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一种确定震源中心的方法: 逆时成像技术(二)——基于人工地震的检验

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A method for determination of earthquake hypocentroid: Time-reversal imaging technique——An examination based on people-made earthquakes

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摘要

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摘要 人工地震的激发时间和震源位置是已知的, 因此, 用人工地震观测资料检验地震定位技术是十分有效的技术途径. 为了检验逆时成像技术的实用性, 我们收集了10次人工地震的观测资料, 5次气枪和5次化学爆破. 气枪记录台网的孔径20 km左右, 而化学爆破记录台网的孔径200 km左右. 首先, 通过测定值与真实值的比较, 从已有速度模型中筛选出两种较好的模型, 然后, 利用筛选出的两种模型分别对10次事件定位, 并通过测定值与真实值的比较以及测定值的不确定性分析挑选出最佳模型, 与此同时确定出最佳定位结果. 结果表明, 在现有最佳速度模型情况下, 气枪与化学爆炸的震中偏差均在500 m左右; 气枪震源深度的偏差在100 m左右, 而化学爆破震源深度的偏差在200 m左右; 化学爆破的激发时间的偏差在0.06 s左右, 而气枪的激发时间的偏差较大, 约在0.4 s左右, 这可能是由于局部水域的较低波速所致. 由此可见, 利用逆时成像技术能够在合理的准度和精度水平上确定发震时刻和震源位置, 甚至包括震源深度.

关键词 逆时成像技术, 人工地震, 定位检验

Abstract: Origin times and locations of people-made earthquakes are known, so examining an earthquake-location technology using seismic recordings from the people-made earthquakes is one of the convincing ways. In order to examine the TRIT (Time Reversal Imaging Technique), we collect seismic recordings from 10 people-made earthquakes, 5 air-guns and 5 chemical explosions. The seismograph network for the air-guns is smaller, about 20 km across and the one for the chemical explosions is larger, about 200 km across. At first, two better velocity models were chosen out from the models available in literatures by comparing the measured values with the true ones. Then, the best one was decided further, while the final measured values for the 10 events were determined based on the two models, by comparing the measured values with the true ones, as well as the uncertainties of the measured values. The results show that, with the best velocity model, the epicenter biases for both the air-guns and chemical explosions are around 500 m; the depth biases of the air-guns are around 100 m while those of the chemical ones are around 200 m; the origin time biases of the chemical ones are around 0.06 s, but those of the air-guns are larger, reaching about 0.4 s, which might be explained by the lower velocity of local water region. As a conclusion, origin times and hypocenters, including even focal depths, are able to be determined at reasonable accuracy and precision by the TRIT.

Keywords Time-reversal imaging technique, People-made earthquakes, Location examination

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