

Deciphering Lithospheric Structures in Transition from Continental Subduction to Arc Collision beneath Southern Taiwan: Integrative Seismic Investigations from the SALUTE Project

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The Southern Array for the Lithosphere and Uplift of Taiwan Experiment (SALUTE) is an amphibious seismic initiative expedition in southern Taiwan and its eastern offshore region. This area, lying at the juncture of the Eurasian Plate subduction and Luzon Arc collision, is crucial for understanding the spatiotemporally evolving Taiwan orogen. The project aims at integrating multi-faceted, array-based seismic imaging, tomography and modeling methods to comprehensively explore the structure and dynamics of the crust-mantle system in this critical transition zone. Here we present major findings from earthquake datasets recorded since October, 2021 by the SALUTE array which consist of 31 closely-spaced broadband inland stations and 11 ocean-bottom seismometers approximately in a cross-shaped configuration. Teleseismic P receiver functions image structures with sharp velocity contrasts, such as the upper/lower crust interface, the hyperextended thin (lower) crust and vertically-disrupted Moho in the rifted Eurasian continental margin of SW Taiwan and the east-dipping Moho associated with the subducted Eurasian lithosphere beneath eastern Taiwan and eastern offshore region. Results of SKS/SKKS splitting analysis reveal intricate details of lithospheric deformation and asthenospheric mantle circulation induced from the interaction of two opposite-vergent subducting Eurasian Plate and Philippine Sea Plate. Additionally, attenuation tomography constrained from P- and S-wave spectral amplitudes indicate the variations of the resulting inverse quality factors, i.e., P- and S-wave attenuation are spatially correlated, decaying at a similar rate with frequency. Moreover, it uncovers a strong positive correlation between elastic wave speeds and inverse quality factors of P and S waves, consistent with seismic characteristics of subsurface geological units. These outcomes collectively enhance our understanding of the complex interplay of subduction and collision processes in shaping the crust and uppermost mantle structures and influencing seismic activities.

Keywords: amphibious broadband array receiver function, shear wave splitting, attenuation tomography, Eurasian continental subduction, Luzon arc collision, southern Taiwan