# S51D-3270 Improved Monitoring of Mining-Induced Seismicity in a Longwall Coal Mine Using an Underground Distributed Acoustic Sensing Array

Friday, 13 December 2024

08:30 - 12:20

*Hall B-C (Poster Hall) (Convention Center)*


## Abstract

Longwall mining extracts all coal from large panels, allowing the roof to collapse immediately behind mining operations. This collapse induces potentially hazardous seismicity. In April and May 2022, we installed ~7 kilometers of fiber-optic cable underground in a longwall coal mine and connected it to a Distributed Acoustic Sensing (DAS) interrogator to record induced seismicity. DAS fiber is safe to deploy underground throughout a coal mine, unlike electronic seismometers, which are a potential fire hazard. DAS is less sensitive to ground shaking than traditional seismometers, however, it can be deployed underground, closer to the events, and it has densely spaced sensors. Much of the cable was suspended along the mine shaft, roof, or walls to connect the cable to the interrogator safely at the mine's surface. About ~1.3 kilometers of cable were laid on the mine floor in the headgate beside the active mining, yielding valuable data at a station spacing of 5.7 meters. Data acquisition spanned ~7 weeks. All events within ~0.3 km of the cable that were detected by a sparse surface seismic network were also detected in the DAS data, plus DAS recorded additional smaller events near the cable, larger events at greater distances, and mining equipment vibrations. The dense station spacing enabled accurate determination of the seismic wave speed. The underground DAS enabled event depths to be determined for the first time, illuminating clusters that correlate with the evolving mining-induced stress. The dense station spacing also enabled backprojection (migration) to detect very small events, and to accurately locate them in two dimensions. The single straight cable presented an azimuthal ambiguity in location, which could have been solved with an additional cable in another entry.

Backprojection automatically detects and locates seismic events, and the resulting catalog will be compared with that of the traditional surface array.

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