

# Hybrid Reverse-time Imaging

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## Abstract

A steady trend in both active (control source) and passive (nature source) seismology research appears to be one of the major research tasks in exploring deep structure features beneath Taiwan. In the past ten year, 3D model derived from travel-time data appears to be a necessary step; however wave form related processing and imaging appears to be more important despite some arguments concerning the quantity and quality of the data available so far. The available 3D models, in general uses generalized linear tomography inversion from earthquake records to construct low resolution, smoothly varying 3D velocity structure. There is no doubt that to better understand the crust structure, more elaborate techniques and careful treatment of all available seismic data collected during last decade becomes critical for source and structure imaging. The concept of “**Reverse-time Imaging**” for source and structure through wave field extrapolation is not new. The original idea can be traced back to the first paper published by G. A. McMechan (1982) 25 years ago.

However, the estimated 3D velocity distribution posed several potential problems: (1) the derived velocity at near-surface (within 5 km) are in general much higher than the measured sediment velocity from borehole and seismic data, (2) long wavelength variation of 3D velocity field do not provide high resolution reflecting surface for more precise wave field simulation and processing, (3) for strong topography and lateral velocity structure changes, particularly at the region with ongoing mountain building processes in Taiwan, the source and receiver static effects becomes obviously important, (4) For better imaging, quality and quantity control on integrating various datasets and fundamental limitations on available data bandwidth become more critical, thus hybrid approach becomes inevitably necessary. To demonstrate more realistic approach for simultaneous imaging of subsurface structure and source rupture processes, this paper presents an alternative works we have been developed so far. Through simulation-based studies and algorithm development, the modified hybrid reverse-time imaging principle will be proposed, tested and implemented to illustrate its potential applicability, reliability and limitations. We will further use the proposed approach, incorporate the best existing velocity model and provide a better constrains on imaging major structure features in and around the Taiwan region.

Keywords: Reverse-time imaging, Hybrid approach, Source and structure imaging.

## Hybrid Reverse-time Imaging: Have We Learned the Lesson

Yet?