Geophysical Research Abstracts
Vol. 18, EGU2016-13817, 2016
EGU General Assembly 2016

Toward probabilistic answers to key scientific questions in source modeling: Bayesian explorations of fault slip and coupling over the earthquake cycle

Romain Jolivet (1), Zacharie Duputel (2), and Mark Simons (3)

(1) Laboratoire de Géologie, École Normale Supérieure, PSL Research University, CNRS UMR 8538, Paris, France (romain.jolivet@ens.fr), (2) Institut de Physique du Globe de Strasbourg, CNRS and EOST/Universit\'e de Strasbourg, Strasbourg, France (zacharie.duputel@unistra.fr), (3) Geological and Planetary Sciences, California Institute of Technology, Pasadena, USA (simons@caltech.edu)

The ever-increasing amount of data sampling ground displacements over tectonically deforming regions continuously opens new perspectives on fundamental questions on the seismogenic behavior of active faults. How much overlap is inferred between seismic and aseismic slip from geodetic and seismological data? Can we quantify the robustness of potential relationships between fault locking, aseismic slip and coseismic slip? However, knowing how much information we have gained compared to our preconceptions and which parameters of our models still need inputs from additional data is difficult to assess and very rarely quantified because of the size of the problems we are dealing with. We have developed AlTar, a massively parallel Monte Carlo Markov Chain algorithm exploiting cutting-edge computing capabilities of Graphic Processing Units, to sample Probability Density Functions (PDFs) in large-dimensional spaces. We use this solver to derive the PDFs of fault coupling and fault slip, seismic or aseismic, along active faults, focusing on the creeping section of the San Andreas fault, California, and on the northern Chilean subduction zone. We derive the gain of information from our coseismic and interseismic data sets and interrogate these probabilities to derive quantified answers to questions pertaining to the behavior of these faults during the earthquake cycle. Large amounts of data are an opportunity and we need to assess how much we still don't know about distributions of slip during the inter-, co- and post-seismic phases in order to assess where progress has to be made for future data developments.