Upper mantle P-wave velocity structure beneath the northern Ryukyu subduction zone from multiscale finite-frequency traveltime tomography

*Shu-Huei Hung[1], Ban-Yuan Kuo[2], Pei-Ying Patty Lin[1], Yuancheng Gung[1], Eh Tan[2], Huihsuan Chen[3], Chau-Chang Wang[4], Shuichi Kodaira[5], Yasushi Ishihara[5], Mamoru Nakamura[6], Ching-Ren Lin[2]

1. Department of Geosciences, National Taiwan University, 2. Academia Sinica, 3. National Taiwan Normal University, 4. National Applied Research Laboratories, 5. JAMSTEC, 6. University of the Ryukyus

We conduct a multiscale finite-frequency tomography of upper mantle structure beneath the northern Ryukyu subduction zone, where the Philippine Sea Plate (PSP) subducting beneath the Eurasian continent forms a trench-forearc-arc-backarc system. The data comprises of vertical-component P waveforms of teleseismic earthquakes with epicentral distance of 30°-95° and magnitude greater than 5.5 recorded by 3 island stations from the F-net network of Japan and 26 broadband ocean-bottom seismometers from the Taiwan-Japan collaborative experiment deployed between Sept. 2018 and June 2019 in the study area. Relative traveltime residuals between the recording stations for each event are measured by cross correlating the band-pass filtered waveforms at periods of 8-20 s. Those with the cross-collelation coefficients > 0.8 are retained for the tomographic inversion of 3-D P-wave velocity perturbations at least down to the depth of 300 km. Data-adaptive, finite-frequency traveltime kernels in conjunction with multiscale wavelet-based parameterization are adopted to resolve the multi-resolution velocity structure. The resulting model reveals a low-velocity anomaly in the forearc wedge and a high-velocity lid in the uppermost 80-km depth beneath the northern Okinawa Trough (NOT) and Ryukyu arc which may correspond to the overriding Eurasian continental lithosphere. Besides, a trench-parallel elongated fast anomaly extending at least down to ~200 km depth and most likely associated with the subducted PSP slab is observed under the NOT. Further appraisal of model resolution and S-velocity structure will be undertaken to verify these resulting seismic features.