

Usage of SH/P amplitude ratios for focal mechanism determination - case study from the Nordland region, Norway

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The fault plane of small earthquakes ($M < 3.5$) is typically found through grid search of polarity observations. Amplitude ratios between S and P wave can be used in addition. However, the correct usage and usefulness of the amplitude ratios is still debated. We are presenting a case study from the Nordland area (65-70N; 8-18E; Norway) which was monitored between August 2013 and May 2016 within the NEONOR2 project by 30+ seismic stations (26 temporary, 4+ permanent). The earthquake catalogue contains about 450 events of $ML > 1.0$ and about 30 of $ML > 2.0$. The largest earthquake recorded was of $ML = 3.2$.

Robust fault planes can be obtained with a large number of polarities and sufficient coverage of the focal sphere. For the Nordland monitoring, this was often not the case and sufficiently stable fault plane solution (FPS) could not be obtained using polarities only. Therefore, the computation and use of SH/P amplitude ratios were investigated. An automated tool for amplitude measurement in time and frequency domain was developed and implemented in the SEISAN software package. The robustness of the tool was demonstrated by comparing time and frequency domain results obtained for various frequency bands.

The FOCMEC program was used for the FPS search. We used the events for which a robust solution could be found based on polarity readings only and then established minimum requirements for events that are more marginal, i.e. insufficient polarities are complemented with amplitude ratios. This work has provided a systematic approach that will help to obtain more robust results and to evaluate the reliability of the results, which is essential when using the FPS to understand the underlying causes of the earthquakes.