

Integrated interpretation of b-value variations and 3D electrical structure in the Anninghe-Zemuhe-Daliangshan fault zone

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SUMMARY

The Anninghe-Zemuhe-Daliangshan Fault Zone (AZDF) is a significant boundary region between the southeastern margin of the Tibetan Plateau and the South China Block. Over the past 40 years, this area has developed into a substantial seismic gap. This study compiles the precise earthquake catalog for the AZDF from November 1981 to April 2023. Based on this data, we calculated the spatial distribution of the b-value and analyzed its temporal evolution over four-year intervals. We then integrated these findings with the 3D electrical structure of the Ludian earthquake region for a comprehensive interpretation.

The results show that the low b-value area in the AZDF are located between the mid-northern section of the Zemuhe Fault and the mid-section of the Daliangshan Fault, indicating a higher seismic risk. The four-year difference of b map (Δb_4) results clearly demonstrate a continuous increase in the b-value decline before the Ludian Ms6.5 earthquake. This decline gradually shifted from the eastern side of the intersection of the Zemuhe Fault, Daliangshan Fault, and Xiaojiang Fault towards the area between the Baoguoao-Xiaohe Fault and the Ludian-Zhaotong Fault, indicating that pre-earthquake stress was gradually concentrating in the local high-resistance zone. After the earthquake, Δb_4 near the epicentral area approached zero, suggesting that the occurrence of the earthquake led to a rapid release of stress. These characteristics of the four-year difference of b-value in the Ludian earthquake region indicate that it is possible to narrow the time window of an impending strong or major earthquake by combining b-value data with 3D electrical structure analysis. In the past four years, the AZDF has shown relatively small changes in Δb_4 amplitude, and there has been no apparent stress concentration similar to the period before the Ludian earthquake.

Keywords: b-value, spatiotemporal variations, 3D electrical structure, earthquake prediction

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