Lessons learned from near-fault recordings of the Emilia, 2012 seismic sequence

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The Emilia 2012 seismic sequence provided a wealth of strong motion data, both from permanent and temporary network. The accelerometric station closest to epicentre is managed by the RAN network and it is located in the town of Mirandola (Code MRN), just close to the faults that generated the two main earthquakes of the sequence that are the M=5.9 and M=5.8, occurred on May 20 and 29 respectively. At same site of the MRN-RAN station, after the event occurred on May, 20 2012, a temporary accelerometric station was installed (code CNR) just 5 meters away. While the MRN-RAN station is inside a small building (electric substation) the CNR station was installed in free-field. After the mainshock, the site was also well characterised from the geophysical and geotechnical stand point with surface and down-hole surveys, and laboratory dynamic test on undisturbed samples.
The analysis of the recordings, also compared with code provisions, provided several useful insights:
1) while the geological setting is apparently 1-D, there is a strong difference between horizontal components, not only for the mainshock but also for lesser quakes (magnitude down to below 2) thus ruling out a source effect;
2) the mismatch with the spectra provided by the Italian seismic code is due mainly to a poor performance of Vs30-based classification for deep soil site like the ones in the Po Valley rather than to PSHA estimates of hazard on rock conditions;
3) the influence of the housing of the RAN station is clearly visible at high frequency, the only portion of the spectra where the to station show different spectra ordinates;
4) integral parameters like Housner Intensity could be strongly affected when the integration range gets closer to very long periods at which the static displacement of the fault could not be neglected.