

# Coulomb 3.0 Short Course

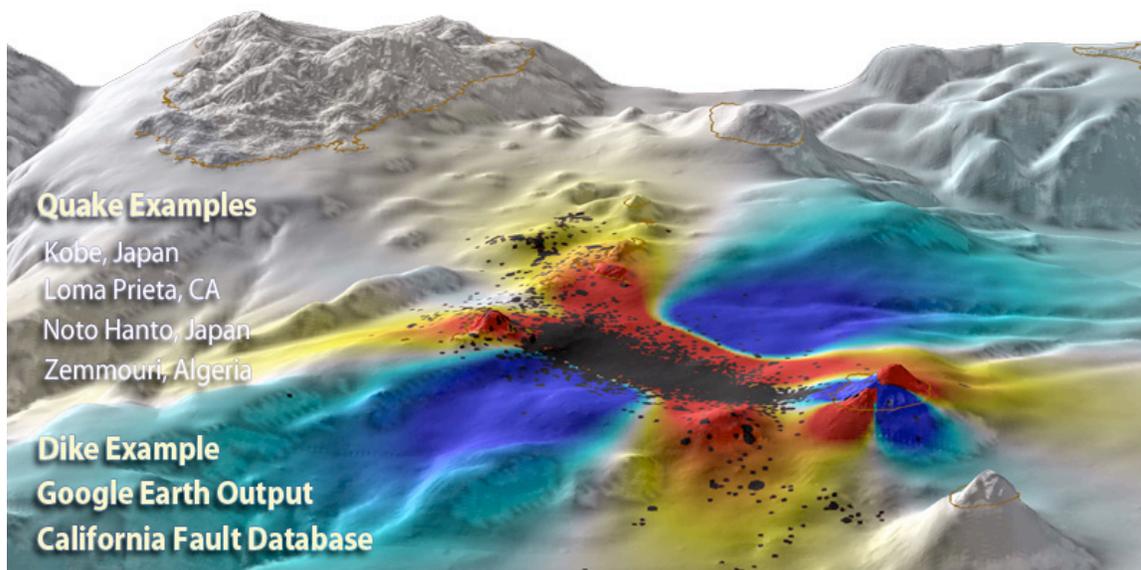
**At the SCEC Annual Meeting on Sunday, 9 Sep 2007**

*Coulomb 3.0 is designed to investigate Coulomb stress changes on mapped faults and earthquake nodal planes, and is intended both for publication-directed research and university teaching and instruction*

Taught by Shinji Toda (AIST), Ross Stein (USGS), and Jian Lin (WHOI), this free, full-day, hands-on course is guaranteed to turn novices into mavens. You will use your own Mac or PC laptop and will receive a bound User Guide. Coulomb is now a MATLAB application, and so runs on all platforms. To register for the class, contact [vsevilgen@usgs.gov](mailto:vsevilgen@usgs.gov) mentioning the SCEC course; your place is reserved if you get a confirmation email. We have room for only 25 people.

**Coulomb 3.0** Graphic-rich deformation & stress-change software for earthquake, tectonic, and volcano research & teaching Shinji Toda, Ross Stein, Jian Lin, and Volkan Sevilgen  
AIST USGS WHOI USGS

**Overview    What's new?    Scientific Background    Download & Support    Training**



Funding by the  
**U.S. Office of Foreign Disaster Assistance**  
is gratefully acknowledged



You don't have to take the class to use Coulomb, but you will learn much faster with us. The program, user guide, and tutorial files are freely available from <http://www.coulombstress.org> or <http://quake.usgs.gov/~ross>, but you need to install MATLAB 7.X, with the Mapping Toolbox, before the class (many universities have site licenses, or students and faculty can buy it at the academic discount). You will be asked to register for Coulomb online, and every time you launch, you will be notified if a newer version is downloadable.

## Why Coulomb?

One can calculate static displacements (on a surface or at GPS stations), strains, and stresses caused by fault slip, magmatic intrusion or dike expansion. Problems such as how an earthquake promotes or inhibits failure on nearby faults, or how fault slip or dike expansion will compress a nearby magma chamber are germane to Coulomb. Geologic deformation associated with strike-slip or normal faults or fault-bend folds is also a useful application. Calculations are made in an elastic halfspace with uniform isotropic elastic properties following Okada [1992].

We believe that one learns best when one can see the most and can explore alternatives quickly. So the principal feature of Coulomb is ease of input, rapid interactive modification, and intuitive visualization of the results. The program has menus, sub-menus, check-items, and dialogue boxes to ease operation. The internal graphics are suitable for publication, and can be easily imported into illustration or animation programs for further enhancements.

## Key enhancements to Coulomb 3.0

- The 1377-patch California Fault Section Database is included as a Coulomb input file in several formats, supplying all geometrical features needed to use the faults as sources or receivers, including the rake of each fault. You can find the stress change caused by any earthquake on all known surrounding faults, or use the fault network to implement simple interseismic stressing.
- The Coulomb graphics can now be exported automatically to *Google Earth*, and you can now use latitude/longitude directly in all input and output files.
- You can now add active fault traces, coastlines, and earthquakes from online catalogs or Coulomb-bundled files. Many catalog formats (Global CMT, NSCN, hypoDD, JMA, Kandilli, etc) are supported. These overlays can then be included in the input files so they plot automatically when the file is rerun.
- Internal graphics are enhanced, more easily changed, and produce much smaller files than before. Graphics can be saved as vector-based .pdf files; numerical output can be saved as *Excel* (.csv) files.
- Stress changes can be resolved on faults in their individual rake directions, on specified rakes, or on optimal planes in the crust. Resolved stress changes can be viewed graphically in 3D or output to tables. Shear and normal stress changes can also be imaged, and the friction can be changed on the fly.
- Faults with tapered or tiled slip are easily generated within Coulomb. Tapering the slip gives more realistic stress changes for simple earthquake sources; tiled slip is used for variable slip models imported from source rupture model databases. Several variable slip examples are included.
- Draped wireframe and 3D deformation graphic outputs provide views of stresses and earthquakes that can be spun and tilted.
- You can now calculate and graphically plot the Coulomb stress imparted to earthquake nodal planes, and can import Global CMT data for this purpose. You can use the parameters to create input faults with appropriate dimensions and slip.