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## Role of Instrument Depth in Seismic Signal Quality: Findings from a Vertical Array at Glasgow Observatory

Seismic data from the International Monitoring System (IMS) captures both natural and environmental noise, along with signals from seismic events such as earthquakes or potential explosions. While most of these stations are surface-based, a few instruments are deployed at depths ranging from tens to 100 meters. Although previous studies suggest that deeper instrument deployment may improve signal to noise ratios (SNR), this enhancement is not always consistent, and no universal pattern has been established. Understanding how instrument depth affects noise and SNR can inform more effective IMS station design and network planning, ultimately improving event detection and characterization. In this study, we analyze a unique dataset of identical broadband instruments deployed at various depths within the same borehole, ranging from approximately 30 to 200 meters. This configuration isolates the effect of depth on seismic signals. By examining both background noise levels and event detection capabilities across a range of frequency bands, we find that while noise levels generally decrease with depth, as reported in other regions, improvements in seismic signal quality and SNR do not always follow the same trend.

### E-mail

dorian@ndc.soreq-ndc.gov.il

### In-person or online preference

**Primary author:** GOLRIZ, Dorian (Soreq Nuclear Research Center)

**Co-authors:** Dr BEN-HORIN, Yochai (NDC Israel); RADZYNER, Yael (Soreq Nuclear Research Center)

**Presenter:** GOLRIZ, Dorian (Soreq Nuclear Research Center)

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