

## Relocations and Velocity Structure for Aftershocks of the 2000 Western Tottori Earthquake, Using Waveform Cross-correlations

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The recently developed double-difference tomography method (Zhang and Thurber, 2003) makes use of both absolute and relative arrival times to produce an improved velocity model and highly accurate hypocenter locations. By using this technique we relocate the aftershocks of the 2000 Western Tottori earthquake and obtain a 3D-velocity model of the aftershock region.

The data consist of a set of 1035 aftershocks recorded at 62 stations during a period of intense observation (Shibutani et al., 2002, 2004). In order to get the best arrival times, a cross-correlation analysis was used to align the waveforms. There are about 47,000 P-wave arrival picks and 300,000 differential travel times used in the inversion.

The epicentral distribution of the relocated events (Fig. 1) reveals clear earthquake lineations, some of them close to the mainshock, and an increased clustering. The aftershocks' depth distribution shows a mean shift of the hypocenters' centroid of about 580m; a clear upper cutoff of the seismic activity and some clustering can be also seen.

The final P-wave velocity model shows higher-value anomalies in the vicinity of the mainshock's hypocenter, in good agreement with the results of Shibutani et al. (2004).

From a theoretical point of view, it is known that the double-difference techniques do not need "station correction" terms to account for shallow un-modeled velocity variations. However, in practice, we noticed that such corrections might be necessary. We are presently using both real and simulated earthquake

data to investigate this problem in more detail. A shortcoming of the "relative" location techniques is the difficulty in determining "error bars" for the results. Our synthetic data tests aim to address this problem.

In order to process a large number of waveforms in a quasi-automatic, GUI oriented environment, we are developing a Matlab-based toolbox (Fig. 2), which greatly facilitates the cross-correlation tasks.

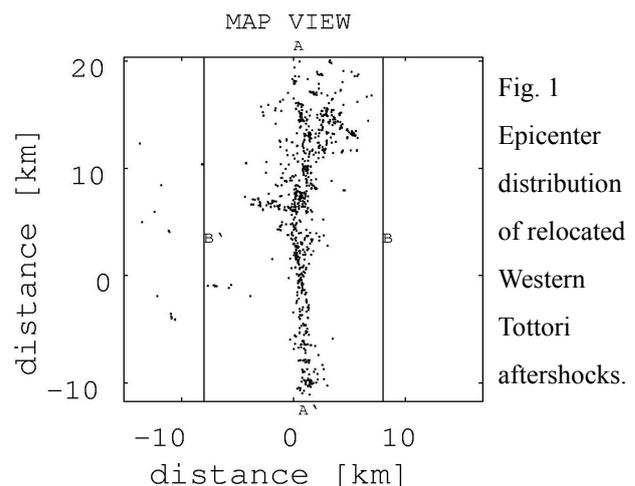


Fig. 1  
Epicenter  
distribution  
of relocated  
Western  
Tottori  
aftershocks.

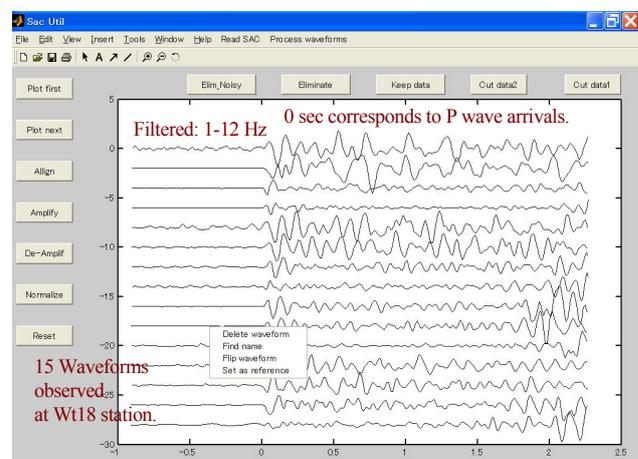


Fig. 2 Interactive Matlab toolbox for waveform analysis.