Geophysical Research Abstracts
Vol. 18, EGU2016-2716, 2016
EGU General Assembly 2016

Changes in rock resistivity image under uniaxial compression and its implications for earthquakes

Tao Zhu (1,2), Lanwei Wang (3), Bin Zhang (1), Jianguo Zhou (1,2)

(1) Institute of Geophysics, China Earthquake Administration, Beijing, China (zxl_tao@126.com), (2) Key Laboratory of Seismic Observation and Geophysical Imaging, China Earthquake Administration, Beijing, China, (3) The Institute of Crustal Dynamics, China Earthquake Administration, Beijing, China

Geoelectrical resistivity has always been one of important physical parameters used in earthquake prediction in China and played an important role in recent 50 years. Case studies have reported that due to the subsurface heterogeneous electrical structure, it is possible not to observe striking abnormal geoelectrical resistivity changes along some directions at a station, even though it is very close to the epicenter, before a strong earthquake via the single separation array observation system currently used in China. For example, the resistivity along NE direction decreased abnormally very greatly between June, 2006 and January, 2008, but there are not striking abnormal changes along NW direction according to the record at Chengdu station (about 36 km to the epicenter) before the 2008 Wenchuan MS8.0 earthquake. Therefore, exploring a complimentary earthquake indictor is useful and necessary. In this paper, apparent resistivity data were acquired along three common-midpoint measuring lines during the fixed-rate uniaxial compression on two sets of dry man-made samples, almost uniform and high-resistivity-block embedded ones. Then we constructed their relative resistivity change images (RRCIs) using electrical resistivity tomography, and plotted the curves of apparent resistivity anisotropy coefficient λ^* and the included angle α between the major axis of apparent resistivity anisotropy ellipse and the axis of load versus stress and depth. Our results indicate that all RRCIs show the same trending change with stress: with the increase of stress, the resistivity-decreased region (RDR) in the RRCIs would shrink while the resistivity-increased region (RIR) would expand gradually, which is consistent with the results in earthquake monitoring (Feng et al., 2001). During the course of unloading, with the decrease of stress, the RIR continues expanding and RDR continues shrinking. The high-resistivity block embedded in a sample has a great influence on the resistivity-increased amplitude just in its location and surroundings, but little effects on the trending change of resistivity image. Our results encourage us to conclude that the trending changes in RRCI with stress could probably become a useful supplementary indicator in the judgement on earthquake-related resistivity anomaly.

This work is supported by National Natural Science Foundation of China (NSFC, Grant 41574083).