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Automatic detection of earthquake-generated long-period disturbances in seismic records

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Pulse-like shaped disturbances have been reported on earthquake recordings from many different types of seismometers worldwide (Zahradník a Plešinger, 2005, 2010; Javelaud et al., 2011). They can be explained by the instrument response to a step-like input acceleration or velocity. These might relate to tilt or electronic saturation, respectively, but other interpretations are also possible. Although these disturbances occur quite often, they might be easily overlooked and misinterpreted in band-pass filtered traces. Use of such disturbed recordings might produce wrong results in several seismic applications, e.g. when inverting waveform data for the centroid moment tensor and slip distribution, or when inverting spectra for the seismic source radius and quality factor. We studied the phenomenon systematically on a 10-years data set of the Swiss seismic network, and developed a software tool (MouseDetect) for automatic detection. The code selects station-events pairs of interest (based on an appropriate GMPE's), downloads data via ArcLink protocol, makes numerical modeling of the disturbances, and performs detection by comparing the modeled disturbance with real 3-component waveforms. The results are automatically evaluated, plotted and tabulated.. The presentation will concentrate on the description of the method and the application. The 10-years data set (spanning magnitudes from 1.0 to 5.9) was extracted to emphasize records from near seismic stations and from larger earthquakes, where the strong disturbances are expected. More than 5000 recordings were automatically searched and processed, resulting in the identification of about 150 records containing the pulse-like shaped disturbances. The detected disturbances were evaluated statistically to find out their possible relation with a particular station, epicentral distance, source depth, magnitude, PGA, used device type, etc. We also studied the relation between polarization of the disturbance and the earthquake azimuth. The developed tool removes efficiently and fully automatically the disturbed recordings from routine data processing. Possible correction of the records (i.e. removal of the disturbances) is a next task to be solved.