Preprocessing GPR data

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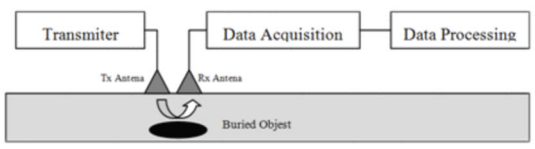
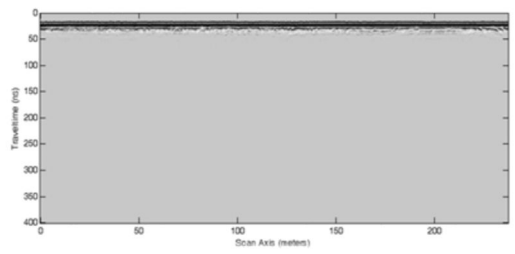
Introduction



GPR system

Introduction



GPR data (radargram)

Data Processing

Basic description of the steps GPR data processing

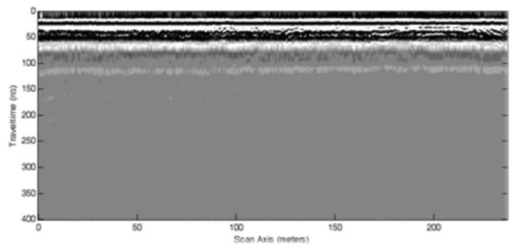
Editing	Removal and correction of bad/poor data and sorting of data files
Rubber-banding	Correction of data to ensure spatially uniform increments
Dewow	Correction of low-frequency and DC bias data
Time-zero correction	Correction of start time to match with surface position
Filtering	1D & 2D filtering to improve signal to noise ratio and visual quality
Deconvolution	Contraction of signal wavelets to "spikes" to enhance reflection event
Velocity analysis	Determining GPR wave velocities
Elevation correction	Correcting for the effect of topography
Migration	Corrections for the effect of survey geometry and spatial distribution
Depth conversion	Conversion of two-way travel times into depths
Display gains	Selection of appropriate gains for data display and interpretation
Image analysis	Using pattern or feature recognition tools
Attribute analysis	Attributing signal parameters or functions to identifiable features
Modelling analysis	Simulation of GPR responses

Data Processing

Signal processing:

- Time-zero adjustment
- Radargram size reduction
- Per-trace subtraction
- Wow elimination dewow
- Deamplification of raw DZT
- Data amplification by Standard Automatic Gain Control
- Data amplification by the Inverse Power Decay
- Data amplification by the Inverse Amplitude Decay
- Trace equalization
- Global Background or mean trace subtraction

Data Processing



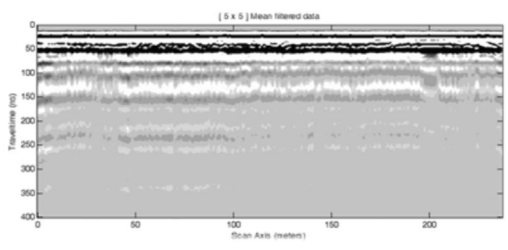
Dewow

Data Processing

Filtering:

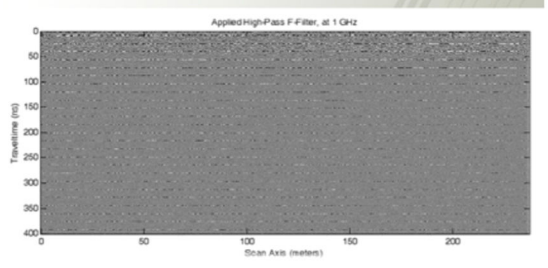
- 1D temporal filters
  - Simple mean
  - The median filter
  - A low-pass filter
  - A high-pass filter
  - A band-pass
- Spatial Filters
  - Simple running average
  - Average subtraction
  - Background Subtraction
  - Horizontal (simple running average) filtering
  - Binomial (simple running average) filtering
  - Low-pass filtering
  - High-pass filtering
  - Median (or alpha-mean trim) filtering
  - Trace Difference filtering

Data Processing



Simple mean

Data Processing



High-pass filtering

Image Processing Techniques

- Gray-scale Morphology
  - First level functions (dilation and erosion) and second level function (opening and closing)
  - Morphological Gradient
  - Feature extraction
- Contrast Enhancement
  - Morphological Contrast Enhancement
  - Contrast stretching
  - Histogram Equalization

Image Processing Techniques

Contrast enhancement

Conclusion

- Some basic procedures for preprocessing GPR data sets are presented.
- This methods will be the part of automatic approach for detection of geological features in GPR radargram.

  Interpretation of GPR data are invariably based on subjective analyses of reflection patterns. Such analyses are heavily depended on interpreter experience. There is no one sequence of processing step for all GPR applications. The operator should be very critical and careful in choosing appropriate processing scheme. What is very important the same scheme should be used for all traces in localization.
- The key to success of this approach lies in proper preprocessing of the GPR data, which is a very important step before formal data analysis. In our opinion, by using such additional methods, information about interesting and promising sections of radargram can be obtained.