The 2012-2015 seismicity of the Sannio-Irpinia border region (Southern Italy)

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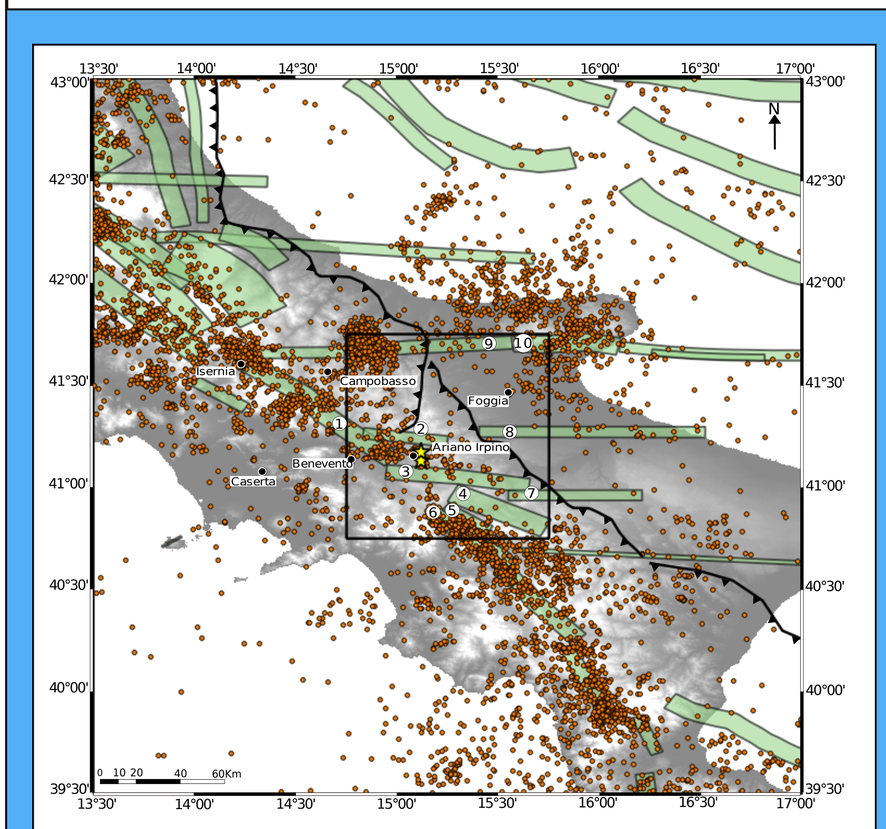

Figure 1 – Spatial distribution of the seismicity occurred between 2000-2015 in the Central Southern Appenine chain (data from ISIDE catalogue). The seismogenic sources reported in the DISS catalogue (DISS Working Group, 2015) are also shown with green boxes (1 Miranda-Apice; 2 Pago Veiano-Montaguto; 3 Mirabella Eclano-Monteverde; 4 Andretta-Filano; 5 Conza della Campania-Tolve; 6 Irpinia-Agri Valley; 7 Rapolla-Spinazzola; 8 Castellucci dei Sauri-Trani; 9 Ripabottoni-San Severo; 10 San Marco in Lamis-Mattinata). The area delimited by a blue box represents our study area (Fig. 2). Yellow stars represent the epicentres of the main events of the Agust 21th 1962 Ariano Irpino Earthquake.

1. INTRODUCTION

The Sannio and Irpinia seismogenic regions fall in the axial-frontal sector of the Southern Apennine belt (Fig. 1). These regions have been struck by several historical destructive earthquakes as the most recent 1962 and 1980. Looking at the border between these two areas historical destructive earthquakes, with Io≥ IX MCS, occurred in 1456, 1702, 1732. Although the location, geometry and kinematics of the causative faults of these earthquakes are still matter of debate, at present almost three main hypotheses of active faults related to these strong earthquakes have been proposed: the Miranda-Apice, the Pago Veiano-Montaguto and the Mirabella Eclano-Monteverde (Fig.1; DISS Working Group, 2015). These three structures would cross the Sannio-Irpinia seismogenic border.

2. DATA AND RESULTS

In order to characterize the seismicity of the Sannio-Irpinia border, we studied the present-day seismicity recorded by the Italian National Seismic Network of the INGV (Fig. 1). In detail the analysis has been mainly devoted to a short time interval across 2012-2015 years, due to the occurence of two low energy seismic swarms. In order to obtain accurate hypocentral distributions and reliable fault plane solutions we collected the wave forms of all the seismic events occurred in the study area to perform a re-picking of P- and S- phases and to obtain a reliable hypocentral location. The re-picking allows also to collect P-wave dataset to compute fault plane solutions.

The relocated events (ML≤3) clearly show an hypocentral distribution aligned along the axis of the Apennine fold-and-thrust belt, with hypocentral depth ranging from 5 to 25 km. A prevalence of oblique-slip kinematics is observed for isolated events. The December 2014 swarm (ML<3), with hypocenter depth between 9 and 14 km, is characterized by normal dip-slip kinematics with NW-SE striking nodal planes. The July 2015 swarm (ML<3.5; depth between 19 and 23 km) shows strike-slip kinematics (Fig. 2).

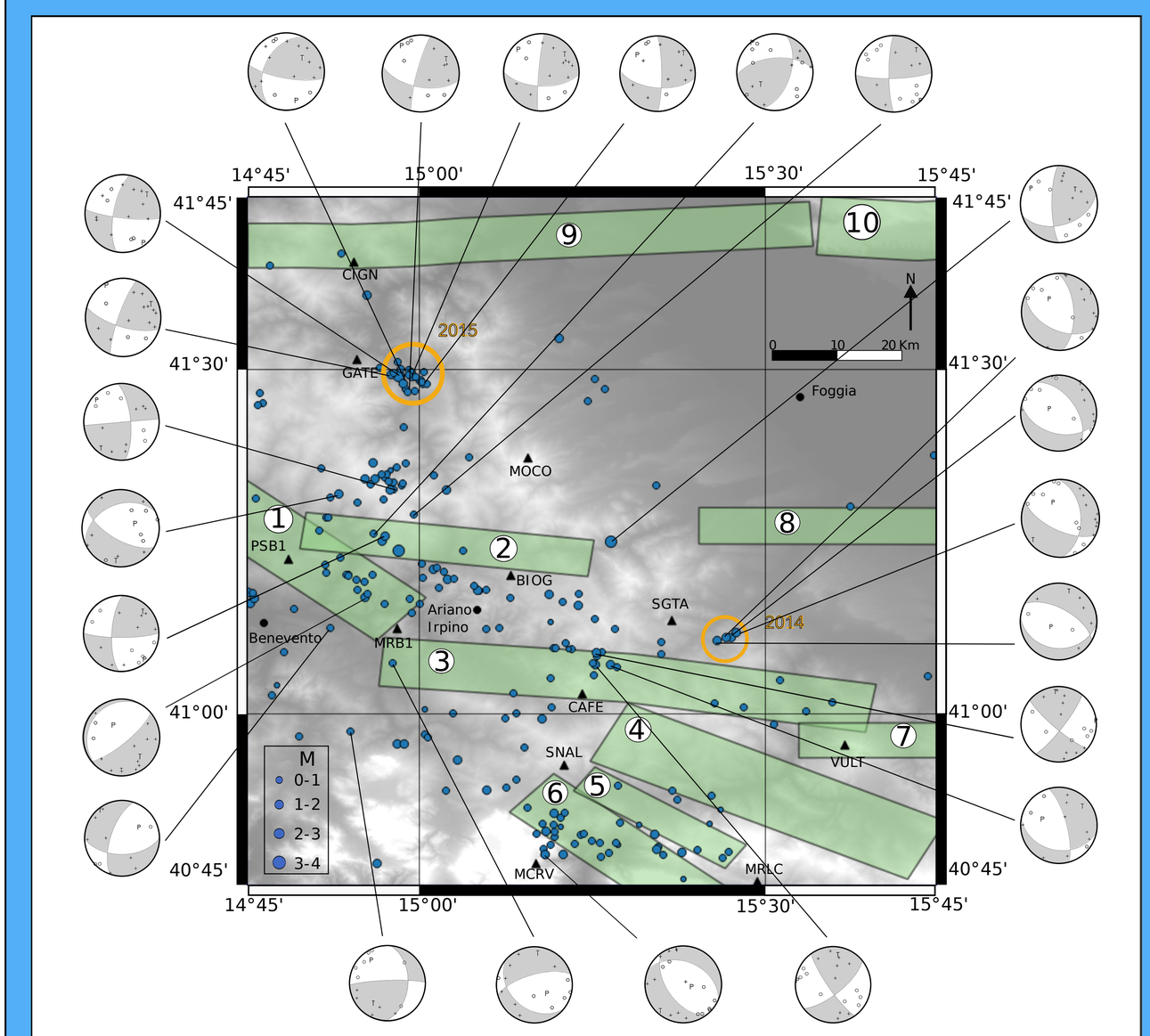

Figure 2 – Epicentral distribution of the best relocated events occurred between 2012-2015 in the study area (see Fig.1). The dimension of the circles is proportional to the magnitude of the events. The trinalges represents seismic stations of the INGV national network running in the area. The seismogenic sources reported in the DISS catalogue (DISS Working Group, 2015) are represented by green boxes (1 Miranda-Apice; 2 Pago Veiano-Montaguto; 3 Mirabella Eclano-Monteverde; 4 Andretta-Filano; 5 Conza della Campania-Tolve; 6 Irpinia-Agri Valley; 7 Rapolla-Spinazzola; 8 Castellucci dei Sauri-Trani; 9 Ripabottoni-San Severo; 10 San Marco in Lamis-Mattinata). Orange circles highlight the seismic swarms of June 2015 and December 2014. The fault plane solutions of the events with at least 10 P-wave polarities are also shown.

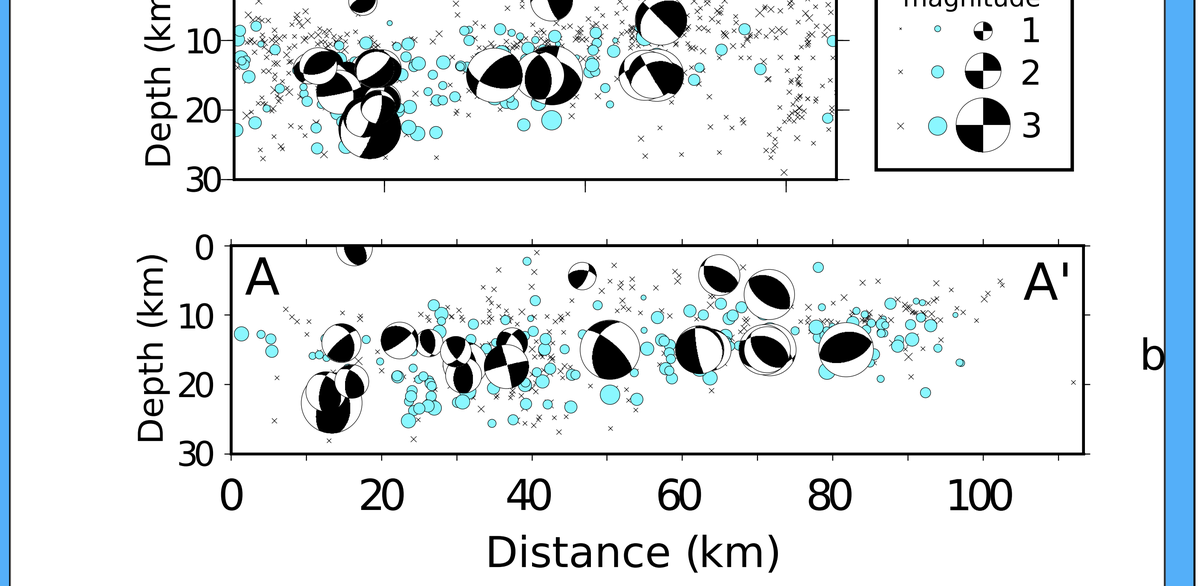

Figure 3 – a) N-S and W-E hypocentral distribution of relocated (2013-2015; pale blue circles) and from ISIDE catalogue (2004-2012; crosses) events. In the two cross sections the projection of the focal mechanisms (see Fig.2) is shown.
b) Hypocentral distribution and projection of focal mechanisms along the A-A' cross section (Appenine axial direction). This section highlights the differences in the tectonic regime between the northern domain (Sannio region) with a predominantly strike-slip regime and the southern one (Irpinia region) where a normal faulting regime prevails. Furthermore the hypocentral depths gradually decreases southward.

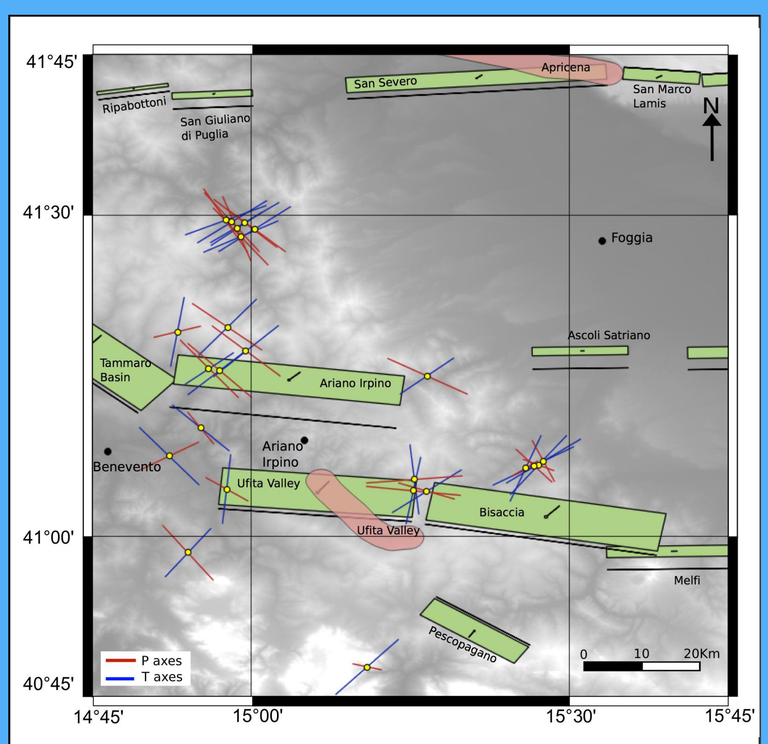

Figure 4 – Spatial distribution of the T- (blue) and P- (red) axes of the focal mechanisms reported in figure 2 (length of the axes is proportional to the cosine of the corresponding plunge). Main seismogenic sourses from DISS catalogue are also

3. COMMENTS

The study area represents the border between the Sannio and Irpinia seismogenic regions. For this restrict area of the Southern Apennines the DISS catalog proposes a quite complex arrangement of possible seismogenic sources (green box in Fig.1).In particular, the study area represents the connection between the NW-SE striking peri-axial structures and the roughly E-W ones affecting the frontal-foreland sector of the Appenine (Fig.1). Notwithstanding the short time interval investigated, the hypocentral distribution of the relocated events shows a deepening of almost all the focal mechanisms of isolated events, as well as those of the 2014 swarm, are compatible with the NW-SE striking peri-axial structures. The hypocentral depths (about 20 km) and the kinematics of events belonging to 2015 swarm agree with the overall dynamics of the Appenine frontal-foreland sectors (Fig.3). This last swarm is located just South of the known north-Apulia seismogenic sources responsible for the 2002 San Giuliano Earthquake. The T- and P- axes of all the computed focal mechanisms agree with the large scale stress regime acting in this portion of the Appenine (Fig.4)

4. REFERENCES

- DISS Working Group (2015). Database of Individual Seismogenic Sources (DISS), Version 3.2.0: A compilation of potential sources for earthquakes larger than M 5.5 in Italy and surrounding areas. http://diss.rm.ingv.it/diss/, Istituto Nazionale di Geofisica e Vulcanologia; DOI:10.6092/INGV.IT-DISS3.2.0
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