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Improvement of Source model for simulating strong ground motions during the 2008 Wenchuan earthquake

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1. Introduction

The Wenchuan earthquake with a moment magnitude of 7.9 (United Statue Geological Survey,USGS) struck the western part of Sichuan Province on 14 May 2008, China, resulting in about 70,000 fatalities as well as huge damage to infrastructures and buildings. Causes of serious damage of structures should be attributed to characteristics of strong ground motions and vulnerability of structures.

The strong motion records during the Wenchuan earthquake will be very useful not only in making source modeling for estimating strong ground motion but also in clarifying the relation between structural damage and strong ground motions through reproduction of ground motions at damage sites. We estimated the characterized source model for simulating ground motions using the empirical Green's function (EGF) method and the hybrid method for the 2008 Wenchuan earthquake (Kurahashi and Irikura,2010). However, it has some problems. One of the problems is that the ground motions at Wolong station (WCW) in backward direction to Asperity 2 have smaller amplitudes, compared with the observed. Second, the contribution from asperities on the north-east segment to ground motions was not considered. In this study, to improve these two problems, the analysis was performed by the discrete wave number method. This model is a tentative version.

2. Analysis

We adopt basically the characteristic source model for the south-west segment reported by Kurahashi and Irikura (2010). The best model was determined by try and error. We used the observed records at 13 stations including the WCW, SFB and MZQ near the source fault. We find that the observed records at WCW are reproduced considering the rupture starting point of Asperity 2 not at the edge of the asperity area but inside it. This means that the rupture on Asperity 2 propagated not uni-laterally but bi-laterally. As a result, the area of Asperity 2 became larger of fit the observed records in forward direction such as SFB and MZQ as well as those in backward direction such as WCW.

Next, we estimated the contributions of asperities on the north-east segment to ground motions as stations in north-east direction.

There are several observation stations near the northeast segment. Remarkable wave pulses at the stations were not observed.

In this study, the best model was determined by try and error comparing the observed and the calculated motions. As a result, we presumed four asperities at the north-east segment. The stress drops on asperities are taken from 10 to 13 MPa. In future, we attempt to simulate ground motions using the empirical Green's function method.