In the present thesis we perform modeling of earthquake source using laboratory derive rate-and-state laws of friction. We have developed a code in Fortran 90 for modeling a planar, two-dimensional fault with general dip and heterogeneous distribution of frictional parameters. We use a quasi-dynamic approximation and assume that the fault is submnerged in an infinite elastic half-space. We performed an extensive number of numerical experiments to study the effect of fricitonal parameters distribution on the spatio-temporal complexity of slip on fault. We also study the effect of the so called Coulomb stress changed on clock advance and clock delay of events. For this purpose we use both a homogeneous model and a model of random frictional parameteres which exhibits the Gutenberg-Richter frequency-size dependence in the range of two magnitudes. We find that the effect of Couloumb stress change is nontrivial and depends on factors such as the domain of stress load and the slip velocity on it.