Subsurface imaging using interferometry of distributed acoustic sensing ambient noise measurement along a dark fiber line; a case study in downtown Reno, Nevada

- **Description:** Distributed acoustic sensing (DAS) technology is an emerging field of seismic sensing that enables recording ambient noise seismic data along the entire length of a fiber-optic cable at meter-scale resolution. Such a dense spatial resolution of recordings over long distances has not been possible using traditional methods because of limited hardware resources and logistical concerns in an urban environment. The low spatial resolution of traditional passive seismic acquisition techniques has limited the accuracy of the previously generated velocity profiles in many important urban regions, including the Reno-area basin, to the top 100 m of the underlying subsurface. Applying the method of seismic interferometry to ambient noise strain rate data obtained from a dark-fiber cable allows for generating noise cross correlations, which can be used to infer shallow and deep subsurface properties and basin geometry. We gathered DAS ambient noise seismic data for this study using a 12 km portion of a dark-fiber line in Reno, Nevada. We used gathered data to generate and invert dispersion curves to estimate the near-surface shear-wave velocity structure. Comparing the generated velocity profiles with previous regional studies shows good agreement in determining the average depth to bedrock and velocity variations in the analyzed domain. A synthetic experiment is also performed to verify the proposed framework further and better understand the effect of the infrastructural cover along the cable. The results obtained from this research provide insight into the application of DAS using dark-fiber lines in subsurface characterization in urban environments. It also discusses the potential effects of the conduit that covers such permanent fiber installations on the produced inversion results.
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