Subject offered for a contract starting october 2014

SUBJECT TITTLE:

Toward a mechanical model of earthquake cycle: The Dead Sea Fault as a test case

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Second Advisor:	**Harsha Bhat, CR, bhat@ipgp.fr**
Host lab/ Team :	**IPGP- Tectonique et Mécanique de la Lithosphère – UMR7154**
Financing:	Doctoral contract with or without assignment

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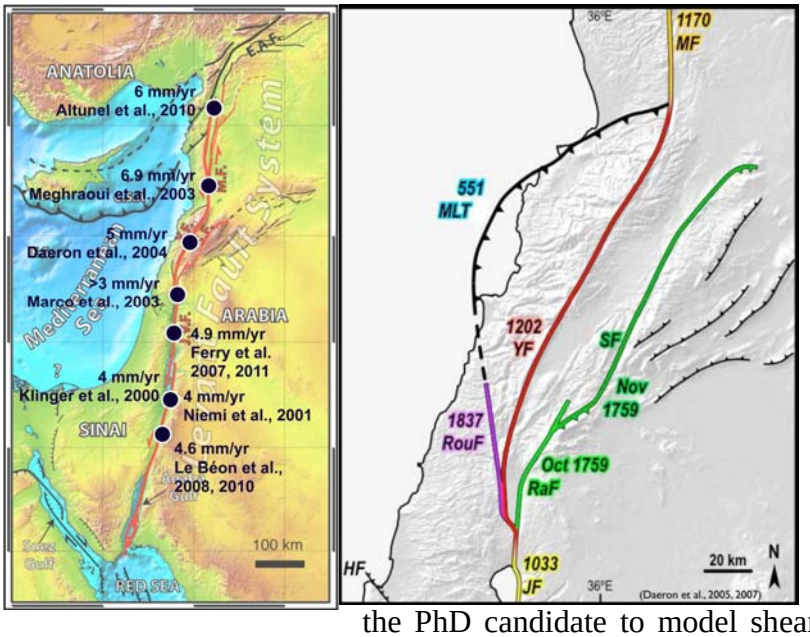
Presentation of the subject: (1 or 2 pages)

Toward a mechanical model of earthquake cycle: The Dead Sea Fault as a test case



Earthquake ruptures are modeled as dynamic shear fractures (Mode II) on a frictional interface. These frictional interfaces, faults, are known *a priori* and are geometrically very complex. To understand the seismic hazard associated with an earthquake one would need to know how these ruptures navigate through a geometrically complex fault/ crack system. We propose, for this PhD, to use a well-known tool called the Boundary Integral Equation Method (BIEM) that utilizes the dynamic representation theorem as its backbone. This technique will allows the PhD candidate to model shear ruptures on a precisely defined fault geometry.

The first part of the PhD project will be to evaluate the static stress distribution for a given geometrically complex fault system, such as the Dead Sea fault system, shown in Figure to the

right. The task will involve evaluating several rupture propagation scenario that best agree with historical earthquakes in such a system, and to estimate associated ground motion, critical for assessment of site effect. The second part of the project will be to build a pseudo-earthquake cycle model, based on BIEM, where one would semi-automatically alternate between implicit, quasi-dynamic and explicit, dynamic simulations to mimic a full earthquake cycle that would incorporate realistic boundary conditions (in that case long-term tectonic loading, see figure on the left inside). Eventually, taking advantage of the unique setting of the Dead Sea Fault (numerous historical and geological data, well constrained fault geometry…) the PhD candidate will be able to propose a meaningful mechanical model of fault behavior that would be consistent with geological observation at different time scales. Because this region is largely inhabited with several large cities in short distances (Damascus, Jerusalem, Beyrouth to cite only a few), understanding how earthquakes propagate and relate to each other in space and time is of primary importance to improve the regional seismic hazard.

Potential candidate should have mandatory background in fundamental solid and fracture mechanics.
The proposing team is composed of H. Bhat (CR CNRS), specialized in fracture mechanics and dynamic rupture propagation, and of Y. Klinger (DR CNRS), specialized in earthquake mechanics and active tectonics.
Please feel free to contact any of them for further information at (bhat@ipgp.fr / klinger@ipgp.fr)

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