屈折法および重力データの同時インバージョンによる不連続面形状の決定

Joint inversion of refraction and gravity data for interface shape

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有限要素法の中にアイコナル方程式を取り入れ，精度よく計算することを考えた.

またデータとしては，屈折法と重力データを同時に入れることによりより高い精度でインバージョンを行うことができた.

We first adopt finite-difference approximation to the eikonal equation for calculating arrival times of seismic refracted waves, because previous ray tracing codes include difficulties for finding ray paths of head waves, but the finite-difference algorithm can calculate them accurately together with those of direct, reflected, or diffracted waves in arbitrarily complex velocity models. We then add a special algorithm for calculating traveltimes in a region where two or more waves encounter each other. Without this algorithm, wavefronts are severely distorted and rays cannot be calculated.

Interface shape inversion using only arrival time data of a refraction experiment is not so stable, even if the intersections of rays with the interface cover all parts of the interface. In addition, parts without any ray intersection may happen in a synclinal model or a region beneath a seismic source. This problem cannot be improved by a dense distribution of receivers.

In this study, we combine arrival times with gravity data to overcome the above problem. Unfortunately, information on densities is poorly known, and the interface shape inversion only with gravity data is unstable unless the density contrast on both the sides of the interface is given. However, joint inversion of arrival time and gravity data is stable even if we include a non-linear density-velocity relation and their parameters are also inverted from the data.