CAP. 2 - TRABAJO 14 - TOMO 1

COST REDUCTION AND QUALITY IMPROVEMENT IN 3D MARINE SEISMIC SURVEYS USING LOCAL TIDAL CONDITIONS

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Abstract :

El uso creciente en Exploración Petrolera de Sísmica 3D en ambientes marinos implica el análisis detallado de costos con la optimización de todas las condiciones existentes.

En este trabajo se presenta la metodología llamada "Tide Match", la que, utilizando las características de mareas de gran amplitud predecibles, en conjunto con una serie de estudios de factibilidad utilizando los datos existentes, no sólo puede disminuir sustancialmente los costos de adquisición sino que además puede ayudar a mejorar limitaciones de técnicas de imágenes de subsuelo.

Durante la etapa de adquisición, el ángulo que adopta el cable (Feathering), debido al impacto de las corrientes, crea espacios vacíos en las imágenes de subsuelo. Para solucionar este efecto se requiere la adquisición de líneas sísmicas que llenen dichos espacios (**infill**). Esta adquisición extra representa normalmente entre 15% y 30% del total de kilómetros adquiridos en la campaña sísmica. Con un incremento proporcional en costos y una dificultad extra para el procesamiento.

La metodología propuesta para reducir los kilómetros de "infill" mencionados incluye:

- El uso de estudios de factibilidad para obtener las recomendaciones de parámetros de adquisición, prediciendo la calidad de datos y estimando el impacto financiero. En particular, el efecto del ángulo del streamer (feathering) y el infill resultante.
- El uso de las fuertes mareas predecibles para orientar la dirección de adquisición sísmica.

El diseño de operadorés de deconvolución y antimultiples debe realizarse considerando la profundidad de agua variable de manera Consistente en el Cable en lugar de en Superficie.

INTRODUCTION

This paper summarizes the TOTAL AUSTRAL acquisition experience of 3D seismic in offshore Tierra Del Fuego (Argentina).

The tide's amplitude can vary until 10m with the subsequent impact in the Water bottom multiples once we are in presence of relative Shallow Water areas (20 to 50m Water Depth). (See Figure 2).

The Tidal Currents ranges around 2.5 to 3 knots with two tidal cycles per day, having also an impact in the feathering angle and Infill needs. (See Figure 1).

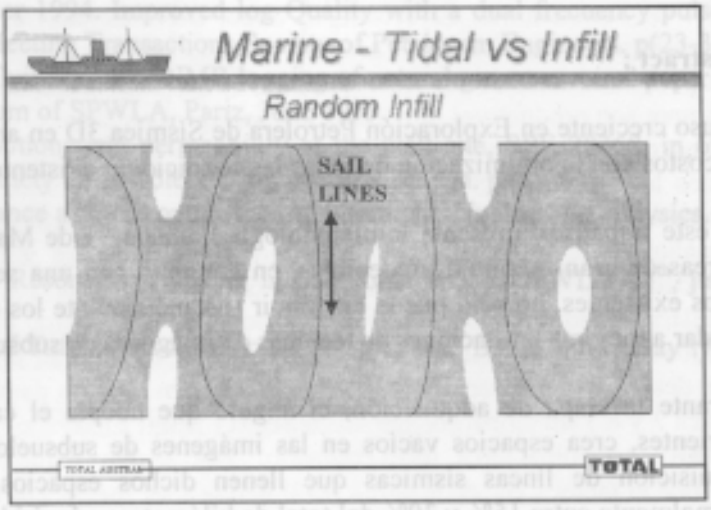
It is interesting to note the quick variability on the Tidal Currents direction, which can change 180 Degrees in few minutes, producing also quick changes in the streamer feathering.
These difficult conditions have strong impact in infill and data quality on 3D Seismic Surveys and it can be easily improved with some simple geometrical considerations and proper planning as **Tidal Matching.**

The processing of 3D data may also be affected by this tidal conditions and again, simple solutions can highly increase the data quality.

TIDAL MATCHING AND INFILL

The quick variation on the current direction creates also quick changes in the feathering angle and, in consequence, it appears some areas of low fold which need to be addressed by Infill.

The figure attached shows one example of low fold areas where Infill will be necessary.

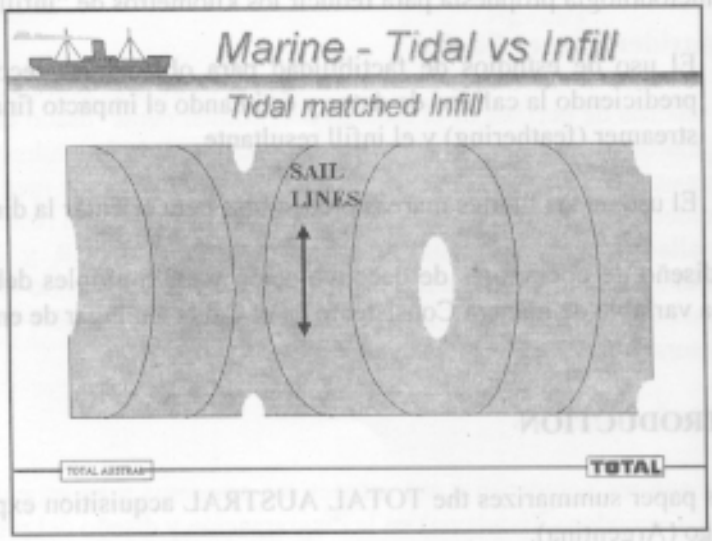


If the currents are predictable (it is generally the case on Tidal Currents), it is possible to design the Survey with line length optimized to acquire a full line with the same current direction and against the current.

The line length should carefully be planned to improve the inline time and diminish the line change over Inline ratio.

In the Tierra del Fuego case we can mention one example where, considering a 3.5 knots of speed velocity and a cycle of 6 hours we should shot between 30 and 40 kms lines length to permit a 1 to 1.5 hour turn with 5 hours inline.

Shooting into current reduces the feathering and the need for infill diminishes as illustrated in the figure.



Some real cases showed the infill reduced as far as 15 %, with a final cost reduction between 20 to 30%.

PROCESSING, TIDAL IMPLICATIONS:

The impact of tides on the seismic processing becomes evident once we are in shallow areas (20 to 30 m Water Depth).

The 10 m change in water depth will have a clear impact on the signal response, due to the Water Bottom's multiples.

It is possible also to note that the advantage of Tidal Matching includes an even Azimuth distribution and will also help to optimize the DMO operator.

One way to first look at the tidal problems, independently on the Tidal Matching during acquisition or not, is to apply Deconvolution operators and antimultiples in a Cable Consistent way, in order to avoid the impact of data acquired with different tides using the same filter.

The participation of data acquired with different tides in the same bin, observed in the case of having high feathering and high infill, will be immediately reduced or eliminated if the acquisition is done with Tidal Matching . which implies lower infill.

Nevertheless, some problems remain due to the presence of packages of lines acquired in one direction (during High tide in North-South shooting direction, for example) together to packages of lines acquired in reverse tides and shooting direction. The processing in ***Cable Consistent*** way remains necessary.

Some clear advantages obtained with Tidal matching can be obtained on the even azimuth distribution and more accurate DMO operator.

CONCLUSIONS

The Tidal Matching needs to be used under high tide conditions to improve the data quality.

The methodology has also a cost saving impact due to the reduction of Infill as much as 15%.

The planning of the geometry must include the current's estimation and line length in order to be able to shoot against current.

Concerning the data processing, it is highly recommended to work the pre-stack processing with ***Streamer Consistent*** instead of Surface consistent.

ACKNOWLEDGE

We thank to our partners DEMINEX and PAN AMERICAN for their support and participation.

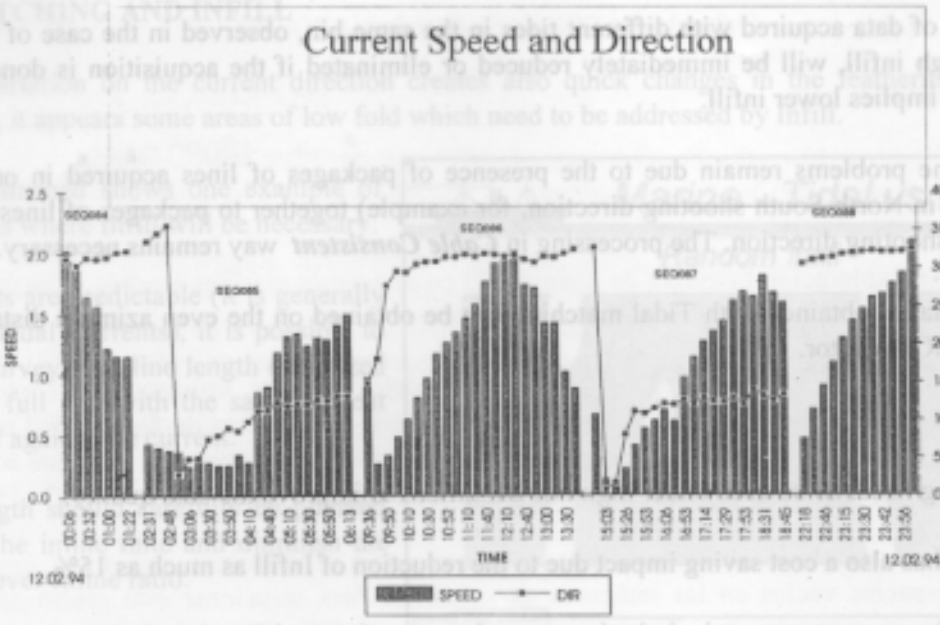


Figure 1

Tide Table (12/2/1994)

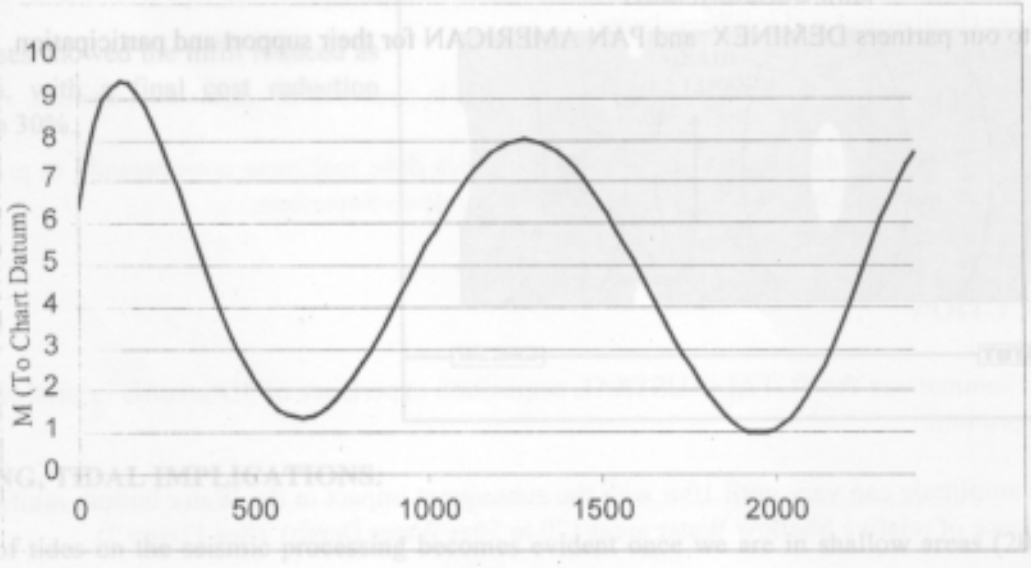


Figure 2

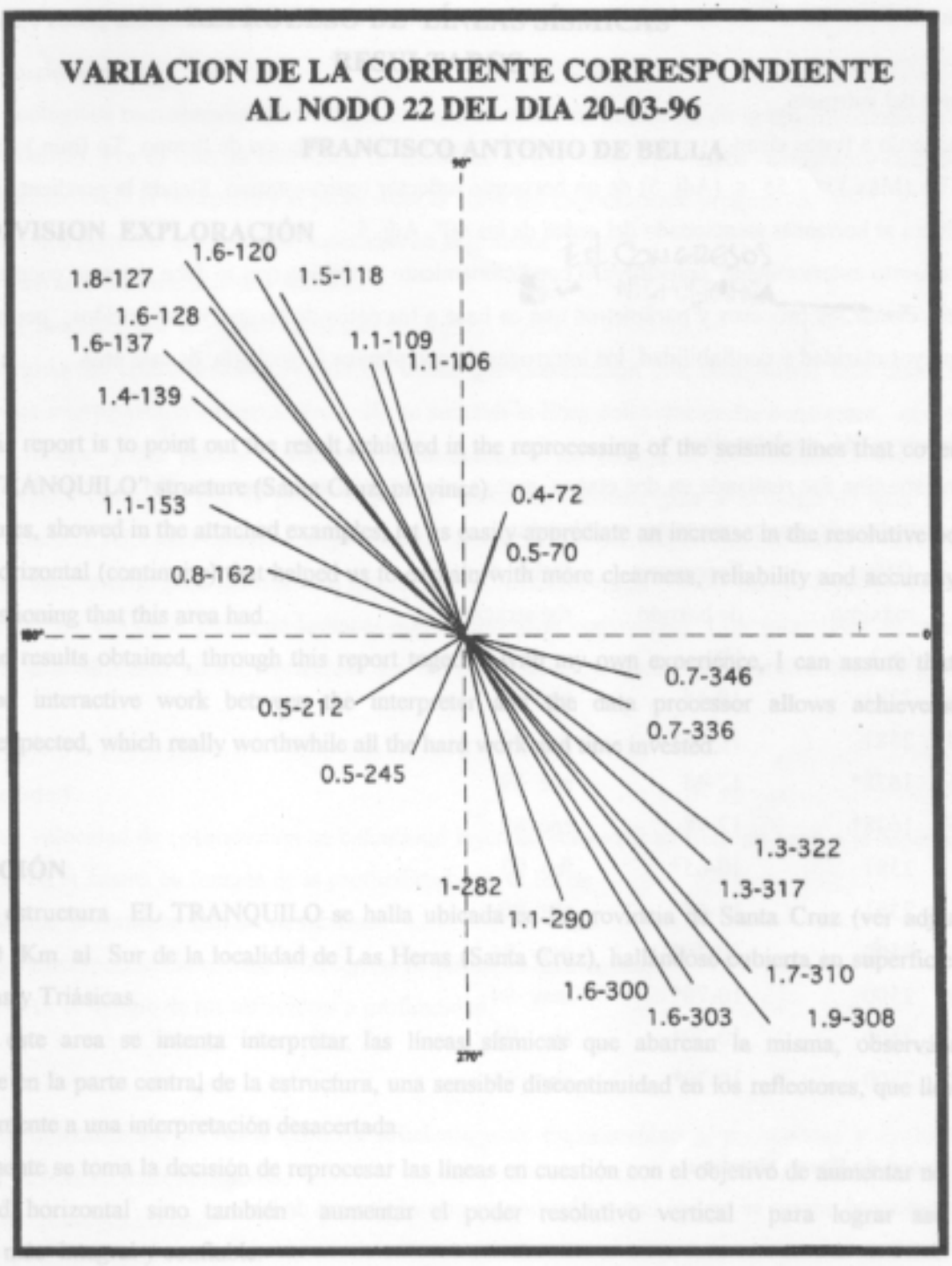

VARIACION DE LA CORRIENTE CORRESPONDIENTE
AL NODO 22 DEL DIA 20-03-96
1.6-120
1.8-127
1.5-118
1.6-128
1.6-137
1.1-109
1.1-106
1.4-139
0.4-72
1.1-153
0.5-70
0.8-162
0.7-346
0.5-212
0.7-336
0.5-245
1.3-322
1.3-317
1-282
1.1-290
1.7-310
1.6-300
1.6-303
1.9-308

Figure 3