

Modeling of the Boso slow slips and effects of the 2011 off the Pacific coast of Tohoku Earthquake on the slow slips

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1. Introduction

Slow slip events (SSEs) off the Boso peninsula have occurred at intervals of about 5-6 years. The Boso SSEs are characterized by occurrence at depth 10-20km on the seismogenic zone. In this study, we model the SSEs using rate- and state- dependent friction law with aging law and investigate value of parameters of friction constitutive law to simulate observed feature of the SSEs. Such a parameter study is important to identify the reason the Boso SSEs occur on the seismogenic zone and to estimate materials and states at the SSEs area. We also research effects of the 2011 off the Pacific coast of Tohoku Earthquake on the Boso SSEs.

2. Methods

In our modeling, the region of the Boso SSEs is set on the basis of an inversion analysis of Hirose et al. (2008). Since the SSEs occur spontaneously, we set velocity weakening ($a-b < 0$) in the SSEs area and velocity strengthening ($a-b > 0$) out of the area. We assume that effective normal stress (S_n) increases with depth, and is set to 5-7 MPa at the SSE area. We run simulations with various parameters of $a-b$, D_c only in the SSEs area. To investigate the effects of the 2011 Tohoku Earthquake, we include changes of shear and normal stresses on the plate interface due to the coseismic slip of the earthquake.

3. Results

The parameter study reveals that parameter sets which can simulate the Boso SSEs are limited. The parameter set of $S_n = 5-7$ MPa, $a-b = -0.004$, $D_c = 1.0$ cm can simulate observed interval, duration, and M_w of the Boso SSEs. The study with the effects of the 2011 Earthquake shows shortening of intervals with about 0.5 yr. This result may explain the shortening of intervals from 58 months (2002-2007) to 50 months (2007-2011).

Keywords: slow slip, parameter study, 2011 Tohoku Earthquake