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Seismic event discrimination : Application to metropolitan France

Alessia Maggi and Sophie Lambotte
Strasbourg University/EOST, CNRS-UMR7516, Strasbourg, France

Accurate seismic hazard assessment requires high quality and complete seismic catalogs. Anthropogenic events such as mining blasts, rock bursts, explosions, etc. can introduce significant errors in statistical analyses, especially in areas with low background seismicity rates such as metropolitan France where most of the recorded events have an anthropogenic origin. Discriminating low magnitude events is complicated by path and attenuation effects, site effects, and the shallow nature of the seismicity. The French seismic network (RESIF) is currently expanding into regions of metropolitan France with even lower background seismicity. In order to produce the high-quality seismic catalogs necessary for tectonic understanding and seismic hazard assessment of these low seismicity areas, we need to improve the routine event discrimination performed in our regional and national observatories.

Starting from the recent revised seismic catalog for metropolitan France (Si-Hex project), we have performed preliminary analyses using classification algorithms based only on catalog features (location and origin time) and obtain correct classification for 80% of the recorded events excluding induced seismicity. In this work, we shall attempt to improve on this classification by adding features extracted from signal measurements to our classification algorithms. The study will be based on the BCSF-RéNaSS catalog over 2012-2016 and will exploit seismic waveforms from near-field stations. We shall test several classification algorithms (both supervised and unsupervised), and select the most discriminant features among a large set extracted from signal measurements, including but not limited to typical P/S amplitude ratios and power at low frequencies (useful to detect the Rg phase of some man-made events).