## Introduction

Traditionally, interpretation of large seismic data sets is a labour-intensive process of manual picking or auto-tracking single horizons within a seismic volume. This workflow is generally time consuming and presents limitations according to the seismic information. The interpretation is often restricted to few horizons.

In this paper, we present a new method to interpret large seismic data sets using on a novel global approach. This method proposed by Pauget et al. (2009), is based on global optimization, which aims to compute a geological model directly from the seismic information. Its application has been already tested on various data sets, where the accuracy of the model was used for the detection of geological targets (Gupta et al, 2008; Bates et al, 2009).

Based on this, an improvement of the technology was achieved in multi-scale modelling. Such innovation allows application of this technique to large seismic data set. The case study presented in this paper shows how the method was applied and helped in the regional understanding of the geology.

## Methodology

The geomodel method in seismic interpretation is a novel approach for geological modelling from 3D seismic data (Fig. 1). Unlike the traditional workflow, which consists in obtaining a geological model from the horizons interpretation, this method first computes the model, called geomodel, which controls the horizons modelling.

This method is global and works on links between seismic points, and offers the interpreters a high level of flexibility in the modelling without being limited by faults. It is based on cost functions and uses an optimisation process to compute the global lower minimum, which produces the optimum seismic model. As opposed to other global methods based on horizons primitives (Lomask 2003; De Groot et al 2006; Monsen et al, 2008; Verney 2008), the modelling can be easily controlled by interpreters through adjusting the links.

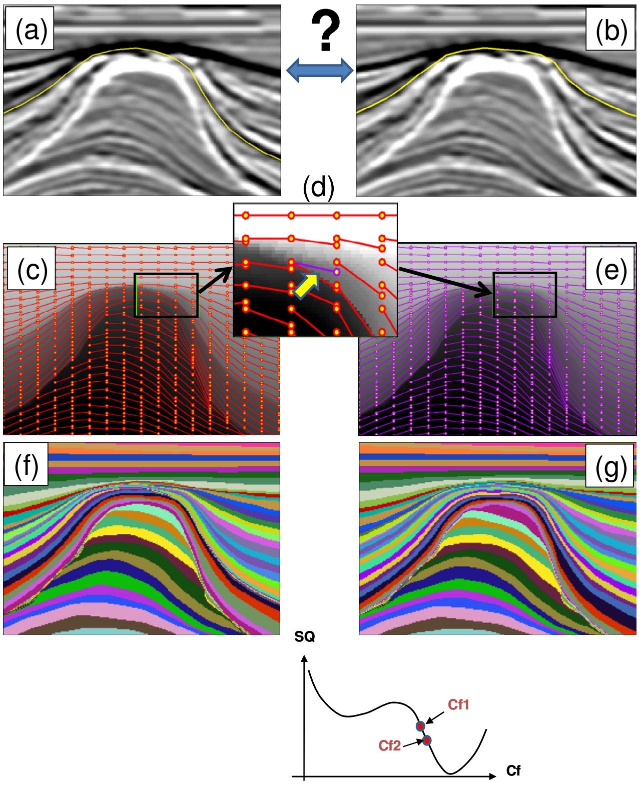

*Figure 1 – Geomodel building main steps (Pauget et al., 2009). a) and (b) Example of two possible seismic interpretations. Two links configurations (c) and (e) corresponding respectively to the models (f) and (g). In this case, the difference between the two configurations is just one link (d). The Global cost SQ is lower for the second configuration, which is then assumed to be better.*

In the event of a large data set, it becomes more difficult to process directly an entire volume into a single geomodel due to the complexity in controlling the quality of the modelling for the interpreter. For these two main reasons, several models have to be generated independently from different sub volumes extracted out of the original data set (Fig 2a). These sub-volumes need to have a common overlapping window.

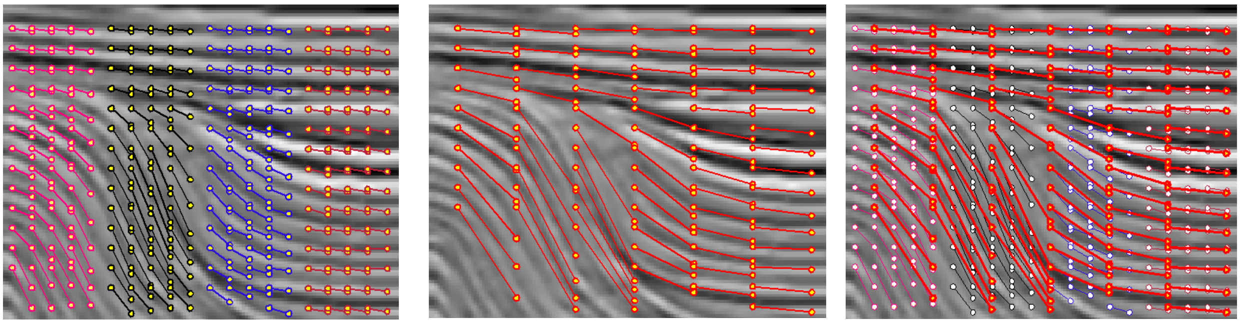

*Figure 2 – Three geological models obtained from real seismic data (left) before and (center) after synchronization with a large scale model( right).*

The interpretation task is then divided into several sub-projects processed in parallel. In this way it reduces drastically the time devoted to this task. Once all the sub-models are obtained, a large scale model, having a larger grid step, is computed (Fig 2c). This large scale model allows control the global consistency of the geology at the scale of the entire volume. When this large scale model is validated, it is then used to synchronize all the different sub models, as shown in the Fig. 2c. To illustrate this, Figure 3 shows how the synchronization with the large-scale model allows the removal of boundary between the sub-models and enhances the regional geology.

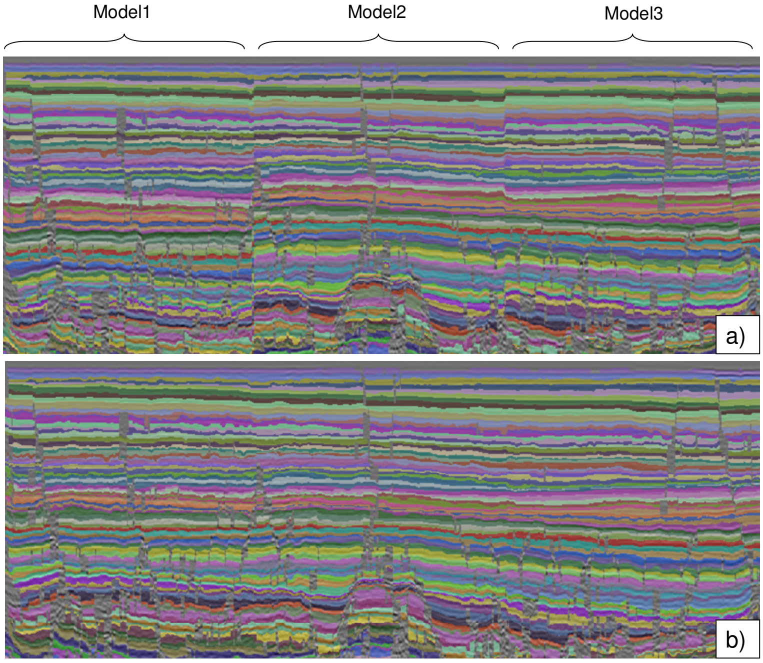

*Figure 3 – Three geological models obtained from real seismic data (a) before and (b) after synchronization with a large-scale model.*

## Example Case Study Tunisia Offshore data

This multi-scale approach was applied on a large data set resulting from merging of several 3D datasets acquired in the Gulf of Gabes, located offshore Tunisia. The total area of the mega merge represents approximately 4,500 sq km and a time range of 3.5 seconds. For the processing, the original cube was divided into 14 sub volumes (Fig. 4). The interpretation of the 14 sub volumes was realized by two seismic interpreters over three months.

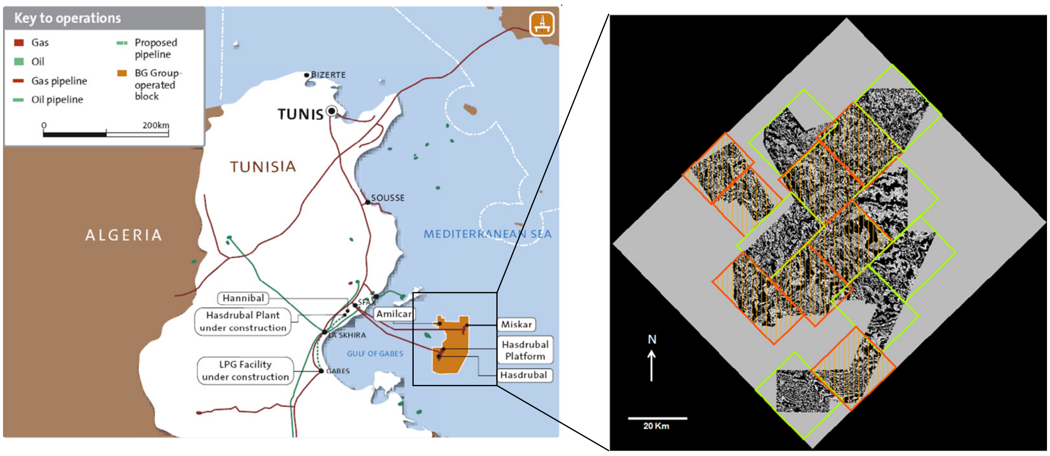

*Figure 4 – Location of field in the gulf of Gabes (Tunisia). Time slice representing the mega merge and its division into 15 sub volumes (red and green rectangles).*

After synchronisation of the models at a regional scale, a surfaces stack was generated and derived on several attributes such as the thickness variations, the fault throw and the seismic envelope. The analysis of the surfaces stack allowed a better characterisation the existing reservoir and the identification of potential new prospects.

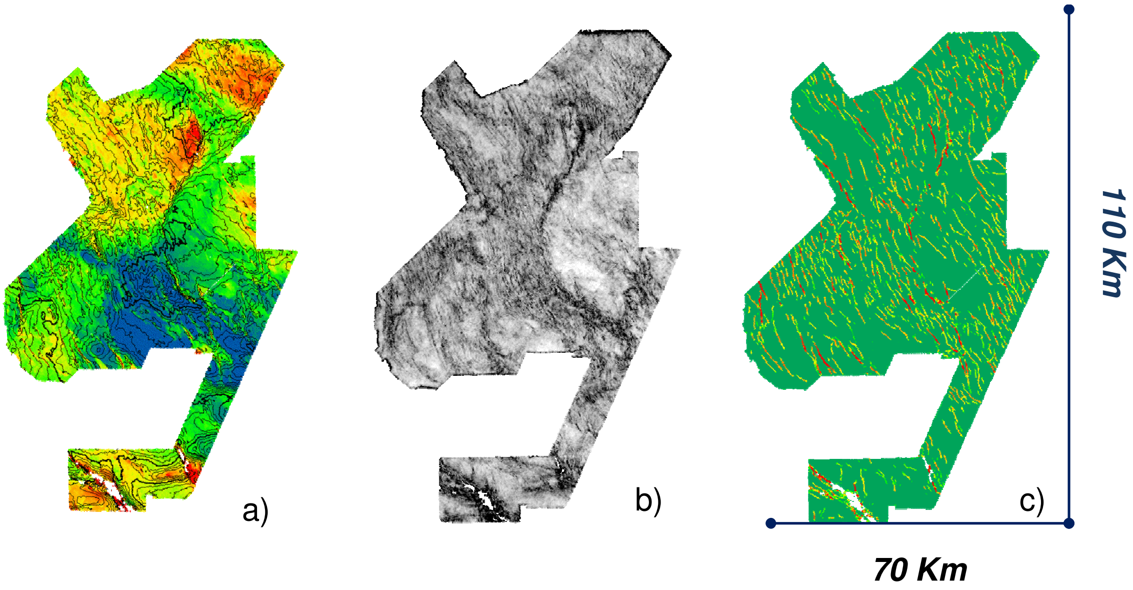

*Figure 5 – Mapping of (a) the thickness variations, (b) coherency and (c) the fault throw on the surface stack at the scale of the entire volume.*

## Conclusion

The multi-scale geomodel approach is a new method wish pushes back the frontiers in seismic interpretation. Indeed, it allows the application of the global algorithms to seismic volumes, without size limitation.

Its application to a real case study of several thousands square kilometers located offshore Tunisia allowed to enhance new features in the existing reservoir in production and to identify potential new geological targets. Moreover it helped in the regional understanding of the geology in this area.

## Acknowledgement

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