

# 3D GRAVITY INVERSION ACROSS THE CENTRAL AND NORTHERN APENNINES

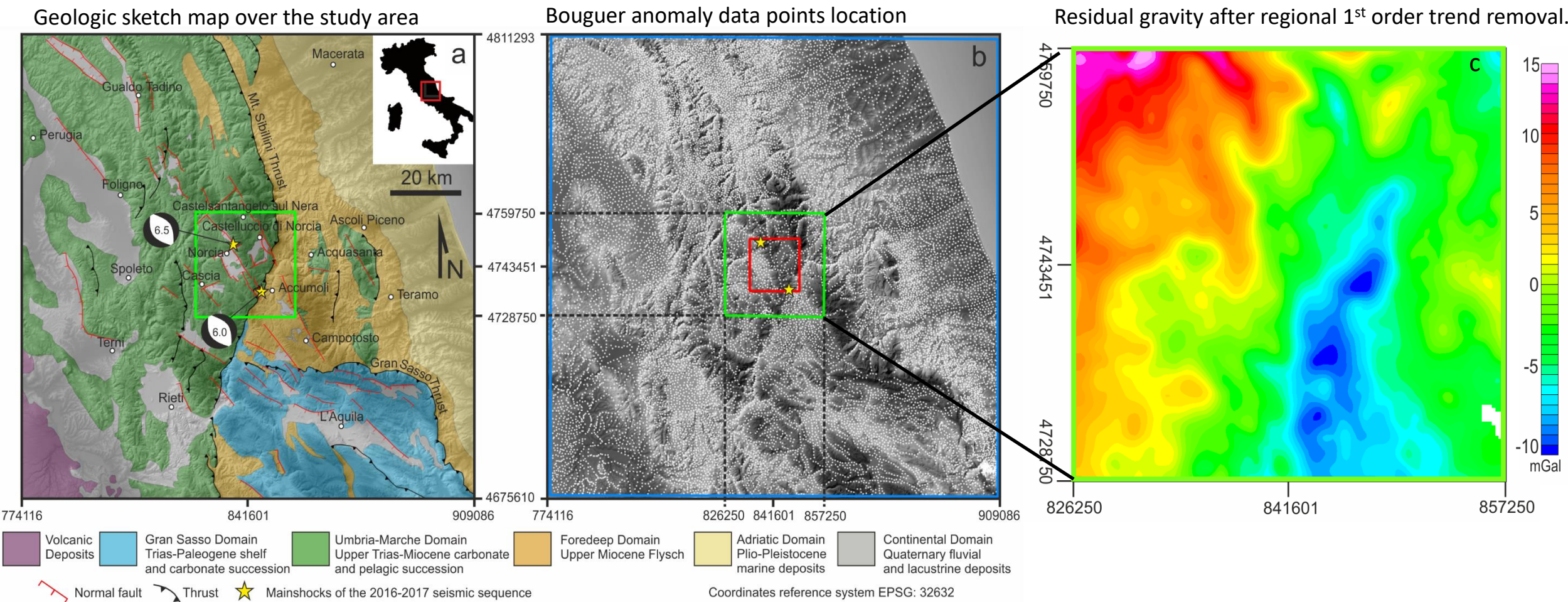
Paolo Mancinelli<sup>(1, 4, \*)</sup>, C. Pauselli<sup>(1)</sup>, D. Fournier<sup>(2)</sup>, M. Fedi<sup>(3)</sup>, G. Minelli<sup>(1)</sup>, M.R. Barchi<sup>(1)</sup>

\*Corresponding author: [paolo.Mancinelli@unich.it](mailto:paolo.Mancinelli@unich.it)

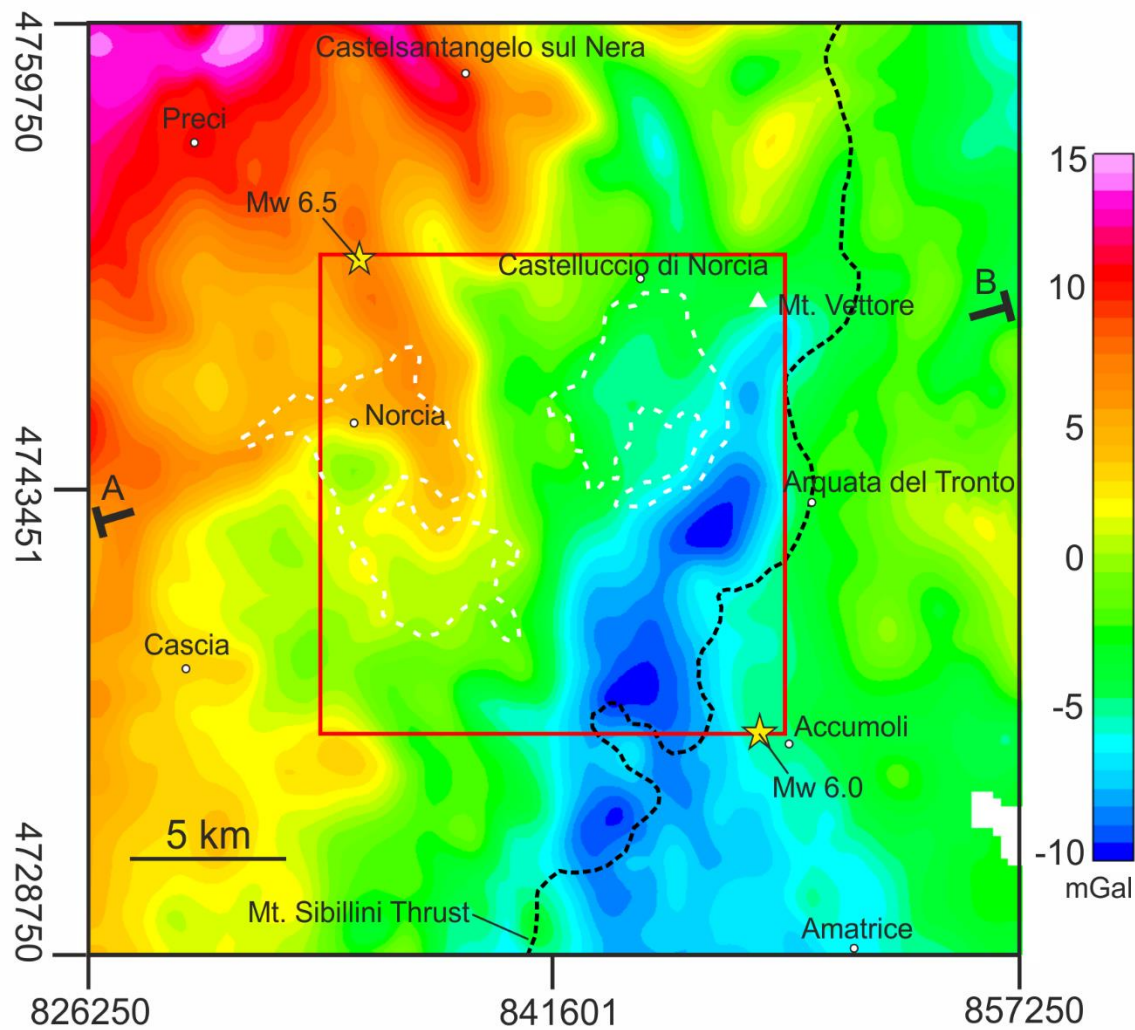


To evaluate relations between the gravity anomalies and the seismogenic layer in the study area, we produce 3D inversion of gravity anomalies constrained to upper crustal geometries and density values. We find that the residual gravity signature, after first order planar trend removal, is not related with low-density surface basins. Moreover, we observe that seismic events mostly locate within high-density units both at shallow or deeper depths. Finally, the modelling supports a four-volumes upper crust, with a low-density upper basement whose density is compatible with low-grade metamorphic composition.

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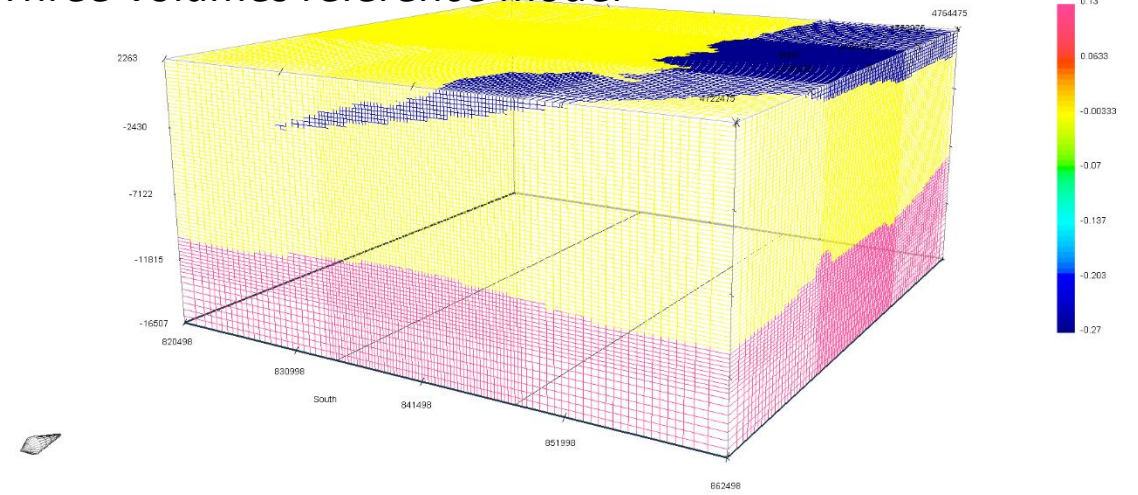




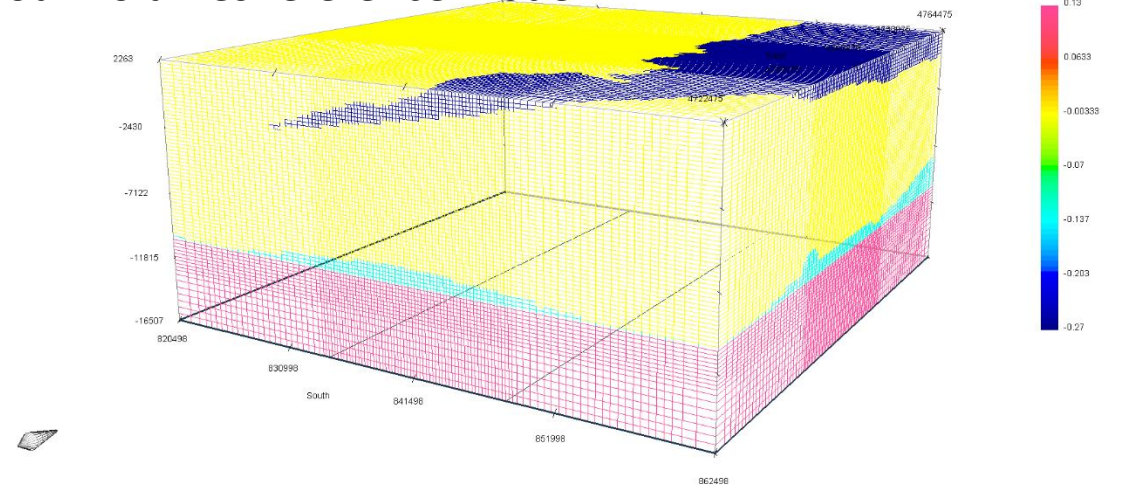


Residual gravity anomaly is not related to intra-chain basins like Norcia or Castelluccio di Norcia (white dashed polygons).

### Three-volumes reference model



### Four-volumes reference model



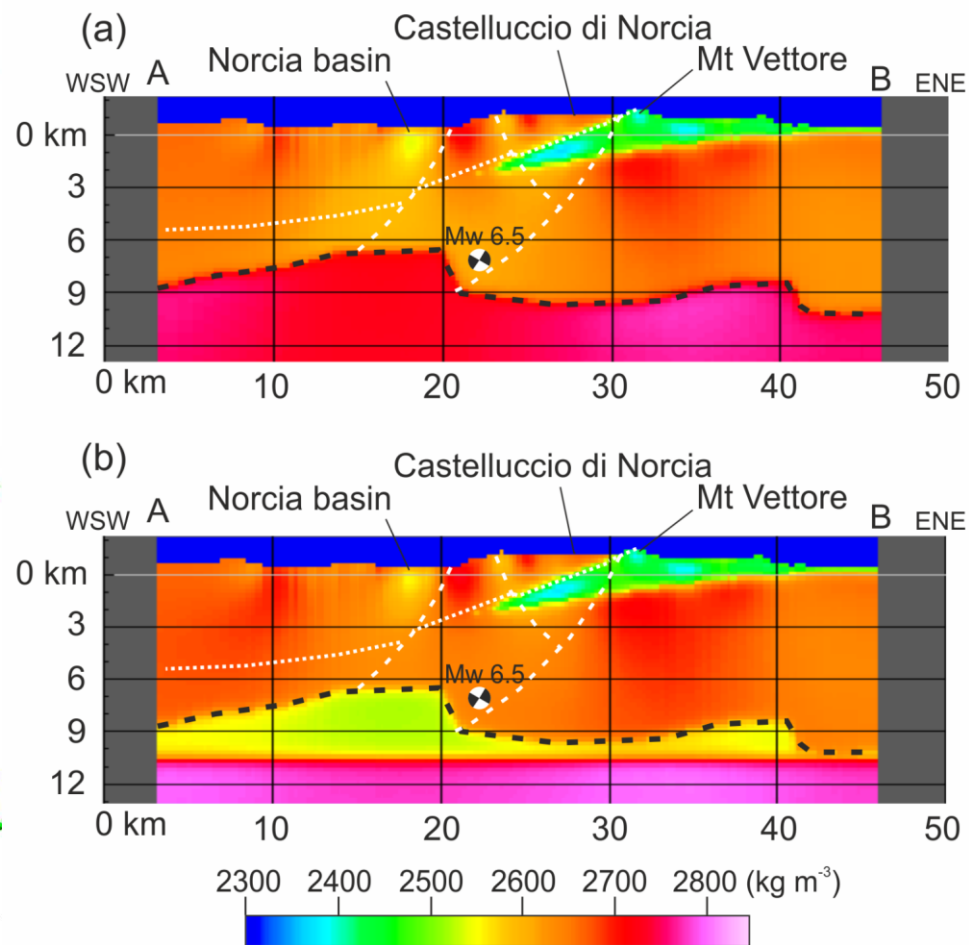
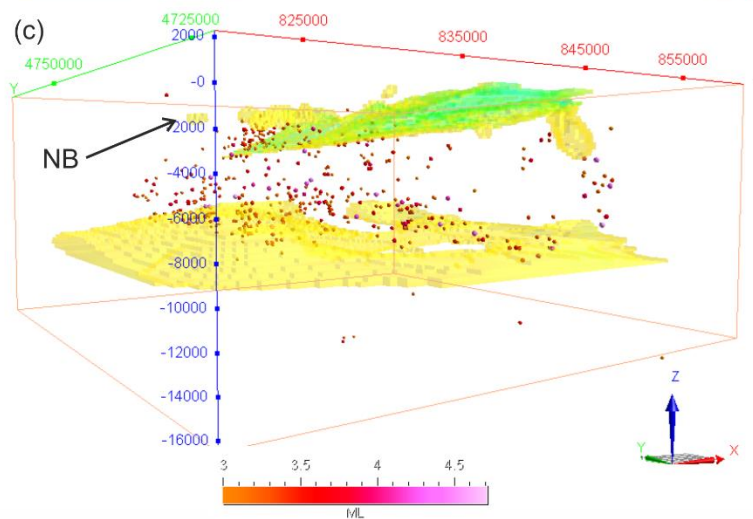
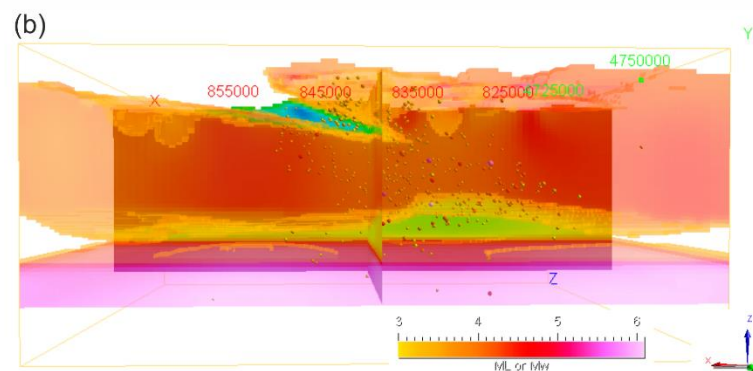
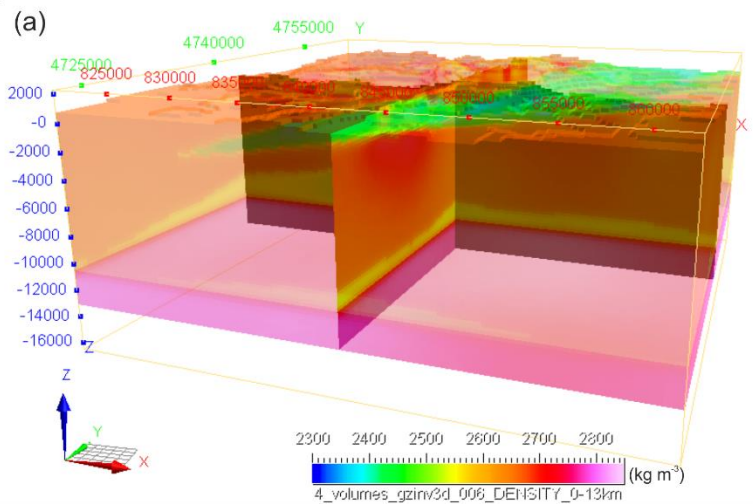
Turbidites ( $\rho=2400 \text{ kg m}^{-3}$ )

Carb+Evap ( $\rho=2670 \text{ kg m}^{-3}$ )

Basement ( $\rho=2800 \text{ kg m}^{-3}$ )

Phyllitic Basem. ( $\rho=2550 \text{ kg m}^{-3}$ )

Inversion algorithm: Li & Oldenburg 1998



#### VOLUME VIEW:

- (a) 3D volume after the inversion constrained to the 4-volumes reference model
- (b) Same volume in (a) with densities < 2570 kg m<sup>-3</sup> switched-off and Mw > 3 events from early catalogue of Chiaraluce et al. (2017)
- (c) Same volume in (a) with densities > 2570 kg m<sup>-3</sup> switched-off and Mw > 3 events from relocated events' catalogue of Improta et al. (2019)

Comparison between 3-volume (section view-top) and 4-volume (section view-bottom) models along a 2D section located in previous page. Main normal faults (white dashed lines) and Monti Sibillini thrust (white dotted line) are related with local density changes observed within modelled volumes.

Slight lateral density changes are observed also in the basement of the 3-volumes model (density values ranging between 2700 and 2800). This evidence, coupled with best-fitting forward model of the post-inversion geometries and densities, supports the 4-volumes model as best representing the upper crustal setting. In this case, the upper basement is represented by a low-density layer whose composition is compatible with low-grade metamorphic rocks.

In the next page you will find QR codes to view some videos of the resulting models compared with the seismic events catalogues available for the 2016-2017 sequence. Just point at them with your smartphone camera and browse to the dropbox folder to view the videos.



See a video of the 3-volumes inversion with densities between 2.3 and 2.57 g/cm<sup>3</sup> switched-off and seismic catalogues:



Volume+Chiaraluce et al. (2017) catalogue with 3<Mw<6.5



Volume+Improta et al. (2019) catalogue with relocated aftershocks with 3<Mw<4.7

See a video of the 4-volumes inversion with densities between 2.3 and 2.57 g/cm<sup>3</sup> switched-off and seismic catalogues:



Volume+Chiaraluce et al. (2017) catalogue with 3<Mw<6.5



Volume+Improta et al. (2019) catalogue with relocated aftershocks with 3<Mw<4.7

See a video of the 4-volumes inversion showing only densities between 2.3 and 2.57 g/cm<sup>3</sup> and seismic catalogues:



Volume+Chiaraluce et al. (2017) catalogue with 3<Mw<6.5



Volume+Improta et al. (2019) catalogue with relocated aftershocks with 3<Mw<4.7

For any question please contact me at [paolo.mancinelli@unich.it](mailto:paolo.mancinelli@unich.it)

These videos were uploaded as supplementary material of the paper published on JGR Solid Earth: [doi.org/10.1029/2019JB018853](https://doi.org/10.1029/2019JB018853)