Characterization and Delineation of Potential Evaporite Geohazards Using Electrical Resistivity Methods along FM 2185, Culberson County, Texas

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Abstract

Extensive karst development within the Delaware Basin of West Texas and southeastern New Mexico poses a significant geohazard threat to infrastructure. Dissolution of regional evaporite strata has led to manifestations of karst geohazard phenomena including sinkholes, subsidence features, and caves. The study area is located within the Gypsum Plain in Culberson County, Texas, and includes outcrops of Castile and Rustler strata that host gypsum karst geohazards. Land reconnaissance surveys conducted during summer of 2019 documented numerous surficial manifestations of karst features proximal to Farm to Market Road 2185 (FM 2185). In combination with traditional survey techniques, electrical resistivity methods were used to delineate karst features along a 48 kilometer segment of FM 2185.

Capacitively-Coupled Resistivity (CCR) and Direct-Current Resistivity (DCR) methods were used to characterize evaporite karst features that do not manifest surficially but pose potential geohazard concerns. CCR data was acquired using the Geometrics OhmMapper G–858 resistivity system, which uses a dipole-dipole configuration composed of five receivers connected by 2.5 meter coaxial cables and a transmitter offset of 2.5 meters. In combination with the medium analyzed, this geometric configuration enabled resistivity soundings up to 5 meters deep. DCR data was collected with a SuperSting (R8/IP) multi-electrode earth resistivity meter using 112 electrodes with 2 meter spacing and a dipole-dipole array configuration. This enabled a depth of investigation of up to 73 meters. Data were processed using AGI's (Advanced Geometrics Inc.) EarthImager 2D software and used to delineate and characterize karst-related geohazards in the shallow subsurface within the study area.