Geophysical Research Abstracts
Vol. 16, EGU2014-14924-2, 2014
EGU General Assembly 2014

Assessing the influence of viscoelastic stress change globally

Fatih Sunbul (1), Suleyman Nalbant (1), Sandy Steacy (1), and Thomas Parsons (2)

(1) Environmental Science Research Institute, University of Ulster, Northern Ireland, UK, (2) United States Geological Survey, California, United States

Long term viscoleastic effects play an important role in stress accumulation along faults. Developing a better understanding of these effects may lead to improve quantification of the seismic hazard in tectonically active areas.

Parsons (2002) computed at a global scale, the difference between the rate of earthquakes occurring in regions where shear stress increased and those regions where the shear stress decreased. Looking at the shear component of the stress tensor, he found globally that 61% of the earthquakes occurred in regions where there was a shear stress increase, while 39% occurred in areas of shear stress decrease. However, he considered only the coseismic period of the seismic cycle and very often this produces an incomplete picture of both the regional stress changes around the fault and its interaction with neighbouring faults. By examining both the coseismic and postseismic periods we aim to develop a more complete understanding of these phenomena.

We individually study the shear and the normal components of the stress tensor with the objective of making a final comparison between the results for each component. Another extension to Parsons' (2002) work is the inclusion of viscoelastic stress change in the calculations. Although the stress change contribution of the viscoelastic relaxation is small for short post-seismic periods and small number of events, when it is cumulated over long periods of time and for many earthquakes, it can become a major contributor to the total regional stress.

We are testing two crustal viscoelastic models, each consisting of three layers. In both cases the thickness for each layer was obtained from CRUST1.0 program. In the first model, the Strong Lower Crust- Weak Mantle (SLC-WM) we treat the upper crust layer as purely elastic, and a strongly viscoelastic lower crust and weakly viscoelastic upper mantle. In the second model, the Weak Lower Crust- Strong Mantle (WLC-SM) the upper crust remains purely elastic but the viscoelastic properties of the lower crust and mantle are reversed.

The comparison between these two cases allows us to assess the influence of the post-seismic viscoelastic stress change globally. Additionally, our approach allows more complete of the relationship between the global earthquake rate and the stress change.