SnT 2025
8 SEPTEMBER ONLINE DAY
9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

P1.2-888

Study on epicenter accuracy based on velocity models acquired from joint inversion

Han Shoucheng, Liu Zhehan, Tang Wei, Shang Jie, Wang Xiaoming

CTBT Beijing National Data Center

INTRODUCTION AND MAIN RESULTS

Research on improved location accuracy has been driven by efforts to effectively monitor the CTBT. The velocity model will greatly influence the location and with the development in seismic imaging methods and accumulation of seismic observed data, a variety of velocity models have been constructed. To develop more accurate velocity models and systematically assess the location accuracy using different velocity models, we conducted joint inversion using body wave arrival times, surface wave dispersion and receiver functions. A comprehensive evaluation has been performed to compare the location accuracy based on different velocity models. The results can provide insights for the application of three-dimensional velocity models in seismic monitoring.

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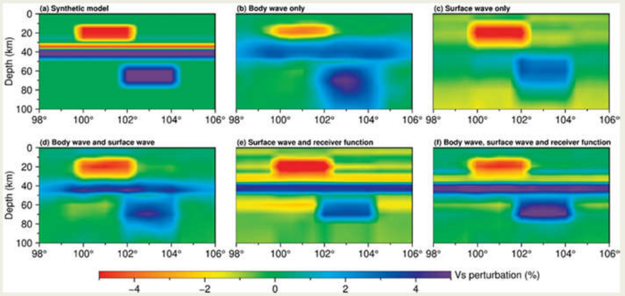
Introduction

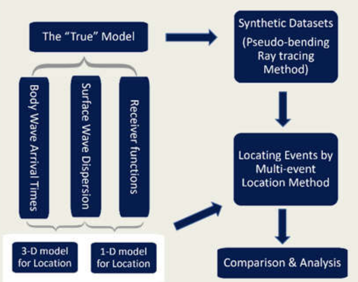
The event location accuracy is crucial to monitor the CTBT, as location can provide insights about the event. Event localization process is to determine hypocenter parameters. But the hypocenters are always coupled with velocity models. It has been shown that global and regional 3D models improve travel-time prediction and event location over 1D models for broad areas and 3D joint inversion model always performs as well or better than model obtained by body-wave-travel-time-only. Here we proposed a joint inversion method that incorporates body wave arrival times (BW), surface wave dispersion data (SWD) and receiver functions (RFs) into one system to jointly constrains Vp and Vs models. The sensitivities of the three types of data are complementary, so joint inversion can reduce the intrinsic non-uniqueness of inversions using fewer types of. To demonstrate the performance of the proposed joint inversion method, we conducted synthetic tests based on synthetic velocity models. We also conducted the synthetic tests in southwest China to investigate the performance of velocity models on event locations.

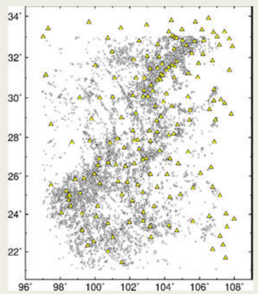
Data and Methods

A series of joint inversions synthetic tests using different combinations of seismic datasets were implemented. In the joint inversion of BW and SWD, the shape of low and high velocity anomalies, as well as the high velocity layer around the Moho are better resolved. But low velocity layer around the Moho is still not resolved. Joint inversion of SW and RFs can better resolves low and high velocity layers around the Moho, but there are artifacts appearing in the crust and mantle. In comparison, joint inversion using three datasets resolves all features in the synthetic model best, including low and high velocity anomalies in the crust and mantle, as well as low and high velocity jumps around the Moho.

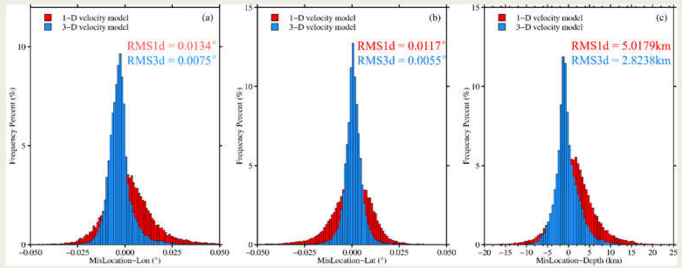


Then we conducted event Location synthetic tests and the flow chart is shown as blew.





This figure shows the mis-location in horizontal and vertical direction. Based on 3-D velocity models, the average mis-location is ~1 km and 3 km in horizontal and depth-direction. Whereas, based on 1-D velocity models, the average mis-location is ~2 km and 5 km in horizontal and vertical direction. The location accuracy is improved by about 50% from 1-D model to 3-D model.



Results and Discussion

- Based on the synthetic tests, we can conclude that a new joint inversion algorithm that can better resolve velocity models has been proposed and the event location accuracy can be improved by about 50% from 1-D model to 3-D model.
- In the future, tests on sparse networks and global model acquired by joint inversion should be conducted for applications in monitoring the CTBT.