Double-Difference relocation and focal mechanisms of Lucanian Apennine (southern Italy) seismicity.

Cosmiana Maggi (1,2)*, Alberto Frepoli (1), Giovanni Battista Cimini (1), Rodolfo Console (1,2), Massimo Chiappini (1)

(1) Istituto Nazionale di Geofisica e Vulcanologia (INGV), via di Vigna Murate, 695, 00143, Rome, Italy. (2) Centro di Geotecnologia e Ingegneria per l’Area del Mediterraneo (GIAM), Potenza, Italy.

Introduction
The Lucanian Apennine belongs to the southern Apenninic chain, which is related to the subduction process of the Adriatic microplate as the northern boundary of the Tyrrhenian basin (Fig. 1). This subduction can also be detected by the tectonic alignment of the Apenninic chain compared to the Pyrenees chain, which is a consequence of the subduction of the Adriatic microplate beneath the Apenninic belt. The Lucanian Apennine belongs to the southern Apenninic chain and is characterized by a complex tectonic geometry. It is located between the Tyrrhenian Sea and the Ionian Sea, and it is characterized by a subduction zone between the Adria microplate and the Apenninic belt. The Lucanian Apennine is accommodated by the collision between the Adria microplate and the Apenninic belt.

Aims and analysis
We studied the seismicity occurred in the period 2000-2008 and a subset of 14 earthquakes occurred in the 1946-1958 period. We used the double-difference (DD) method to relocate the hypocenters and to determine the focal mechanisms. We focused on the earthquake sequence occurred on 23.07.2000 in the Mercure Valley, which is located between the Adria microplate and the Apenninic belt.

Methodology
The double-difference (DD) method is used to relocate the hypocenters and to determine the focal mechanisms. We used the HypoDD code (Galadini, F., Meletti, C. and E. Vittori, 2000. Stato delle conoscenze sulle faglie attive in Italia: elementi geologici di supporto a decisione pubblica. Roma: Ministero delle Infrastrutture e dei Trasporti; P. 1-329.) to relocate the hypocenters and to determine the focal mechanisms. We used the HypoDD code to relocate the hypocenters and to determine the focal mechanisms. We used the HypoDD code to relocate the hypocenters and to determine the focal mechanisms.

Results
The relocated hypocenters are concentrated between 10 and 18 km of depth (Fig.4g, h). The estimated depth distribution of the 50 earthquakes located using Hypoellipse (a, c, e, g) and HypoDD code (b, d, f) is shown in Fig.4. The estimated depth distribution of the 64 earthquakes located with Hypoellipse (a, c, e, g) and HypoDD code (b, d, f) is shown in Fig.5. The estimated depth distribution of the 64 earthquakes located with Hypoellipse (a, c, e, g) and HypoDD code (b, d, f) is shown in Fig.6.

Conclusions
The double-difference relocation performed with the double-difference method used in this study allows us to overcome a very classical issue of the inaccuracy in the area of the Lucanian Apennine. Earthquakes are mostly located along the Apenninic chain and covered by the present active fault system and the Apenninic chain (Fig. 7). The focal mechanisms determined using the double-difference method are in agreement with previous studies.

References

Table I
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<td>10-18</td>
<td>5</td>
<td>5</td>
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<tr>
<td>2</td>
<td>64</td>
<td>10-18</td>
<td>5</td>
<td>5</td>
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Fig.1: Map view of the hypocentral distribution and W-E cross-sections of the 64 events located with Hypoellipse (a, c, e, g) and HypoDD code (b, d, f).

Fig.2: Map view of the hypocentral distribution and W-E cross-sections of the 50 events located with Hypoellipse (a, c, e, g) and HypoDD code (b, d, f).

Fig.3: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

Fig.4: a) Number of events plotted vs. hypocentral depth for the different groups of events. b) Number of events plotted vs. hypocentral depth for the different groups of events. c) Number of events plotted vs. hypocentral depth for the different groups of events. d) Number of events plotted vs. hypocentral depth for the different groups of events. e) Number of events plotted vs. hypocentral depth for the different groups of events. f) Number of events plotted vs. hypocentral depth for the different groups of events. g) Number of events plotted vs. hypocentral depth for the different groups of events. h) Number of events plotted vs. hypocentral depth for the different groups of events. i) Number of events plotted vs. hypocentral depth for the different groups of events. j) Number of events plotted vs. hypocentral depth for the different groups of events. k) Number of events plotted vs. hypocentral depth for the different groups of events. l) Number of events plotted vs. hypocentral depth for the different groups of events. m) Number of events plotted vs. hypocentral depth for the different groups of events. n) Number of events plotted vs. hypocentral depth for the different groups of events. o) Number of events plotted vs. hypocentral depth for the different groups of events. p) Number of events plotted vs. hypocentral depth for the different groups of events. q) Number of events plotted vs. hypocentral depth for the different groups of events. r) Number of events plotted vs. hypocentral depth for the different groups of events. s) Number of events plotted vs. hypocentral depth for the different groups of events. t) Number of events plotted vs. hypocentral depth for the different groups of events. u) Number of events plotted vs. hypocentral depth for the different groups of events. v) Number of events plotted vs. hypocentral depth for the different groups of events. w) Number of events plotted vs. hypocentral depth for the different groups of events. x) Number of events plotted vs. hypocentral depth for the different groups of events. y) Number of events plotted vs. hypocentral depth for the different groups of events. z) Number of events plotted vs. hypocentral depth for the different groups of events.

Fig.5: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

Fig.6: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

Fig.7: Map view of the hypocentral distribution and W-E cross-sections of the 64 events located with Hypoellipse (a, c, e, g) and HypoDD code (b, d, f).

Fig.8: Map view of the hypocentral distribution and W-E cross-sections of the 50 events located with Hypoellipse (a, c, e, g) and HypoDD code (b, d, f).

Fig.9: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

Fig.10: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

Fig.11: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

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Fig.13: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

Fig.14: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

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Fig.18: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

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Fig.33: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

Fig.34: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.

Fig.35: 3D plots of events relocated with double-difference method (e, f). Green stars indicate the expected locations of the seismic sources.