Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SSS31-12 Room:502 Time:April 30 17:30-17:45

A friction to flow constitutive law and its application to a two-dimensional modeling of earthquake cycles

SHIMAMOTO, Toshihiko[1*] ; NODA, Hiroyuki[2]

[1]Institute of Geology, China Earthquake Administration, [2]JAMSTEC

Establishment of a constitutive law from friction to high-temperature plastic flow has long been a task for solving problems such as modeling earthquakes and plate interactions. A linear combination of friction and flow laws disagrees with experimental data. Here we propose an empirical constitutive law that describes this transitional behavior with good agreements with experimental data on halite shear zones. A complete spectrum of properties including steady-state and transient behaviors can be predicted if friction and flow parameters are known. We show numerical models of seismic cycles of a fault across the lithosphere as an application. Our friction-to-flow law merges brittle-plastic Christmas-tree strength profiles of the lithosphere and rate-dependency fault models used for earthquake modeling on a unified basis. Conventionally strength profiles were drawn assuming a strain rate for the flow regime, but we emphasize that stress distribution evolves reflecting the fault behavior. Previous fault models are revised based on our earthquake modeling. Seismic fault motion is followed by fault creep in the transitional regime and this explains pseudotachylytes overprinted by mylonitic deformation, reported at various places in the world.

Keywords: Friction to flow constitutive law, Earthquake cycle modeling, Fault model, Lithosphere rheology, Mylonite, Pseudotachylite