A Slow Slip Event (SSE) of an equivalent magnitude Mw7.5 took place in Guerrero, Mexico during the year 2009-2010. It was formed of two sub-events distinguished in space and time, the latter one being probably triggered by the stress perturbation following the February 27th 2010 Mw=8.8 Maule, Chile, earthquake. The spatio-temporal evolution in shear stress of this SSE is determined from the kinematic inversion results of the slip evolution along the interface. Without imposing any friction law a slip weakening behavior is systematically observed over the whole slipping area, while no unique relation between shear stress and slip velocity is found. The mean slope of the slip weakening process (slip weakening rate) is about -0.5 [MPa/m], slightly lower than the value known for the dynamic rupture process of regular earthquakes at seismogenic depth.

The stress perturbation due to the Maule earthquake is found to be much smaller than the stress release during the SSE. However, the constitutive relation is unchanged before and after the 2010 Maule earthquake. The complex trajectory obtained between shear stress and slip velocity is fitted with a rate-and state-friction law through an inversion. The characteristic length (L) and the two other parameters ($A=a.\sigma n$ and $B=b.\sigma n$ where σn is the normal effective stress, a and b are two experimentally determined dimensionless constants) are obtained; for instance L = 4 [cm], A=0.001 [MPa] and B=0.02 [MPa] at the point of largest slip during the SSE. The direct (rate) effect A is very small and even negligible comparing to the evolutional (state) effect B during the SSE. If the common frictional values for b-a (b-a=0.004) is adopted, our analysis also infers a significant low normal effective stress of a few MPa. This could be coherent with the occurrence of SSEs within a high pore pressure zone.