Angle gathers from areal shot migration with controlled illumination

Claudio Guerra

ABSTRACT

In very complex ares, wave-equation migration is mandatory to obtain reasonable images. Because of its high cost and small flexibility relatively to Kirchhoff migration, however, it is rarely used in migration velocity analysis. The accuracy of the velocity model, therefore, can be compromised by the use of an inadequate method to perform migration iterations. Fortunately, the linearity which governs the wave propagation permits to generate areal shots by linearly combining several shots as a way to decrease the cost of migration velocity analysis using wave-equation migration. Here, I show the usefulness of areal shot migration with controlled illumination to generate data suited for migration velocity analysis. ***

INTRODUCTION

Oil exploration is being conducted in increasingly more geologically complex areas. The imaging challenges along with the continuous growth of computer power has augmented the relative importance of depth migration, in particular wave-equation migration. A variety of wave-equation migration algorithms have been developed to balance cost and final image quality. Velocity model definition for depth migration, however, remains strongly dependent on Kirchhoff algorithms because of their flexibility and low cost when compared with wave-equation migration velocity analysis. In areas where the high-frequency approximation is violated and the wavefields become too complex, this dependence might result in inaccurate velocity models that yield poor quality or unreliable images even when a state-of-the-art wave-equation algorithm is used to produce the final image. In these areas it is therefore desirable to use wave-equation migration to generate image gathers in order to evaluate the accuracy of the velocity model.

Every iteration in velocity model definition for depth migration includes: 1) migration; 2) measurement of some property that diagnoses the accuracy of the current velocity model; and, 3) update of the velocity model. When using wave-equation migration, step 1 can be by far the most expensive of all. It is important, therefore, to decrease the cost of applying wave-equation migration for wave-equation velocity analysis to be cost effective.

Based on the linearity of wavefield extrapolators, different strategies have been formulated