

Signature of a Cavern Created by an Underground Nuclear Explosion in 2-D Exploration Seismic Data

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The On-Site Inspections (OSI) are the final verification regime of CTBT. Its principal purpose is to detect if an underground nuclear explosion (UNE) has been carried out. Several geophysical techniques are used on a suspicious area to detect cavities, holes or devices that indicate the realization of a nuclear essay. One of these techniques is seismic reflection. There is scarce information in the literature about the seismic response of caverns created by UNEs, for this reason, in this work we use wave-propagation simulations to obtain the seismic signature of these types of caverns. We solve the elastic wave equation in the time domain using the spectral element method with fourth order basis functions and quadrilateral elements. We show the results for models with cavities and caverns corresponding to explosions of 1, 20 and 100 kilotons. In seismic traces we can observe the effect of these structures and we can see that cavities behave like points or diffractor bodies, depending on their sizes, whereas caverns, which are more complex structures, behave like two concentric diffractor bodies.

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Promotional text

In an OSI there is limited time to process the acquired geophysical data and thus it is important to determine if an UNE has been carried out as fast as possible. We investigate the seismic signature of caverns in order to provide critical insight to be able to reach a verdict.

Oral preference format

online live

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