Estimation of parameter values for a slip-dependent friction law using slip-stress relations of the Boso slow slips

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Studies on friction laws and effective normal stress on faults is important for understanding fault behavior and earthquake events. Kobayashi and Sato (JpGU, 2019) proposed that relation of slip-rate and stress change for slow slip events can estimate absolute values of effective normal stress on the basis of a rate and state dependent friction law. This presentation proposes an estimation method of parameter values for a slip-dependent friction law from slip-stress relations of slow slip events using that friction force balances shear stress for slow slip events.

To obtain slip-stress relations of slow slip events, we used the daily F3 coordinate values of GNSS stations from the Geospatial Information Authority of Japan. The GNSS data were fitted with a time series model that takes account of the linear trend and seasonal variations in the data, and then the fitted data were smoothed. We made every 3 days transient movements from the smoothed data. From the 3 days data, we estimated slip distributions using ABIC inversion method. We calculated stress changes from the slip distributions using Coulomb 3.3 (in details, see Kobayashi and Sato, JpGU, 2019). We used a slip dependent friction law proposed by Matsu’ ura et al. (Tectonophys, 1992), which considers interaction between statistically self-similar fault surface and abrasion of surface asperities. Important parameters of this friction law are upper fractal limit of wave length on the fault and abrasion rate.

We need to determine a stress scale for comparing observed and theoretical relations between slips and shear stresses. We determined a stress scale from absolute values of effective normal stress estimated by Kobayashi and Sato (JpGU, 2019).

From the comparison of observed and theoretical relations between slips and shear stresses for the Boso slow slip events, we estimate about 100 cm for the upper fractal limit of wave length on the fault and about 0.01~0.1 for the abrasion rate.

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Keywords: Friction law, slow slip, abrasion rate, fractal limit of wave length

