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A contribution to the seismic hazard of the Apulia Region (Southern Italy): environmental effects triggered by historical earthquakes in the last centuries

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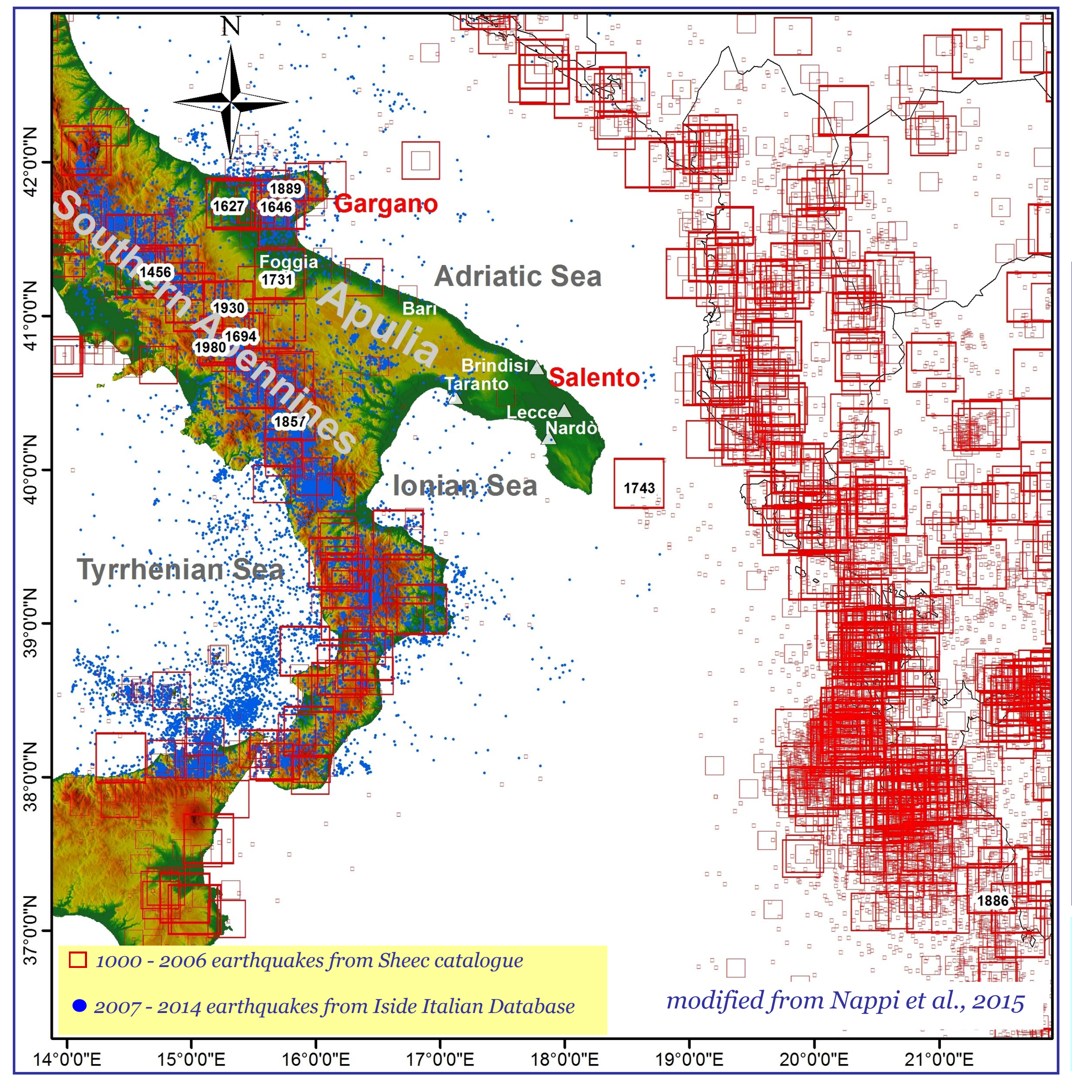
The Apulia (Southern Italy) has been hit by several low energy and a few high energy earthquakes in the last centuries. The strongest historical earthquakes (Rovida et al., 2011) are:

- the July 30, 1627 Gargano earthquake (I=X MCS);
- the May 5, 1646 event (I=IX MCS), the strongest earthquake of the Gargano promontory;
- the March 20, 1731 earthquake (I=IX MCS, Mw=6.5), the most relevant of the Foggia province;
- the February 20, 1743 earthquake (I=IX MCS, Mw= 7.1, I ESI=X, Nappi et al, 2015), the strongest of the Salento area.

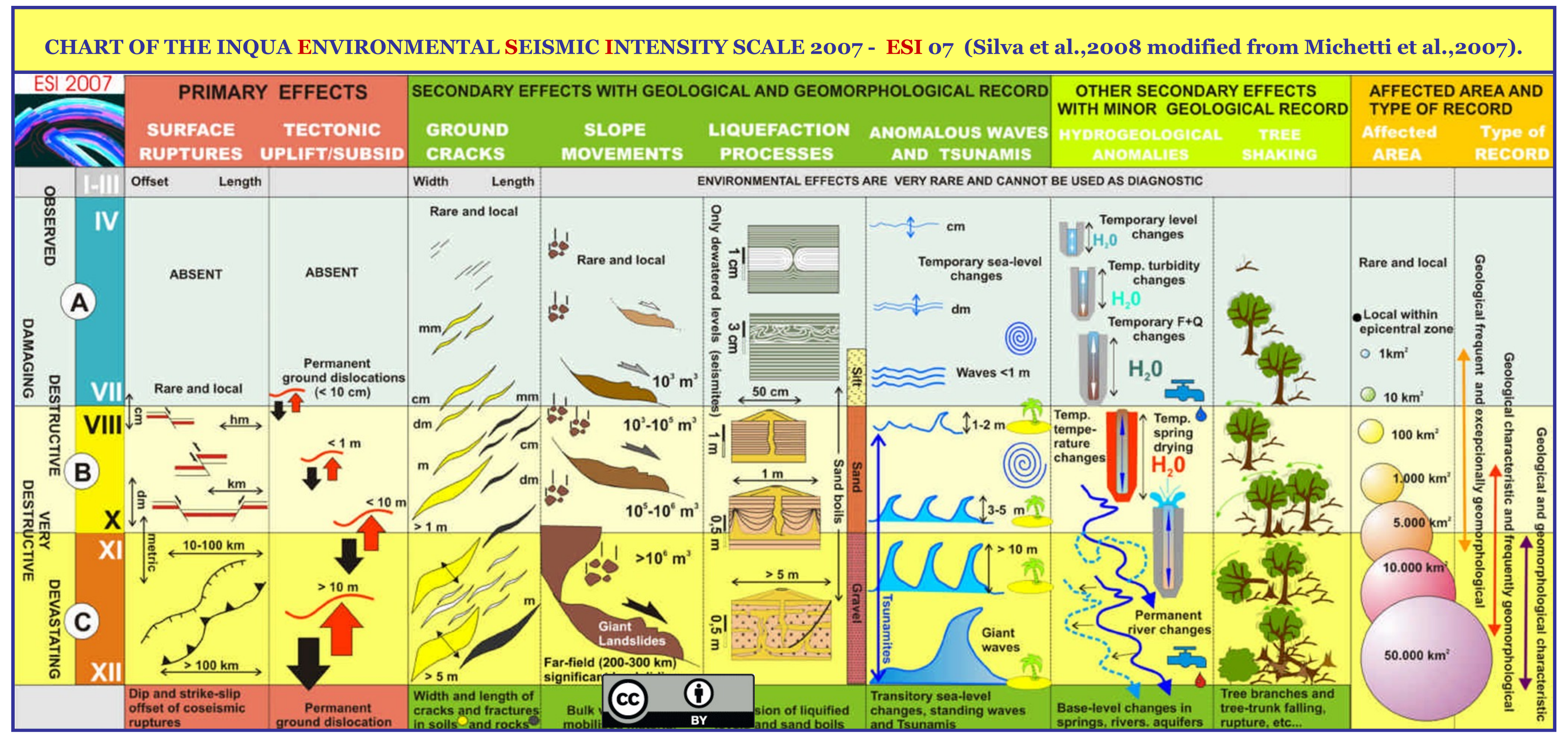


Aim of the study: a critical revision of the historical and recent seismicity of the Apulia and surrounding seismogenetic areas, for re-evaluating the macroseismic effects in MCS scale and ground effects according to the ESI 2007 scale, as a contribution to the seismic hazard of the region.

The Apulian Seismicity

The 1627, 1646, 1731, 1743 and 1889 earthquakes of Apulian area have generated considerable seismo-induced environmental effects such as tsunami deposits along the Apulian coasts, landslides, liquefactions and hydrological changes (Camassi et al, 2008; De Simone, 1993; De Martini et al., 2003; Maramai et al., 2014, Margottini, 1982; Mastronuzzi et al., 2007; Nappi et al.,2015).

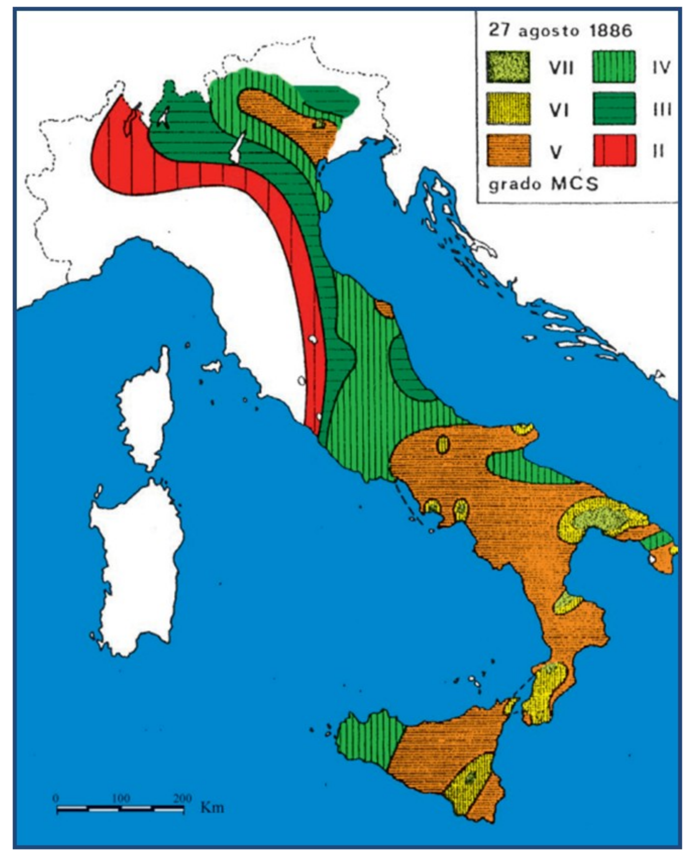
Spatial distribution of historical and recent seismicity extracted from: CPTI11 (Rovida et al, 2011) and SHEEC, (Stucchi et al., 2013; Grünthal et al., 2013).



The Southern Apennines Seismicity Felt in The Apulia Region

The earthquakes located in the Southern Apennines felt in the whole Apulia region that gave rise to several ground effects, mostly hydrological variations are:

- the December, 1456 Central-Southern Apennines earthquake (Imax =XI MCS);
- the September, 1694 Irpinia earthquake (Imax =XI MCS);
- the December, 1857 Basilicata earthquake (Imax=XI MCS);
- the July, 1930 Irpina earthquake (Imax=X MCS);
- the November, 1980 Irpinia earthquake (Imax=X MCS).



The Balkan Peninsula Seismicity Felt in The Apulia Region

The strong earthquakes of neighbouring seismogenetic areas located in the Adriatic and Ionian Sea, Albania and Greece, are strongly felt in the whole Apulia region.

A well documented example of Greek earthquake that caused significant seismoinduced anomalous sea waves along the Southern Apulian coast (De Giorgi, 1898) was the August 27, 1886 Peloponnesus earthquake (Imax=X-XI MCS).

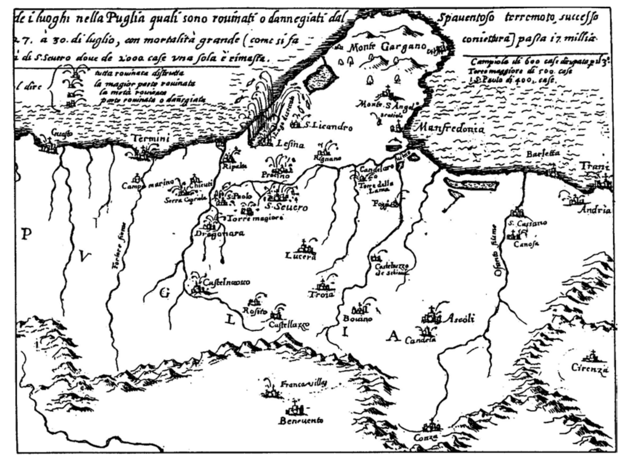
Isoseismals of August 27, 1886 Peloponnesus earthquake (Margottini, 1982, Serva & Michetti, 2010).

Case studies: the 1627 Gargano earthquake, the 1743 Salento earthquake

The 1627 Gargano earthquake:

The July 30, 1627 Gargano earthquake (Imax=X MCS, M_w=6.6, CPTI11, CFTI04Med) was considered the strongest historical event of the Gargano area that caused disastrous effects with a number of victims in order of thousands (more than 5000). It was followed by four large aftershocks and destroyed several villages in the northern Gargano.

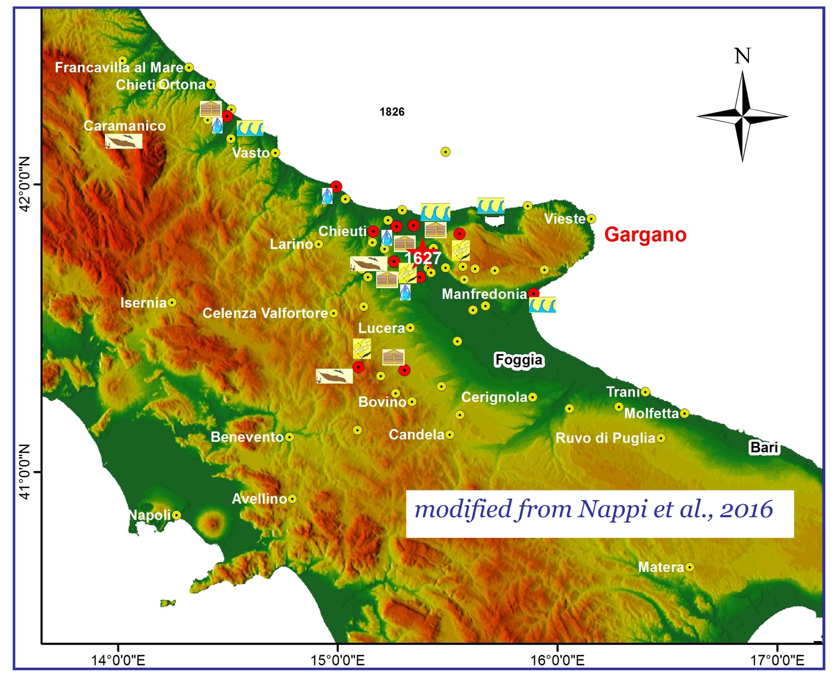
The first italian macroseismic map of the July 1627 Capitanata earthquake (M. Greuter, 1627).



The macroseismic map of the July 30, 1627 (de Poardi, 1627).

The strongest damages were located between S. Severo town and Lesina lake area. The earthquake induced several secondary effects such as landslides, liquefaction phenomena, ground cracks, hydrological changes, and generated a tsunami causing strong landscape modifications, especially in the Lesina lake.

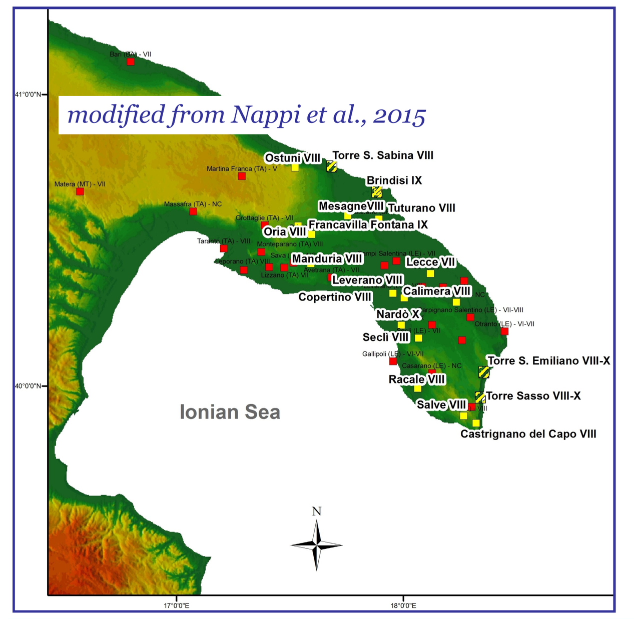
The historical chronicle reported a retreat of the sea followed by a returning surge that flooded the Lesina town. On the bases of the tsunami effect, a I=X ESI scale was assessed for Lesina town and the surrounding area.

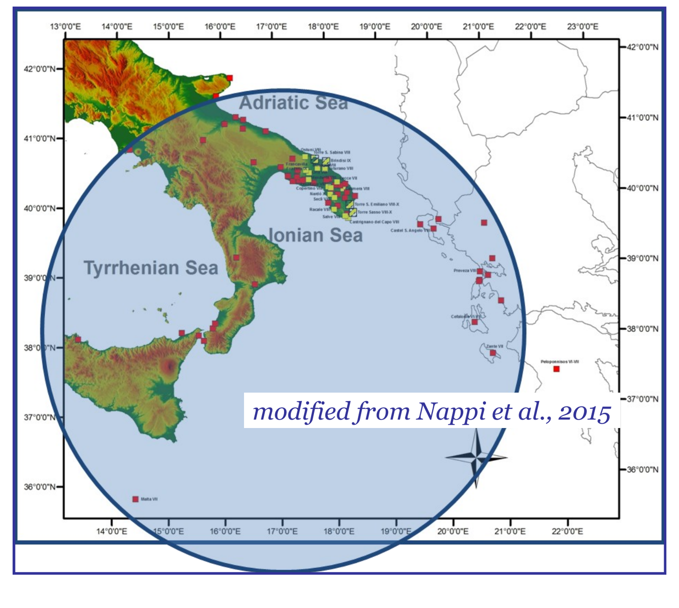


The map of environmental effects of the 1627 earthquake according to the ESI scale.

The 1743 Salento earthquake:

The February 20, 1743 Salento earthquake (I=IX MCS, Mw=7.1; CPTI11, CFTI04Med) was the strongest historical event of the Salento region that caused about 180 dead, of which 150 in the town of Nardò. Heavy damage affected particularly the towns of Nardò (Lecce) and Francavilla Fontana (Brindisi). Furthermore the February 20, 1743 earthquake has been a complex seismic event since more than three shocks, beginning from 23.30-23.45 "orario all'italiana" (16:30 GMT) followed each other over a period of 2 to 20 minutes, according to the contemporary accounts (Cagnes and Scalese, 1743; Libro dei morti, 1743). The seismic event was also felt on the western coast of Greece, on the Malta island, in Southern Italy and in some localities of Central and Northern Italy. The 1743 earthquake also generated a tsunami, which deposits are distributed along the southern Adriatic coastline of Salento (Margottini,1985; Mastronuzzi et al., 2007; Nappi et al., 2014, Nappi et al.,2015).





Maps of the intensity values of the 1743 Salento earthquake (red squares) from CFTIMED, 2007; re-evaluated MCS intensity values (yellow squares); re-evaluated ESI 2007 intensity values(yellow striped squares). The circle includes the localities with MCS macroseismic intensities I≥VI (right map).

Boulders at Torre S. Emiliano, Otranto (Lecce)

Preliminary Results: one of the most important environmental effect for both the 1627 and 1743 Apulian earthquakes was the tsunami occurrence, followed by landslides, liquefaction phenomena, hydrological changes and ground cracks. This study is a contribution for a better evaluation of the seismic hazard for the whole Apulia region, that represents one of the most crowded touristic destination of the Southern Italy, all over the summer season.

Porto Badisco, Otranto (Lecce)

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