Basis for calculations of travel time curves in a 1D model and optimization problem associated to seismic tomography

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Abstract

This work is divided in two parts. First, we discuss some theoretical base of refraction and reflection seismology, which are used to describe the earth structure based on velocity models, to help in the understanding of a simple model of that structure. We provide an algorithm using refraction seismology to identify the velocities and calculate the depths of a multilayer model of the earth using travel-time data collected by geophones (seismograms) from artificial sources. This algorithm allows us to create a one dimensional model, which can be used as the input for calculating a 3D velocity model of the earth structure through a seismic tomography approach. Second we modify a widely used procedure to calculate this 3D model to implement state-of-the-art algorithm for solving the nonlinear optimization problem, that arises in seismic tomography applications. Then compare the results obtained with both methods in terms of efficiency and accuracy.