IS THERE VALUE IN REPROCESSING LEGACY MARINE STREAMER SEISMIC FOR IMPROVED RESOLUTION? A RECENT EXAMPLE FROM INDONESIA

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ABSTRACT

This case history demonstrates the value of reprocessing a vintage towed-streamer dataset acquired in a high-tidal-current, shallow-water environment from Berau Bay, Papua Barat Province, Indonesia.

The cable was single sensor, towed flat, and did not have a deep tow to improve the signal-to-noise ratio. To maximize image resolution, a modern 2D deghosting algorithm, Single Streamer Deghosting (SSD), with an updated processing flow was applied to deliver short-offset 3D reprocessing.

The result was significant resolution uplift (a much improved bandwidth) from the existing conventional processing of the legacy seismic data, both at the low and the high frequency end. The success of this case study has resulted in reprocessing the full survey area (1440 km²) and may lead to routine future applications.

INTRODUCTION

Reprocessing of legacy seismic data occurs in cycles, benefitting from the continuous development of new processing and/or imaging algorithms. Over the last few years we have observed rapid development of broadband acquisition and processing techniques, with various benefits for subsurface imaging and seismic inversion.

Broadband acquisition is becoming commonplace for modern seismic surveys, and many different types of 1D/2D/3D broadband processing technologies have begun to be presented in the literature. While most of these new processing algorithms have been designed to include modern slant streamer or dual sensor acquisition, some may also be applied to legacy towed streamer datasets (such as acquisition using hydrophones only, with flat towed streamers, and towed at moderate cable depths).

Ghost reflections from the sea surface are a well-known phenomenon limiting the bandwidth of marine seismic data, referred to as the source and receiver ghost notches. Recent developments of new broadband acquisition and processing techniques have made significant progress in overcoming this problem in modern survey towed streamer acquisition (Bayly, 2013).

Today we can choose between two approaches to acquiring data: a special cable geometry, using slanted or over-under geometry (Ray, 1982), (Haggerty, 1956) to reduce the impact of the notch by increasing notch diversity and de-tuning the receiver array (Moldoveanu, 2012) or to use multi-component sensors that allow full wavefield reconstruction and decomposition into up going (ghost free) and down going wavefields (Robertson, 2008).

Note that the latter solution is commonly referred to as PZ summation in Ocean Bottom Cable (OBC) acquisition. The processing deghosting solution for slant cable acquisition however, has not been successfully applied to single-sensor flat towed streamers until recently, but these new broadband processing technologies may be applicable to both modern and vintage conventional marine streamer data.

How much value will this deliver? The answer depends both on the quality of the input data and the depth of interest and the results of our study are presented below.

DESCRIPTION OF SURVEY AND THE MAIN FEATURES

The survey was acquired in 1997 and it covers approx. 1440sq km (Figure 1). Water depths within...