Effect of lithospheric model assumption on the interpretation of geodetic data.

Rocco Malservisi[1] **Gina Schmalzle**[2] **and Tim H Dixon**[2]

[1] *Dept. of Geophysics,Ludwig-Maximilians University, Muinich, Germany*
[2] *RSMAS, University of Miami, USA*

The use of geodetic measurements to evaluate the slip rate (thus slip deficit) along a fault during the interseismic period, is a very important tool for seismic hazards assesment. Unfortunately the geodetic measurement itself is only telling us the movement (or relative movement) of selected points and is not a direct measurement of the fault slip rate. In order to compute this value we need to introduce different assumptions on the behavior and the properties of the lithosphere surrounding the fault. The easiest assumption made in the analysis of geodetic data is the elastic half space assumption (e.g. Savage and Burfurd, 1973). This is directly derived from the elastic rebound theory and assumes that in the interseismic period the fault is locked to a defined depth and creep at a fixed rate beneath that level. Despite the oversemplify assumption this model in general can fit the geodetic data pretty well. Unfortunately, this model do not keep in account the earthquake cycle and the viscoelastic behavior of the lower crust/upper mantle. This effects can be very large in case that the recurrence of seismic event on the fault is very long respect to the relaxation time and can introduce big biases if we are interested in partitioning the strain among faults in different stages of their earthquake cycle (Dixon et al 2002). To solve this problem Savage and Lisowski (1998) introduced a model of an elastic layer over a viscoelastic half space loaded by an infinite number of ea! rthquake on an infinitly long fault that break through the elastic layer. Since this model is currently widely utilized we test here the effects of some of the assumptions in this model on the velocity field. In particula we analyze the effect of the assumption of the infinite number of earthquake that imply a quasi-steady state in the stress regime of the ductile material. We observe that if the material is relaxed before the event the relaxation is much more fast than expected by the model of Savage and Lisowski indicating that the local stress regime can have an influence on our extimation of the viscoelastic properti through interseismic data. We also analyze the effect of lateral heterogeneity in the elastic and/or viscoelastic material properties on the strain accumulation during the earthquake cycle.

References:

Dixon, Decaix, Farina, Furlong, Malservisi, Bennett, Suarez-Vidal, Fletcher, Lee, Seismic cycle and rheological effects on estimation of present day slip rates for the Agua Blanca and San Miguel Valencitos faults, northern Baja California, Mexico, JGR, 107(10) 2002.

Savage, Burfurd, Geodetic determination of relative plate motion in Central California, JGR, 78, 1973.

Savage, Lsowski, Viscoelastic coupling model of SAF, JGR, 103, 7281-72-92, 1998.