Full Azimuth Long Offset Data for Fracture Characterization: A Jurassic Case Study in North Kuwait

Hanan Al-Hasan[1], Fatma Basha[1], Riyanto Kusumo[1], Agus Abdullah[1], and Taiwen Chen[1]

[1]exploration , KOC, Abu fatira, Kuwait.

ABSTRACT

KOC acquired 4672 km2 of 3D single-sensor full azimuth long offset seismic data covering North Kuwait during 2012-2015. A total of 115,200 live channels, laid on 30 receiver lines for each shot with a maximum inline and crossline offset of 6000 m. The survey has multi objectives; firstly to improve the structural and fracture mapping of the Jurassic reservoirs. Secondly, to provide the highest resolution in order to map the intra- reservoir architecture of the Cretaceous. Finally to better image the deep potential Paleozoic for exploration objectives. In addition, this data set will be used for reservoir characterization studies such as ' AVO / AVAZ ' and fracture mapping. The current study focuses on data conditioning in order to produce a dataset suitable for AVAZ/AVO studies in general and for fracture orientation and density mapping in particular. The processing has been carefully designed to ensure the preservation of amplitude, phase and azimuth at each stage of the sequence. The main challenge was the lack of near offset coverage due to ground facilities, etc. that lead to irregular fold/amplitude distribution, poor quality of static solution, existence of residual noise and gather misalignments. The statics problems have been addressed, 3D interpolation in Offset Vector Tile domain was carried out incorporating near offset of legacy dataset. Particular attention was paid to attenuate residual noise while preserving azimuthal anisotropy, gather flattening, amplitude balancing and azimuthal sector generation from which we generated 60 volumes for 12 azimuth sectors and 5 offsets. Examples of quality chick (QC) steps and data examples will be presented. As a byproduct of gather flattening, magnitude of azimuthal anisotropy and azimuth of fast velocity were computed using NMO velocities and travel times. This is a useful tool as fast velocity (Vf) is shown to align with the dominant fracture strike. Simultaneous inversion for each azimuth is performed in order to obtain elastic parameters such as P-Impedance and Vp/Vs. Based on elastic property variation as a function of azimuth, seismic anisotropy is estimated, which could infer fracture orientation and density. The study results will be presented during the presentation.