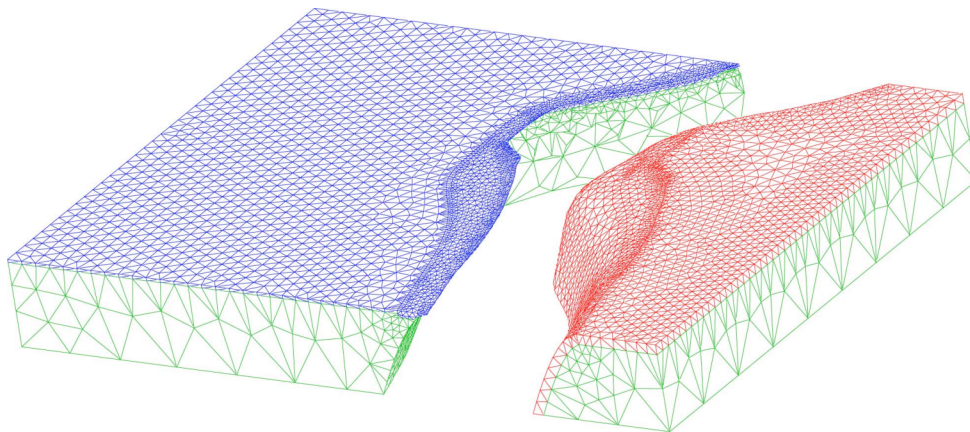


Contemporary strain and stressing rates across Alaska from interseismic and postseismic processes

Andy Freed (*Purdue*), Tabrez Ali (*Purdue*), and Jeff Freymueller (*U. of Alaska, Fairbanks*)

We are using a finite element model to calculate the contemporary evolution of stress in Alaska in an effort to identify regions of highest seismic hazard. We are interested in identifying regions with the fastest current stressing rates and regions of highest unrelieved stress accumulated over the past century. To date we have developed a geologically and seismologically constrained 3-D viscoelastic finite element model of the region that incorporates the highly contorted subducting Pacific slab and all active upper plate fault systems (figure below). The mesh was developed using the Cubit mesh generator toolkit [cubit.sandia.gov], while all calculations are performed using the CIG finite element code PyLith [geodynamics.org/cig/software/packages/short/pylith]. We drive the Pacific slab kinematically (i.e. velocity boundary conditions at surface and depth) in accordance with its observed motion relative to North America in a manner that maintains its current convergent geometry. This enables us to study how properties of the plate interface (i.e. locked and/or sliding megathrust) and currents within the mantle wedge influence strain and stressing rates within the North American plate. In addition to interseismic convergence, we are also simulating all of the major earthquakes to have occurred over the past century to incorporate stress changes due to slip as well as the influence of postseismic relaxation of the mobile mantle on strain and stressing rates. We are currently calibrating the model to geodetic (GPS) constraints prior to the 2002 Denali earthquake. Our initial results indicate that significant strain rates occur a few hundred km inboard of the megathrust and must be due to weakness (e.g., lower effective viscosity) in the upper crust (distributed or due to low angle faults at depth we cannot yet say). In addition, we find that currently measured southward velocities (anomalous since the Pacific plate drives northward) that extend more than 500 km inland in some locals, are consistent with continued on-going postseismic relaxation associated with the great M9.2 1964 Alaska earthquake. That postseismic responses are so long-lived is a testament to their overall importance in the evolution of the stress field through the earthquake cycle.

Our research has benefited greatly by the accessibility of PyLith's developers, who willingly help us work through solver problems (mostly user caused, sometimes code bugs) and are being very responsive to our need for the code to expand its capabilities, especially more complex rheologies, cohesive elements. The accessibility and expertise of the developers has been key to our continual progress on this project and will serve to make PyLith more versatile in the future.



Finite element mesh of Pacific plate subducting beneath North America