STOCHASTIC AND FULL-WAVEFIELD FINITE-FAULT GROUND-MOTION SIMULATIONS OF THE M7.1, MESSINA 1908 EARTHQUAKE (Southern Italy)

Gaetano Zonno¹, Gemma Musacchio¹, Roberto Basili², Walter Imperatori², P. Martin Mai²

Poster S43C-1893

Istituto Nazionale di Geofisica e Vulcanologia

Introduction
On December 28, 1908, Europe's largest earthquake shook southern Italy causing almost 1,000,000 fatalities.

This work focuses on the episodic prediction of seismogenic hazards that enabled models forecasting prediction in Italy. Today, the central challenge of seismology is to reflect the short-scale variability of the earthquake rupture process as well as the potential sources for earthquakes larger than M 5.5 in Italy and surrounding areas.

We use a fault model, in this work, based on an updated ISS of the Messina 1908 earthquake from Valensise et al. (2008). The kinematic earthquake rupture causes variable slip over the rupture plane as well as constant rise time and rupture velocity. The slip is modeled as a spatial random field with magnitude dependent correlation lengths and a Van Karman correlation function (Mai and Beroza, 2002).

Here we display Shake maps for the rupture model shown to the left: ME3H2, Hypo: X=14.0, Z=10.0 km; contour lines show the rupture propagation, assuming constant rupture speed v = 2.7 km/s and the rise time is fixed to 1.5 s.

The Shake Maps (PGA, MMI, and Housner) can be qualitatively compared with the over-predicted observed MCS Intensities (DBM04 , Stucchi et al., 2007). We examine single-site statistics at Point A, in Orti Superiore (X-XI MCS).

We derive IMM as a function of PGA (Wald et al., 1999). Although only qualitative comparison between IMM and MCS Intensities can be drawn we remark that the equation is roughly MCS=IMM+1.

High Frequency Shake MAPS (PGA, MMI, HOUSNER)

Here we display Shake maps for the rupture model shown to the left: ME3H2, Hypo: X=14.0, Z=10.0 km; contour lines show the rupture propagation, assuming constant rupture speed v = 2.7 km/s and the rise time is fixed to 1.5 s.

The Shake Maps (PGA, MMI, and Housner) can be qualitatively compared with the over-predicted observed MCS Intensities (DBM04 , Stucchi et al., 2007). We examine single-site statistics at Point A, in Orti Superiore (X-XI MCS).

We derive IMM as a function of PGA (Wald et al., 1999). Although only qualitative comparison between IMM and MCS Intensities can be drawn we remark that the equation is roughly MCS=IMM+1.

Conclusion & Outlook
We compute HF time-series at site Orti Superiore, to investigate the epistemic uncertainty caused only by different slip distributions (MEI to 4).

High Frequency Shake MAPS (PGA, MMI, HOUSNER)

We successfully combine EXSIM HF-synthetics with deterministic LF-time series. Both HF and LF time series, and corresponding spectral accelerations.

We compute HF waveforms at site Orti Superiore to investigate the epistemic uncertainty caused only by different slip distributions (ME1 to 4).

The top panels display acceleration time histories (left) and velocity (right) waveforms. The left panel displays the corresponding spectral accelerations.

HYBRID broadband ground-motions using COMSYN and EXSIM

We use the "mean" HF-time series (marked in bold font, PGA=596cm/s²) for our following broadband seismic simulations.

References
Valensise G., Basili R. Valensise G, Vannoli P, Burrato P, Fracassi U, Mariano S, Tiberti MM, Boschi E., 2008, The Database of Individual Seismogenic Sources (DISS) as a repository of geologic, tectonic, and active-fault data for Italy. Today, the central challenge of seismology is to reflect the short-scale variability of the earthquake rupture process as well as the potential sources for earthquakes larger than M 5.5 in Italy and surrounding areas.


Spudich and Xu, 2003) while HF-waveforms are stochastic (computed with the software COMSYN, the reflect the short-scale variability of the earthquake rupture process as well as the potential sources for earthquakes larger than M 5.5 in Italy and surrounding areas. http://diss.rm.ingv.it/diss/