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Investigation of Geological Structural Anomalies

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We report on advances in capabilities toward detailed three-dimensional (3-D) density evaluation of shallow underground features. We are currently developing software to use a 3-D Geological Framework Model (GFM) to predict gravitational anomalies from underground structures such as faults, cavities or tunnels that might be detected with surface and/or subsurface gravity measurements. This software is being built within a Python operating environment and is leveraging parallelization capabilities of Python to accelerate the computations for large models (billions of elements) parameterized at high resolution. The models ingested by the algorithm are built upon a grid of right rectangular prisms with associated densities. The gravitational contribution of each prism is estimated using the method of Nagy (1966) for each measurement position in a survey. Because the gravitational field is a linear sum of the independent prisms for each station, the problem is well-suited to parallelization. The goal of our development is to build an inverse capability which would allow for iterative model adaptation based upon measured gravity in an area of interest. We present the status of this tool and its application to gravity survey locations at the Nevada National Security Site. LA-UR-22-31036.

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Promotional text

The work described herein serves to support nonproliferation research by seeking to validate a multidisciplinary geophysical model that can reduce uncertainties in the location of seismic sources and inform the models of relevant seismic wave speeds.

Oral preference format

in-person

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