A study on shear wave splitting of local earthquakes based on the Array of BinChuan (ABC), Yunnan

Hui Dou[1], Baoshan Wang[1], Yihe Xu[1,2], Weitao Wang[1]

[1]Key Laboratory of Seismic Observation and Geophysical Imaging, Institute of Geophysics, China Earthquake Administration, Beijing 100081, China, douhui_crg@163.com
[2]School of Earth Sciences and Engineering, Nanjing University, Nanjing 210046, China

The Binchuan area, located in Yunnan Province, is situated on the southeastern margin of the Tibetan Plateau. Subjected to eastward extrusion of the plateau, it forms the second largest basin in the northwestern Yunnan Rift Zone. The area is both densely populated and surrounded by two active faults that is the Chenghai fault in the east and the Red River-Ailaoshan fault in the south. A better understanding of the active system will contribute to mitigating the potential earthquake risks in northwestern Yunnan.

The regional tectonic stress background is meaningful for assessing seismic hazards, which relates to anisotropy caused by aligned micro-cracks in the crust. Shear wave splitting serves as a good measurement of the anisotropy. The polarization direction of fast shear waves and the time delay of the slow shear waves are effective parameters for analyzing the stress environment.

We chose an automatic shear-wave splitting measurement tool (Savage et al., 2010), which is presented for three-component local earthquakes, to calculate the splitting parameters. The sole manual step of the technique is choosing an S arrival time. The technique is based on the eigenvalue minimization technique and the cluster analysis method. Applied over multiple measurement windows, the technique uses the dominant period of each waveform to set the minimum and maximum window lengths. Cluster analysis determines the best solution among all the filters, and quality grading criteria assess the results automatically.
The local earthquakes recorded by the ABC are used to study the area's shear wave splitting. The ABC is covered by 381 three-component short-period seismometers, and recorded 62 local earthquakes during the period from March 25, 2017 to May 25, 2017 (Figure 1).

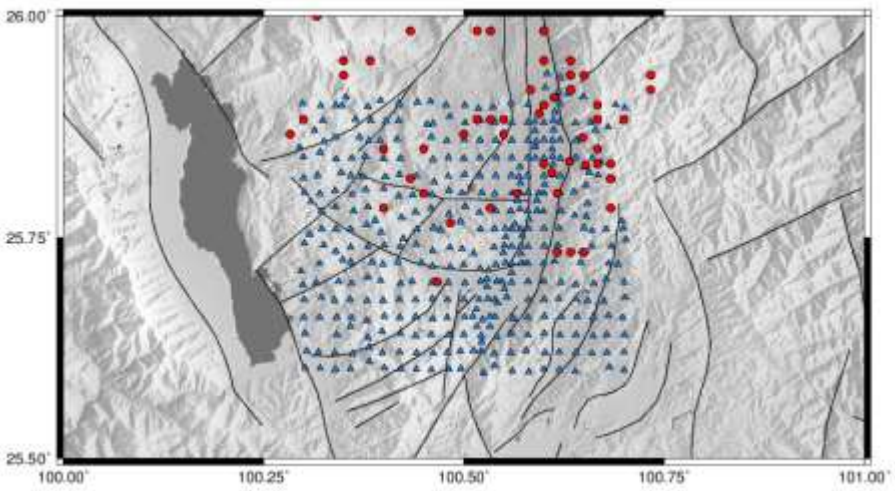

Figure 1. Distribution of ABC (triangles) and local earthquakes (circles).

The shear-wave splitting results for the better quality are shown in Figure 2. The polarization directions are mainly NNW, NS, and NNE. Among these, the NNW direction can be related to the Red River fault, whereas others are related to the Chenghai fault's sub-branch. The combined results demonstrate that the

average fast shear wave polarization is $-25.6^{\circ} \pm 3.3^{\circ}$, and the average time delay of slow shear waves is $0.208 \pm 0.003s$. The negative sign represents a counterclockwise from the north. That is, the average polarization is NNW, which suggests that the predominant polarizations are related to the horizontal principal compressive stress in the Binchuan area, as well as to the strike of faults in the southern Binchuan Basin. Besides, some stations' results with scattered distribution may show a complicated stress background in the area.

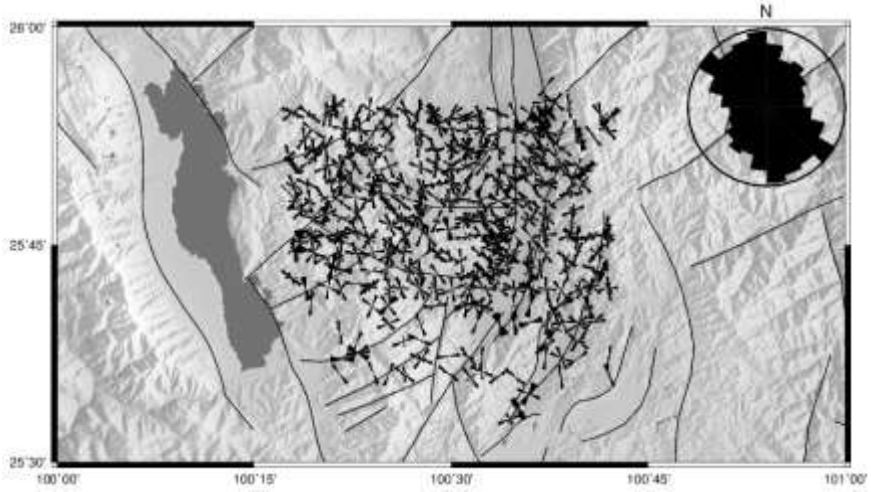

Figure 2. Map of the shear-wave splitting results. The upright diagram is the combined result from 297 stations. Others are rose diagrams at each station.

Reference

M. K. Savage A. Wessel N. A. Teanby A. W. Hurst ,2010. Automatic measurement of shear wave splitting and applications to time varying anisotropy at Mount Ruapehu volcano, New Zealand. Journal of Geophysical Research, 115, B12321, doi:10.1029/2010JB007722.