

Seismotectonics of the Central Japan inferred from a block-faults model analysis

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Interplate megathrust earthquakes have repeatedly occurred along the Nankai trough, east off the Kii peninsula. The inland area of central Japan is also tectonically active, and the Niigata-Kobe Tectonic Zone (NKTZ) [Sagiya et al. (2000)] and many active faults accommodate east-west contraction between northeastern and southwestern Japan. We analyze the GPS velocity in central Japan data to discuss interplate as well as inland deformation.

The GPS displacement rate data are based on daily coordinates of 227 stations in the central Japan from April 1996 to March 2000. We use a inversion program DEFNODE developed by McCaffrey (2002). The software simultaneously solves rotation velocities of blocks on the spherical surface, elastic strain rates within each block, and coupling fraction or slip deficit on the block boundary faults. We assume the plate boundary configuration at Nankai subduction zone by Ozawa and Sagiya (2007) estimated from microearthquake hypocenters and seismic exploration results. The study area is divided into several blocks referring to GPS data, distribution of active faults and seismicity data. We choose the optimal block model with Akaike Information Criterion (AIC).

The optimal model estimated takes NKTZ, Yoro-kuwana-Yokkaichi faults (YKYF), Itoigawa -Shizuoka Tectonic Line (ISTL) into account as block boundaries. Estimated slip deficit distribution of the Nankai Trough is consistent with the previous work by Ohta et al. (2004).

It also corresponds well to the coseismic slip distribution of the 1944 Tonankai earthquake estimated by Kikuchi et al. (2003). Estimated relative block motions show a good agreement with these based on geological data. Therefore, our result demonstrates that deformation signals detected by recent GPS observation reflect not only temporary crustal deformation but also long-term one over centuries and millenniums. We also estimate seismic moment accumulation rates within model blocks from block strain rates with Kostrov's (1974) formula. Average moment accumulation rate within NKTZ block is comparable to the moment release rate in the block estimated from the seismic activity for 85 years (1923-2007). Based on this result, we speculate that deformation of NKTZ is basically elastic and accumulated strain energy is mainly released seismically.