[PS]Alternative to Improve Seismic Imaging of a Structurally Complex Subsurface*

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Abstract

There is inherent ambiguity in velocity model building that generates inaccurate subsurface images in structurally complex areas. This issue is subject of analysis by the geoscience community, who researches for innovative techniques to improve seismic images.

The following methodology offers an alternative to reprocess seismic data, analyze multiple velocity models, and the amplitude effects on the target. To this purpose we used Halliburton Landmark single platform to integrate seismic interpretation and processing tasks. Among the benefits of this integration were the optimization of exploration targets to facilitate the decision-making process, by using a high-performance cloud environment. Such scheme enhanced the collaboration between users and contributed to de-risk new opportunities.

The implemented methodology includes interpreting seismic data, generating several velocity models, demigrating the stacked seismic data, remigrating for each velocity scenario, illumination analysis and evaluation of seismic amplitude and repositioning of target reflectors.

This work addresses data integration, cloud computing, imaging enhancement of geologically complex structures, and optimization of uncertainty in oil and gas exploration.

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SEISMIC IMAGE

The implemented methodology consist of two phases:

- Phase 1 – Using DecisionSpace® Geoscience to loading data, data assessment, seismic well tie, build the first and subsequent velocity models.

- Phase 2 – Linked to SeisSpace® execute procedures to Demigration, Illumination and finally Remigration data.

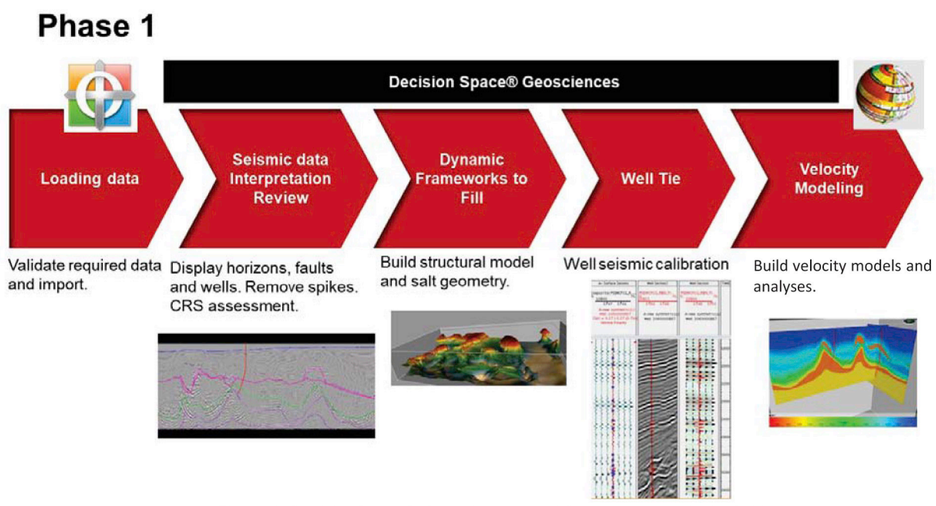


Figure 1. DecisionSpace® Geosciences workflow to model velocity field.

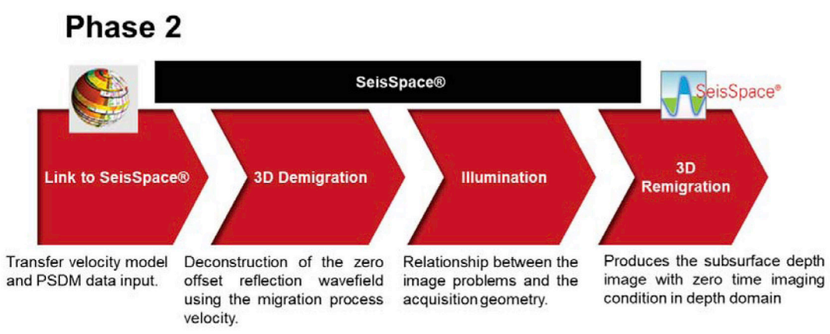


Figure 2. SeisSpace® suggested workflow.

This work was developed in a cloud environment, providing the integration of interpretation instead of expert concurrently. The main workflow starts with the deconstructed or demigrated PSDM data, improve velocity model, review the energy field by applying total illumination analysis. Finally decided if it is necessary more iteration and repeat cycle.

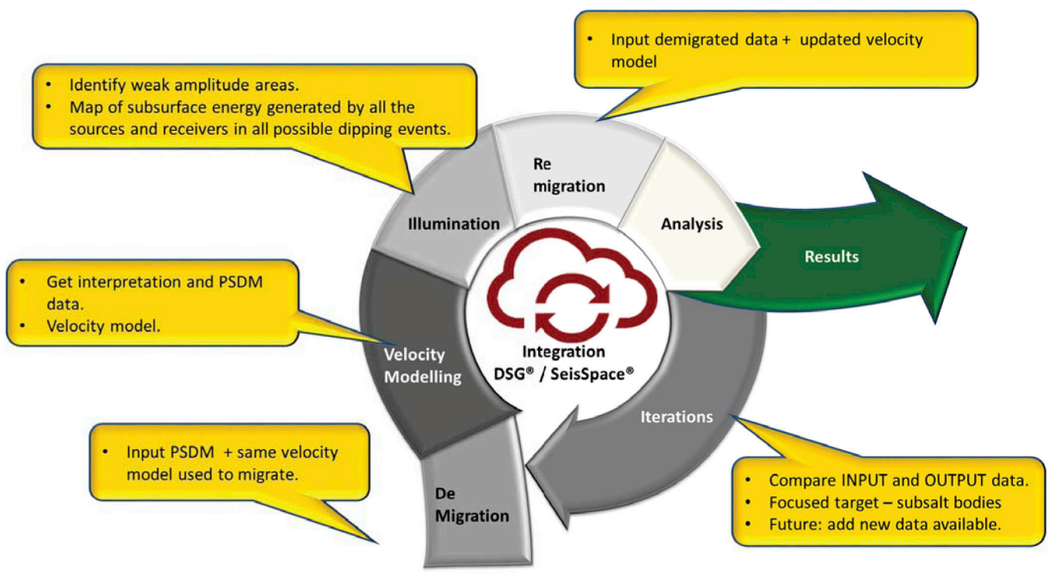


Figure 3. General workflow of the methodology.

RESULTS

Once the seismic data was demigrated, the bow-tie effect appeared as is indicated by the red circles (figure 4B), these distortions were properly corrected by re-migration process using the multiple velocity models and obtaining several re-migrated images, originating different scenarios to be analyzed by the interpretation team.

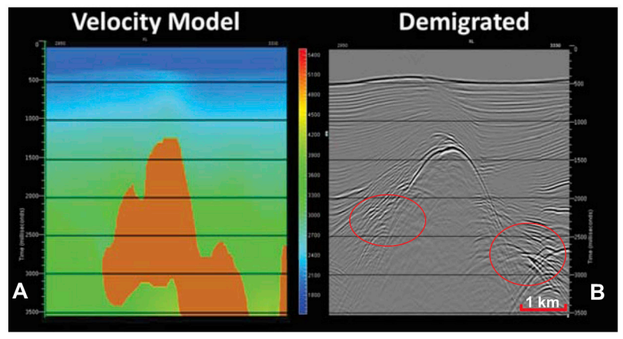


Figure 4. (A) Example of velocity model obtained in the Phase 1. (B) Demigrated data using the velocity model of migration.

The main differences between the input vs the output PSDM (figures 5A and 5B) are associated to (1) zones of low energy indicated by black arrows (figure 6) due to acquisition parameters and revealed in the Illumination analysis, in the other side (2) the different velocity models resulting from different interpretations used to re-migrate.

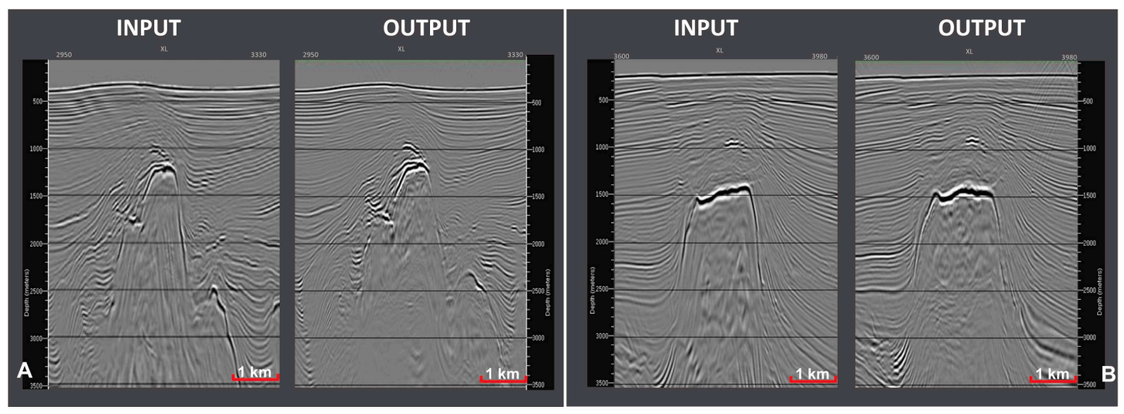
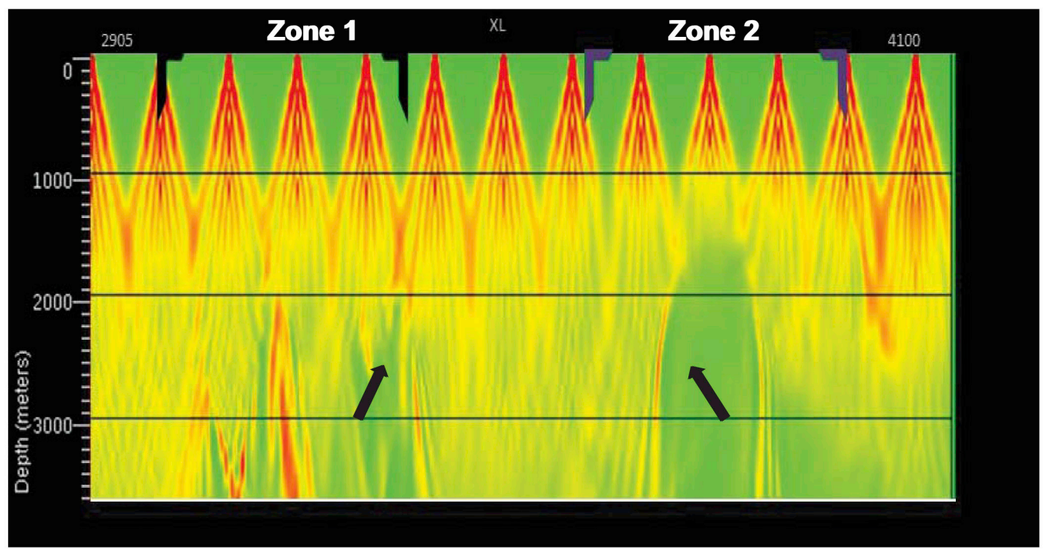


Figure 5. Seismic compare from INPUT and OUTPUT PSDM in selected area (A) reference inline zone 1 and (B) reference inline zone 2.



Figures 6. Results of total illumination showing the energy spreading from reference Inline.

FINAL COMMENTS

This methodology is an alternative that permits reduced uncertainty associated with complex geology targets by review of multiples scenarios from several users and an work collaborative environment while doing the iterative velocity modelling, Demigration and Remigration.

The illumination analysis shows spreading energy areas, the algorithms helps to know how efficient was the geometry to illuminate the target like subsalt and re-direction of the illumination to this target.

The execution time of this workflow was really enhanced related to the integration workflows platform and the cloud services configuration that currently allows delivery of lower cost simplified systems, enabling more agile and collaborative work, translating into economic savings.

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