Short-Term Tectonics Science

By Brad Aagaard, USGS

IMMEDIATE, URGENT GOALS

- Post-doc / more developer time (51+%)
- Tecton features
- nonlinear rheologies
- friction
- large deformations
- semi-analytic codes (layered elastic and viscoelastic, internal and surface loads

SCIENCE

- Observationally constrained and internally consistent physics for the entire seismic cycle
  - earthquake nucleation and rupture dynamics
  - postseismic to nucleation
  - resolve strain localization, stress concentration
    - + fault rheology
    - + bulk rheology
- Integration of tectonic processes with heat flow, fluid flow; scaling of seismic to tectonic time-scales
  - temperature dependent rheologies
- Observationally constrained and internally consistent physics for tectonics of magmatic systems, geothermal systems, and the cryosphere
- Deformation resulting from loading/unloading of the crust (glacial rebound, reservoir impounding)

TOOLS

- Energy equation (temperature)
- Data assimilation and inversions
- Adaptive Mesh Refinement (resolve evolving strain localization)
- Coupling long-term deformation (GALE simulation) and short-term deformation (PyLith simulation)
- Workflow (geologic model - meshing - simulation - post-processing)
  - Implementation possibilities
  - Continued development of PyLith
  - p4est, deal.ii
  - X-FEM and related methods
  - FEniCS
  - Workflow (VisTrails)

ORGANIZATION STRUCTURE

- Working group
  - Software development
    - Accessible to new users
    - Flexible, extensibility for expert users
- Training (workshops)
  - Continue workshops
  - Complementary training
    - embedded/visiting scientists (travel grants for in-depth training)
    - Online
- Subcontracts for scientific driven cutting-edge development [feeding back into main software tools]
  - Spectral element basis functions
  - Solvers and coarse-scaling (homogenization) for dynamic weakening during rupture