EGU2020-7083
https://doi.org/10.5194/egusphere-egu2020-7083
EGU General Assembly 2020
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Expected impact of the 2016 central Italy earthquakes on the local gravity field

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We have modelled the surface volume and gravity changes caused by the three mainshocks (moment magnitudes Mw 6.0, 5.9, 6.5) occurred during the last seismic period started on 2016, August 24 in central Italy. Our calculations start from the source parameters estimated by the inversion of the largest dataset of InSAR and GNSS observations ever managed in Italy after earthquake occurrences, based on the half-space elastic dislocation theory. The vertical displacements modelled after the 2016 events allow to infer a substantial unbalance between the subsided and uplifted volumes. In particular, we detected ~106□10^6 m^3 of hangingwall subsidence against ~37□10^6 m^3 of footwall uplift, that accounts for ~74% of the total volume mobilization. From the ratio between the footwall and total deformed volumes, we have computed an average fault dip of ~47°, in line with the values retrieved by seismological methods. The total gravity variations which affected the study area are of the order of ~1 μGal (1 μGal = 10^{-8} ms^{-2}) in the far field, and ~170 μGal in the near field.
The area affected within a gravity change of 1 μGal is ~140 km long and ~57 km wide, parallel to the Apennines chain. The larger contribution is given by positive variations which account for the tensional style of deformation and larger subsided area.