M33

Interval Velocity Analysis in Complex Areas - What About the Azimuth?

M. Reshef* (Tel Aviv University & Landmark Graphics) & E. Landa (Opera)

SUMMARY

Three dimensional interval velocity analysis must deal with the problem of lateral velocity variations along different azimuths. Traditionally, when this azimuth dependency is treated, the analysis refers to the acquisition azimuth. The main idea presented in this study is that in complex geological regions, the acquisition azimuth may not be the optimal domain for analyzing velocity errors. We suggest here to define the azimuth in the image domain. Together with the scattering angle and dip, all parameterized in the depth image domain, accurate CIG analysis method can be designed.

In recent years exploration targets have become more challenging due to their deeper position and higher complexity. In order to map these targets correctly, accurate 3D PSDM is usually required. Interval velocity analysis in such areas becomes a critical process.

To improve our ability to successfully determine the subsurface structure, modern marine surveys offer larger acquisition offsets, longer recording times and cover wide range of azimuths.

The major concept of most velocity analysis procedures is that after PSDM, common image gathers (CIGs) should be flat if the migration was carried out with the correct velocity function. When the CIGs contain non-flat events the problem is how to relate the interval velocity to this non-flatness.

Several authors argued that many of the popular CIG analysis techniques suffer from severe limitations when applied over complex geological regions. The main criticism is related to the fact that these techniques order (and sum) the migrated traces into the CIGs with respect to their acquisition parameters, e. g. offset and azimuth. Since most of these studies were demonstrated on 2D data, they mainly concentrated in the issues related to offset, dip and scattering angles.

Three dimensional interval velocity analysis must deal with the problem of lateral velocity variations along different azimuths. When this azimuth dependency is treated, the analysis refers to the acquisition azimuth.

The main idea presented in this study is that in complex geological regions, the acquisition azimuth may not be the optimal domain for analyzing velocity errors. We suggest here to define the azimuth in the image domain. Together with the scattering angle and dip, all parameterized in the depth image domain, accurate CIG analysis method can be designed.

Through careful analysis of simple examples, we demonstrate how parameterization of the CIGs according to the acquisition azimuth of the migrated traces, may lead to a wrong velocity model. We then present a method for defining a CIG in a way that will allow to correctly relate the non-flatness of the events, to the azimuth defined in the image domain. Practical aspects of the analysis will be presented using synthetic and field data examples.