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# of OSI Forward Modelling Capacity for Non-Seismic Geophysical Techniques

An on-site inspection (OSI) foresees the use of multi-geophysical methods to investigate the presence of possible underground nuclear explosion (UNE)-relevant observables at a given site to assist in identifying any possible violator of the Comprehensive Nuclear-Test-Ban Treaty. We present the results of numerical simulations obtained by means of Python functions based on the Simpeg libraries, calculating the 3-D forward response of UNE-observables for non-seismic methods such as magnetic, gravimetric, frequency/time-domain electromagnetic methods and electrical resistivity tomography. We have identified five main scenarios based on realistic possible UNE emplacements: a buried cavity with eventual addition of alteration shells and a chimney with and without a metallic borehole casing; and a horizontal emplacement including a tunnel with metallic rails and doors, alteration shells, a chimney, an apical void, and changing topography. For each scenario, simulations have been carried out varying the observables' geometric and physical parameters. Our results provide a portfolio of UNE non-seismic anomalies that can greatly aid the choice of the OSI technique to apply and the design of the surveys. Therefore, the results are of extreme importance for the further development of the OSI training programme for surrogate inspectors as well as for the development of the OSI equipment list.

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