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Investigation of Asperity and Rupture Nucleation for Earthquake Scenarios along the Itoigawa-Shizuoka Tectonic Line

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The Itoigawa-Shizuoka Tectonic Line (ISTL) is one of the active fault systems whose probabilities of occurrence are estimated to be high in long-term evaluation. In order to evaluate the earthquake hazard along the ISTL area, the Headquarters for Earthquake Research Promotion (HERP) of Japan predicted strong ground motions assuming earthquake scenarios along the ISTL [HERP, 2002]. Recently, the Integrated Research Project for the ISTL provides a lot of survey findings those are useful to construct the source model along the ISTL, such as seismic profiles across the fault segments, geomorphological surveys, distribution of the seismicity, and seismic velocity and electric conductivity tomography images.

Based on the above results, Ishise et al. [2008 SSJ fall meeting] proposed a new ISLT source model with six fault segments for strong ground motion prediction, and calculated peak ground velocities using the attenuation relationship. The results indicated that dip angles of the fault planes as well as the amplification factor of the shallow subsurface layers affects the distribution of peak ground velocities.

Another evaluation method for strong ground motion prediction during large earthquakes is to simulate ground motion time histories. This is more realistic scheme because it includes the effect of the earthquake rupture process on the heterogeneous fault plane. In order to perform the advanced strong ground motion prediction, we need to specify inner fault parameters that represent the heterogeneity inside the source fault, such as asperity, and extra fault parameters such as the location of rupture nucleation.

In this study, we investigate the locations of asperity and rupture nucleation for earthquake scenarios along the ISTL using various geophysical observations. For the locations of asperity, it is often observed that asperities estimated by source process analyses coincides with locations of (a) high Vp, (b) low seismicity, (c) high conductivity, (d) slip deficit, and (e) large offset. Following these relationships, the asperities are likely to be in Hakuba (a), Ikeda (a), Sakamuro (a), Lake Suwa (c), central part of Fujimi (b). As for the location of rupture nucleation, (a) low Vp and high Vp/Vs, (b) low conductivity, (c) earthquake swarm, and (d) fault branching are likely to be evidence of the rupture starting point. Following them, the location of rupture nucleation is set either at Lake Aoki (c), Lake Suwa (d), Matsumoto (d), or western part of Fujimi (b, c).