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Tomography of subduction zone in southern Taiwan: an implication of subducting seamount beneath the forearc

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This paper investigates velocity structure of the active plate boundary in southern Taiwan by joint analysis of gravity anomaly and seismic arrival time data from 3,238 earthquakes. In addition to CWBSN permanent networks, seismic data include the Central Weather Bureau permanent networks and a temporary network consisting of 11 ocean bottom seismometers (OBSs) that was deployed to collect the aftershocks of a ML7.1 earthquake occurred beneath southern Taiwan. The total available OBS data set consists of $\sim$700 detected earthquakes, from which about 450 events have been used in simultaneous inversion for hypocenters, three-dimensional Vp and Vp/Vs models for the study area. The aim of incorporating gravity analysis is used to improve the velocity model for the offshore area, where it is poorly sampled by local earthquakes. This study found a low-velocity zone existing above the subducting South China Sea slab in the mantle wedge. Based on gravity modeling and resulting velocity models suggest that the subduction complex, which is characterized with a low P-wave velocity and low Poisson's ratios beneath the southern Taiwan. This duplex structure is characterized by a zone of low P-wave velocities in the range of 6.2–6.8 km/s between 25 and 40 km depth which could be interpreted as a subducting seamount with the penetration of the South China Sea Plate. It also shows that earthquake hypocenters do not fall within this low velocity zone. We have also used seismic tomography velocities to estimate the volume percentage of serpentinite and silica concentrations in southern Taiwan. The calculated serpentinite is about 30% and the volume percentage of quartz estimated is about 20% at the base of the forearc lower crust.