

## On the physical mechanisms of slow events (I)

# Bunichiro Shibazaki[1], Yoshihisa Iio[2]

[1] IISEE, BRI, [2] ERI

Recently a lot of slow events have been observed by high-resolution observations of crustal deformation. For example, slow thrust slips were detected on the plate boundary around Lake Hamana. However, any realistic physical models for these slow events have not been proposed yet. Understanding the relationship between slow events and nucleation process is thought to be a key factor in predicting large earthquakes (Kawasaki et al., 1998). In the present study, we investigate the physical mechanisms of slow event through numerical simulations using some frictional constitutive laws.

There are two types of slow events. The one is a event which can not be detected in strain meter observations but is observable in GPS measurements. The other is a event which is observable in strain meter observations. First, we consider the former event. Slip velocity of this event is  $10E-9$  m/s, which is almost equal to the average rate of the relative plate motion. This kind of slow event can be reproduced using a rate- and state-dependent friction law. In simulations using a rate- and state dependent friction law, several years before instability, slip velocity is enhanced at the deeper part of the seismogenic zone. Slip velocity reaches  $10E-9$  m/s at some places at the deeper part of the seismogenic zone. By considering heterogeneity in constitutive law parameters, we can reproduce silent events.

Next, we consider a event, which is observable in strain meters. We consider the model proposed by Tanaka (2000) in which unstable slip coexists with flaw processes. The simplest law, which represents this process, is the constitutive law combining a rate- and state-dependent friction law and a flow law in series, which was first proposed by Reinen (1994). In this model, slow slip caused by flow process coexists with unstable slip. Slip and slip velocity during unstable slip is small compared with slip velocity of usual earthquakes. We will report results of numerical simulations for slow events using some frictional constitutive laws.