STRUCTURAL UNCERTAINTY MODELLING IN RESERVOIRS (HAVANA-SUM): THE EFFECT OF VARYING FAULT GEOMETRY AND TRANSMISSIBILITY ON RECOVERY.

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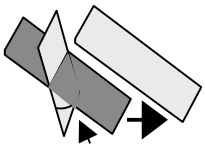
Present day fault description and fault seal calculation is a severe simplification of the observed complex nature of faults in outcrop (Foxford et al. 1998, Hesthammer & Fossen 2000). Fault description and seal estimation is, however necessary to be able to realistically simulate fluid-flow in faulted hydrocarbon-bearing reservoirs. Simple algorithms like SGR (Shale Gouge Ratio) and SSF (Shale Smear Factor) combined with microtectonic core analysis of fault processes and property measurements (Fisher & Knipe 1998, 2001) allow the differentiation of relative sealing capacities between and along different faults. (Knipe 1997, Knai & Knipe 1998 , Ottesen Ellevset et al. 1998). The uncertainty in the sealing algorithms, and in the different input parameters to the sealing algorithm (Figs 1 & 2) are, however, so large that the investigation of these uncertainties are necessary (Hesthammer & Fossen 2000).

Statoil, together with Norwegian Computing Centre, have developed a methodology to assess structural uncertainty and implemented it into a software called HAVANA-SUM (HAVANA Structural Uncertainty Modelling). The method efficiently assesses the uncertainty by varying fault parameters and building multiple realizations of an ECLIPSE simulation grid, including fault transmissibility multipliers. The parameters which can be varied include, fault location, dip, strike, displacement, drag, thickness and permeability/sealing. The presentation will describe the methodology used and the results from a HAVANA-SUM pilot study of a field from the southern Viking Graben, with gas bearing Brent Group reservoir rocks. The study shows that an increasing number of faults in the model reduces recovery, even if the faults are not completely sealing, indicating that sub-seismic faults may reduce recovery even further. The choice of fault permeability has the second largest effect on recovery.

The effect of varying the fault parameters is most probably case specific, in particularly it is related to the depositional setting of the sediments.(Lescoffit & Townsend in prep.) This points to the need to carry complimentary studies where various sedimentary environments are examined. However the value of this type of study should not be underestimated in helping to determine where further work should be concentrated.

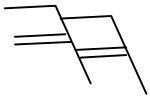
* Working for Statoil at the time of initiation of this project

Uncertainty in FAULT ZONE GEOMETRY

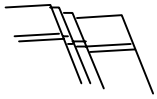


Change in position

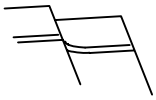
Change in Dip



Seismic resolvable fault throw



Multiple faults

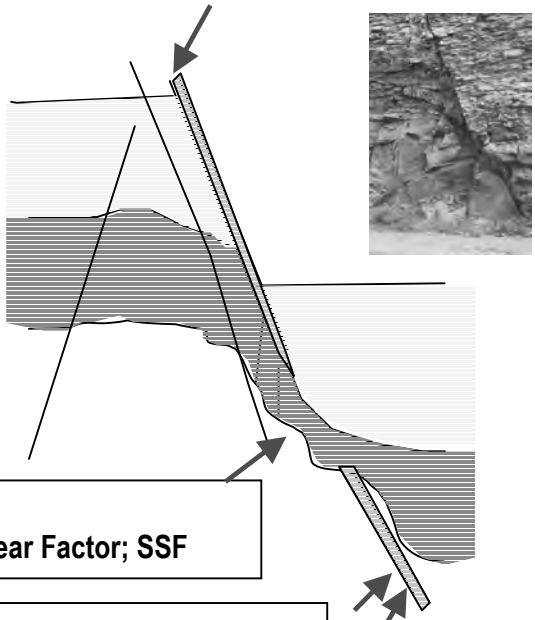


Drag

Fig 1

UNCERTAINTY IN FAULT ROCK PROPERTIES

Fault rock thickness
Can be described by a **thickness/throw relationship**



Continuity of Clay smear
Can be described by **Shale Smear Factor; SSF**

Fault rock type
Can be described by shale gouge ratio (**SGR**)

Fault rock permeability
Can be described by **SGR/permeability relationship**

Fig 2

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