P039 MULTIPLE ATTENUATION — A CONTRACTOR EVALUATION

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SUMMARY

Six geophysical contractors have been invited to apply their best multiple suppression technology on a seismic data set prepared by Statoil Research. Based on a geological model, approximately 19 km long, synthetic seismic was modeled and given to the contractors. Each contractor applied basic standard pre-processing, before applying their chosen multiple attenuation technique, followed by standard post-processing. A final comparison, carried out by Statoil Research, of the contractor's processed data with the true geological model, allows a fair evaluation of each geophysical contractor's software as well as ingeniousness to attenuate multiples in the specific data set.

INTRODUCTION

To test how seismic data processing images seismic data, it is advantageous to use synthetic data modelled over a known model. The model should, however, be as realistic and true to nature as possible. In this study, our intention is to evaluate geophysical contractor's de-multiple software on a data set with severe primary/multiple interference. In many geological settings, especially when the structures are relatively flat, primary/multiple interference is the rule and not the exception (for an example, see Ikelle et al., 1997). The challenge to data processing in these circumstances is to attenuate multiples while preserving primaries.

The model is briefly described below.

THE MODEL

Based on extensive field work on large-scale outcrops along the fjords in West Spitsbergen, a group of islands in the Arctic Ocean, a detailed 2-D geological model, approximately 19 km long and 1 km deep, has been established (Johansen et al., 1997). The main formations compose an overall progradational package dominated by six facies associations including coastal plain, delta front and slope, turbidite, and offshore marine shale facies (Mellere et al., 1997). This model with its inherent complexity may be thought to represent an offshore 2-D reservoir unit. To make the task of seismic modelling and imaging of this structure more "realistic", a typical North Sea overburden of 1.1-1.4 km thickness was added on top of the outcrop model, in addition to a water layer of 0.1-0.2 km thickness. The combined model, consisting of elastic and isotropic layers, was finally gridded with sampling intervals 2 m in both horizontal and vertical directions. In order to simulate a marine seismic survey over this model, an in-house 2-D finite difference modelling program was run to generate synthetic seismic data with a maximum frequency of 80 Hz. The minimum and maximum offsets were 0 m and 2000 m, respectively, with a group spacing of 12.5 m. The recording time was 3 s.

Brute in-house processing and interpretation of the modelled data showed that the migrated stack section imaged the outcrop model quite well. However, since we at this stage did not concentrate on optimum multiple suppression, multiple energy disturbed the processed image. Without knowledge of the outcrop model, parts of these false multiple related events could easily have been misinterpreted as primaries. Hence, this specific data set was considered to be well suited for evaluation of geophysical contractor's multiple suppression software and their cleverness in identifying troublesome multiples. At the same time, their processing should preserve amplitude and enhance resolution to accurately image thinly bedded structures in the outcrop model.

CONTRACTOR EVALUATION

Several geophysical contractors were invited to bid for the processing of the synthetic data. The chosen contractors were CGG (Massy), Ensign (Weybridge), Geco-Prakla (Stavanger), PGS Tensor (Oslo), and Western Geophysical (Stavanger). The contractor's were free to define the total processing sequence and choose appropriate parameters. Their proposal for optimum multiple suppression ranged from the simple strategy with predictive deconvolution before and after stack, to Radon-based techniques, and wave equation prediction and subtraction multiple attenuation.

None of the contractors, however, proposed to apply free-surface elimination techniques, as described e.g. by Verschuur et al. (1992) and Weglein et al. (1997). This technique, which essentially removes the effect of the air/water surface from seismic recordings, should be ideally suited on this controlled data set to attenuate those events having at least one reflection at the free surface. The method does not require any knowledge of the subsurface, and is not based on periodicity, statistical assumptions on the reflection series, or moveout differences. To evaluate this method, Geco-Prakla (Gatwick) and Delft University were asked to apply their proprietary free-surface multiple attenuation techniques on the data.

Final contractor processing results are presented and compared during the formal presentation.

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