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Deep seismic reflection profiling of the subduction megathrust across the Sagimi trough and Tokyo bay, Japan

Hiroshi Sato (1), Takaya Iwasaki (1), Susumu Abe (2), Hideo Saito (2), Taku Kawanaka (2), and Naoshi Hirata (1)
(1) ERI, The University of Tokyo, Tokyo, Japan (satow@eri.u-tokyo.ac.jp), (2) JGI Inc., Tokyo, Japan

Beneath the metropolitan Tokyo, the Philippine Sea plate, in particular the fore arc portion of the Izu-Bonin island arc, has been subducted. Subduction megathrust beneath Tokyo generated M-8 class earthquakes, such as the 1923 Kanto (M7.9) and 1703 Genroku (M8.0) earthquakes. Due to the buyant subduction of the Izu-Bonin arc, the megathrust lies very shallow part of the crust. The Kozu-Matsuda fault, probable spray fault from the megathrust, emerged at the surface. In 2009, we acquired the deep seismic reflection data across the toe of the thrust system to reveal the connectivity of the probable spray fault to the megathrust. Together with the deep seismic section acquired in 2003, we show a 120-km-long deep seismic reflection profile from the front to 30 km in depth and discuss the geometry and characteristics of the thrust system. We performed deep seismic profiling across the Sagami trough for a 70-km-long seismic line in September 2009, using two ships for offshore seismic data acquisition: a gun-ship with a 3020 cu. inch air-gun and a cable-ship with a 2-km-long, streamer cable and a 480 cu. inch air-gun. The seismic signals were recorded at Miura and Izu peninsulas located both ends of the seismic line. At both sides of the onshore line, off-line recorders were deployed along total 20-km-long seismic lines at a 50m interval. Seismic reflection data were acquired by different offset of ships making large-offset gathers. The northeast end of the seismic line connected with the 2003 Tokyo bay seismic line (Sato et al., 2005: Science). The obtained seismic sections portray the detailed geometry of the spray faults, suggesting an emergent thrust with 4 km thick landward dipping strata. It merges to the megathrust at 6-7 sec (TWT). Judging from the geometry of fault-related fold in the trough fill sediments, the tip of the megathrust is located at 3 sec (TWT) beneath the trough axis. According to the co-seismic crustal deformation, the slip of the 1923 Kanto earthquake occurred along the main megathrust. According to the paleoseismic trenching survey of the spray fault (the Kozu-Matsuda fault, KMF), KMF displaced from AD 1100 to 1350 (Kanagawa Pref., 2005). Shimazaki et al. (2009: JpGU meeting) found the tsunami sediments correlatable to the 1923 Kanto, the 1703 Genroku and 1293 seismic event. Judging from the connectivity of KMF to the megathrust, the seismic event of AD 1293 was caused by displacement of the megathrust and out-of-sequence spay fault (KMF). From the coseismic crustal deformation and seismic waveforms of the 1923 Kanto earthquake, the locations of asperities were well determined (Sato et al., 2005). The distribution of slip deficit on the plate interface determined by GPS (Sagiya and Sato, 2005: Seismol. Soc. Jpn. meeting) accords well to the estimated asperity zone. On the seismic reflection profile, the asperity zone (stack plate interface) is marked by poor reflection from the fault surface and the plate interface is clearly identified as strong reflectors at the deeper steady creeping zone.