Submission code: QXG46P5K9V

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SADTW Seismic Attribute: A new approach to support insights into seismic data interpretation

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INTRODUCTION

Seismic interpretation plays a key role in subsurface characterization and is often enhanced by using attributes derived from seismic data. The increasing volume of acquired data has driven the development of new tools to support identifying relevant geological features. In this context, the Dynamic Time Warping (DTW) algorithm offers a promising approach to measure dissimilarities between seismic traces. This work proposes the generation of a seismic attribute based on DTW, aiming to highlight structural and stratigraphic variations that may not be evident through conventional attributes.

METHOD AND/OR THEORY

The Dynamic Time Warping (DTW) algorithm measures the dissimilarity between two time-dependent sequences by identifying an optimal alignment path that minimizes differences in shape and timing, even when offsets or distortions are present. This is achieved by computing a cost matrix that evaluates the similarity between each sample pair, followed by an accumulated cost matrix. The least-cost path through this matrix defines the alignment, adhering to conditions of boundary inclusion, monotonicity, and continuity to ensure consistent temporal mapping.

This work proposes a new seismic attribute called SADTW by calculating the DTW-based dissimilarity between each seismic trace and its neighbors within a defined pseudo-cube. For each central trace, a DTW Cost value is selected according to a chosen statistical criterion and used to replace the original trace value. This process enhances the representation of local variations in waveform shape across the dataset. Traces on the edges of the volume are excluded due to limited neighboring information, ensuring the reliability of the attribute computation.

In order to understand the seismic attribute, we applied the innovative approach in two datasets: a synthetic dataset generated with well log information and an interpreted seismic horizon from the Marlim field, located in the Campos Basin, Brazil.

RESULTS AND CONCLUSIONS

The seismic attribute generated using the Dynamic Time Warping algorithm (SADTW) demonstrated strong potential for enhancing seismic interpretation. In both synthetic and field datasets, the attribute effectively highlighted geological features such as fault zones, facies boundaries, and depositional variations. By integrating waveform shape information, SADTW complements traditional methods and can support more accurate and efficient subsurface analysis.