

Study on the spatial and temporal change of velocity structure before and after 2003 Chengkung earthquake, Taiwan

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Taiwan is located in the plate converge zone, in which the Longitudinal Valley(LV) is the suture zone between the Eurasian Plate and Philippine Sea Plate. The collision process yields two nearly parallel major fault systems: the Central Range fault (CRF) and the Longitudinal Valley fault(LVF). The Chihshang fault is a creeping thrust fault, which is located in the southern section of the LVF in eastern Taiwan. According to geodetic survey, this fault moves to northwest at a rate approximately 2–3 cm/yr. There were two significant earthquakes occurred nearby the Chihshang fault, the 1951 M7.1 Hualien-Taitung earthquake and the 2003 M6.4 Chengkung earthquake. In this study, the spatial and temporal variations of velocity structure before and after 2003 Chengkung earthquake were obtained through the tomography inversion beneath the southern segment of the Longitudinal Valley. The damping least-square technique and 3D ray tracing scheme were adopted to calculate the most appropriate solution and obtain the velocity structures. The results showed that the V_p values exhibit less significant variations than the parameters V_s and V_p/V_s ratio. But the V_s structures show larger variation after the 2003 mainshock. These results imply that V_p/V_s ratios began to increase before the mainshock, at the hanging wall of the Chihshang fault, which may be related to the increasing density of microcracks and fluid. Previous studies has shown that high V_p/V_s ratio may lead to cracks generating and fluid migration, which can result in changing rock volume and produce partial compensation. Therefore, our results not only give better understanding the seismogenic structures in the ES Taiwan, but also allow us to detect variations of physical parameters caused by crack propagating in stratum during the strong earthquake sequence. Hence, this study shows that the results from temporal and spatial variation of V_p/V_s values in the southern segment of the LVF could allow us to assess the seismic hazard potential in this area, and further explore the relationship between the seismicity and the rheology of fault plane. Finally, long-term monitoring of fault activities will contribute to the research of future earthquake early warning.

Keywords: spatial and temporal variations, V_p/V_s ratio