NEAR-FAULT GROUND MOTION PREDICTION, SITE EFFECTS AND WAVE PROPAGATION AT REGIONAL SCALE FOR A SHALLOW EARTHQUAKE IN SOUTHEAST FRANCE

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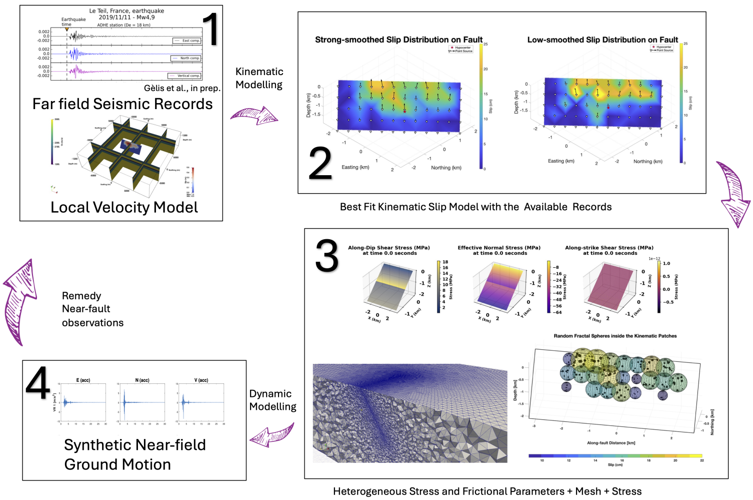
The 2019 Mw 4.9 Le Teil earthquake was a shallow, moderate event that caused significant damage in its epicentral area and evidenced surface rupture. This event demonstrates that a moderate-magnitude quake can pose a significant threat to infrastructures and its near-fault ground motions (NFGM) need to be properly predicted. However, NFGM records for similar events worldwide are few. To understand their variability and intensity, synthetic physics-based NFGM simulation, including source, propagation, and site effects, is required. An accurate fault rupture model is crucial for NFGM modeling, especially when the fault rupture is shallow and reaches the surface, such as the 2019 Le Teil event. In this study, we employ both kinematic and dynamic approaches to model fault rupture while considering wave propagation and site effects (shallow layer not included yet) by incorporating seismic properties of the medium. We introduce an original method to estimate and map dynamic parameters from inverted kinematic slip models prior to dynamic rupture modeling. Essentially, we derive a 3D distribution of heterogeneous frictional parameters, scaled by slip magnitude and spatially bounded by a static slip distribution, within the slip-weakening friction framework. Furthermore, we investigate the impact of the smoothing level of the inverted slip model on dynamic fault rupture and coupled GM using our approach. Additionally, we apply the strain-constrained condition proposed by Aochi and Tsuda (2023) to configure the initial stress field in a layered model, which hypothesizes that strain gradually increases with depth. Our preliminary results suggest that the variability and intensity of synthetic NFGM depend on the smoothing level of the inverted slip model using our approach.

Note: Figure is on the next page.


1
Le Teil, France, earthquake
2019/11/11 - Mw4,9
Gèlis et al., in prep.
Far field Seismic Records
Local Velocity Model
Kinematic Modelling
2
Strong-smoothed Slip Distribution on Fault
Low-smoothed Slip Distribution on Fault
Best Fit Kinematic Slip Model with the Available Records
3
Along-Dip Shear Stress (MPa) at time 0.0 seconds
Effective Normal Stress (MPa) at time 0.0 seconds
Along-strike Shear Stress (MPa) at time 0.0 seconds
Random Fractal Spheres inside the Kinematic Patches
Heterogeneous Stress and Frictional Parameters + Mesh + Stress
Dynamic Modelling
4
E (acc)
N (acc)
V (acc)
Synthetic Near-field Ground Motion
Remedy Near-fault observations