SERDP
Strategic Environmental Research and Development Program

Improving Detection and Discrimination of UXO in Magnetic Environments

Unexploded Ordnance
UX-1414

Background:

Detection and discrimination of unexploded ordnance (UXO) can be seriously hindered by the presence of magnetic rocks and soils. In regions of highly magnetic soil, magnetic and electromagnetic (EM) sensors often detect large anomalies that are of geologic, rather than metallic, origin. In a preliminary study (SERDP SEED project UX-1285), the research team used numerical simulations to examine the effect of magnetic soil on the static magnetic method and time-domain EM method in UXO discrimination problems. The team assessed the level of soil response that severely affected the reliability of current discrimination algorithms based on geophysical inversion. It was clear from this research that the successes of these, and other, data processing algorithms require an understanding of the spatial characteristics of the susceptibility and the dependence of susceptibility on frequency.

Objective:

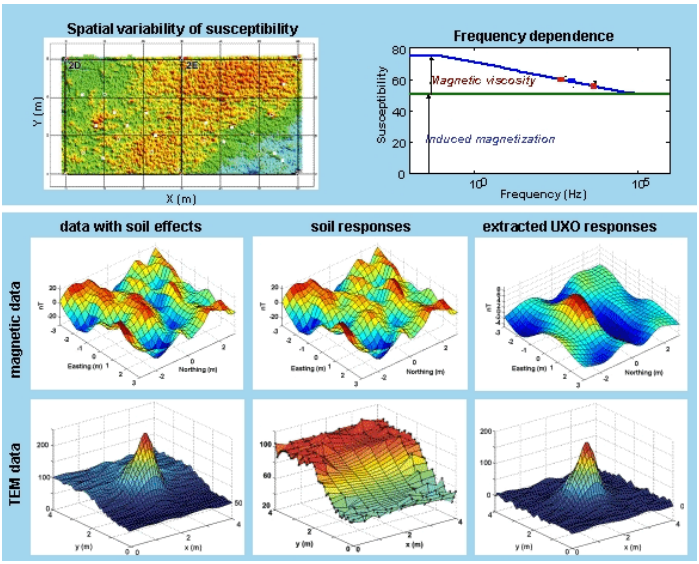
This project focuses on practical questions regarding the physical understanding of magnetic soils, how to generate useful site characterizations of magnetic properties, and how to use information from the site characterization to process magnetic and EM data. Specific technical objectives include: (1) understand the geologic origins and physics of soil magnetization, (2) develop protocols and practical procedures for characterizing site magnetization, (3) develop methods and procedures for removing the effects of soil responses from magnetic measurements, and (4) develop methods and procedures for preprocessing EM data.

Process/Technology Description:

In this project, the research will be guided by practical questions that arise from four sites with different magnetic soil properties. The spatial distribution and frequency dependence of susceptibility will be studied, and its effects on different sensor modalities will be quantified. The geological factors governing the spatial and grain size distribution of magnetic iron oxides, and hence their susceptibility, will be studied. New filtering techniques that incorporate geostatistical information and a physical understanding of the phenomenon of complex magnetic susceptibility also will be developed.

Expected Benefits:

This project addresses one of the Department of Defense's most pressing environmental problems; that is, the efficient and reliable identification of UXO without the need to excavate large numbers of non-UXO. (Anticipated Project Completion - 2007)



Detection and discrimination of UXO can be severely hampered by the presence of magnetic soils. Top panels show examples of spatial distribution and frequency dependence on soil susceptibility. Lower panels illustrate the improvement in sensor data that can be obtained by removing the soil effects.

Contact Information:

Dr. Yaoguo Li
Colorado School of Mines
Department of Geophysics
1500 Illinois Street, Room 280N
Golden, CO 80401
Phone: (303) 273-3510
Fax: (303) 273-3478
E-mail: ygli@mines.edu

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