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Detection of possible seismic station phase reversals using parametric data from seismological bulletins

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A simple and fast technique to detect systematic changes in the performance of seismic stations by using parametric data is being presented. The methodology is based on a simple principal, notably, quantifying the goodness of fit of first motion manually picked polarities from seismological bulletins versus available earthquake mechanism solutions over time. The probability of the reporting polarity data fitting (and not fitting) source mechanisms is quantified by calculating the probability distribution of several Bernoulli trials over a randomly perturbed set of hypocentres and velocity models for each earthquake mechanism - station polarity combination. The method was applied to the registered seismic stations in the bulletin of the International Seismological Centre (ISC) after grouping each polarity pick by reporting agency, using data from the past two decades. The overall agreement of first motion polarities against source mechanisms is found to be good with a few cases of seismic stations showing indications of systematic phase reversals over certain time periods. Specifically, results were obtained for 50% of the registered stations at the ISC, and from these stations 70% show reliable operation during the operational time period under investigation, with only 3% showing the opposite, and 7% showing evidence of systematic changes in the quality of the reported first motion polarities. The rest showed great variability over short periods of time, which does not allow one to draw any conclusions. Comparing waveform data with the associated reported polarities revealed a mixture of cases of either questionable picking or true station phase reversals.