As part of the Global Earthquake Model (GEM) project (www.globalquakemodel.org), there is a need for geodetically constrained, high-resolution, strain rate models of plate boundary zones. These models can be used to assess the completeness of the moment rate budget implied by Quaternary faulting data bases and earthquake productivity rates, which are the typical foundations of any seismic hazard model. The ultimate goal is to create strain rate models that best satisfy the geodetic, geologic, and seismic observations simultaneously. Such models could reveal any significant discrepancy between Quaternary faulting slip rates and geodetic observations, and could constrain the maximum expected magnitude in light of a Gutenberg-Richter or Characteristic Earthquake distribution of seismicity.

We present strain rate models for southwestern North America and Alaska based on geodetic, geologic, and seismic observations. When solving for a continuous velocity gradient tensor field that best matches the horizontal GPS velocities, we use the seismic and geologic data as apriori constraints on the strain rate model covariance matrix. These constraints are essential to damp the solution, guarantee equal data fit in low and high straining regions, and avoid aliasing the strain rate model as a result of the uneven spacing of GPS stations. For the a priori strain rate variances, we use Quaternary fault slip rates from the USGS where available, and for all “non-faulting” cells of our model grid we combine unit summed moment tensors with strain rates associated with the moment release rate given an area's a- and b-value and assumed maximum moment. We will show results for this preferred model, but will also present the strain rate models that are based on either the geologic or seismic data alone. We will briefly discuss the significant differences between these models in terms of using these data sets in seismic hazard modeling.