Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07485, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-07485
EGU General Assembly 2008

2-D and 3-D seismic refraction travel-time tomography based on the adjoint state method

C. Taillandier and M. Noble

Centre de Géosciences, Ecole des Mines de Paris, France.

It is now a common fact that current refraction seismic acquisition surveys deploy thousands of sources combined with thousands of receivers leading to millions of first arrival travel-times. Moreover the area under investigation could be very large and this could lead to a velocity model containing millions of parameters. For 2-D geometries, classical refraction tomography algorithms may not suffer from computational limitations. On the contrary for 3-D geometries, the Fréchet derivative matrix could turn out to be very difficult to handle in terms of memory requirement, even if sparsity is fully accounted for. To overcome this limitation one could decimate the data or the number of parameters of the model, both leading to either a loss of information or resolution. We address these issues with the use of adjoint state techniques to compute the gradient of the misfit function.

The amount of memory required by this method depends only on the size of the discretized velocity model. In other words it is independent of the amount of data available. We present in this work the governing equations of the adjoint state method and its implementation in a refraction tomography algorithm. Validation results obtained on 2-D and 3-D datasets are shown and reveal the great potentiality of the method.