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Seismic motion in Grenoble valley for two hypothetical earthquakes: a 3D hybrid simulation

M. Galis (1,2), **P. Moczo** (1,3), J. Kristek (1,3), P.-Y. Bard (4,5)

(1) Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovak Republic, (2) Now at the Faculty of Mathematics and Physics, Charles University, Praha, Czech Republic, (3) Geophysical Institute, Slovak Academy of Sciences, Bratislava, Slovak Republic, (4) LGIT UJF, Grenoble, France, (5) LCPC, Paris, France (moczo@fmph.uniba.sk / Phone: +421 2-65429025)

Geology and seismicity studies indicate the possibility of earthquakes as large as M 5 - 5.5 in the Grenoble area. A right-lateral, strike-slip event is likely to occur on the fault located along the Belledonne massif to the east of the basin (N30˚). An overthrusting structure corresponding to subalpine mountain ranges, located just beneath the city of Grenoble, is also capable of producing a significant event. Considering both the importance of site effects in the young (post-glacial) Grenoble sedimentary valley, and the differences in locations and focal mechanisms, we considered it interesting to compute and compare the response of the whole 3D valley to both kinds of events.

The numerical simulations for both events were performed by a 3D hybrid modeling technique based on the combination of the finite-element (FE) and finite-difference (FD) methods. The technique was developed to allow for relatively efficient simulation of dynamic rupture propagation on a fault, seismic wave radiation and propagation in a heterogeneous viscoelastic medium with realistic model of the attenuation. In an arbitrarily shaped part of the whole computational region, the 2^{nd}-order displacement FE method is used to simulate rupture propagation on a possibly non-planar fault. The FE part of the region may also have a non-planar free surface. The rest of the computational region is solved by the 4^{th}-order velocity-stress staggered-grid FD scheme. The dynamic rupture propagation is solved using the traction-at-split-node method (TSN, developed independently by Andrews and Day).

We show the ground motion due to two different selected events, the effect of different positions of the earthquake hypocenter on the Belledonne fault, and difference

between the motions produced by the dynamically rupturing faults and those due to the equivalent double-couple point sources.