PhD Open Days

Hydrocarbon reservoir modelling in frontier exploration areas

PETROLEUM ENGINEERING

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1. Introduction

Deep offshore exploration plays a central role for the oil and gas industry being mostly related with frontier areas and in the last years these areas proved to be highly prospective, but the risk and uncertainty in these areas are very high. The risk in these areas is related to the lack of data (well-log data) and direct measurements for the properties of interest, normally it is only available seismic reflection data. Conventional geo-modelling workflows can help building reliable geological models of the subsurface petrophysical properties, useful for planning and decision making.
This project aims at the development of a new framework (Figure 1) to help exploration in frontier areas reducing risks and uncertainties in this areas by integrating different sources of geological and geophysical information using geostatistical tools, particularly for deriving petro-elastic models from seismic reflection data.

2. Methodology

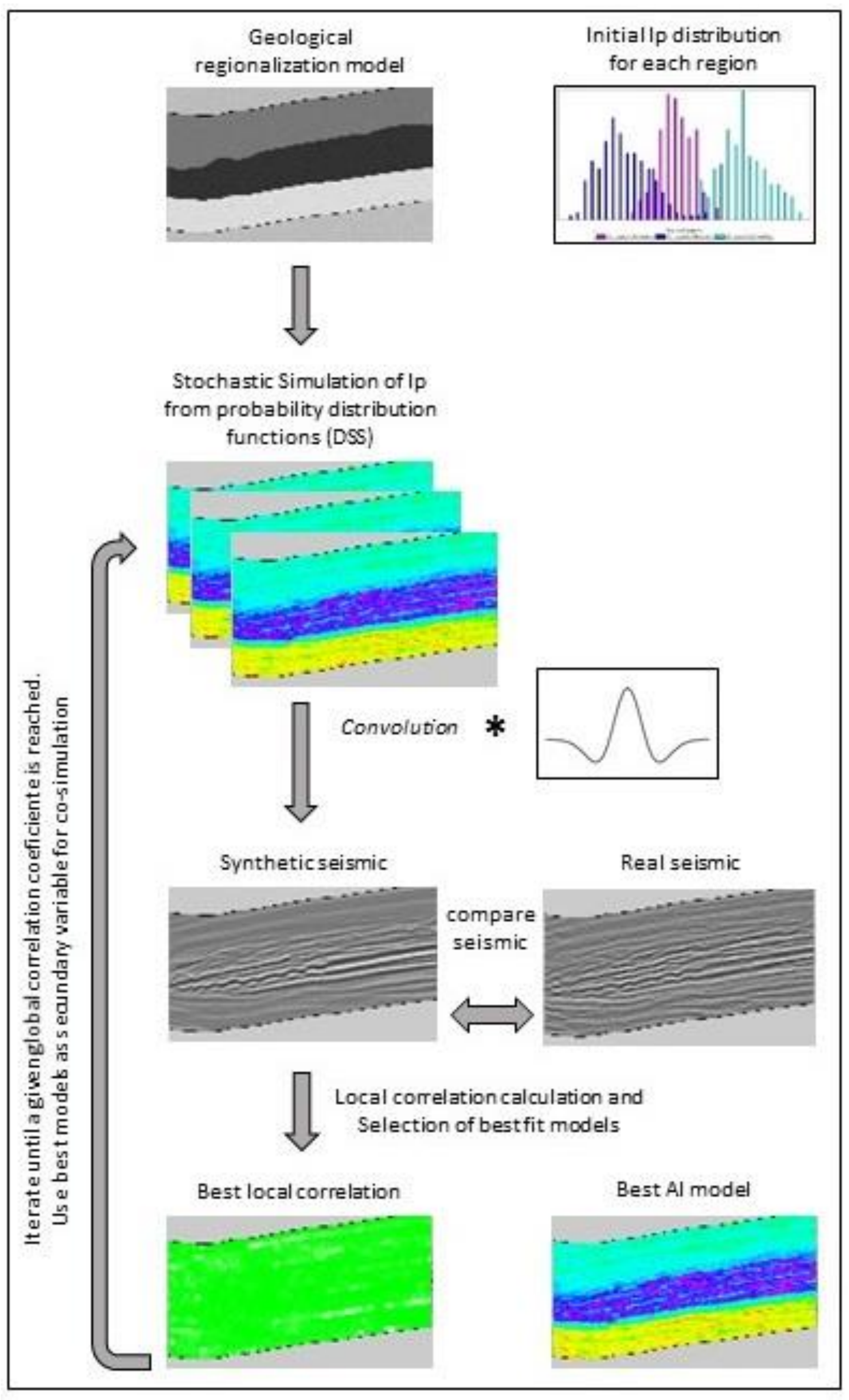

Figure 1: Workflow of the proposal geostatistical seismic inversion for frontier exploration.

3. Case study

The area of study corresponds to a prospect with a turbidite system, that is located in an offshore unexplored basin (Figure 2), The data used was 3D post-stack seismic reflection data volume and 3 appraisal wells located outside the prospect area.

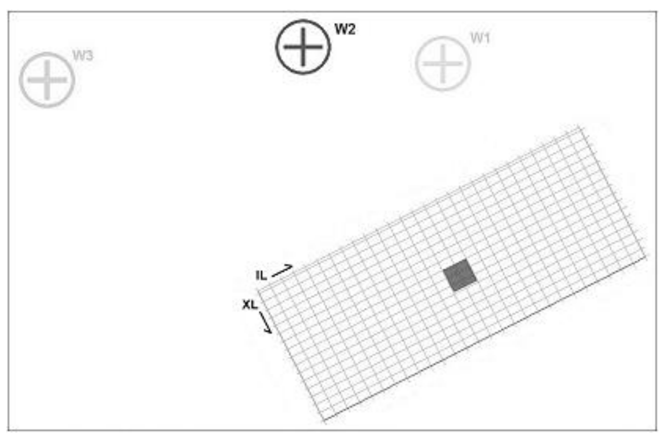

Figure 2: Available data located within the unexplored basin.

4. Results

The method was successfully applied to a frontier exploration area. The retrieved elastic subsurface models are geological consistent, and the match between the inverted seismic data and the real is very good, reaching 85% to 90% in some regions (Figure 3).

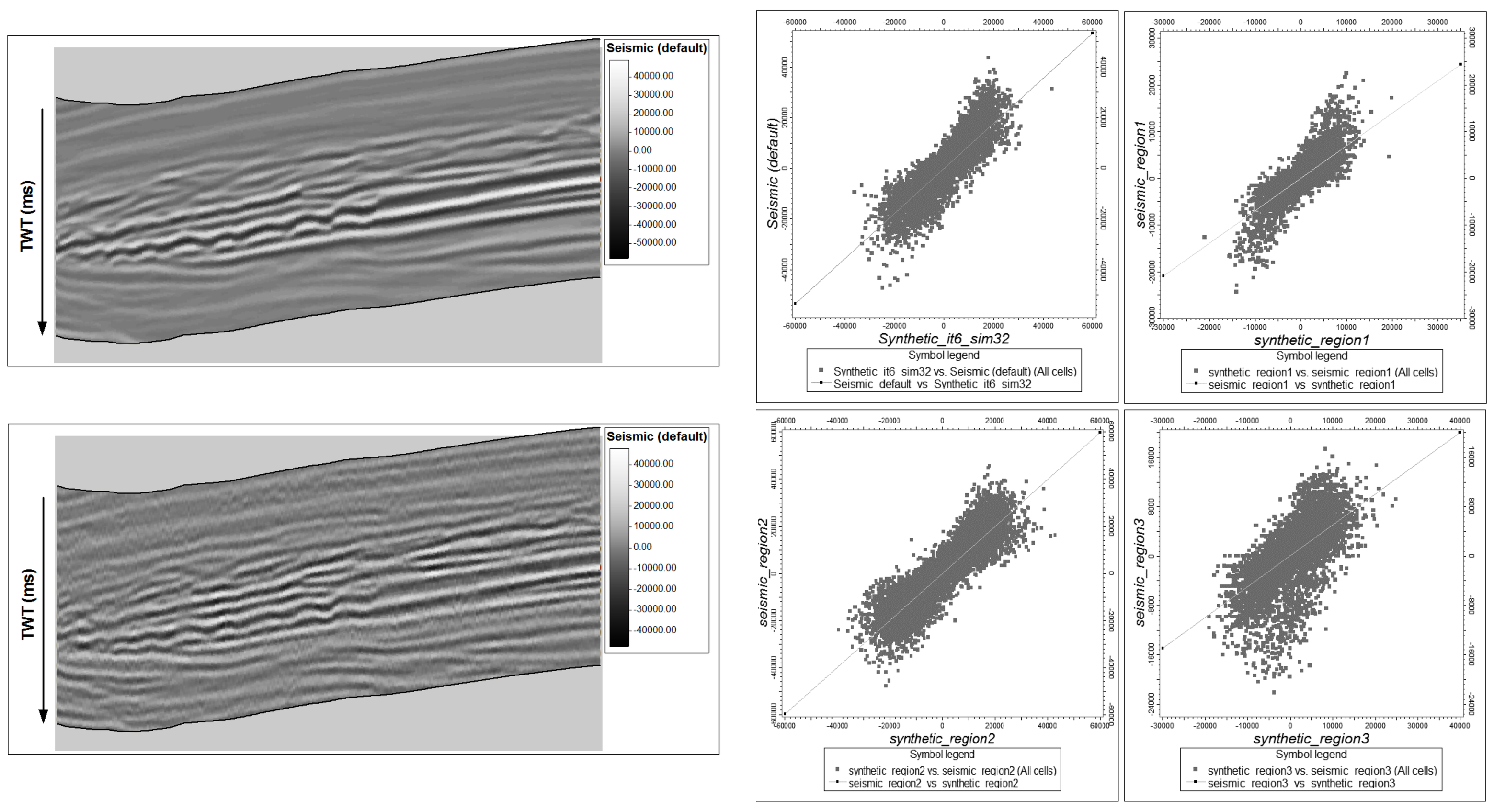

Figure 3: (Left - above) Real Seismic data. (Left – below) Synthetic seismic obtained from the best-fit inverse Ip model . (Right) Scatterplot between the real seismic full stack vs and the synthetic volume resulting after the inversion procedure finished.

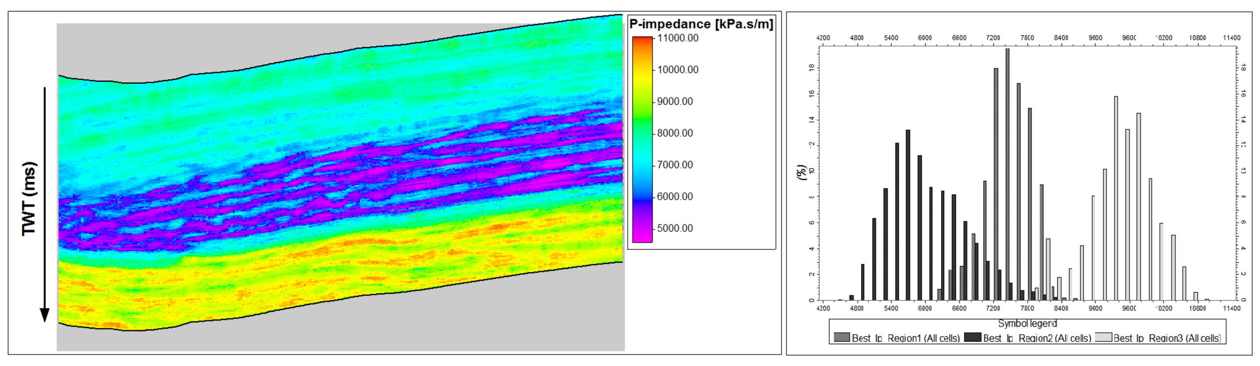

Figure 4: (Left) Best-fit inverse model of Ip retrieved after 6 iterations. It is possible to identify the turbidite system of interest corresponding to lower acoustic impedance values (purple). (Right) Distribution function of the Best-fit inverse model of Ip, which reproduces the initial distribution function of Ip.

5. Conclusions

The proposal geostatistical seismic inversion procedure, have shown good results and can be very useful for oil and gas exploration in deep offshore frontier areas. Constraining the seismic inversion to regional geology model and to a priori distribution functions of elastic properties of interest obtained from geological analogs (i.e. nearby wells), it generate a more consistent and reliable geological subsurface model and help to better predict the behavior of the reservoir.

6. Acknowledgements

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7. References

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