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Seismic Event Detection on Single Stations Using Deep Learning

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Automatic detection of seismic events in processing pipelines at the International Data Centre and many National Data Centres is mostly done using beamforming on arrays; however, extensive use of single stations can improve the detection capability and accuracy of event location. Advances in deep learning methods enable faster and more accurate processing of large quantities of single station data not seen previously. We use event catalogues including phase picks on a range of arrays in Scandinavia at regional distances (200-2000 km) i.e. up to 3 min separation between P and S arrivals, to train several deep learning models (PhaseNet and EQTransformer variants) using single stations within the arrays. The models are trained on clips of 324 s to capture the multiple arrivals. The models are then applied to various single stations in Norway to assess their generalization. We can detect events at a variety of back-azimuths and distances.

Furthermore, we expand the existing deep learning models to provide predictions for back-azimuth and distance. This imposes physical restrictions on the models, leading to increased picking accuracy for the predicted phase arrivals. Moreover, this enables us to use the vast number of single stations available to efficiently detect and locate distant events.

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Promotional text

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Oral preference format

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