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Estimate of a non-planar fault model based on crustal deformation data due to the Iwate-Miyagi Nairiku earthquake(Mw6.9)

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Iwate-Miyagi Nairiku Earthquake

On 14 June, 2008, Iwate-Miyagi Nairiku earthquake occurred in the south of Iwate. The epicenter was located in the strain concentration zone along the Ou Backbone Mountains (Miura et al., 2004), in which the reverse faulting earthquake by EW compression was not surprising. However, there are no previously known active faults near the epicenter and thus crustal deformation observation has been mainly performed around Dedana fault to the northeast. There are 17 casualties in five prefectures of Iwate, Miyagi, Akita, Yamagata and Fukushima, and more than 2600 houses were damaged (Cabinet Office, AM11:00 on 23 June, 2010). It seems much more human suffering than the buildings collapsed and landslides because its epicenter is located in mountain area despite inland earthquake.

Previous Research and Purpose of study

Several studies on this earthquake have already been published. For example, Takada et al. (2009) estimated fault models using SAR data, in which five rectangular fault segments with uniform slip was assumed. Iinuma et al. (2009) inferred two west-dipping faults based on GPS data. Around its epicenter, however, there are few GPS observation points, and it is difficult to explain the detailed signals revealed by SAR data. Moreover, while all previous studies assumed rectangular-planar models, the observed crustal deformation data show complex spatial distributions. In order to explain the observed data, it is necessary to assume non-planar fault surfaces.

Observed Result

As a result of data analysis by InSAR and pixel offset technique, both data of ascending (South-North orbit) and descending (North-South orbit) detected more than 1 meter displacements along LOS (Line Of Sight). InSAR data indicates that this fault motion is consistent with reverse fault caused by EW compression. Also, in the result of pixel offset technique, there are characteristic displacements around the eastern edge of Mt. Kurikoma. This is a signal that can't be explained by a west-dipping fault. Thus, we inferred the fault plane normal to the ground surface, and assumed the non-planar east-dipping fault.

Estimate of non-planar fault model

Based on data by InSAR and pixel offset technique, we inferred a number of non-planar fault models, and performed inversion analysis. In modeling, we used triangular dislocation model assumed in a uniform elastic half space, and Gmsh (Geuzaine and Remacle, 2009) for its shape decision. Then, we calculated Green's function by triangular dislocation using Meade (2007) script. For the estimate of slip distribution, we applied a smoothness constraint as well as a"non-negativity"constraint (Maerten et al., 2005) on the slip direction.

We are going to show the fault model that can better-explain the observed data and analysis result, using GPS data as well.