EVALUATION OF GROUND MOTION NUMERICAL SIMULATION RELEVANCE: MAIN RESULTS OF THE EUROSEISTEST VERIFICATION AND VALIDATION PROJECT

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Numerical simulations are often used to evaluate local ground motion amplification (site effects). Before using these approaches for civil engineering design purposes, it is necessary to evaluate their reliability. Within the framework of this evaluation effort, an ongoing international collaborative work was organized, jointly by the Aristotle University of Thessaloniki, Greece, the Cashima research project (supported by the CEA and the Laue-Langevin institute), and the Joseph Fourier University, France. We decided to focus the study on a site (1) where the site geometry and geotechnical properties are well known and (2) where accelerometric time histories are available. The EuroseisTest site, located few tens of km East of Thessaloniki, was chosen since it provides a detailed 3D model of the sedimentary basin (about 5 km wide, 15 km long, sediments reach about 400 m depth) and the signals of 8 local earthquakes with magnitude from 3 to 5, recorded on 19 surface and borehole accelerometers. The project involves more than 10 international teams from Europe, Japan and USA, employing different numerical techniques (FDM, FEM, SEM, DGM, PSM, DEM). It consists in computations of different 2D, 3D, linear or non-linear cases. Through these exercises, it is possible to evaluate (1) the accuracy of numerical methods when applied to realistic applications where no reference solution exists (verification) and (2) quantify the agreement between recorded and numerically simulated data (validation). We will present the site, the objectives, the 3D model construction strategy, the different computing cases and main results of this project. The verification work allows us to clearly identify and understand the discrepancies between the predictions of the different simulation methods. The validation work shows surprisingly good agreement for the largest magnitude event, even at high frequencies (up to 4 Hz). This last exercise has been performed for 6 local, weak to moderate magnitude events recorded by a local array of 19 surface and borehole accelerometers. In general, while the detailed waveforms do not match, the overall amplitude, duration, and spectral shape exhibit a relatively satisfactory agreement. The level of agreement is however found to be event-dependent, as a combined result of the large sensitivity of waveform details to the source location and mechanism, the geometry of the sediment-basement interface, and the internal sediment layering, and of the uncertainties in the source parameters and basin structure. The best agreement is found indeed for the largest – and thus best known- event.