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Towards microseismic moment tensor inversion in boreholes with DAS

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We present preliminary results on a moment tensor inversion workflow for Distributed Acoustic Sensing (DAS). It makes use of a fast-marching Eikonal solver and synthetically modeled data. The study specifically focuses on borehole settings for geothermal sites. Distributed Acoustic Sensing measures the wavefield with high spatial and temporal resolution. In borehole settings, individual DAS traces generally prove to be noisier than co-located geophones, whereas the densely spaced DAS shot-gathers show features that would have otherwise been missed by the commonly more sparsely distributed geophone chains. For example, the coherency in the DAS records shows the polarity reversals of the arriving wavefield in great detail, which can help constrain the moment tensor of the seismic source. The synthetic tests encompass different source types and source positions relative to the deployed fiber to assess moment tensor resolvability. Further tests include the addition of a three-component seismometer at different positions to investigate an optimal network configuration, as well as various noise conditions to mimic real data. The synthetic tests are tailored to prepare for the data from future microseismicity monitoring with DAS in the conditions of the Utah FORGE geothermal test site, Utah, USA. The proposed method aims at improving amplitude-based moment tensor inversion for DAS deployed in downhole or underground lab contexts.