

THE ZERO-VELOCITY LAYER: MIGRATION FROM IRREGULAR SURFACES

C J Beasley
Western Geophysical
Singapore

W Lynn
Western Geophysical
Houston

Abstract

Seismic migration algorithms generally assume that sources and receivers are positioned on a horizontal surface. However, a good deal of seismic exploration is being done in rough, mountainous terrain. This paper focuses on problems that occur when traditional approaches to migration are applied to data collected on irregular surfaces. A simple solution, setting the velocity to zero in certain strategic layers, gives an accurate approach to migration of data from irregular surfaces that fits easily into conventional data processing flows.

Seismic data acquired in areas with irregular topography are usually time-shifted to a flat datum before migration. This simple time shift, or elevation-static correction, cannot properly represent wide-angle or dipping reflections as they would have been recorded at the datum. As a result, when elevation varies significantly, accuracy in event positioning may be compromised for migration and other wave-equation processes, such as DMO.

Here, we propose an efficient technique for doing migration from irregular surfaces using almost any migration algorithm. As in elevation-static corrections, surface-recorded data are time-shifted to a horizontal datum. In the migration step, the velocity is set to zero in the layer between the surface and the datum; below the original surface, the interval velocity represents the best estimate of the sub-surface geology. Synthetic and field data examples demonstrate that use of the "zero velocity layer" significantly improves imaging accuracy relative to conventional migration from a flat datum.

Authors

CRAIG BEASLEY received his B.Sc. in mathematics in 1974 from the University of Houston and completed an M.Sc. at Emory University in 1977. After receiving his Ph.D. in mathematics from North Texas State University in 1981 he joined Western Geophysical in Houston and served in several capacities in both the Computer Sciences and Geophysical Research and Development departments. He is currently Manager of Geophysical Research and Development in Singapore.

WALT LYNN is a Research Consultant with Western Geophysical at Houston.