# An optimization strategy for robust first motion P-wave automatic picking – Application to the FilterPicker algorithm

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Automatic phase pickers are key components in early warning systems and /or the composition of preliminary automatic bulletins, and therefore they are usually focused on identifying the onset times of multiple phase arrivals. The International Seismological Centre (ISC) has recently developed routine and fully automated procedures for the determination of earthquake focal mechanisms from local to teleseismic scale, combining the reported parametric data (first motion polarities) which are available in its reviewed bulletin and auto-picked first motion polarities obtained from waveform data using a broadband automatic picker (FilterPicker). Robust focal mechanism computations strongly depend on the correctness of the stations' first motion polarities, especially in the case of poorly constrained mechanisms. For the purpose of the above application an optimization strategy is put into test in order to investigate the possibility of enhancing the performance of the FilterPicker algorithm to pick correct first P-wave arrivals (onset time and polarity). A large data set consisted of nearly 7000 manually picked first P-wave arrival times and polarities which are reported to the ISC, is compared with auto-picked waveform phase arrival times and polarities. The optimization is carried out by the Neighbourhood Algorithm in a 24-processor mini computer cluster. A six-dimensional parameter space search is driven by a weighted misfit function which takes into account the data estimated uncertainties expressed as the inverse of the data covariance matrix. Moreover, a regularization factor monitors the performance of the automatic picker as its sensitivity in picking new phase arrivals changes through the search. Different global searches are carried out for different sampling rate instrument channels and preliminary results show an increase of 10% of the correct first motion polarities in comparison with the obtained results from the default set up of the automatic picker.