Shallow crustal structure and slip tendency of normal faults in the outer rise of the Japan Trench

*Yue SUN[1], Ayumu Miyakawa[2], Koichiro Obana[3], Ehsan Jamali Hondori[4], Jin-Oh Park[1]

1. Atmosphere and Ocean Research Institute (AORI), The University of Tokyo, 2. National Institute of Advanced Industrial Science and Technology (AIST), 3. Japan Agency for Marine-Earth Science and Technology (JAMSTEC), 4. Geoscience Enterprise Inc. (GSE)

Many normal faults have developed in the outer-rise of the Japan Trench, including a mixture of recent faults caused by oceanic plate bending and reactivated faults that were created during plate formation. In the vicinity of the Japan Trench, outer-rise earthquakes (M8 class) which generated huge tsunamis had previously occurred after megathrust earthquakes. However, it is still unclear what kind of faults are most likely to trigger outer-rise earthquakes. It is important to understand the shallow crustal structure and geometry of the normal faults developing in the outer-rise of the Japan Trench, as well as the development process and activity of the normal faults in terms of evaluating the risk of earthquake occurrence under current stress filed. In this study, shallow crustal structure and fault geometry were studied using several MCS (Multi-Channel Seismic) profiles covering the seaward side of the Japan Trench. Fault strikes were extracted from the seafloor bathymetry map and dip angles were interpreted from the 2D seismic sections after a time-to-depth conversion of time-migrated profiles. To evaluate the activity of normal faults, the near-fault stress field was calculated from the earthquake catalog data, and the fault slip tendency was estimated with stress field and fault geometry. We found that the slip tendency in west-dipping faults is significantly higher than slip tendency in east-dipping faults. An area of low fault activity is recognized around 38.5˚-39˚N near the Japan Trench, where the magnetic anomalies do not continue and fracture zone faults are developing. Based on the fault activity analysis, this study shows that the earthquake occurrence in the outer-rise of the Japan Trench is spatially heterogeneous and more likely to occur on the west-dipping faults.

