Quick assessment of the fault plane of the April 6, 2009, Mw 6.3, Aquilano (Italy) earthquake

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Based on previous testing of the so-called H-C method (Zahradnik et al., 2008), applied in 2008 to five M6 earthquakes in Greece (e.g. http://www.emsc-csem.org/Doc/20080608_GREECE/H_C_08_06_2008.pdf), we issue a quick assessment of the fault plane for the most recent Mw6.3 (GCMT, Harvard), ML5.8 (INGV) earthquake in central Italy, Abruzzo – L'Aquila (20090406 at 01:32:39 UTC). This case, of normal event with both nodal planes of similar azimuth and dip, and a shallow depth, belongs to the most difficult for the H-C method. Therefore we just show that the INGV location and centroid-moment tensor solutions available during writing of this report on web

http://cnt.rm.ingv.it/~earthquake/data_id/2206496920/event.php

do represent the H-C consistent data, i.e. the data providing some (although weak) preference of one of the nodal planes. Shown in Figure 1 is the hypocenter at the INGV calculated horizontal position (42.33, 13.33); instead of the location depth of 8.8 km, four alternative depths are considered, 7.8 to 10.8 km, step of 1 km. The two plotted planes correspond to the INGV centroid-moment solution (*strike/dip/rake=147/43/-88 in green, and 324/47/-92 in red*), passing through the QRCMT centroid position at 42.32, 13.32, fixed depth of 12 km. As evident from the figure, using these published data, hypocenter is closer to the green plane, in particular with its depth of 10.8 km. Figure 2 shows the same for the INGV hypocenter combined with the GCMT, Harvard moment-tensor solution (*42.33, 13.32, fixed depth 12 km; strike/dip/rake=127/50/-109 in green, and 336/43/-68*). In that case (and with the H-depth of 10.8 km), the distance of H from the preferred green plane is 0.3 km, smaller than from the red plane, 1.8 km; the mutual hypocenter-centroid distance is of about 2 km.

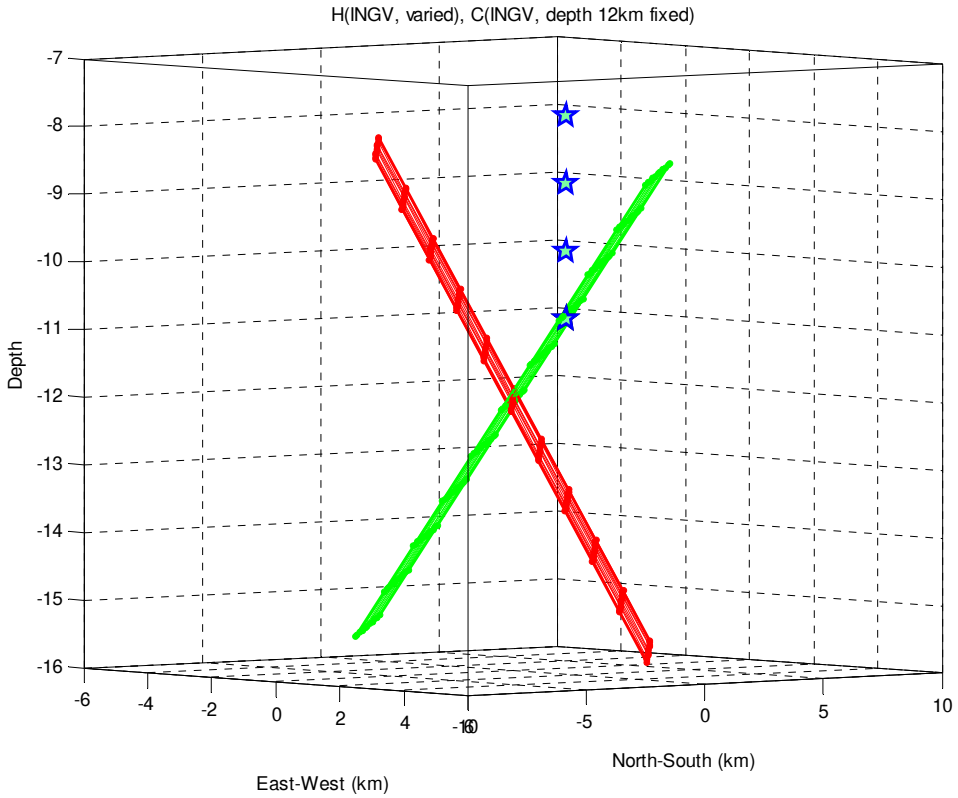

Figure 1. H-C Plot using the INGV epicenter and four varied depths of hypocenter H (stars), and the INGV moment tensor solution. The centroid C is in the middle of the two crossing nodal planes. The plane plotted in green, encompassing H (strike 147) is the likely fault plane.

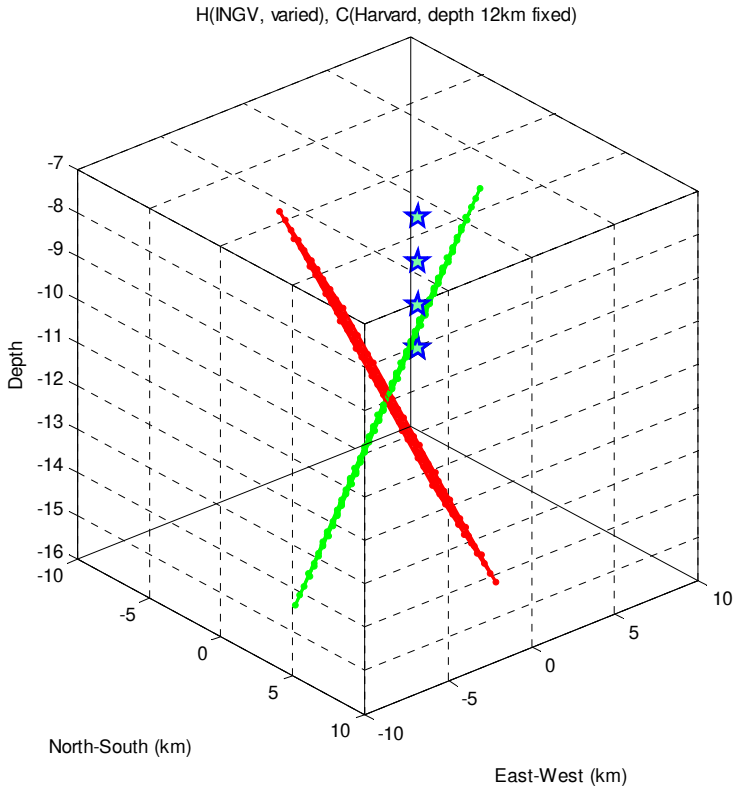

Figure 2. Same as in Figure 1, but using the Harvard centroid moment solution.

Furthermore, a test using the EMSC relocated epicenter position (http://www.emsc-csem.org/index.php?page=current&sub=indepth&id=p0924;INFO) and Harvard moment-tensor solution provides similar results (Figure 3). In the same figure the hypocenters of INGV, GFZ and THE agencies, are plotted. EMSC and INGV hypocenters favor the green plane (127/50/-109) while GFZ and THE hypocenters don't favor any of the two planes.

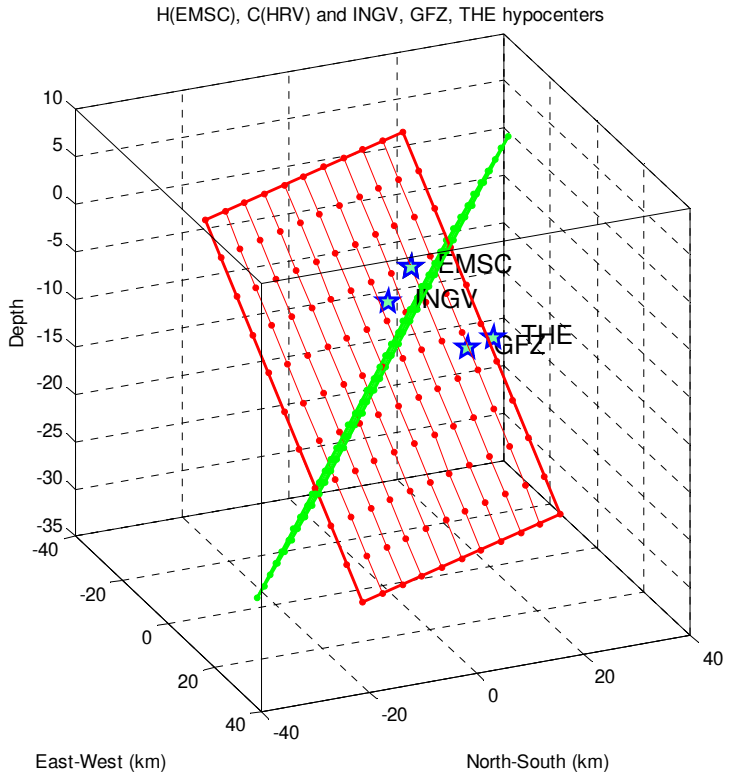

Figure 3. H-C Plot using the EMSC relocated epicenter, hypocenters provided on EMSC web page by INGV, GFZ and THE (stars), and the HRV moment tensor solution. The centroid C is in the middle of the two crossing planes. The plane plotted in green, encompassing GFZ and INGV hypocenters (strike 127) is the likely fault plane.

We conclude that in spite of fact that this geometry is the least favorable for the H-C method, the fault plane of this earthquake seems to be the south-west dipping plane (e.g., strike 147 degrees in case of the INGV solution). The above conclusion needs to be checked against new data as they become available.

Reference:

Zahradník, J., Gallovič, F., Sokos, E., Serpetsidaki, A., Tselentis, G-A. (2008). Quick fault-plane identification by a geometrical method: application to the Mw6.2 Leonidio earthquake, January 6, 2008, Greece. Seismol. Res. Letters 79, 653-662.