Comparison of crustal movements along the Nankai trough area obtained by simulation and GPS observation

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We simulate great earthquakes along Nankai trough. Plate configuration has 3 dimensionally curved boundary. Plate subduction speed is constant in time. We apply rate- and state friction law on plate boundary located in an elastic half body having constant rigidity. When we set friction parameter a-b as negative at depth from 10km to 30km, great earthquakes occur repeatedly along Nankai trough. We can calculate crustal movement for any time and any point by simulation results.

Along Nankai trough, great earthquakes have occured with the period of 90 years to 150 years. The last series of great earthquakes are the Syowa Tonankai earthquake in 1944 and Syowa Nankai earthquake in 1946. At that time, observation of crustal movement was insufficient. But, in 1990's, we can easily observe crustal movement along Nankai trough, as Geographical Survey Institute established GPS observation network called GEONET in Japan..

So, we compare crustal movements obtained by simulation and GPS observation. The observed crustal movement are estimated from the differential data of GEONET between Jan.-Feb., 1999 and Jan.-Feb., 2000, that is not affected by the Tokai slow slip event.. This period is about fifty years after the last Nankai earthquake. The simulated crustal movement we use to compare is that at about fifty years after a large earthquake in simulation. By comparing these results, we can possibly find suitable conditions of the simulation. We change distribution of subduction speed, plate configuration and evolution law of rate- and state friction law. We compare between results and observation.

We use two kinds of distribution of subduction speed. One is based on Seno et al.(1993) and another is based on Heki and Miyazaki(2001). Crustal movement simulated by subduction speed based on Seno et al.(1993) is consistent with that of GPS observation. We use two kinds of plate configuration. One is based on seismicity along plate boudary and another is based on DD-tomography and seismic survey. The simulation results for both configurations are almost the same. We simulate using two kinds of evolution law of rate- and state friction law. One is slip law and another is composite law. Both results are almost the same.

We also calculate crustal deformation just before an large earthquake begins using the distribution of subduction speed based on Seno et al.(1993). We find reversal crustal movement in a few years before an earthquake begins.

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