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Seismic Ambient Noise Study in the 2008 Wenchuan Earthquake and its Adjacent Region

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Body : Seismic ambient noise correlation function(NCF) method has the very important property of not needing a specific seismic source and having the ability to simulate repeative point source, hence has become one of the most versatile seismology methodology for seismic tomography and earth medium monitoring. Since October, 2006, the Western Sichuan passive Seismic Array (WSSA), which consists of 297 broadband stations with an average of 20~30km station spacing, had been continuously operating for more than 2 years. The period of recording of the WSSA spans the 2008 Wenchuan Mw 7.9 earthquake, and the network covered the southern 2/3 of the fault system activated during the earthquake. The WSSA provided an ideal dataset for both imaging of the high resolution crustal structure and the monitoring of temporal structural changes associated with the Wenchuan earthquake.

We used continuous recordings from WSSA to extract empirical Green's functions by long-term cross-correlations. Rayleigh wave phase velocity structure and 3D shear velocity structure are then obtained. Our results showed large area low velocity zone in the middle and lower crust under Chuandian block, which could support the channel flow conjecture. Large area of low velocity zone also exist under the Songpan-Ganzi block, but the crustal stucture is relatively complex. Nevertheless it inferred evidently weaker crust than that in the Sichuan basin. NCFs in a 30-day moving window for periods between 1 and 3 seconds are further computed, and a doublet analysis on the NCF coda is performed to detect temporal velocity changes with respect to a reference correlation. We found clear evidences that the seismic velocity drops by an average amount of about 0.05% in the fault region after the Wenchuan earthquake, while the velocity fluctuates within 0.02% in the months before the earthquake. We compared the measurements in different sub-arrays to get a spatial distribution of the velocity changes. This distribution is consistent with the pattern of stress change during the Wenchuan earthquake.