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Active emergent thrust associated with a detachment fold: A case study of the eastern boundary fault of Takada plain, central Japan

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To estimate seismic hazards, understanding the relationship between active fault and seismic source fault is crucial. Along the Japan Sea coast of Northern Honshu, Japan, thick sediments, deposited in the Miocene rift-grabens, formed fold-and-thrust belt, due to the shortening deformation since the Pliocene time. Most of the thrusts are active and show clear geomorphological evidences. Some of the thrusts are secondary faults, produced by the folding of competent layers. To elucidate the relationship between an emergent thrust and deep-sited seismogenic source fault, we performed shallow high-resolution seismic reflection profiling across the eastern boundary fault of the Takada plain, central Japan. Based on the moropho-tectonic data, the vertical slip rate of the Eastern boundary fault of the Takada plain is 0.9 mm/y and has potential to produce M7.2 earthquake (AIST, 2006). For shallow structure, we obtained CMP-seismic reflection data from a 7-km-long seismic line, using 541 channels of off-line recorders. Seismic source was an Envirovibe (IVI). Receiver and shot intervals are 12.5 m and seismic signals were recorded by fixed channels. Shallow seismic data were acquired as a piggy-bag project of 70 km-long onshore-offshore deep seismic profiling.
High-resolution seismic section portrays the emergent thrust, dipping to the east at about 30 degrees. The hanging wall consist Pliocene interbedded mudstone and sandstone and deeper extension of the thrust can be traced down to the Miocene mudstone of the Teradoamri Formation as a low-angle fault. In the Niigata basin, the lower part of the Teradomari Formation is known as over pressured mudstone and shallow detachments are commonly developed in this unit. Based on the deep seismic section, including velocity profile obtained by refraction tomography, deep sited fault does not connect to the shallow active fault directly.