

Visualizing GPR data in Google Earth using MALÅ GPS MAPPER

Introduction

In almost all GPR applications it is crucial not only to know where the measurements were performed, but also to be able to display the results in a suitable way. A GPR investigation typically aims to map the depth to a target (e.g. bedrock or ground water level) or to map the thickness of a layer. The results from such investigations can be presented in Google Earth*, with a couple of keystrokes, by using the software MALÅ GPS MAPPER.

This Application Note will discuss the use of GPS MAPPER together with Google Earth.

Equipment and software needed

- MALÅ shielded antenna and the X3M control unit. Data acquisition with the MALÅ Monitor XV11 (or any notebook computer). The procedure described in this note also applies for unshielded antennas (e.g. the MALÅ RTA antenna) with the control units CU11 or ProEx also.
- GPS or DGPS for positioning of the measurements.
- REFLEXW™ for processing and layer interpretation. The programs RadExplorer™ and REFLEX 2DQUICK™ (also available from Malå Geoscience AB) can be used as well.
- MALÅ GPS MAPPER from Malå Geoscience for conversion of the layer interpretations to Google Earth format.
- Google Earth for presentation of the results. A free version (for personnel use only) is available at <http://earth.google.com>. Appropriate versions are available also for professional or corporate use.
- An Internet connection is needed when using Google Earth.



Typical field setup. On the MALÅ shielded antenna the GPS equipment is mounted, elevated above the radar antenna.

Benefits of the MALÅ GPS MAPPER

- No need for any coordinate transformations or struggling with different coordinate formats. Only geographical coordinates (lat/long) are used, and the process works equally well at any place on Earth.
- In case a custom map is needed instead of the images available in Google Earth, simply use the "Image overlay" function and drag the custom map until it fits the underlying Google Earth image.
- Display the path of the measured profiles immediately after finishing the measurements, by importing the coordinate file (MALÅ *.cor-file) into GPS MAPPER.
- Works with any GPS on the market, provided it communicates in NMEA via serial interface. Use ordinary GPS or differentially corrected GPS, depending upon the needs of accuracy.
- Take advantage of the flexibility of displaying interpretations as different layers in Google Earth. Even transparency of layers can be adjusted.
- Imports column based text data from other types of equipment also.

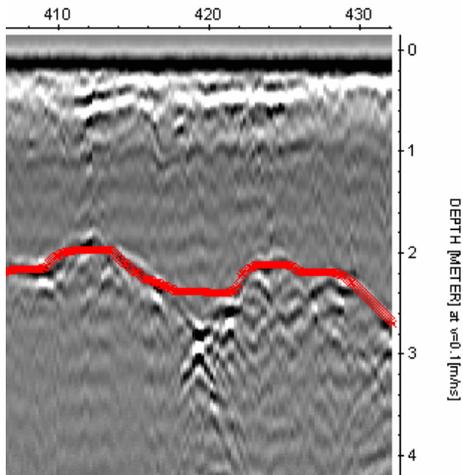


Figure 1. Short part of a typical radar interpretation. The interpreted bedrock surface (red curve) together with the trace coordinates is exported into a text file used as input into GPS MAPPER.

Example 1 – depth to bedrock

The goal of the project was (prior to the burial of utility pipes) to map the depth to the granitic bedrock, with special attention to locations with a depth less than 1 meter. The measurements were performed with a 500 MHz shielded antenna, and the positioning with a Trimble AgGPS using BEACON differential correction.

The interpretation in REFLEXW (the red curve in Figure 1) is exported to a text file, which is directly imported into GPS MAPPER. In GPS MAPPER the suitable plotting options are specified (line thickness, color scale etc.), and the result is saved in a file used in Google Earth (so called kmz-file). The kmz-file contains information on position for each radar trace and interpreted thickness. The result displayed with Google Earth is shown in Figure 2. In this example, the red end of the color scale is used to display areas with shallow bedrock.

Note that all markers, defined during the data collection, can easily be read by the GPS MAPPER and displayed in Google Earth.

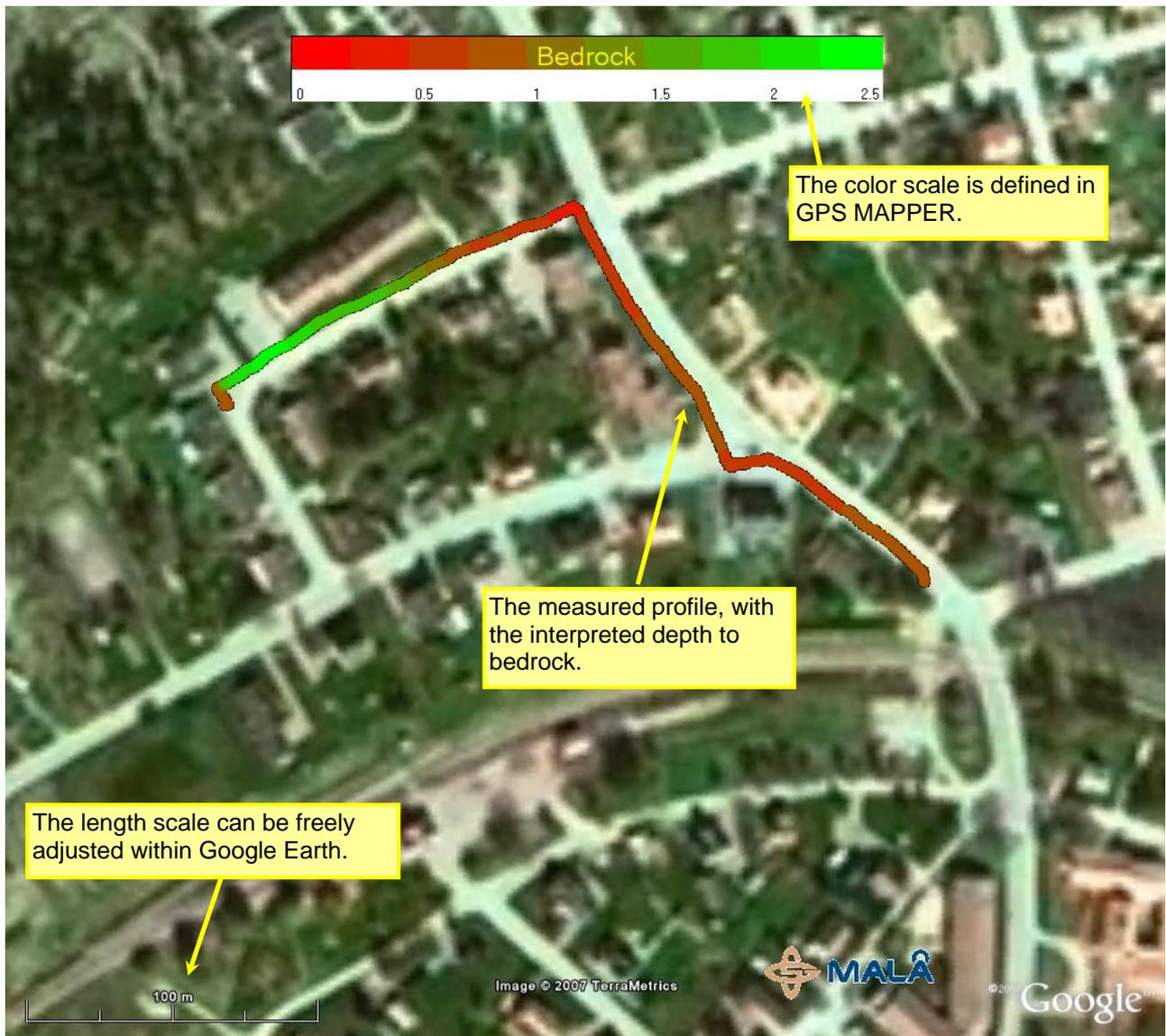


Figure 2. The interpreted bedrock depth from Figure 1, displayed in Google Earth with a color-coded scale along the measured path

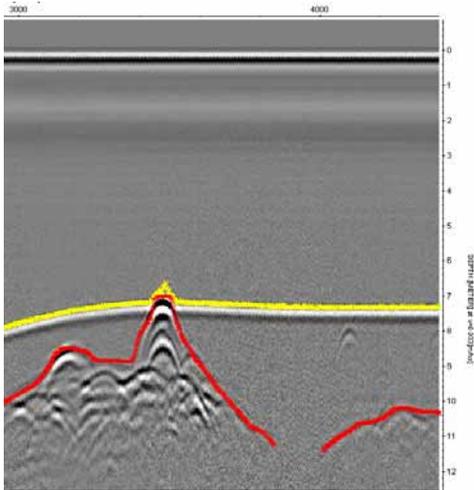


Figure 3. Short part of a typical radar interpretation. The water surface is at depth 0. The yellow curve shows the interpreted bottom, and the red curve the transition from soft sediments to solid bottom. The interpretations are exported to text files, used as input into GPS MAPPER.

Example 2 – sediments in a lake

This project aims to map the depth to the lake bottom, together with the thickness of the sediments. Figure 3 shows a short section from REFLEXW with the bottom (in yellow) and the solid moraine or rock bottom (in red). In this example a 20 MHz RTA antenna mounted in a plastic pipe behind a boat was used. The measurements were conducted with time triggering, two traces per second.

The interpreted depth to the bottom is displayed in Figure 3. Similar figures are produced for the depth to the solid bottom, as well as for the sediment thickness. As seen, no interpretations were performed in sections where the depth exceeds 16 meters. In these parts only the path of the measurements are shown (thin yellow curve).

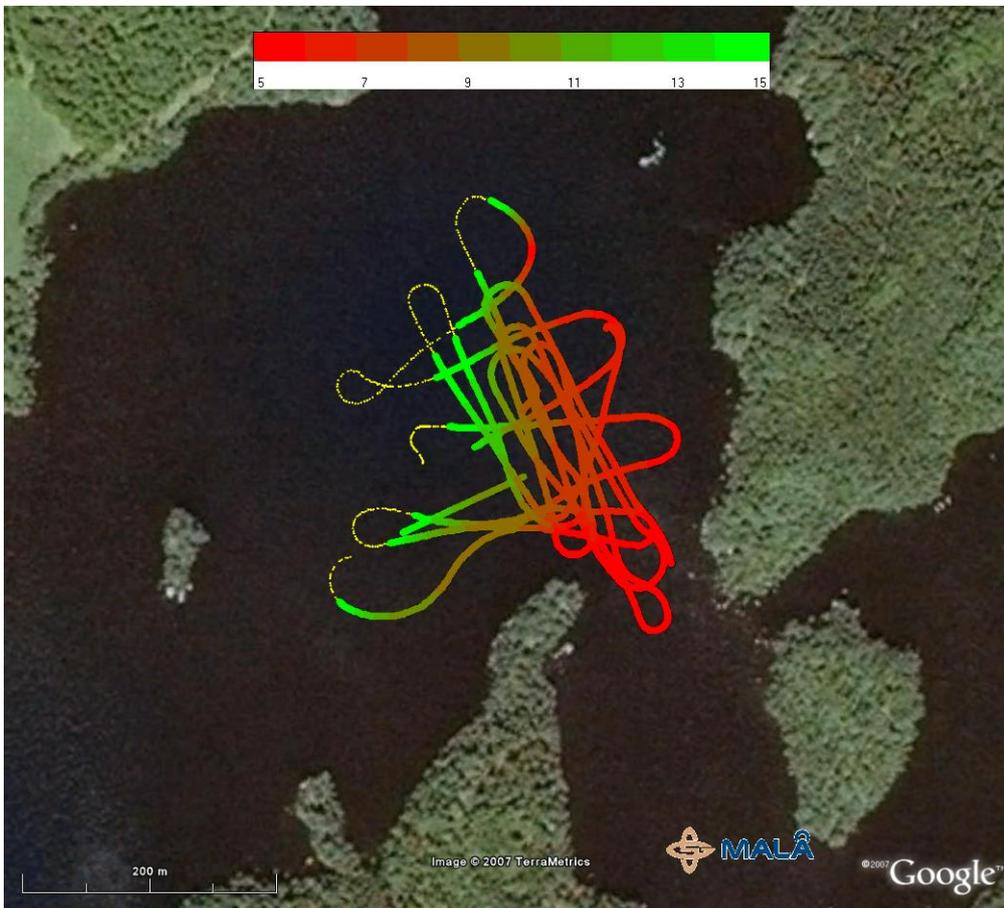


Figure 4. The interpreted depth to the bottom of the lake from Figure 3 is displayed in Google Earth with a color-coded scale along the measured path. In sections where no interpretations is performed, only the path of the investigation is shown (in yellow).



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