Synthetic Seeding Applications for AGC Data Quality Control

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Quality Control Seeding

Objectives:

- QC seeds test AGC performance
- Seeds placed near maximal depths
- Verifies that vertical boundary objectives are achieved
- Performed internally by the GCO contractor using a firewall to ensure seeds remain blind to the data collectors and analysts

Limitations:

- May be cost prohibitive to implement a statistically large sample size (minimum requirement of 1 seed/team/day)
- Difficult to capture the impact of variable environmental factors (e.g., background, noise, and density variability)

Synthetic Seeding: Augmenting The QC Program

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Benefits of Synthetic Seeding for QC:

- Implemented on real data collected on the project site

- Captures the site-specific variables: environmental noise, terrain effects, geology, operator effects

- Can be used to rapidly populate a grid with a variety of seeds without the cost of excavation and survey

- Can be distributed over a site to capture variations in target density, geology, or other site features

- Provides further verification of operating envelope and identifies any limitations or exclusions (i.e., SRA's)
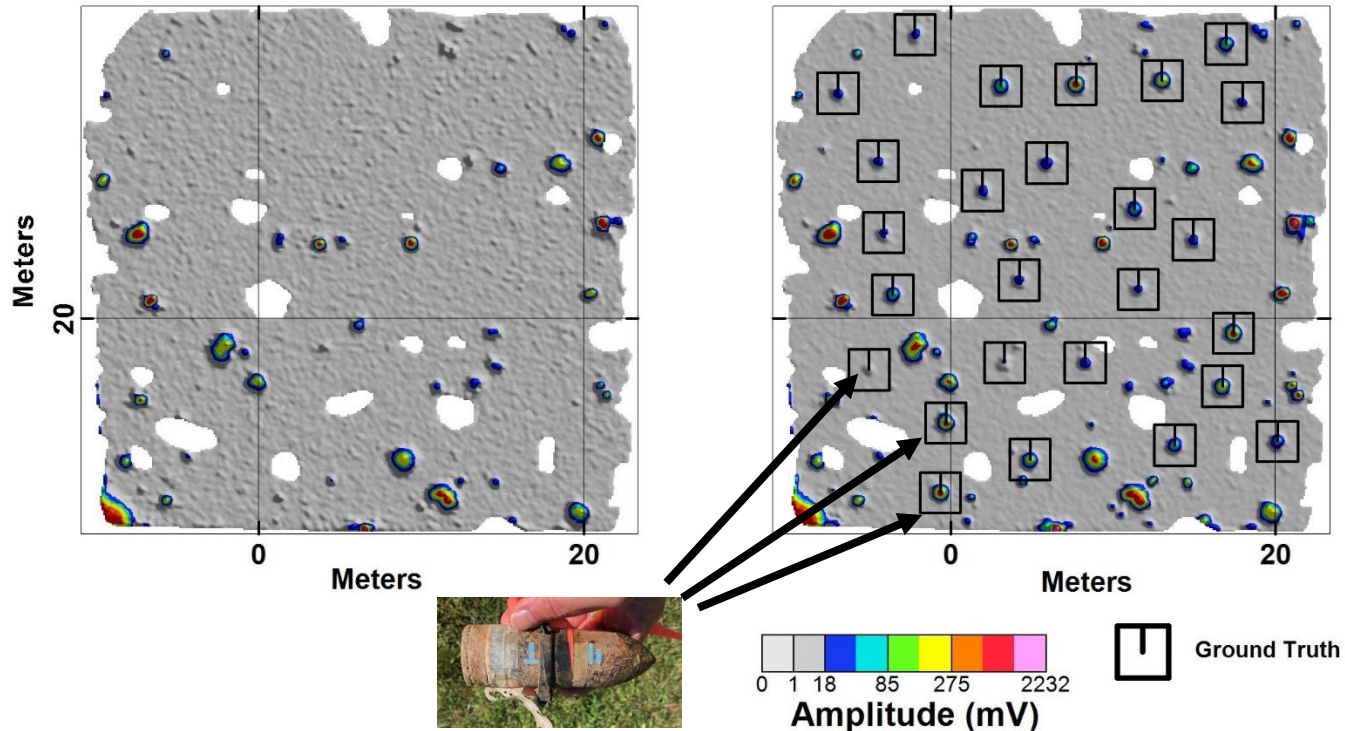
Low Noise Grid
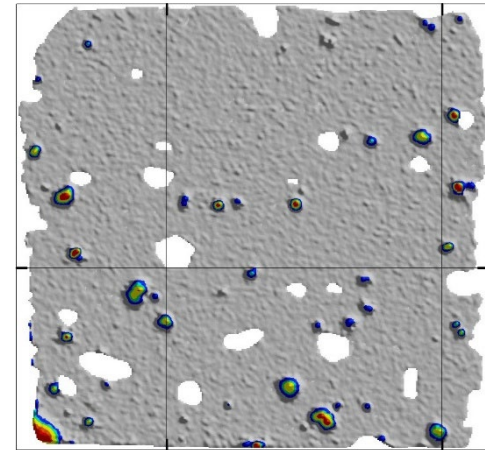
High Geology Grid
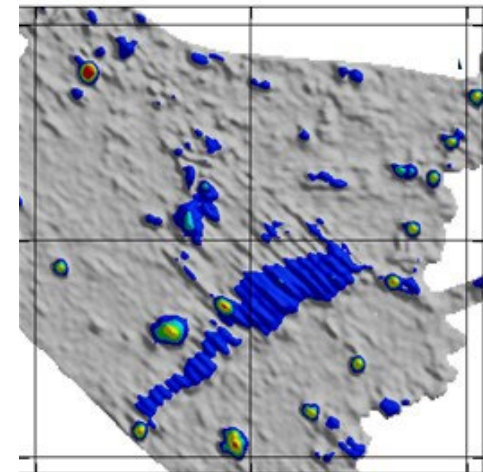
Synthetic Seeding Process

Implementing synthetic seeding:

- Select a TOI from your library

- Select a location and an orientation

- Apply TOI polarizabilities to the forward model to generate the target response in the relevant spatial and temporal channels

- Insert response back into the raw data and reprocess

AGC Performance Assessment

Synthetic Seed Analysis:

- Invert the data and perform classification using library match statistic

- Site characteristics such as environmental noise, geology, target density will impact the library match quality

- Provides a quantitative assessment of the impact of site-specific factors on classification performance
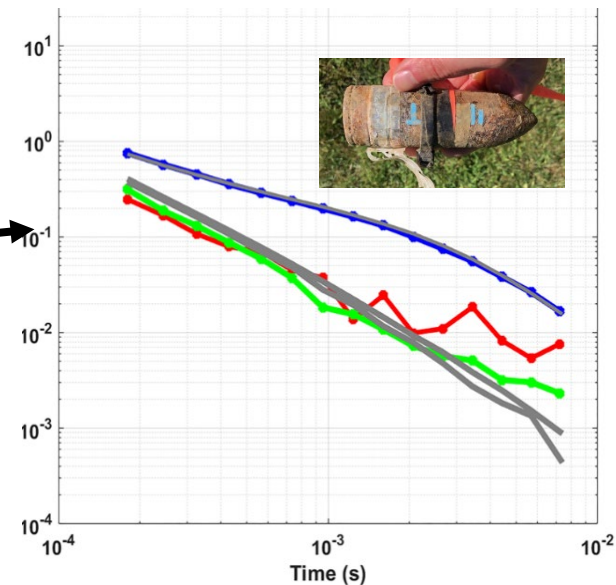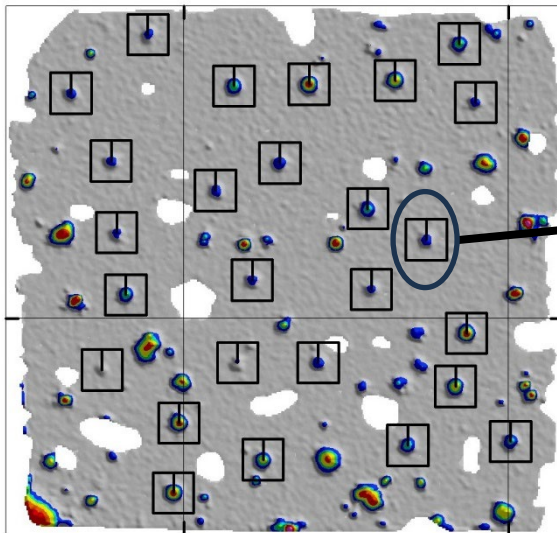
Example 1: Environmental Noise

Noise Mitigation:

- Powerline noise is a common environmental interference source

- Noise varies spatially and temporally

- Placing synthetic seeds in locations and during times of peak noise provides assessment of performance in worst-case conditions

- Enables verification of mitigation techniques such as noise filters

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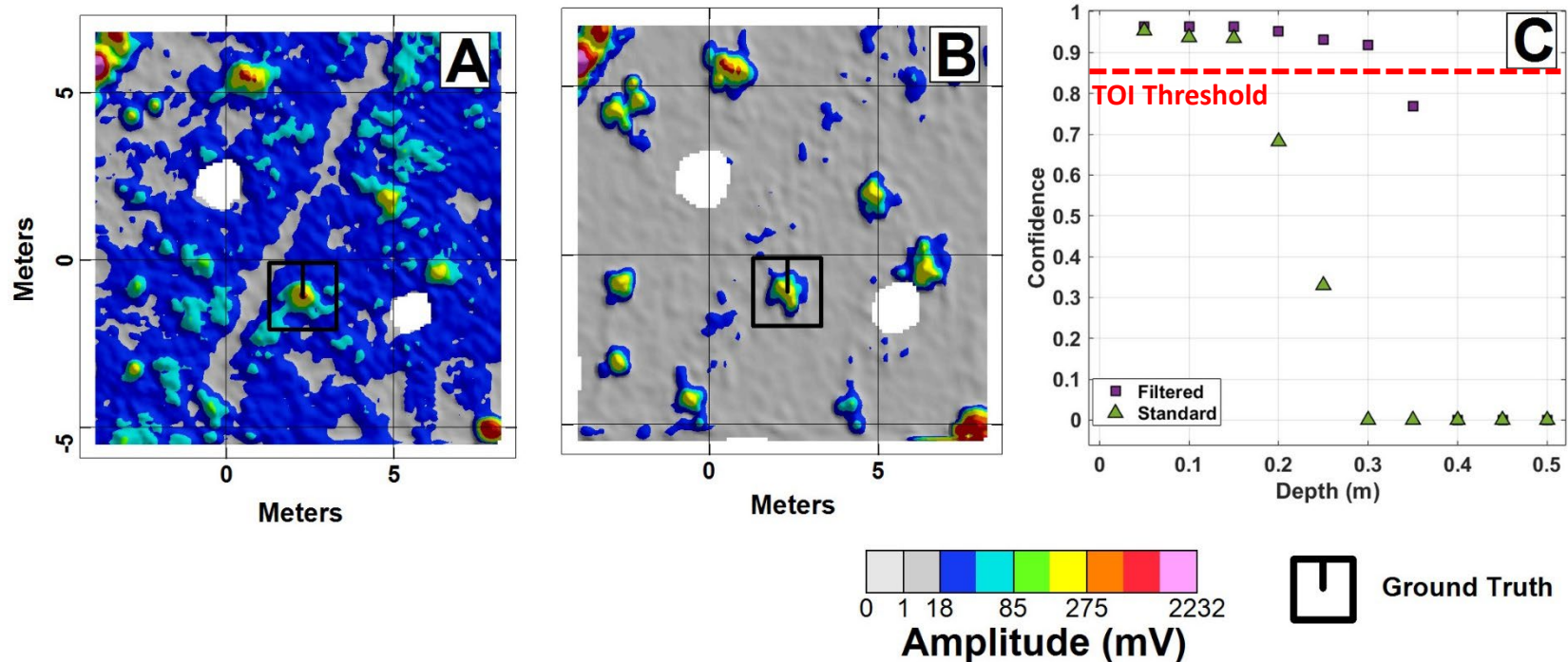
Example 2: Geology

Background leveling:

- Sites with magnetic geology produce low frequency background variability

- Spatial frequency can overlap significantly with that of deeper target responses

- Synthetic seeding in locations with high background variability provides a method for quantifying AGC depth performance

- Enables selection of optimal background leveling filters to maximize background removal without removing target response

Amplitude (mV)
0 1 18 85 275 2232

Ground Truth
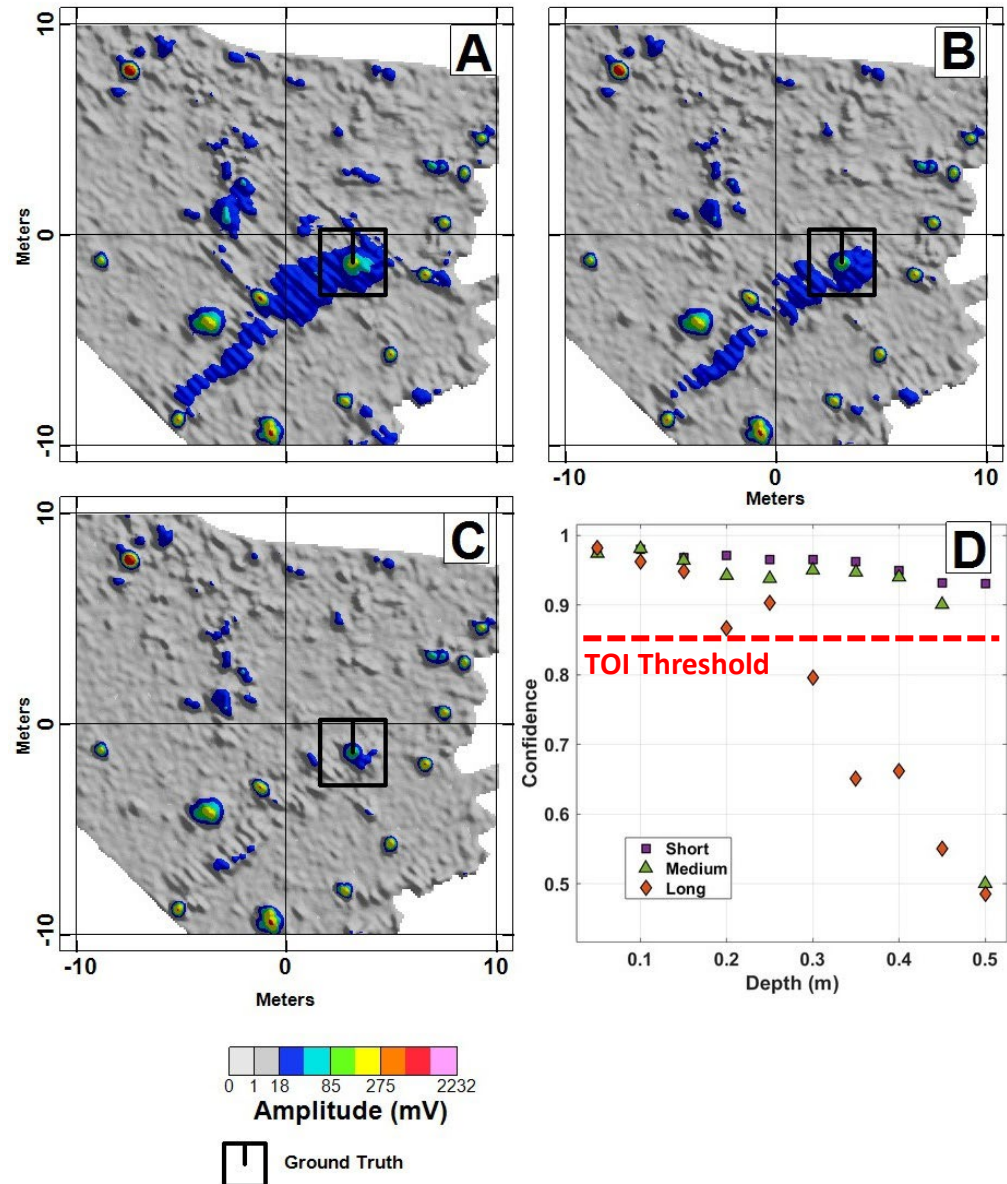
Synthetic Seeding Benefits and Limitations

Benefits:

- Cost-effective way to increase sample size to evaluate AGC performance and limitations

- Can be targeted to known "problem areas" discovered after data are collected

- Provides a quantitative assessment of project-specific techniques, such as filters, to determine best approach for a site

Limitations:

- Will not capture positioning errors

- May not identify equipment problems

- Limited ability to determine terrain impacts on standoff