Exploring Crustal Electrical Structures in Guangdong-Hong Kong-Macao Greater Bay Area (GBA) using Magnetotelluric Method

S. Feng[1], D. Yang[2], F. Jiang[3], P. Wang[4], and L. Liu[5]
[1]Southern University of Science and Technology, cicifst@gmail.com
[2]Southern University of Science and Technology, yangdikun@gmail.com
[3]South China Sea Institute of Oceanology, Chinese Academy of Sciences, fengj.cn9@gmail.com
[4]Southern University of Science and Technology, wangpj@sustech.edu.cn
[5]Southern University of Science and Technology, liulian@sustech.edu.cn

SUMMARY

The Guangdong-Hong Kong-Macao Greater Bay Area (GBA), characterized by its economic vitality and dense population, is highly susceptible to seismic hazards such as earthquakes and tsunamis. Historical seismic events, including a 5.7 magnitude earthquake on Dangan Island in June 1874 and a 7.2 magnitude earthquake in Shantou in February 1918, highlight this vulnerability. Recent years have seen an increase in seismic activity, suggesting the presence of potential weak zones within the regional crust. Despite extensive seismic studies, research on the crustal resistivity of this region remains sparse.

To enhance understanding of the GBA's geological and crustal structures, we conducted a Magnetotelluric (MT) survey over a 100 km transect with 20 stations spaced 5 km apart. Data acquisition employed Phoenix V5 MT devices, with continuous sampling at 15 Hz, supplemented by 150 Hz and 2400 Hz intervals. Data processing utilized the rho+ model, particularly effective in high-interference zones, to obtain reliable impedance estimates. We performed 3D inversion, incorporating seawater effects for detailed analysis.

Our analysis identified a significant low-resistivity anomaly beneath the Xinhui district in Jiangmen. This anomaly, detected at depths of 10-18 km and extending approximately 10 km wide in the direction of the survey line, could be indicative of several geological processes. Preliminary interpretations suggest that the region may have experienced partial melting and that the parent rock has a different composition than its surroundings, potentially contributing to its distinct resistivity characteristics. Such properties highlight its potential as a critical factor in crustal deformation and seismic hazards.

This research calls for interdisciplinary efforts to explore the seismic implications of such anomalies, promoting a proactive approach to seismic risk mitigation in the GBA. Further investigation into the anomaly's composition and behavior is essential to fully understand its impact on regional crustal dynamics.

Keywords: Magnetotelluric, Electrical Structures