The May 2012 Pianura Padano-Emiliana seismic sequence: INGV strong-motion data website

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On May 20th 2012, 06:03:02 UTC, a M_L 5.9 (M_w 6.0) earthquake struck the Northern Italy (http://cnt.rm.ingv.it/tdmt.html). The epicenter was localized at 11.23° E and 44.89° N, in an area among the cities of Ferrara, Modena and Mantova. The event occurred at a depth of about 6.30 km, and was characterized by a reverse focal mechanism (http://cnt.rm.ingv.it/). From May 20th, thousand of earthquakes, the strongest of which with a M_L 5.8 (May 29th, 07:00:03 UTC), occurred in the same area (http://iside.rm.ingv.it/).

This note presents a new web site, www.mi.ingv.it/ISMD/ that includes about 2.000 three-components strong-motion recordings related to the events with $4.0 \leq M_L \leq 5.9$ occurred in the central part of the Pianura Padano-Emiliana (Northern Italy) from May 20th to June 3rd. The data come from all INGV strong-motion stations installed in Northern Italy (i.e. Strong-Motion Network of Northern Italy, RAIS, http://rais.mi.ingv.it/, Augliera et al., 2011; strong-motion stations of the National Seismic Network, RSN, http://cnt.rm.ingv.it) and selected with a minimum latitude of 43.5°N. The earthquake locations reported in the web site come from the National Earthquake Center of INGV (preliminary location form: http://cnt.rm.ingv.it/).

An automatic procedure was developed in order to publish in the web site both metadata (processed by an automatic system) and downloadable waveforms in ascii format (uncorrected version).

After each earthquake occurrence, the procedure downloads 5 minutes (starting from the event origin time) of MINI-Seed waveforms from EIDA (http://eida.rm.ingv.it/) archive and applies a fast processing and data analysis tool.

The automatic data processing includes: i) a first-order baseline operator applied to the entire record, in order to have a zero-mean of the signal; ii) a baseline correction, in order to remove the linear trend, computed with a least square method; iii) tapering of the signal through a cosine function (0.01%) at the beginning and at the end of each selected window; iv) the application of a 4th order Butterworth band-pass acausal (Boore and Akkar, 2003; Boore and Bommer, 2005) filter in order to remove the high and low-frequency noise: the filter cut-off thresholds were automatically selected on the basis of the event magnitude (i.e., 0.1-40 Hz with $M_L \geq 5.5$; 0.2-35 Hz with $4.5 \leq M_L < 5.5$; 0.3-35 with $3.5 \leq M_L < 4.5$).

Considering the available digital instrumentation (i.e. 24 bits Kinemetrics Episensor with a flat response up to 200 Hz) the deconvolution for the instrument response was not applied. At the end velocity waveforms were obtained through integration of the processed accelerometric data.

For each component of the automatically processed signals the following GM parameters are evaluated: PGA (peak ground acceleration), PGV (peak ground velocity) and SA (5%-damped acceleration response spectra) for periods up to 4 s were calculated. Moreover, the automatic system provides PSV (5%-damped pseudo-velocity response spectra), Sd (5%-damped displacement response spectra), Ia (Arias Intensity; Arias 1970) and Ih (Housner intensity; Housner 1952). In correspondence of each recording site the horizontal-to-vertical spectral ratio (HVSR) was automatically performed considering 5 s and 10 s of S phase (starting from 1s before the S-phase onset).

At the end of the automatic procedure, for each single event, a web page is generated. On each web page the results are published in terms of tables (text format) containing main strong-motion parameters and generic plots (e.g., location of recording stations, HVSRs, response spectra, accelerograms, comparison between recorded data and Italian Ground Motion Prediction Equations, Bindi et al., 2011). For each event the strong-motion records, in uncorrected ascii-format, are downloadable. Following the standards of the ITalian ACcelerometric Archive, ITACA (http://itaca.mi.ingv.it, Pacor et al., 2011), the waveforms ascii files are composed of 43 header lines followed by acceleration data in cm/s^2.

References

Arias, A. (1970). A measure of earthquake intensity, in Seismic Design of Nuclear Power Plants, R. Hansen (Editor), M.I.T. press, Cambridge.

Augliera P., Massa M., D'Alema E., Marzorati S (2011). RAIS: a real time strong-motion network in northern Italy. Annals of Geophysics, 54, 1, 23-34, doi: 10.4401/ag-4855.

Bindi D., Pacor F., Luzi L., Puglia R., Massa M., G. Ameri and R. Paolucci (2011). Ground Motion Prediction Equations Derived from the Italian Strong Motion Data Base. Bulletin of Earthquake Engineering, DOI: 10.1007/s10518-011-9313-z, vol. 9, n. 6, 1899-1920.

Boore D.M., Bommer J.J. (2005). Processing of strong-motion accelerograms: needs, options and consequences, Soil Dynamics and Earthquake Engineering, 25, 93-115.

Boore D.M., Akkar S. (2003). Effect of casual and acasual filters on elastic and inelastic spectra. Earthquake Eng. Struct. Dyn., 32, 1729-1748.

Housner, G.W. (1952). Spectrum intensities of strong-motion earthquakes: Proc. Symp. Earthquake and Blast Effects Structures, C. M. Feigen (editors), Univ. California, Los Angeles, 21-36.

Pacor F., Paolucci R., Ameri G., Massa M. and Puglia R. (2011). Italian strong motion records in ITACA: overview and record processing. Bulletin of Earthquake Engineering, DOI: 10.1007/s10518-011-9295-x, vol. 9, n. 6, 1741-1759.

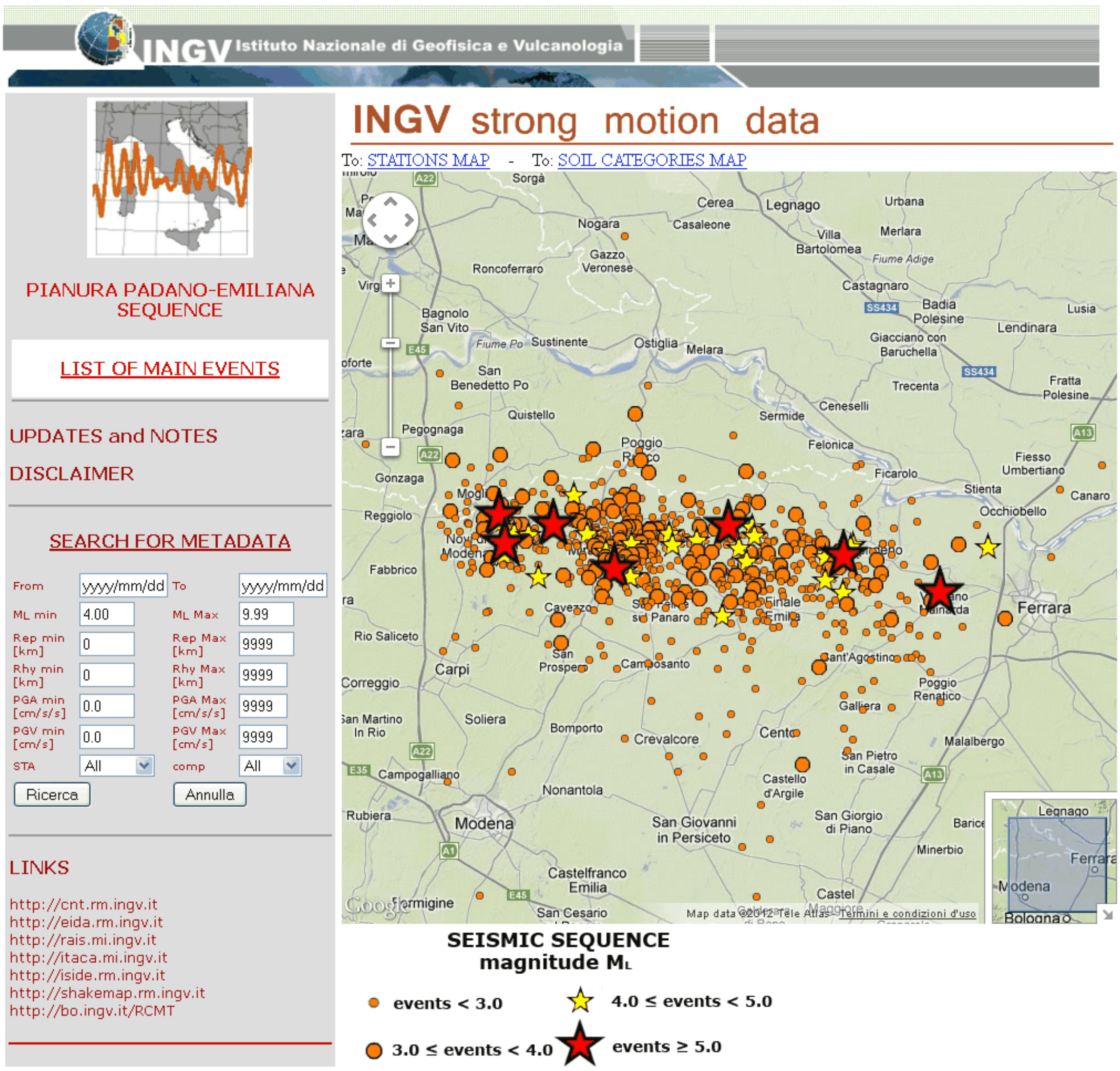
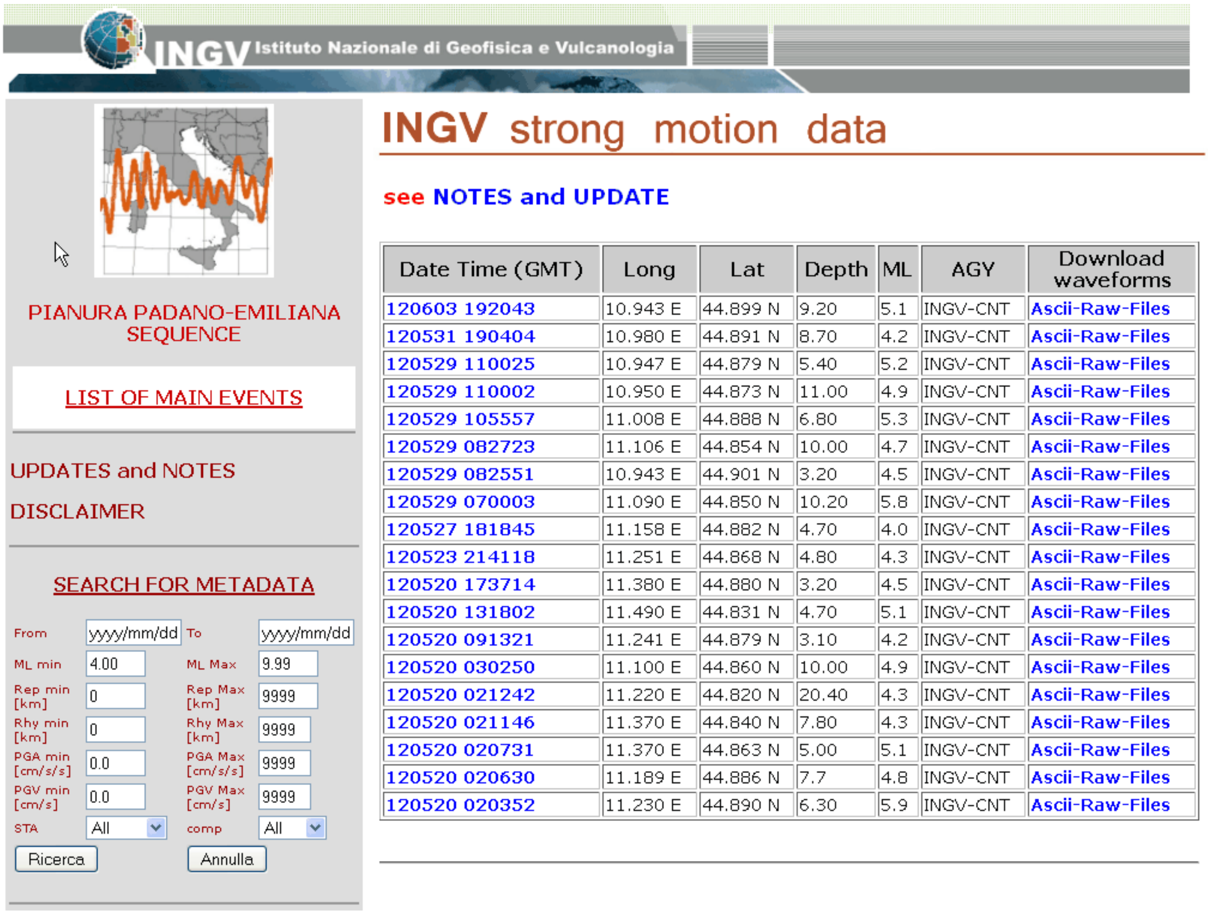


Figure 1 : www.mi.ingv.it/ISMD/ home page.



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PIANURA PADANO-EMILIANA SEQUENCE

LIST OF MAIN EVENTS

UPDATES and NOTES

DISCLAIMER

SEARCH FOR METADATA

From yyyy/mm/dd To yyyy/mm/dd

ML min 4.00 ML Max 9.99

Rep min [km] 0 Rep Max [km] 9999

Rhy min [km] 0 Rhy Max [km] 9999

PGA min [cm/s/s] 0.0 PGA Max [cm/s/s] 9999

PGV min [cm/s] 0.0 PGV Max [cm/s] 9999

STA All comp All

Ricerca Annulla

INGV strong motion data

see NOTES and UPDATE

Date Time (GMT)	Long	Lat	Depth	ML	AGY	Download waveforms
120603 192043	10.943 E	44.899 N	9.20	5.1	INGV-CNT	Ascii-Raw-Files
120531 190404	10.980 E	44.891 N	8.70	4.2	INGV-CNT	Ascii-Raw-Files
120529 110025	10.947 E	44.879 N	5.40	5.2	INGV-CNT	Ascii-Raw-Files
120529 110002	10.950 E	44.873 N	11.00	4.9	INGV-CNT	Ascii-Raw-Files
120529 105557	11.008 E	44.888 N	6.80	5.3	INGV-CNT	Ascii-Raw-Files
120529 082723	11.106 E	44.854 N	10.00	4.7	INGV-CNT	Ascii-Raw-Files
120529 082551	10.943 E	44.901 N	3.20	4.5	INGV-CNT	Ascii-Raw-Files
120529 070003	11.090 E	44.850 N	10.20	5.8	INGV-CNT	Ascii-Raw-Files
120527 181845	11.158 E	44.882 N	4.70	4.0	INGV-CNT	Ascii-Raw-Files
120523 214118	11.251 E	44.868 N	4.80	4.3	INGV-CNT	Ascii-Raw-Files
120520 173714	11.380 E	44.880 N	3.20	4.5	INGV-CNT	Ascii-Raw-Files
120520 131802	11.490 E	44.831 N	4.70	5.1	INGV-CNT	Ascii-Raw-Files
120520 091321	11.241 E	44.879 N	3.10	4.2	INGV-CNT	Ascii-Raw-Files
120520 030250	11.100 E	44.860 N	10.00	4.9	INGV-CNT	Ascii-Raw-Files
120520 021242	11.220 E	44.820 N	20.40	4.3	INGV-CNT	Ascii-Raw-Files
120520 021146	11.370 E	44.840 N	7.80	4.3	INGV-CNT	Ascii-Raw-Files
120520 020731	11.370 E	44.863 N	5.00	5.1	INGV-CNT	Ascii-Raw-Files
120520 020630	11.189 E	44.886 N	7.7	4.8	INGV-CNT	Ascii-Raw-Files
120520 020352	11.230 E	44.890 N	6.30	5.9	INGV-CNT	Ascii-Raw-Files

Figure 2 : list of main events (from May 20th 2012 to June 3rd 2012, $M_L \geq 4.0$).