FORCE
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Predicting pressure and fluid saturation changes using 4D seismic attributes, production data and simulation model

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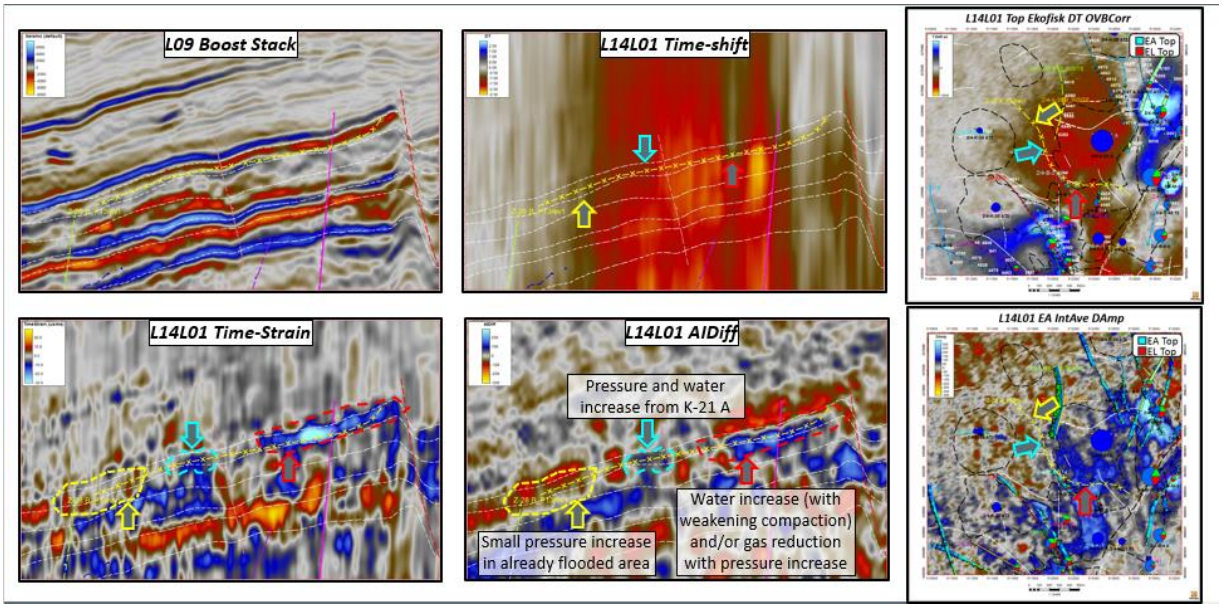
Optimizing the location of infill wells in a mature field such as Ekofisk with a long history of production and a hectic drilling schedule requires a fast and integrated solution that incorporates all available data in an efficient manner. In addition to finding locations with remaining oil in between the many producers and injectors, it is of paramount importance to drilling safety and well performance to characterize the pore pressure behavior on the target area and more specifically along the proposed well paths.

In the Ekofisk chalk field, there are multiple sources of data and models available to characterize pressures and fluid saturations in the reservoir. Traditionally, pressure and water saturation logs from recently drilled wells in addition to produced fluid rates and borehole pressures in the producer and injector wells are used in history matching to generate a deterministic flow model which characterizes the dynamic behavior of pressures and saturations. More recently, seismic 4D attributes have increasingly been incorporated as additional data to be assimilated in the history matching process and in the estimation of the dynamic behavior of the reservoir properties. In this paper I describe a methodology or framework to efficiently integrate all the relevant data regarding flow model properties, well activities, production data and observed 4D attributes to estimate the pressure and fluid saturation changes from the reference history matched model at a reference date to a target date given by the last available seismic survey.

The methodology presented in this paper is based on a non-linear and constrained rock physics model 4D inversion that uses estimated seismic elastic properties and a reference history matched flow model. This methodology is a shortcut to doing full seismic assisted history matching in the sense that it quickly calculates deviations between the elastic properties predicted from the model and the observed elastic seismic attributes generating alternative pressure and fluid saturation profiles along the planned well paths without explicitly using production and injection data. The method then finds an alternative solution in reservoir property changes that better explain the observed seismic attributes and honors constraints given by surrounding well activities. The workflow and results will be illustrated with a recently planned producer well.



Seismic 4D Attributes along planned well path which are input to 4D RPM inversion.