, cellars, and pipes. However, a clear attribution is problematic since, presumably, relicts from the time before and after the camp and from the time of the Berlin Wall complex remain and overlap (Meyer and Ullrich 2022).

Conclusion

The radar-data processing provides a large leeway, especially for the step-frequency radar, due to the different frequencies. Both radar arrays complement each other in their results and allow a differentiated data view. In connection with other sources, the former camp site Blankenfelde can be reconstructed in great detail.

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