Abstract

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4D reservoir monitoring has recently become a major tool used to manage the hydrocarbon production of reservoirs. When combined to production well data, high quality 4D seismic is very useful to address production changes in a reservoir over time. This becomes very challenging though, for most of the clastic reservoirs from the J-Area field, in Central North Sea. These reservoirs are frequently compartmentalized with complex faulting which can result in different initial fluid contacts and pressures across the same field. Full understanding of which faults are acting as hydrocarbon baffles or flow barriers would be very useful in optimizing drilling. This work aimed to determine whether 4D seismic techniques could realistically aid this understanding by quantifying the reservoir production effects relating to pore pressure and water saturation changes in J-Area Triassic using real and predicted well data. It further aimed at testing the viability of repeated seismic reservoir monitoring in this field using the normalized root mean square (NRMS) technique. The modelled 4D seismic response derived from synthetic seismic traces based on seismic volumes generated from the well data was used to design a new dedicated 4D survey. The results show that both pore pressure depletion and water saturation changes produce a significant 4D effects in the reservoir. Yet, pore pressure depletion become the major production effect in this field as the majority of 4D effects are due to pore pressure reduction through depletion of the reservoir. The study suggest that, for optimum reservoir monitoring, a baseline survey must be reprocessed in parallel with the monitor survey to reduce the NRMS noise or alternatively a dedicated repeat survey is acquired matching the design of the latest vintage of seismic.