Pore Pressure Inversion using AVO Information. The Influence of Overburden Changes on Pore Pressure Quantification

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Abstract

In this paper we investigate the possibility to quantify the changes in pore pressure at the reservoir level over time. An AVO (amplitude versus offset) approach is used to invert the stress field from the seismic impedances. By applying the AVO method we are meeting several assumptions which may have a signifficant influence on the accuracy of the pressure inversion process. Geomechanical modelling on synthetic examples is carried out in order to investigate the contribution of the most significant effects: 1) The Overbuden Effect , 2) Ray-bending effect, 3) Effect of weak anisotropy in the overburden. Literature studies show that the absolute changes in the seismic attributes are less in the overburden than inside the reservoir as a result of injection, where as in case of pressure depletion the effect in the overburden is larger. Using the stress/strain - velocity relations we inverted the time lapse changes in seismic parameters from changes in stress field as a result of production. Even in cases where the time - lapse effect is larger inside the reservoir than in the overburden, by ignoring the overburden effect, we observed untill 20% non - accuracy in pressure quantification.The effect of weak anisotropy is insignificant. The Ray-bending effect as a result of velocity – density changes in the overburden is tied to the Overburden Effect and in case of small time-lapse changes in the overburden it is of minor importance. From our numerical case study we conclude that the overburden effect biases the results of pressure quantification from AVO data and should be taken into account in order to achieve an accurate quantification of the rockphysics properties.