

Published shakemaps for M 3.0+ (665 evens since October 2006)

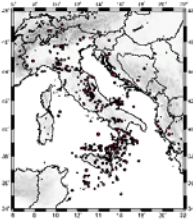
# ShakeMap Implementation at INGV

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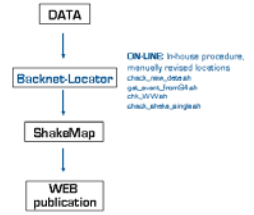
## ABSTRACT

Since 2005, the Italian Civil Protection (Dipartimento della Protezione Civile, DPC) has funded several projects driven toward fast assessment of ground motion shaking in Italy - the final goal being the organization of the emergency and to direct the search and rescue (SAR) teams. Similarly, in mid 2006, the EU SAFER project aimed toward rapid assessment of ground motion shaking started. To this end, the Istituto Nazionale di Geofisica e Vulcanologia (INGV) has started to determine shakemaps using the USGS-ShakeMap package within 30 minutes from event occurrence using a manually revised location. In this work, we present the INGV implementation of USGS-ShakeMap for earthquakes occurring in Italy and immediately neighboring areas. Emphasis is put on adopted ground motion predictive relations, site correction for the amplification of the ground motion and on fast procedures for data processing and the in-progress developments to determine near real-time shakemaps.

## Shakemap generation at INGV :

The parametric PGM data are determined directly from the waveforms assembled for each event in SAC format after Backnet-Locator procedure.

Shakemaps are determined automatically after manual revision of the hypocenter location by the H24 on duty personnel (max 30 minutes and on average 15 minutes after the event) using an "in-house" procedure.



The left panel shows the new "real time" data feeding that will be implemented at INGV :

I) 5 to 6 minutes are necessary to process an event shakemap. The procedure is fully automatic and based on the EarthWorm processing packages.

II) As more information (data and source parameters) become available, updated shakemaps are generated automatically.

The right panel shows the "current" procedure, that is triggered after manual location.

## IMPLANTATION

### DATA

Ground Motion Parameters (GM): PGA, PGV, PSA at 0.3, 1 and 3 s with 5% damping all on horizontal components

- Italian National Seismic Network (IV) + MedNet (MN)

~260 stations of which ~130 BB + VBB (T >= 40 s)

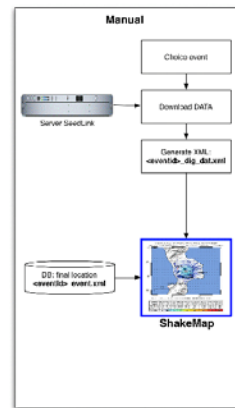
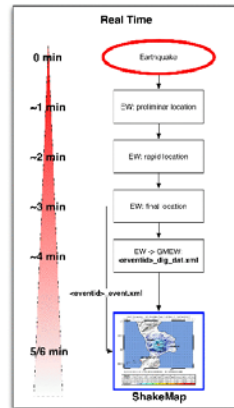
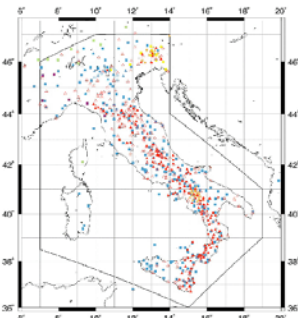
~56 BB have accelerometers.

- data from other non-INGV local nets can be very relevant for some areas

- ETH stations  
- OGS, UniTS, AMRA and UNIGE networks (will be integrated during the near future)

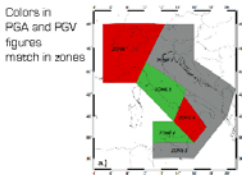
- RAN (national strong motion network: ~470?+ stations, maintained by DPC) integrated in the near future

- ▲ Accelerometers INGV
- ▲ Accelerometers RAN
- ▲ Accelerometers other Italian nets
- ▲ Future Accelerometers
- BB INGV
- BB not taken net
- BB other taken net



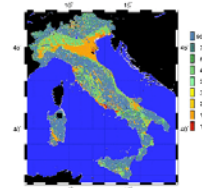
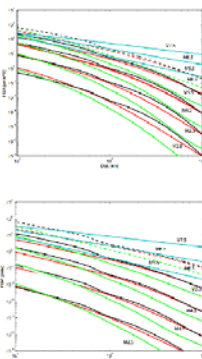
## Ground Motion

Regionalization of the attenuation relations for M < 5.5 events (Malagnini et al.). For M >= 5.5 events the relations of Akkar and Bommer 2007 are used.



## Site Condition Map

based on geology and shear wave velocity in the top 30 m. The geology units have been gathered into five classes, according to the EuroCode8 provision. For the classification, lithological and age criteria have been used.



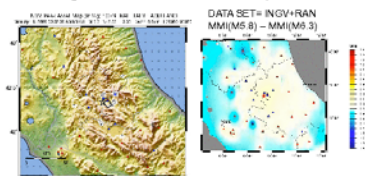
## April 2009:

### Aquilano Sequence ShakeMaps

- i) During this sequence we have tested the robustness of the ShakeMap procedures
- ii) The 7 additional INGV stations in epicentral area have been included in the processing
- iii) A total of
  - 98 3 <= M < 4 ShakeMaps
  - 14 4 <= M < 5 ShakeMaps
  - 3 M >= 5 ShakeMaps
 have been published since the mainshock.

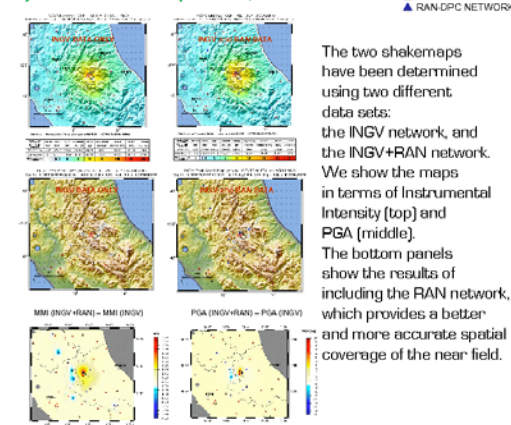
### 2) MAGNITUDE VALUE IN SHAKEMAP:

Is Ml 5.8 a proper quantification of the magnitude of this event? What could have happened with the CMT magnitude Mw 6.3 in ShakeMap?



With a good spatial station coverage ShakeMap observes ~~the~~ magnitude values. The research has been supported by the DPC-S3 (2008-2010) and the EU-SAFER project (contract n. 036835). The authors thank:  
 1) The Quest team - Quick Earthquake Survey Team - for providing the Macroseismic field of the Aquilano eq;  
 2) the Italian Macroseismic data base DBMIDB (<http://emidius.mingv.it/DEMIDB/>);  
 3) ITACA data base (<http://itaca.mingv.it/ItacaNet/>);  
 4) DPC for providing the data  
 The work is done in collaboration with JRA3 NERES EU project

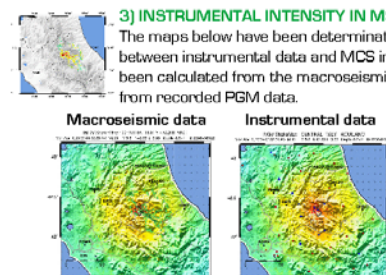
### 1) MAIN EVENT: 6th April 2009, 3.32 am



The two shakemaps have been determined using two different data sets: the INGV network, and the INGV+RAN network. We show the maps in terms of Instrumental Intensity (top) and PGA (middle). The bottom panels show the results of including the RAN network, which provides a better and more accurate spatial coverage of the near field.

### 3) INSTRUMENTAL INTENSITY IN MCS SCALE

The maps below have been determined using the new regression between instrumental data and MCS intensities. The left panels has been calculated from the macroseismic data whereas the right panel from recorded PGM data.



Preliminary Macroseismic Field courtesy of QUEST

