**ABSTRACT**

Computer-aided fault imaging and interpretation is a fundamental tool for subsurface structure characterization and modeling, and the existing methods are primarily based on seismic discontinuity analysis (e.g., coherence and semblance) that evaluates the lateral variation of waveform and/or amplitude. However, such attributes have a limited resolution on subtle faults without apparent displacements in seismic images, which correspondingly decreases the accuracy of fault detection and interpretation. This study presents a new method for volumetric fault imaging based on seismic geometry analysis, consisting of two components. First, the curvature and flexure analysis is performed for fault detection from the perspective of evaluating the changes in the geometry of seismic reflectors, which helps highlight both the major faults and the subtle ones. Then an isolation operator is performed for differentiating the faults from the non-fault features observed in the curvature/flexure volumes, which leads to a fault volume with each lineament representing a potential fault. The added value of the proposed method is verified through applications to two 3D seismic volumes from the offshore New Zealand and the Netherlands North Sea. The results not only clearly depict the faulting complexities with varying sizes and orientations, but also indicates its great potential for improving the semi-automatic/automatic fault extraction from 3D seismic data.

**RESULTS & Applications**

- **(a) Seismic amplitude**
- **(b) Seismic variance**
- **(c) Fault from seismic curvature**
- **(d) Fault from seismic flexure**

**INTRODUCTION**

- Robust characterization of faults and fractures is essential for subsurface structure interpretation from 3D seismic data.
- Traditionally, seismic discontinuity analysis (e.g., coherence and semblance) is implemented into the process of fault detection and computer-aided fault extraction. The discontinuity attributes are limited in the detection resolution for subtle faults and fractures beyond the seismic scale and offers no physical link for predicting the fault/fracture properties (e.g., intensity, and orientation).
- Such limitations are overcome by generating seismic curvature and flexure that evaluate the lateral variation of the geometry of seismic reflectors.
- Both faults/fractures and the adjacent anticlinal/synclinal blocks are mapped in the images of seismic curvature and flexure.

**CONCLUSIONS**

- A new workflow has been presented for improved fault/fracture detection and interpretation based on 3D seismic geometry analysis, consisting of two components:
  a. seismic curvature and flexure attributes for highlighting subtle faults that often not visible from the traditional seismic discontinuity analysis;
  b. lineament isolation for differentiating potential faults from non-faulting features (anticlinal and synclinal bending).
- Applications: (a) volumetric fault imaging and (b) seeded fault picking.