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Two-ship deep seismic profiling across the Kozu-Matsuda fault, Sagami trough, central Japan

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The Kozu-Matsuda fault runs parallel to the axis of the Sagami trough and shows large slip-rate in late Quaternary. Based on the paleo-seismic records, the probability to rupture for next 30 years of this fault shows one of the highest values in the onshore active fault in Japan (The Headquarters for Earthquake Research Promotion, 2005). However, this evaluation is based on the fault behaviour of an isolated inland fault. The deep seismic reflection profile across the fault system along the Sagami bay in 2003 (Sato et al., 2005) suggests that this fault is a mega-spray from the subduction megathrust. In case of a spray fault, rupturing occurs only associated with megathrust, suggesting the probability is much smaller that currently estimated. The previous profile suggests that the smooth plane geometry of the megathrust. However, the image of the converged part of KM fault with megathrust is not so clear. To reveal the connectivity between the splay fault and mega-thrust, deep seismic profiling was undertaken across the Sagami trough in September 2009. The survey was carried out using two ships: a ship towing 2-km-long streamer cable with 480 cu. Inch air-gun, and another ship with 3020 cu.inch. air-gun. The offshore seismic line has 47-km in length and extended to Miura and Izu peninsulas for 8 and 12 km, respectively. Onshore part, offline recorders were deployed forming a receiver array of 50 m interval. All air-gun shots were recorded by onshore recorders. To resolve deeper structure, large offset shot gathers were produced by changing the offset between two ships. A seismic reflection profile was produced by using conventional CMP-methods. P-wave velocity profile was obtained by diving wave tomography. P wave velocity structure was solved down to 15 km in depth in the central part of the seismic section. The subducted Philippine Sea plate (PHS) is marked by east dipping reflectors. The upper surface of PHS is identified at 4.5 sec (TWT) at the trough axis and traced to 6.5 sec (TWT) beneath Miura peninsula. The location of upper surface of PHS coincides with the result of the deep seismic profile along the Tokyo bay (Sato et al., 2005). The velocity profile of the upper part of PHS shows lateral heterogeneity at the western part of the Sagami trough. Here, the upper part shows reflective characterization and low velocity (ca. 4 km/sec). Beneath the surface trace of the Kozu-Matsuda fault, high-velocity mound with poor reflection is located. It is interpreted as a probable volcanic mound. The trough fill sediments form gentle anticline at the eastern part of the trough axis. Thus, it is interpreted that the tip of megathrust exists beneath the trough axis. The Kozu-Matsuda fault occurs as an emergent thrust and identified as a boundary between gently east dipping domain at the footwall and steeply east dipping domain at the hanging wall. The fault surface is traced down to 6 sec (TWT) as east dipping at moderate angle. At the present stage of analysis, the direct connectivity with the megathrust and this fault is obscure. Reflection from the megathrust shows large amplitude at 5 to 6 sec., and poor in the deeper part.