Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SCG64-20 Room:501 Time:April 30 17:30-17:45

Numerical simulation of slow slip events before the 2011 Tohoku-Oki Earthquake

NAKATA, Ryoko[1*] ; ARIYOSHI, Keisuke[1] ; HYODO, Mamoru[1] ; HORI, Takane[1]

[1]JAMSTEC

In the Japan Trench, the M9.0 great interplate earthquake occurred on 11 March 2011, off the coast of Tohoku, Japan. Before this earthquake, two slow slip events (SSEs) were observed on 2008 and 2011. The second SSE occurred on February 2011 at the downdip end of the huge-coseismic-slip region, and it continued at least until the occurrence of the M7.3 largest foreshock on March 9 [Ito et al., 2013]. In addition, following the largest foreshock, postseismic slip propagated to the location of the mainshock hypocenter and triggered the dynamic rupture there [Ando & Imanishi, 2011].

In this study, we numerically simulated cycles for occurrences of seismic and aseismic events along the Japan Trench with the 3D geometry of the Pacific plate. We model the M9 2011 Tohoku-Oki Earthquake, the largest foreshock of the M9 earthquake, and the SSE before the foreshock using the slowness law, which is a type of rate- and state-dependent friction law. We set frictional properties at source area of earthquakes and SSEs to satisfy a condition of unstable slip and slow slip, respectively. We evaluated simulation results achieved using different values of frictional parameters with respect to characteristics such as the slip history leading to the 2011 Tohoku-Oki earthquake and crustal deformation before and after the Tohoku-Oki earthquake.

As a result, we quantitatively reproduced the observed scenario. Temporal characteristics of the resultant scenario were sensitive to both sizes and locations of the circular fault patches. Now, we are improving our model to reproduce various characteristics qualitatively. Based on some of the reasonable results achieved, we will discuss frictional conditions for the pre-seismic process of the 2011 Tohoku-Oki earthquake.