Estimation of Anisotropy Parameters Using Intrinsic Rock Properties in a Selected Swamp Field in Niger Delta

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Inaccurate estimation or total disregard of anisotropy in seismic velocity accounts for suboptimal imaging especially in depth positioning and focusing even when prestack depth migration algorithm has been used. In most sedimentary basins, like the Niger Delta, comprising of about 70% shales, the type of anisotropy often observed is the vertical transverse isotropy (VTI) or polar anisotropy. This type of anisotropy can be quantified by estimating the three Thomsen parameters epsilon (ε), delta (δ), and gamma (γ) including the anellipticity parameter eta (η) that derives its significance from the two parameters epsilon (ε) and delta (δ).

In this study these parameters are derived from well log data comprising gamma ray, density, compressional and shear wave velocity logs, and checkshots from wells in the central depobelt of the Niger Delta. In order to completely characterize a VTI system in our area of study a system of five elastic stiffness moduli was estimated and subsequently used in the estimation of these parameters. The values of the parameter delta (δ) estimated from wells lies within the range $-0.3 \leq \delta \leq 0.2$. This correlates well with the values of the same parameter obtained analytically with a combination of seismic moveout velocity (VNMO) and vertical velocity (Vo) from checkshot data. The values of the parameters epsilon (ε), gamma (γ) and eta (η) are also observed in our work to lie within the ranges of $-0.3 \leq \varepsilon \leq 0.4$, $-0.2 \leq \gamma \leq 0.4$ and $-0.1 \leq \eta \leq 0.3$ respectively.