Subject offered for a contract starting october 2014

SUBJECT TITTLE:

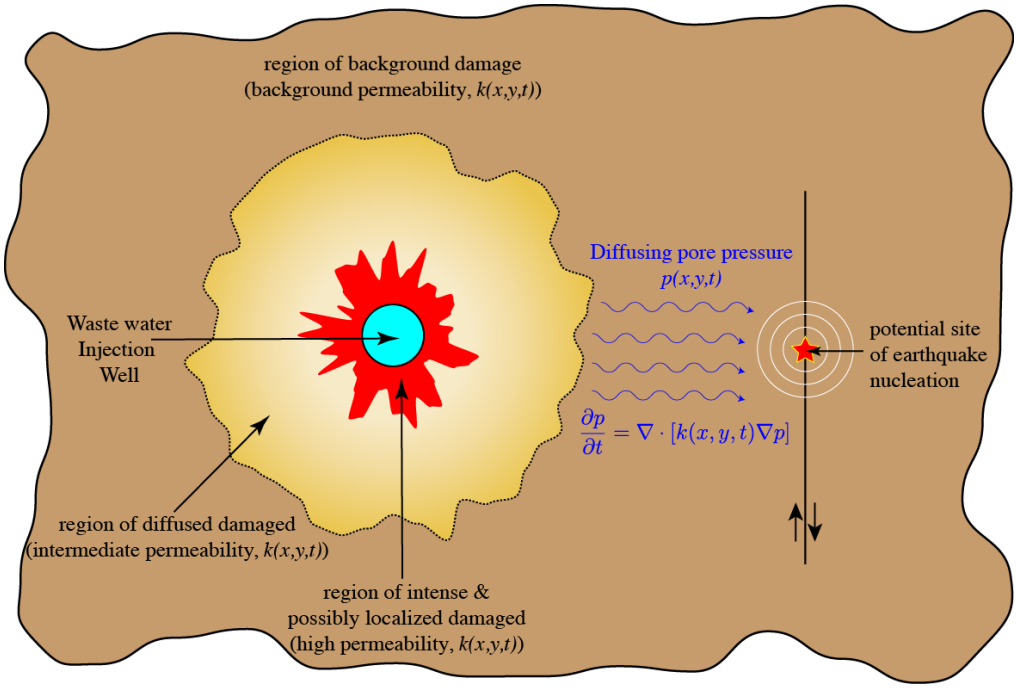
Advisor: **MADARIAGA, Raul, Pr madariaga@biotite.ens.fr**
Second Advisor/ Supervisor: **BHAT, Harsha, CR bhat@ipgp.fr**
Host lab/ Team : **IPGP- Tectonique et Mecanique de la Lithosphere – UMR7154**

Financing: Doctoral contract with assignment

For more information go to http://ed109.ipgp.fr, section: Offres de these (PhD offer), You must apply on the Doctoral School website

Insights into Induced Seismicity from Mechanical Models and Observations

Earthquakes attributable to human activities are called induced seismic events or induced earthquakes. In the past several years induced seismic events related to energy development projects have drawn heightened public attention. Three major findings from a recent study by the United States National Research Council has found that a) The process of hydraulic fracturing a well as presently implemented for shale gas recovery does not pose a high risk for inducing felt seismic events b) Injection for disposal of wastewater derived from energy technologies into the sub-surface does pose some risk for induced seismicity, but very few events have been documented over the past several decades relative to the large number of disposal wells in operation c) Carbon Capture and Storage, due to the large net volumes of injected fluids, may have potential for inducing larger seismic events. Induced seismicity associated with fluid injection or withdrawal is caused in most cases by change in pore fluid pressure and/or change in stress in the subsurface in the presence of faults with specific properties and orientations and a critical state of stress in the rocks. The factor that appears to have the most direct consequence in regard to induced seismicity is the net fluid balance (total balance of fluid introduced into or removed from the subsurface), although additional factors may influence the way fluids affect the subsurface.



The aim of this project would be to model permeability and pore pressure changes in a fractured medium surrounding a wastewater injection site and understand its role in triggering earthquake ruptures in a neighboring fault. The student would first be involved in developing numerical models to account for earthquake nucleation on a geometrically complex fault system due to pore pressure diffusion from an injection well. The second part of the thesis would be to extract hydraulic properties around fault zones from seismicity catalogs by looking at earthquake migration etc. The final part would be to use the mechanical models developed to explain these observations.