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Messa in sicurezza di edifici storici

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Politecnico di Torino, Italy

October 31, 2016



POLITECNICO DI TORINO - DISEG

G. P. CIMELLARO



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Outline

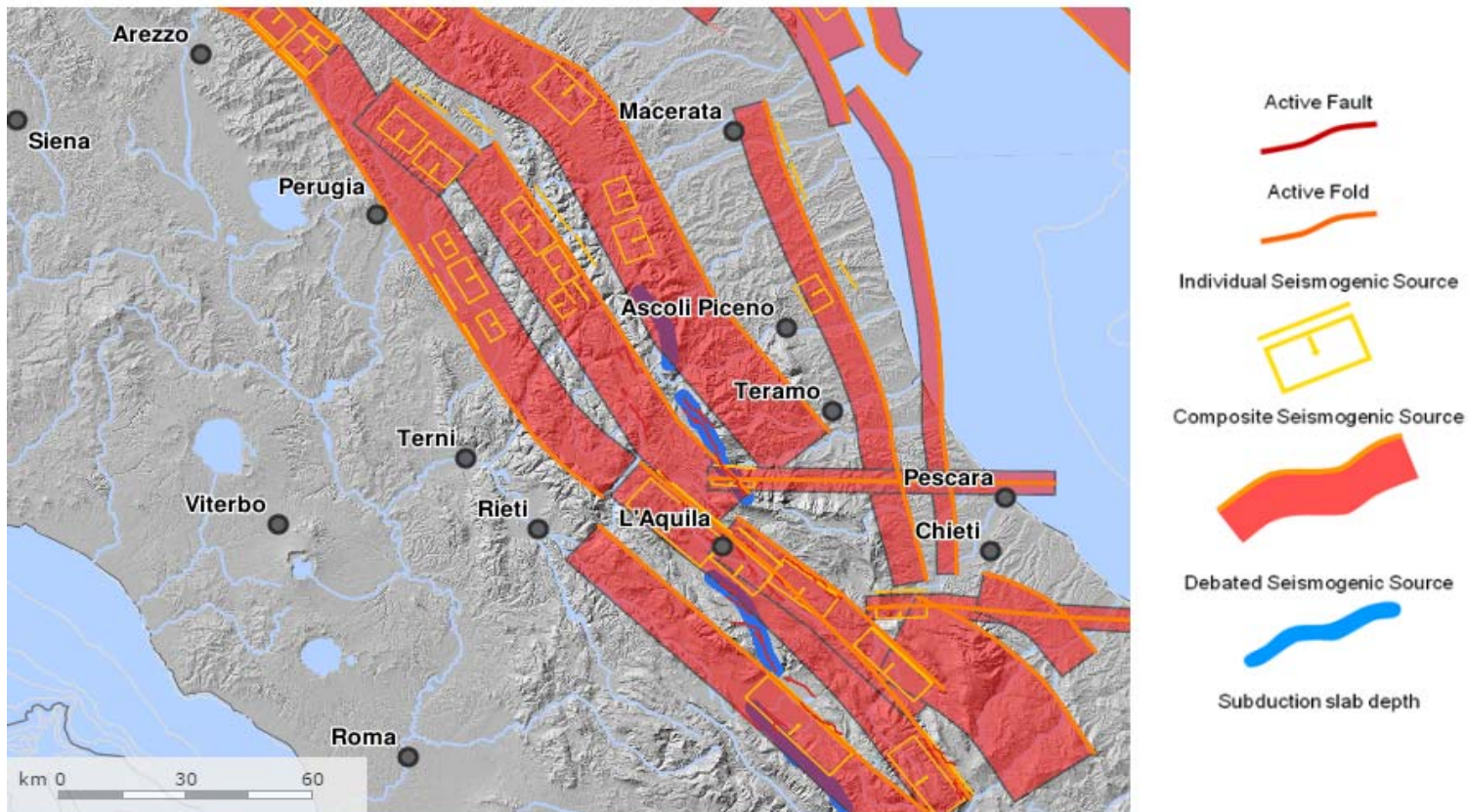
- Tectonic summary;
- Historical seismicity;
- Seismic sequence;
- Main event of October 30th, 2016 (Mw 6.5)
- Conclusion.



Tectonic summary



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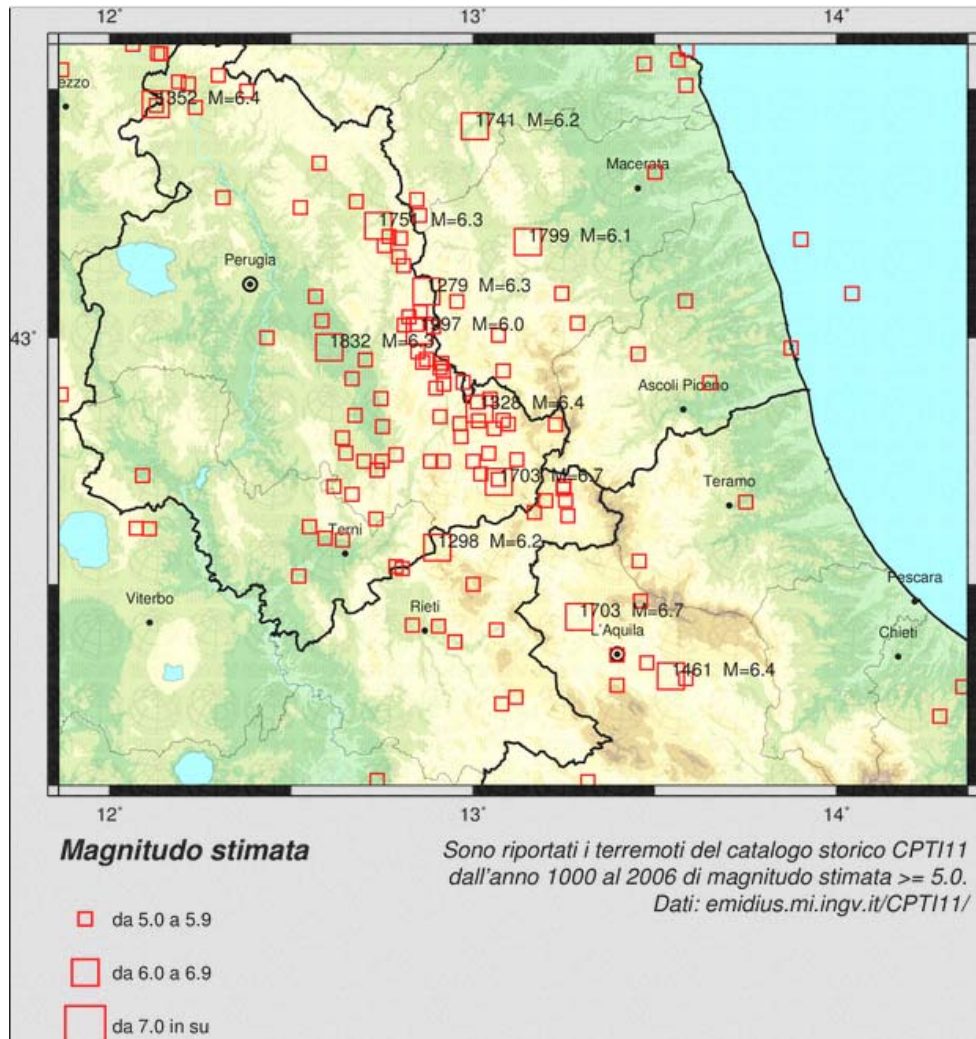
Individual Seismogenic Source for the Central Apennines' zone (INGV, 2016).



Historical seismicity



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Historical Catalogue of strong earthquake from 1000 to 2016. (INGV, 2016)

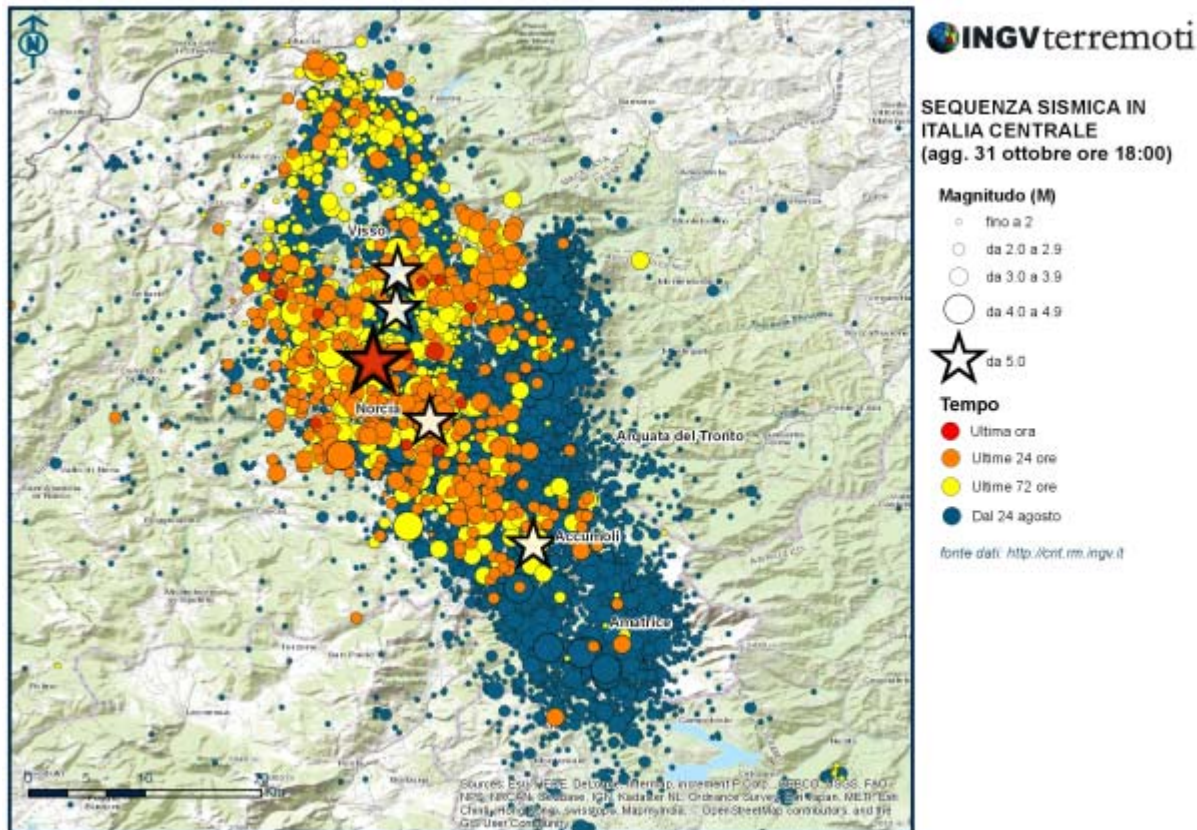
Mw	Number of earthquakes
6.0-6.9	12
≥ 7.0	1



Seismic sequence



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Seismic sequence in Central Italy from August 24 to October 30.

INGV (2016)



Main event of October 30th, 2016 (Mw 6.5)



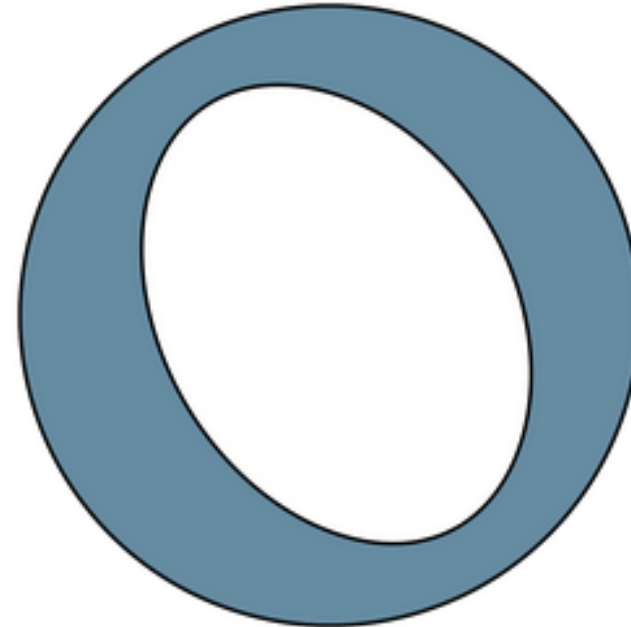
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- **Fault mechanism**

Piani Nodali

Nome	Strike	Dip	Rake
PN1	151	47	-89
PN2	330	43	-91

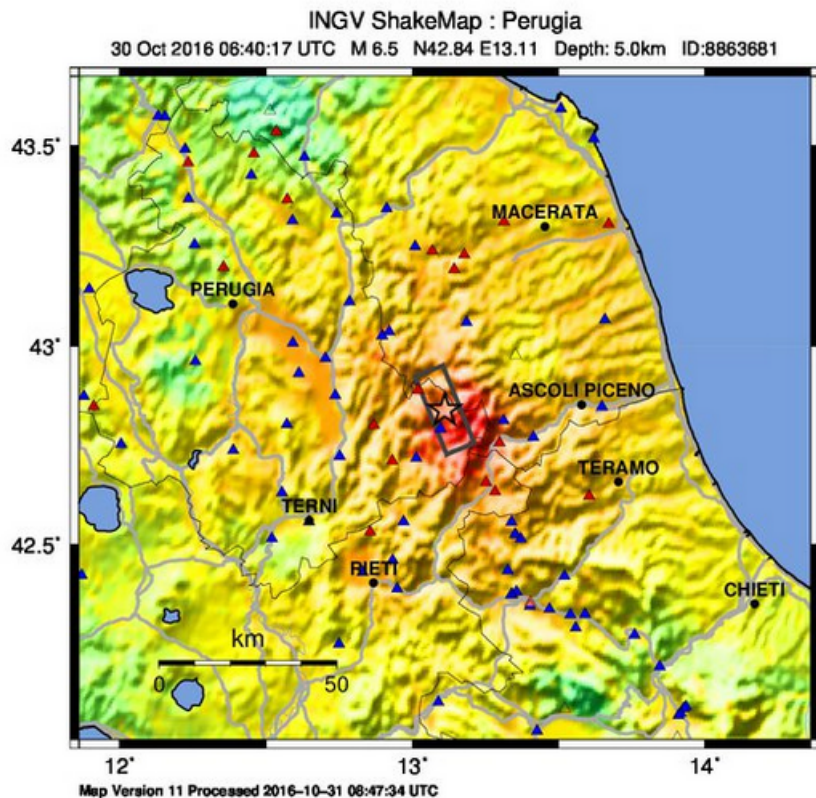
Meccanismo Focale



Main event of October 30th, 2016 (ML 6.5)



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Shakemap in the zone close to the epicenter for the main event of 6.5 ML (INGV, 2016).

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC. (%g)	<0.06	0.2	0.8	2.0	4.8	12	29	70	>171
PEAK VEL. (cm/s)	<0.02	0.08	0.3	0.9	2.4	6.4	17	45	>120
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Faenza and Micheli, 2010, 2011



Main event of October 30th, 2016 (Mw 6.5)



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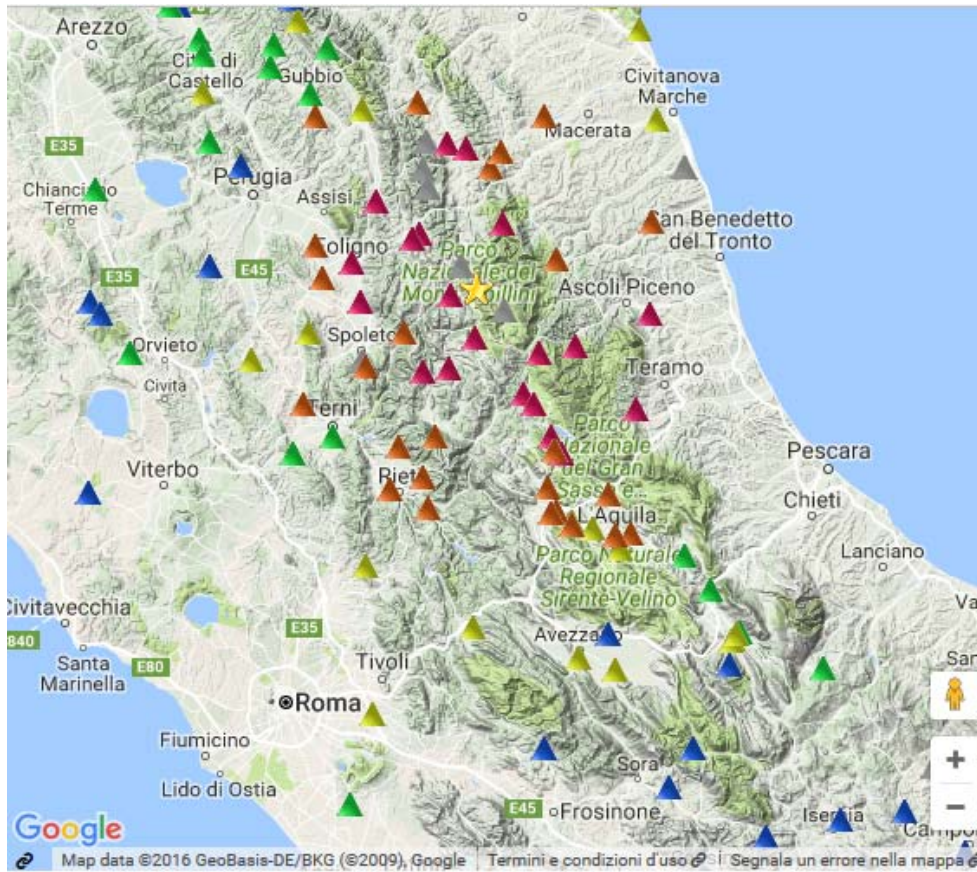
Recording stations

Epicenter:

Lat: 42.7925 N,

Long: 13.0965 E

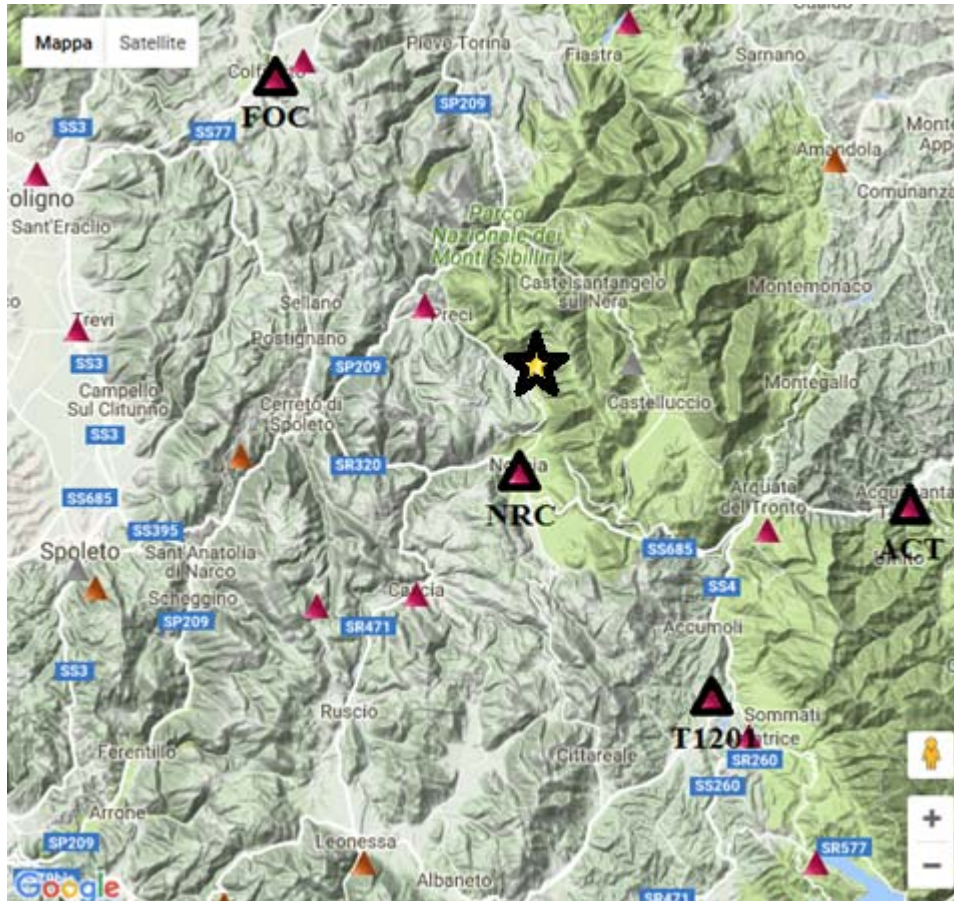
(City of Norcia)



Main event of October 30th, 2016 (Mw 6.5)



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Selected recording stations

Station	Location	Re [km]
NRC	Norcia	5.40
ACT	Acquasanta Terme	25.90
T1201	Domo	23.30
FOC	Colfiorito	27.10

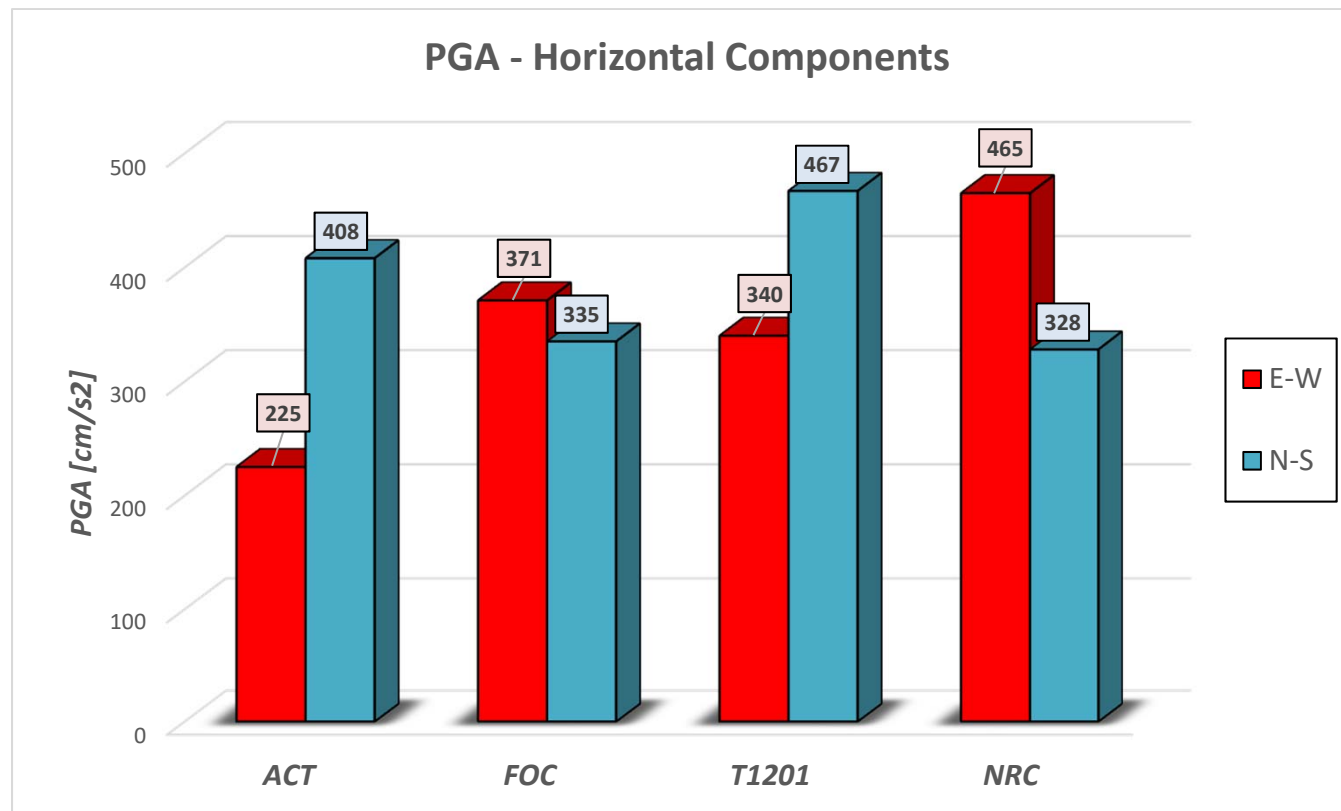


Main event of October 30th, 2016 (Mw 6.5)



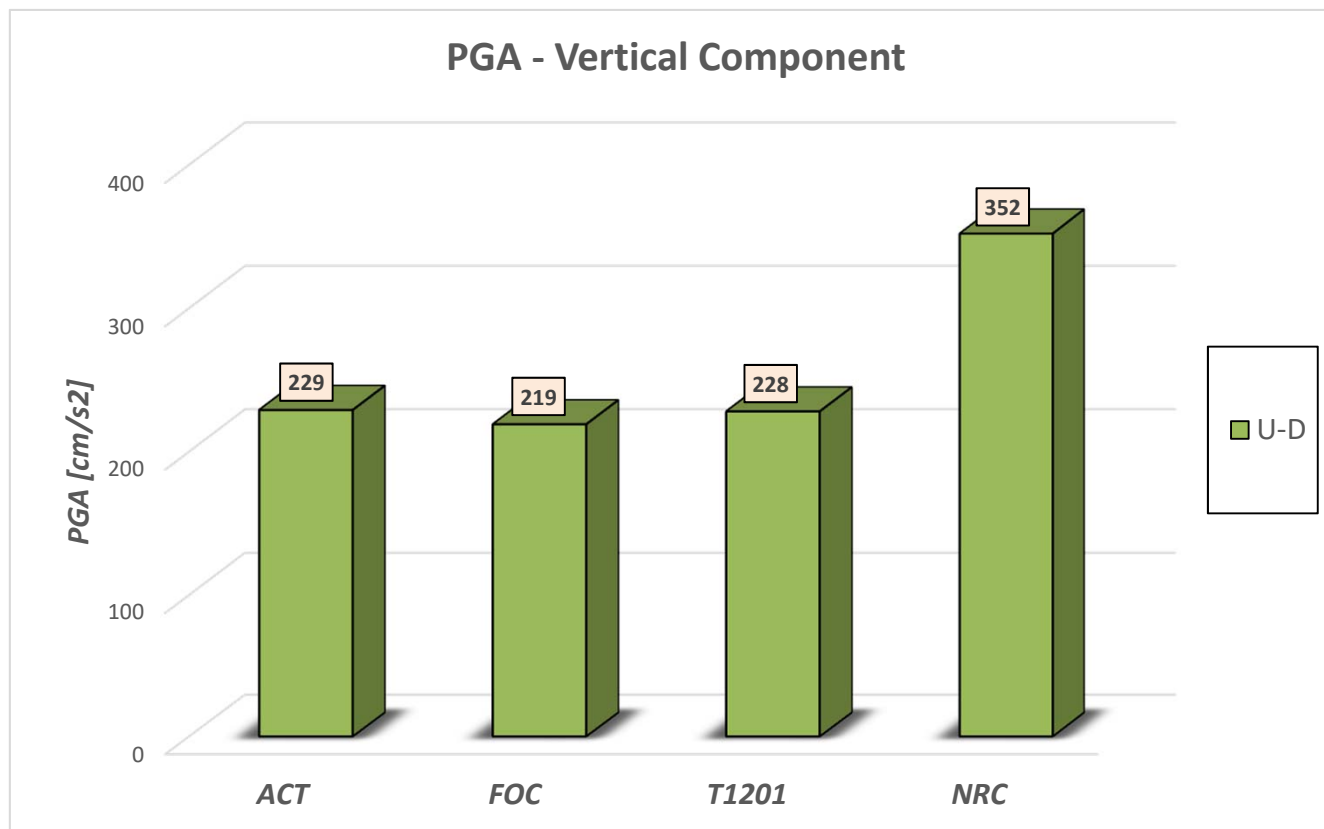
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Horizontal peak ground accelerations



Main event of October 30th, 2016 (Mw 6.5)

Vertical peak ground accelerations

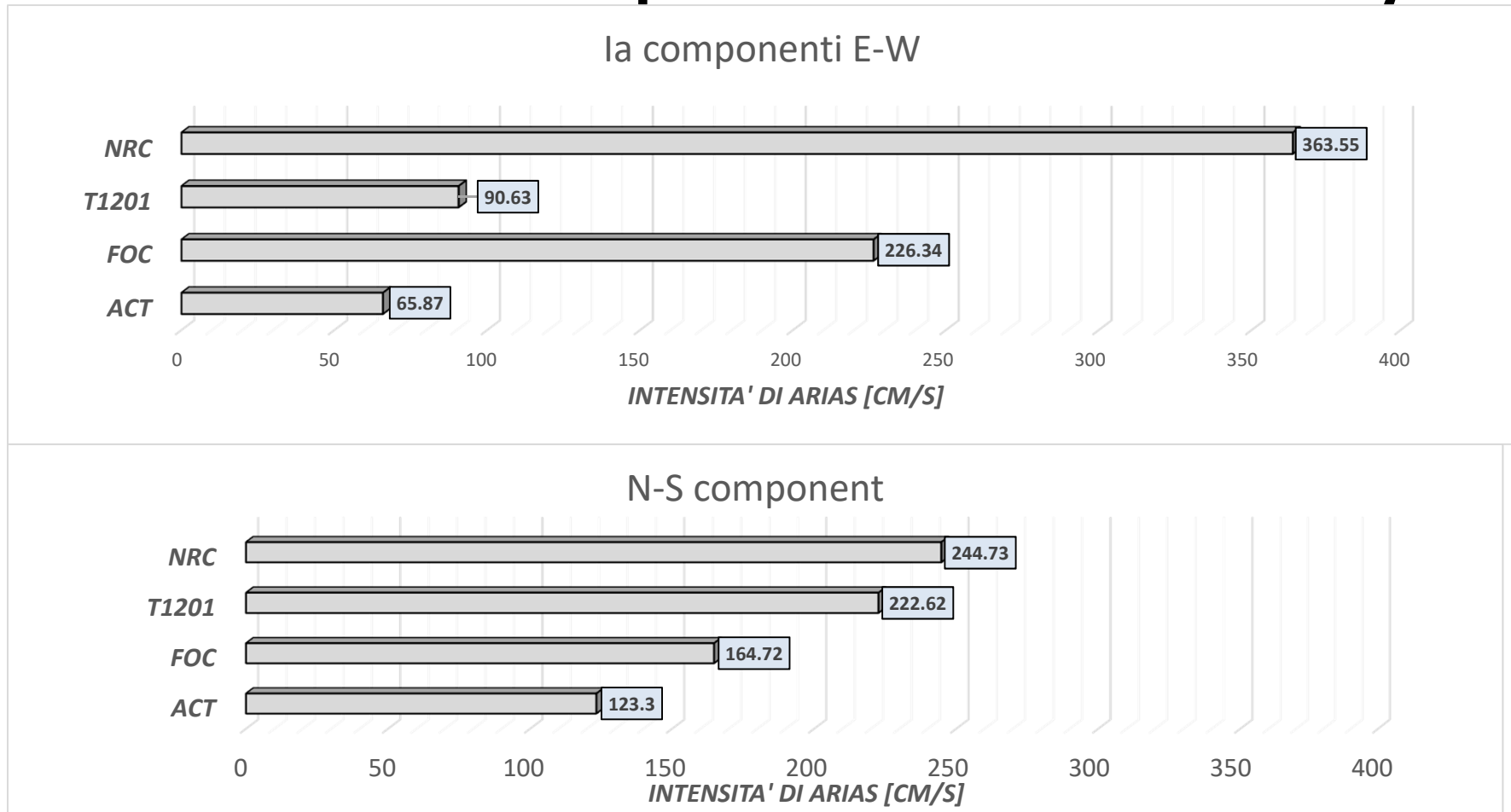


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Horizontal components of Arias Intensity

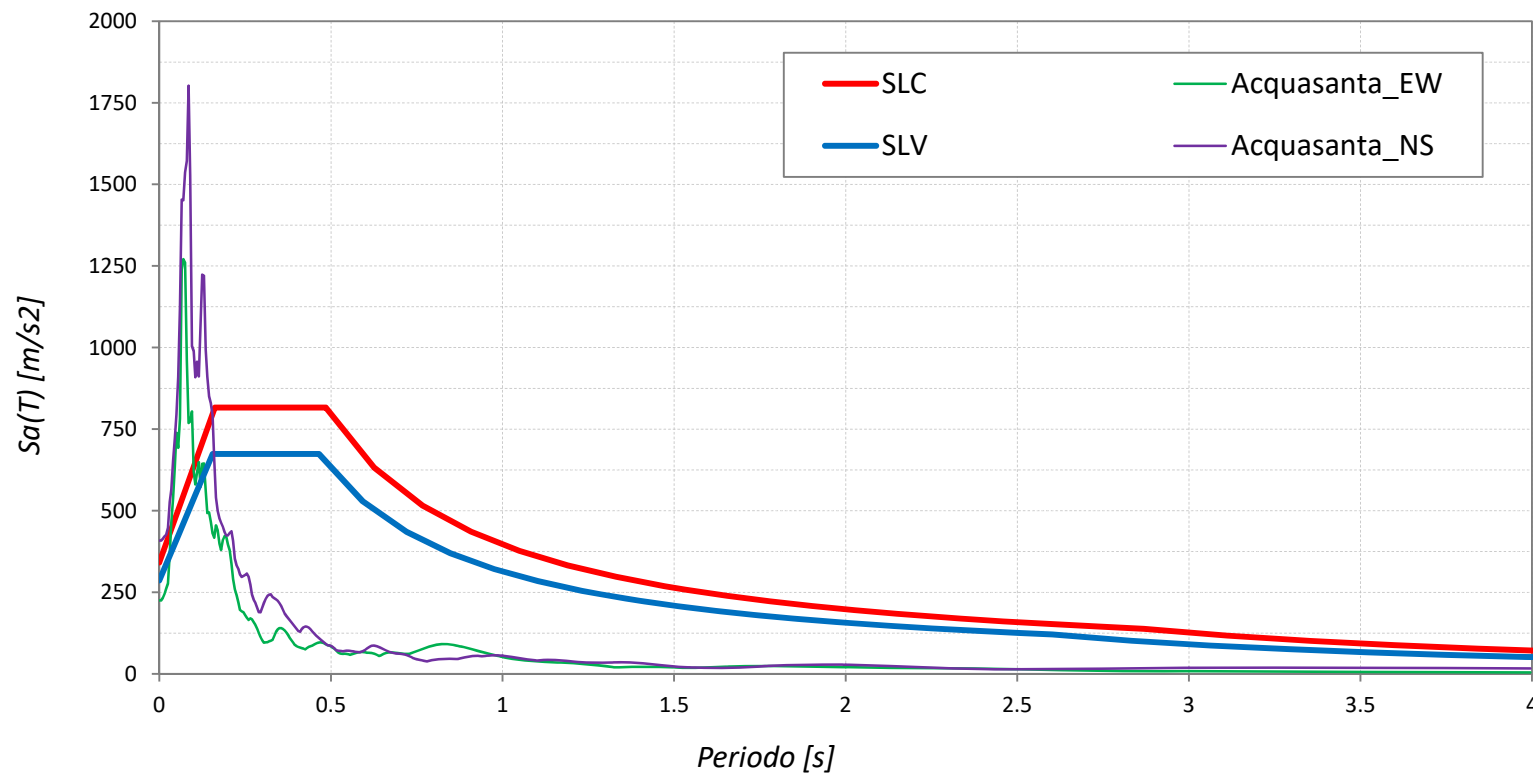


Main event of October 30th, 2016 (Mw 6.5)



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Comparison between horizontal spectra and Design Code spectra (SLV and SLC)

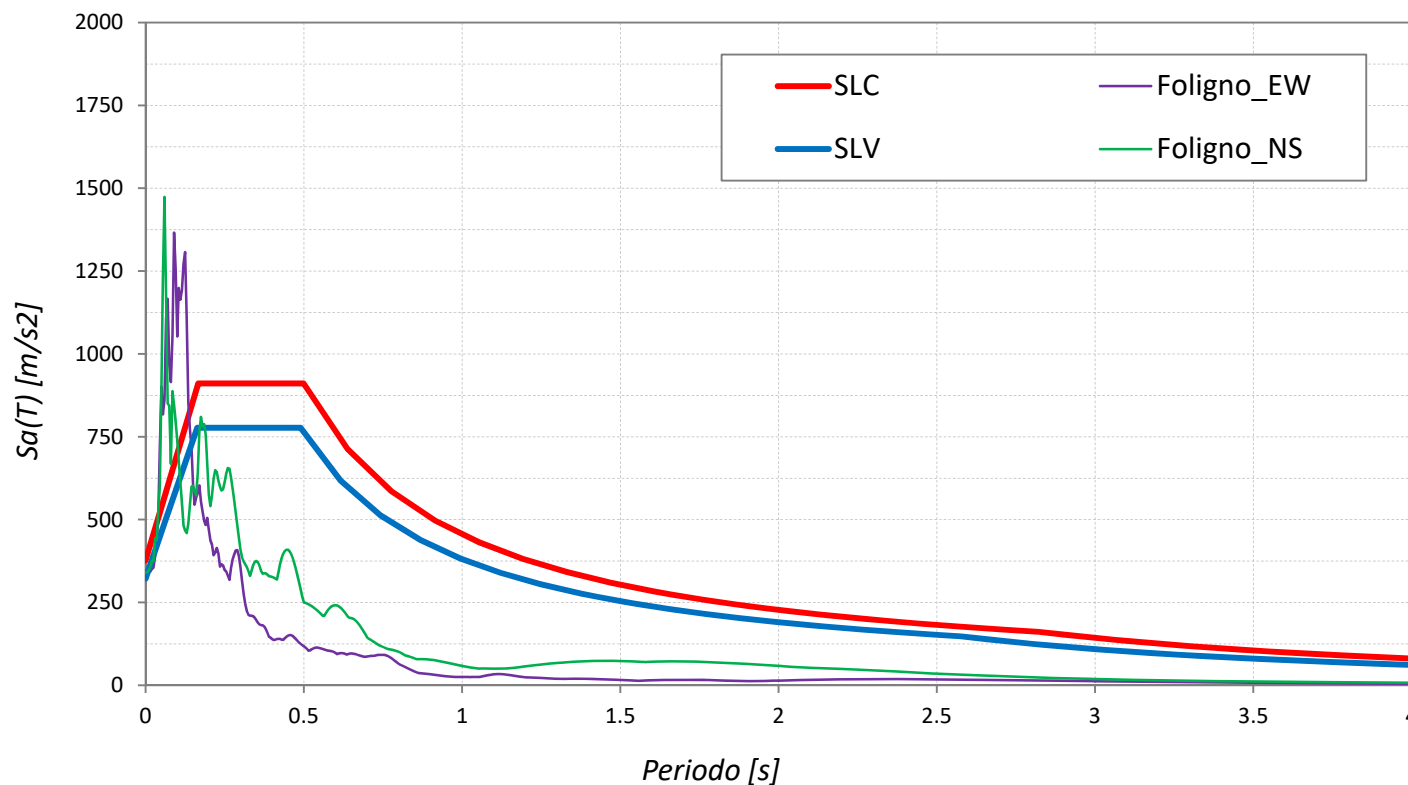


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Comparison between horizontal spectra and Design Code spectra (SLV and SLC)

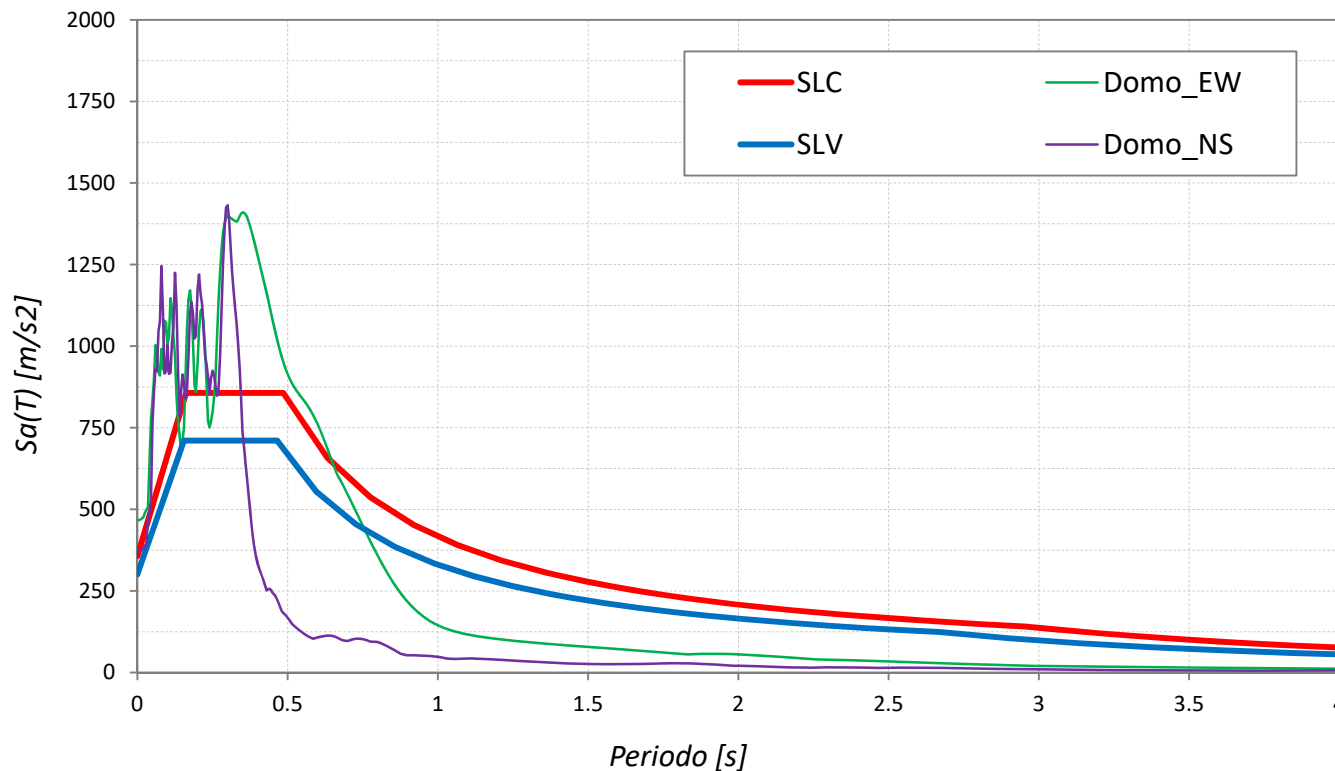


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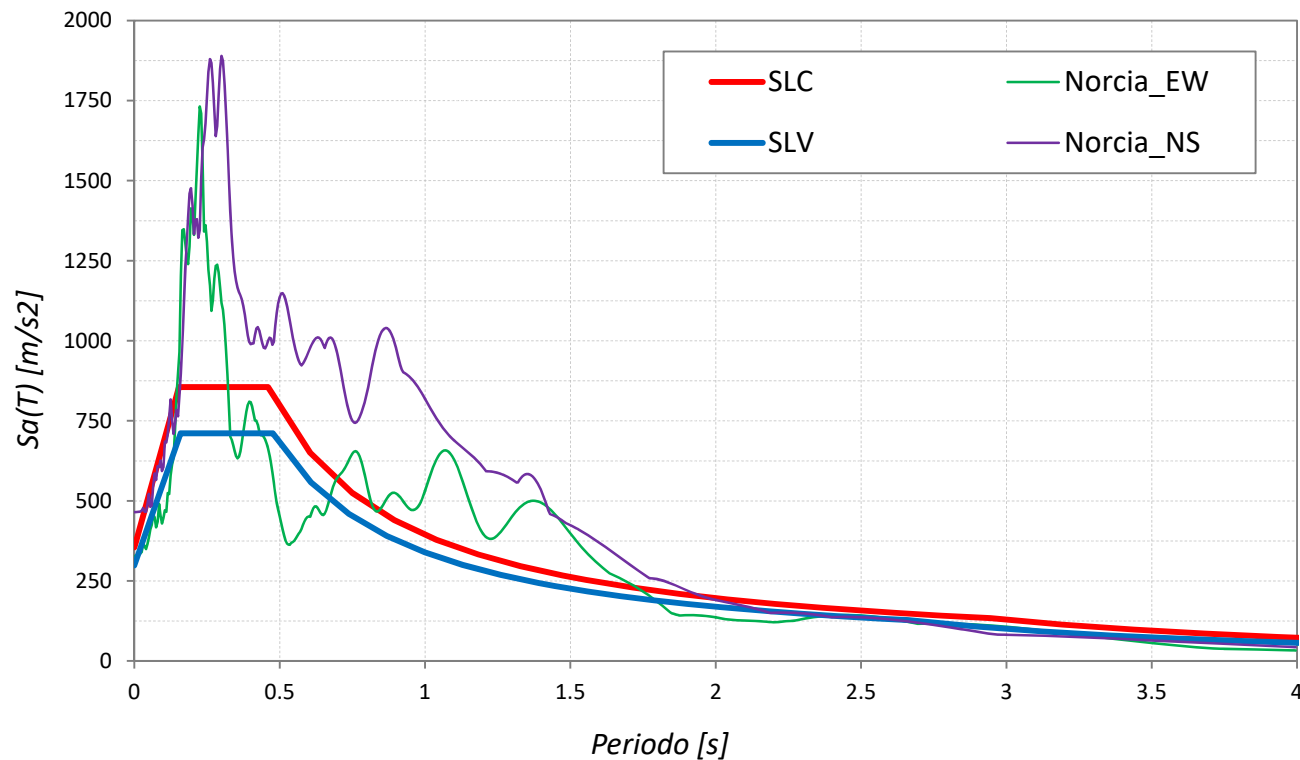


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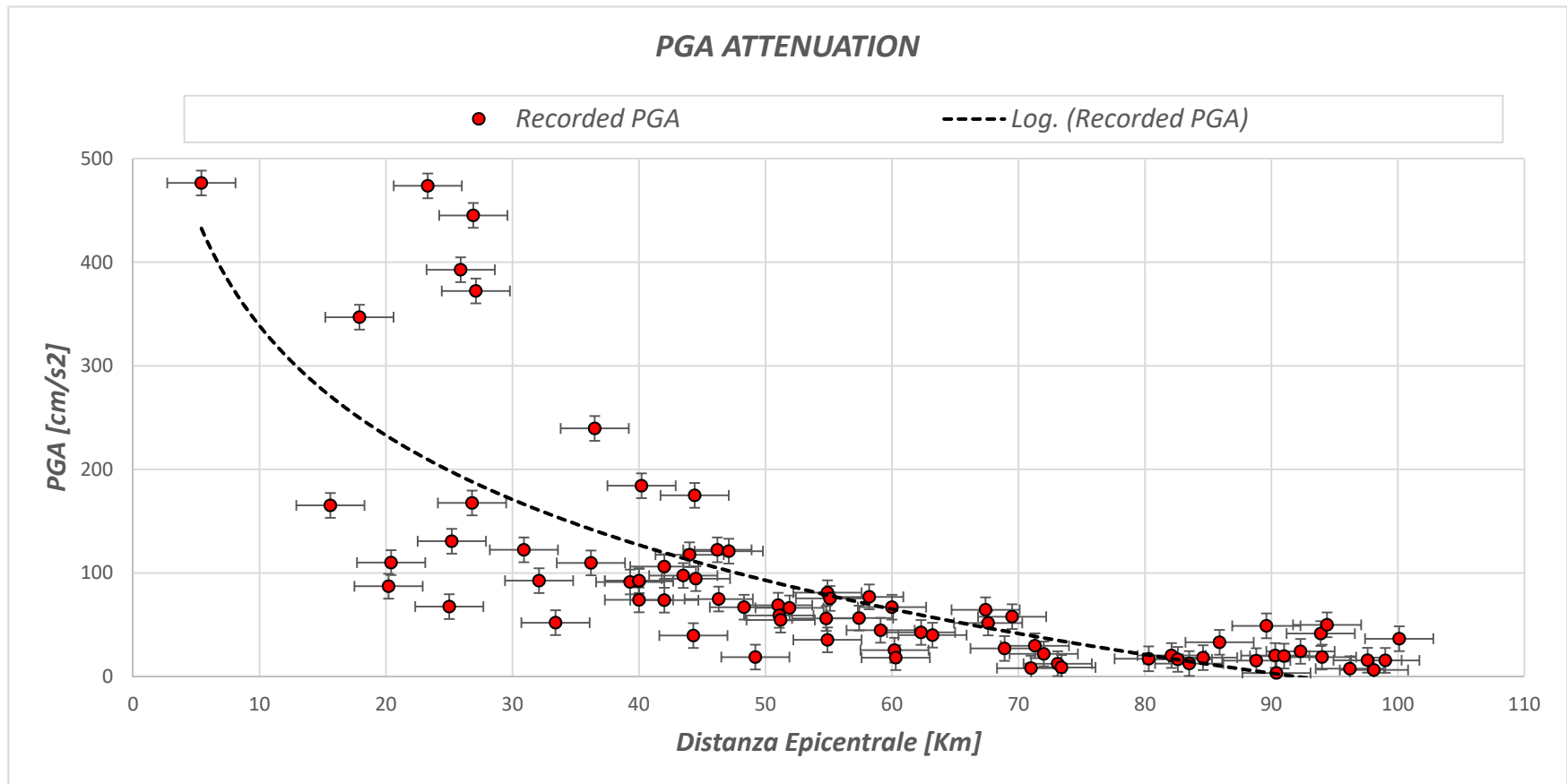


Main event of October 30th, 2016 (Mw 6.5)



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PGA attenuation

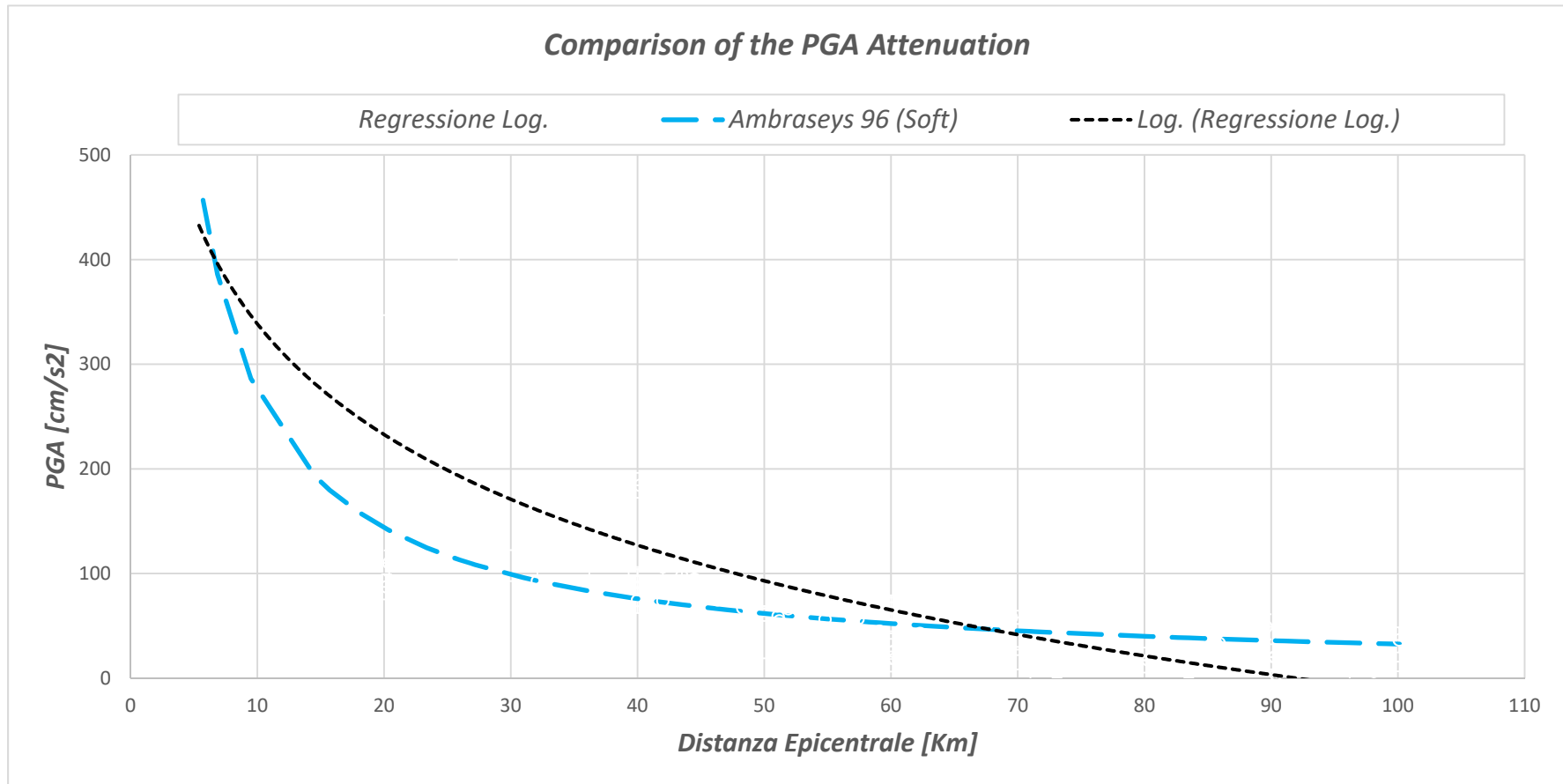


Main event of October 30th, 2016 (Mw 6.5)



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Comparison of the PGA attenuation

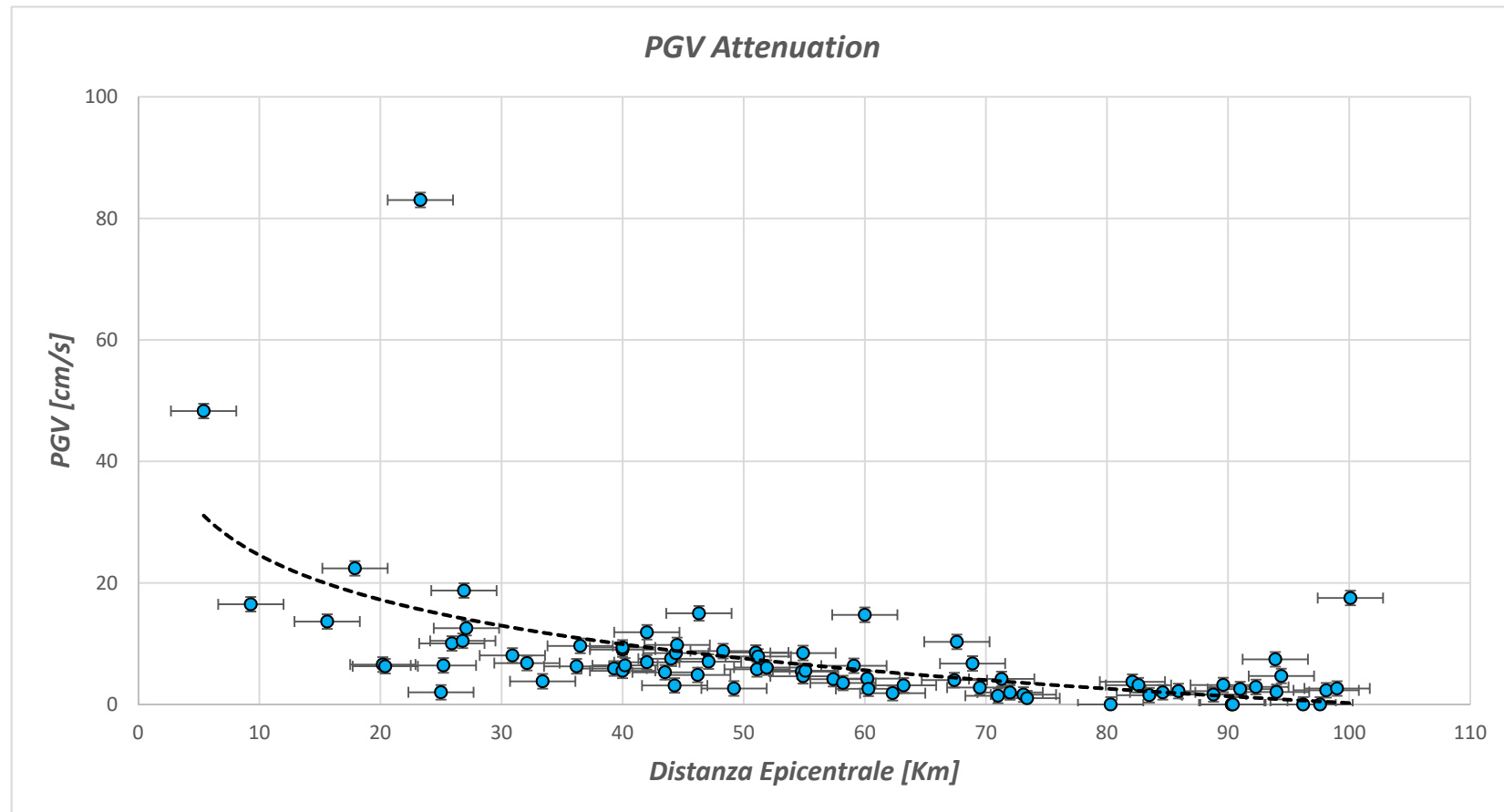


Main event of October 30th, 2016 (Mw 6.5)



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PGV attenuation



Castelluccio

Town general view



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Castelluccio

“soft story behavior”



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Castelluccio

Open stirrups



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Ancient city walls - Norcia



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Ancient city walls - Norcia

Incomplete shoring up intervention



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Monastery of Sant'Antonio -Norcia

Complete shoring up intervention



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