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Gravimetric and microseismic characterization of the Gemona (NE Italy) alluvial fan for site estimation

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The urban area of Gemona (NE Italy) is mainly built on alluvial fan sediments that contributed to its destruction during the Friuli earthquake, May-September 1976. Three accelerometric stations of the Friuli Venezia Giulia Accelerometric Network (RAF), run by the Department of Earth Sciences, University of Trieste, in collaboration with the Civil Defence of Friuli Venezia Giulia are set in Gemona for site effects estimation purposes. Using weak motion recordings of these stations, we are able to derive the horizontal to vertical spectral ratio and also to apply the reference site techniques. The result of these elaborations shows different resonant frequencies in the two sites (one on the fan, one on the sedimentary basin), when excited by the same event, and also different resonance frequencies at the same site when excited by different events. This can be explained with 2D or 3D site effects modelling, that requires, however, the characterization of the local subsoil structures, in particular the sediment-bedrock contact.

In this work we use two different, unrelated approaches to determine the thickness of alluvial fan sediments upon which the city is built and on its variation with depth. We use gravimetric data to characterize of a model with a homogeneous sedimentary layer of variable thickness along five selected profiles. The models were elaborated using the residual Bouguer anomaly. The constraints used in the modelling were three boreholes that reach the bedrock, geological outcrops and intersection points on the profiles. We derived the mean thickness along all the profiles and the bedrock undulations. We have validated the modelling using a second approach based on seismic noise data. We measured seismic noise along one of the profiles. The data were analysed to calculate the fundamental frequency of soft soil using Nakamura's techniques

(H/V ratio), that was compared to resonance frequencies calculated from weak motion events. The lack of agreement confirms the 2D or 3D character of the alluvial fan. However, the thickness of sediments along all the profiles matched the ones determined from gravimetric inversion results. This result encourages us to extend the noise measurement over all the fan to characterize its 3D geometry.