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, Surface and Remote Observations of Legacy Nuclear Explosion Sites

Underground nuclear explosions (UNE) result in numerous signatures that manifest on a wide range of temporal and spatial scales. In case studies of legacy nuclear explosion sites, we demonstrate the scalar variability of surface and subsurface observables, briefly discuss current capabilities to locate, detect and analyze potential nuclear explosion locations, and explain how emergent technologies and amalgamation of disparate data sets will facilitate improved monitoring and verification. At the smaller scales, material and fracture analyses on rock collected from legacy UNE sites can be incorporated into predictive modeling efforts. Subsurface data collected includes gravity and magnetics. Spatial analyses of digital elevation models and orthoimagery show subtle surface topographic changes and damage at nearby outcrops. Additionally, it is possible to use the vegetation as a companion signature reflecting geologic conditions and showing subsurface effects. Aerial systems based on Red-Green-Blue (RGB) imagery, light detection and ranging, and hyperspectral imaging can allow for combined remote sensing modalities to perform pattern recognition and classification tasks. Finally, more remote systems such as satellite based synthetic aperture radar and satellite imagery are other techniques in development for UNE site detection, location and analysis. Together, these observations provide critical input for predictive modeling efforts.

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