

Influence of the brittle creep fault zone on the seismic cycle

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The portion of the fault below the seismogenic fault zone has been shown to play an important role in the seismic cycle, especially in the postseismic period. We will refer to this zone as the Brittle Creep Fault Zone (BCFZ), and it is roughly defined as the portion of the fault between the isotherms 250° C and 600° C. The BCFZ is also of particular interest since it is where slow slip transients (named also slow earthquakes) have been observed. This is particularly clear in the Cascadia subduction zone but this class of events have been observed in other subduction zones, and also on different tectonic settings. We present a dynamical model of the BCFZ assuming that it obeys rate and state strengthening friction. We first show briefly that postseismic slip and aftershocks, in the case we have considered, seem to be driven by the relaxation of the BCFZ. In this case, the BCFZ respond to the large scale stress changes induced by the mainshock. We further study the effect of a localized stress perturbation and show that the corresponding response of the BCFZ generates slip transients similar to observed slow earthquakes. Those results illustrate the importance of the BCFZ in the seismic cycle, and also suggest that rate and state friction laws seem to be adapted to model the complex dynamic of this part of the fault.