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Accelerometer housing as a cause of variation of recorded ground motion: the example of the L'Aquila (Italy) 2009 earthquake

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A possible reason for deviations in statistics of ground-motion parameters is the fact that the time-histories recorded at stations placed within or near buildings could be not representative of the true free-field ground motions but instead they could be contaminated by the frequencies of the buildings. These effects are known for years for large structures, but little attentions was paid to small buildings: numerical simulation show that the effect is different on peak, spectral and integral parameters and may range from a maximum of 20% for PGA to 100% for spectral ordinates (Ditommaso et al., 2010, Bull. Earthq. Eng). Several stations of Italian Accelerometric National Network are located within the sub-stations of national electric grid. The main constructive typologies used are brick masonry, reinforced concrete and pre-cast concrete, one or two floors high. To understand the influence of housing on accelerometric recordings obtained during the L'Aquila earthquake sequence (April 2009), we set up an experimental campaign focused on the dynamic characterization of housings and analyses of accelerometric recordings. The structural dynamic identification was aimed to housings and the pillars driven into the ground on which accelerometers are fixed. We studied four stations, and for all of them the preliminary results confirm that housings contaminated the accelerometric recordings. We analyzed at least 15 earthquakes for each station in terms of rotational HVSR. For each station, in correspondence of the main frequency of vibration, we always have an amplification factor greater than 1.5, but in one cases it reaches a value is greater than 4. In our opinion, great care should devoted when comparing strong motion recordings obtained near or close even to small buildings, or recorded on artificial surfaces (concrete slabs, pillars, etc.): part of the observed variability could be due to the influence of different types of housing.