Understanding the evolution of fault geometry with on-going slip

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Point

■ Development of a new numerical methods to model earthquake cycle simulations on non-planar faults (spectral boundary element method)

■ Development of new analytical tools using semi-analytical solutions

■ Observation of the effect of plate geometry or fault-geometry on the dynamics of earthquakes

研究の領域

予防	応急対応	復旧･復興
予測･情報力		
防災基礎力		

Outline

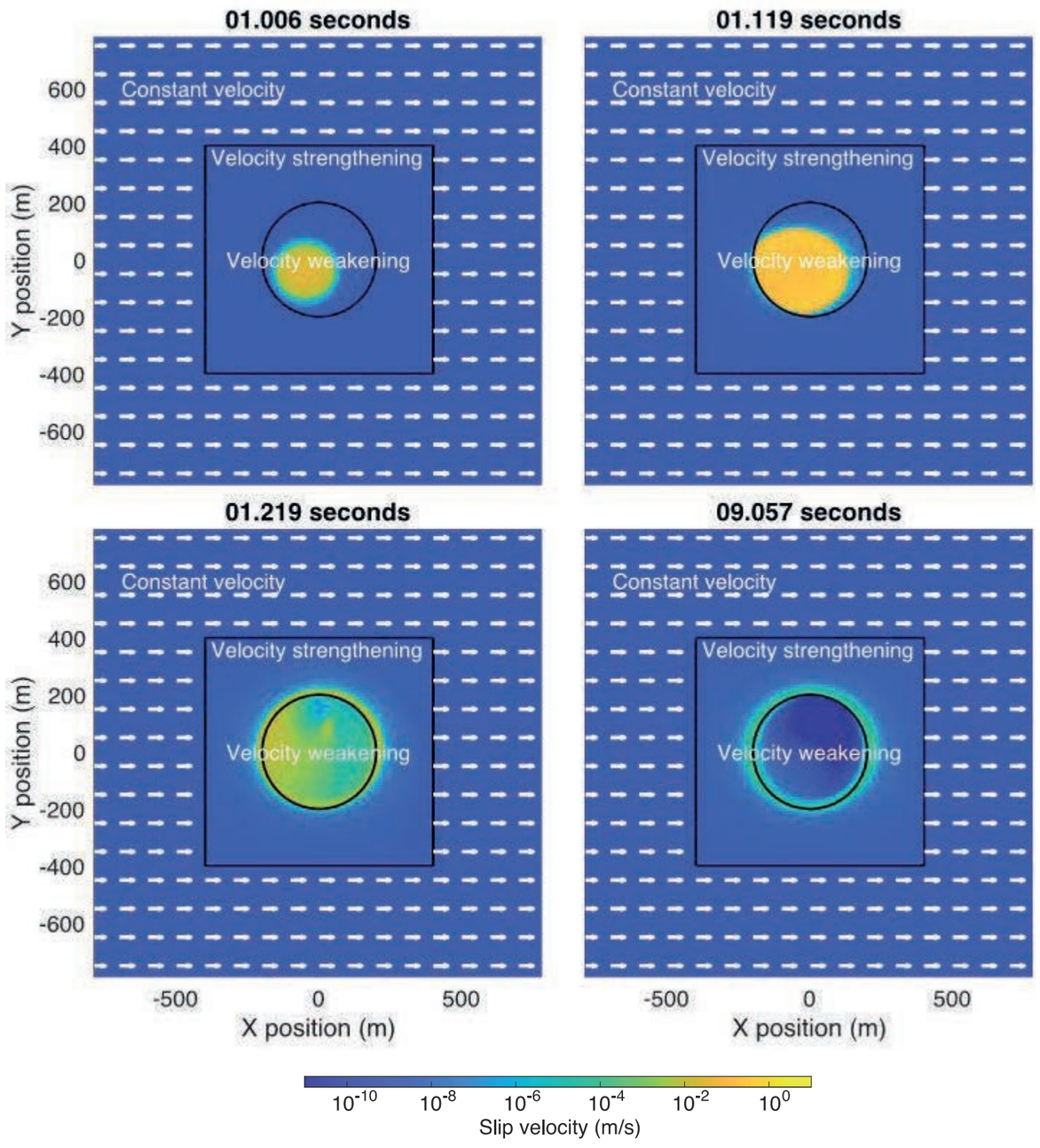
Despite the fact that fault geometry is one of the parameter that can be measured either directly (by mapping fault trace) or indirectly (by analyzing micro-seismicity), its role in the process of earthquake dynamics is still not well understood. Which fault geometrical feature will promote large earthquake generation? Which fault geometrical features will impede large earthquake? How is the fault geometry evolving with on-going slip on the fault and how does it affect the behavior of earthquakes?

In order to answer these questions, we try to develop new analytical tools and numerical models.

(1) Numerical models: We developed new numerical models of earthquake cycles in the context of non-planar fault geometry. One current limitation of such kind of models is the running time consumption. This is why, we developed a fully-dynamic spectral Boundary Element Method, in 3D, that can handle non-planar fault geometries. Taking advantage of the Fourier transform, it accelerates the calculation and can be computed on regular desktop.

(2) We apply the tools that we have developed to better understand the role of fault-geometry on the earthquake mechanics, its evolution and how it affects the seismic cycle behavior.

We hope that in the long term, these developments will improve hazard map for earthquakes by integrating the fault geometry.



Example of a 3D fully dynamic earthquake cycle simulation. The model parameters are following SCEC benchmark BP7. This figure represents the slip velocity of an earthquake, at different time, breaking a velocity-weakening asperity.

Future research

The last year, we successfully generalized our work to 3D medium. We are now able to compute 3D fully-dynamic earthquake cycle simulation on slightly non-planar fault, only using a regular desktop.

- Mature faults are known to be less rough that younger fault. We would like to develop a model of earthquake cycle to understand this phenomena, i.e.: the evolution of fault geometry with on-going slip.
- We would like to develop more the observation of fault geometry and its effect on subduction zone and strike slip fault systems. For example, by systematically calculating the stresses induced by the fault geometry and the long term slip of the fault.

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