High-Resolution Imaging of Fault Zone Structure and Its Temporal Variation

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High-resolution fault zone structure is essential for understanding seismogenic environment, seismicity distribution, earthquake rupture process, and earthquake hazards. Its temporal variation provides important information for stress variation and earthquake nucleation process of active fault zones. A linear array double-difference adjoint tomography method using ambient noise data was proposed and applied to the central Tanlu fault zone. The resulting high-resolution upper crust Vs models reveal a continuous low-velocity anomaly in the upper crust beneath the eastern branch of Tanlu fault zone. Using a standard spectral ratio (SSR) method, we found significant amplification effects at specific stations along the eastern branch of the TLFZ also suggesting a localized low-velocity zone along the fault. In the Anninghe fault zone, SW China, we observed clear upper crustal low velocity zone and significant site amplification around the eastern branch of this fault zone using dense array data. In order to obtain temporal variations of the fault zone structure, we used coda waves of ambient noise autocorrelation functions to obtain temporal velocity variations around the Anninghe fault zone. We observed that tidal forces can significantly affect velocity changes within the fault fracture zone, inducing periodic changes in seismic velocity on daily, semi-diurnal, and monthly scales. Moreover, the response to Earth tide is notably more pronounced in the fault fracture zone compared to other areas. This can be attributed to tidal forces affecting the opening and closing of cracks in the fault fracture zone. In order to better capture the physical process of active fault zones, we propose to establish an integrated geophysical experiment site to monitor temporal variations of multi-physical parameters in SW China.

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