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Strain pattern from geodetic measurements

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Even in the extremely well studied areas, like Southern California, some of the very destructive earthquakes like the 1994 Northridge MW 6.7 earthquake, occurred where they were not expected. As geodetic measurements, above all GPS data, provide outstanding possibilities in directly observing crustal deformation at active plate boundaries, they are of increasing importance for seismic hazard estimation. In particular with the deployment of dense networks like the one of SCEC in southern California in different parts of Europe, Southern America and Asia.

However, in order to characterize active faults in terms of slip rates, locking depths and earthquake recurrence times, the geodetic data have to be interpreted using models. The most common ones are the Elastic Halfspace Model (Savage and Burford, 1973), the Visco-Elastic Halfspace Model (Savage and Prescott, 1978) and the Elastic Block Model (McCaffrey, 2006; Meade, 2005). All these Models include rheologic assumptions and require geologic information (e.g. location of the faults and their locking depths) not always available with an appropriate accuracy. These uncertainties might introduce errors in the results. The application of such models are also very limited in terms of identifying unknown faults or areas of high seismic hazard due to high strain accumulation rates.

We apply a mathematical interpolation scheme, which only includes geodetic data in order to obtain strain rates. In doing so we calculate a field of the magnitude of the velocity and its gradient, which can be interpreted as strain accumulation rate. These results then can be used as a starting point for further modeling or geologic field work.