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RESUM, Volumetrics and Report Maker

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Summary

This paper presents an extension/plugin for the Schlumberger software Petrel that enables user to apply cutoff's and summation, generate scatter sets from the Net Reservoir and Net Pay average properties, calculation of volumetrics and risk, P, 2P and 3P volume of hydrocarbons based on uncertainty in porosity, area, net pay, water saturation and FVF and prepare effective reports inside petrel itself, without the use of external report makers like MS word. This module is an essential kit for a petro- physicist to form a preliminary idea about the variation of properties in a map and the volume of hydrocarbon reserves in a basin without actually constructing a detailed reservoir model.

Keywords: Petrel, Ocean, Reservoir Summation, Cutoff, Monte Carlo, Volumetrics

Introduction

Petrel is a Seismic to Simulation software product of Schlumberger. The Petrel architecture allows the common users to develop extension using its platform Ocean. The current paper presents such an extension/Plugin that has three different components ReSum, Volumetrics and Report Maker.

In Petrel, Hydrocarbon reserves are calculated after developing a detailed reservoir model. So the petro-physicist is not provided with any tool to use well logs that are generated and processed from software like "TechLog" and reservoir summation and average property maps like porosity, water saturation on a regional scale etc. From these logs. Though the Net Pay can be calculated using the calculator tool provided in Petrel, which is highly time consuming. Report generation of the cutoff's and average reservoir properties is also not efficient if generated using external programs like M S Word. This kit provides a Report maker inside petrel itself.

Method

As discussed above the Plugin consists of three modules. The ResSum module is a multi-well multi-zone analysis module used to generate net reservoir (Ross, 2001) and net pay properties for volumetric analysis. The computation of these reservoir properties involves a hierarchical use of cutoff criteria. There are three cutoff levels namely Gross, Net Reservoir and Net Pay. In this application use of a multi well multi zone approach was done, empowering the user to run cutoff and summation on multiple zones concurrently.

The gross properties do not have any cutoff applied, although a discriminator curve could be used as a preliminary filter. Net Reservoir has a cutoff applied for porosity, Vshale and the two discriminator logs. In case of Net Pay, it has a cutoff applied for porosity, Vshale, water saturation and two discriminator logs. A facility is also provided to input a Non-Shale/GR log in place of a Vcl log. At the end of the processing a complete report is generated zone wise. In case of a multi-well analysis, a scatter set is generated at the end of the ReSum. This scatter set can be used to generate maps using the Petrel's "Make Surface" tool in the "Utilities" menu.

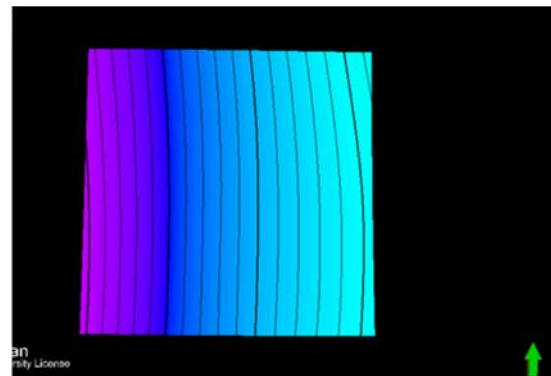


Fig.1. Property surface maps generated from the scatter set.

The volumetrics module enables user to use these average reservoir properties or the HCPV surface generated to calculate the multi-zone volumetrics. The plugin analyses each zone separately and gives the amount of recoverable oil/gas produced from each zone. Uncertainty analysis (Swinkels, 2001) on the amount of oil/gas generated is also provided. Monte Carlo simulations on different properties like area, FVF, porosity, water saturation and net pay are carried out and the P10, P50 and P90 values are given in the



summary. At the end of the workflow the user can generate a complete summary of the operations and the total oil produced.

Output

Graphs are generated and stored in petrel input pane as functions and can be used in further analysis. The scatter sets are also generated at the end of the ReSum and are stored as "Points with attributes" in Petrel. At the end of all the operations the user has a detailed report of the Gross, Net Reservoir and Net Pay of different zones, Scatter sets and property maps of different properties like porosity, water saturation, Vshale and HCPV(Hydro carbon pore volume), volumetrics report, Uncertainty (P10, P50, P90 reserves) report, and final graphs of the uncertainty.

Conclusion

ReSum and Volumetrics is an inevitable module for every oil and gas exploration process. The module is architecturally well built and all the algorithms used for volumetrics are SPG standard formulae. The module consists of a spreadsheet interface which helps the user to easily edit any value or insert new zones at any stage. The Monte Carlo uncertainty reserves graph created at the end of the process are used to determine any percentile at the later stage of the reservoir modeling. This module gives a preliminary idea of amount of reserves that could be present in the basin area without actually creating a reservoir model. The maps generated from the scatter plot are helpful in the decision making process of the production well placement.

References

- Ross, J.G., 2001, Petroleum Resources Classification and Definitions. Guidelines for the Evaluation of Petroleum Reserves and Resources; Society of Petroleum Engineers, Texas. 7-25.
- Heiberg. S., Swinkels, W.J.M., 2001. Guidelines for the Evaluation of Petroleum Reserves and Resources. Probabilistic Reserves Estimation Procedures; Society of Petroleum Engineers, Texas. 41-53.

Acknowledgement

We would like to thank Schlumberger for providing us an opportunity to interact with the industry's leading software and contribute to the benefit of the industry. We would like to thank the whole SIS team for their unconditional help to complete this work with a real success.

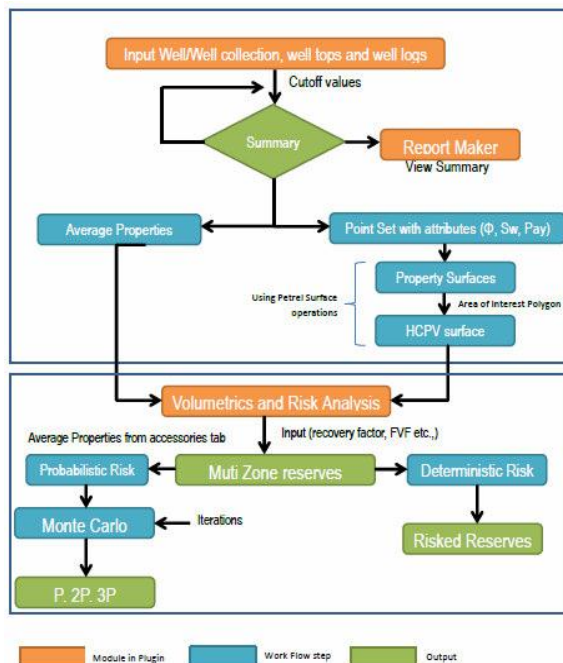


Fig. 2. Flowchart showing different modules and work flow.

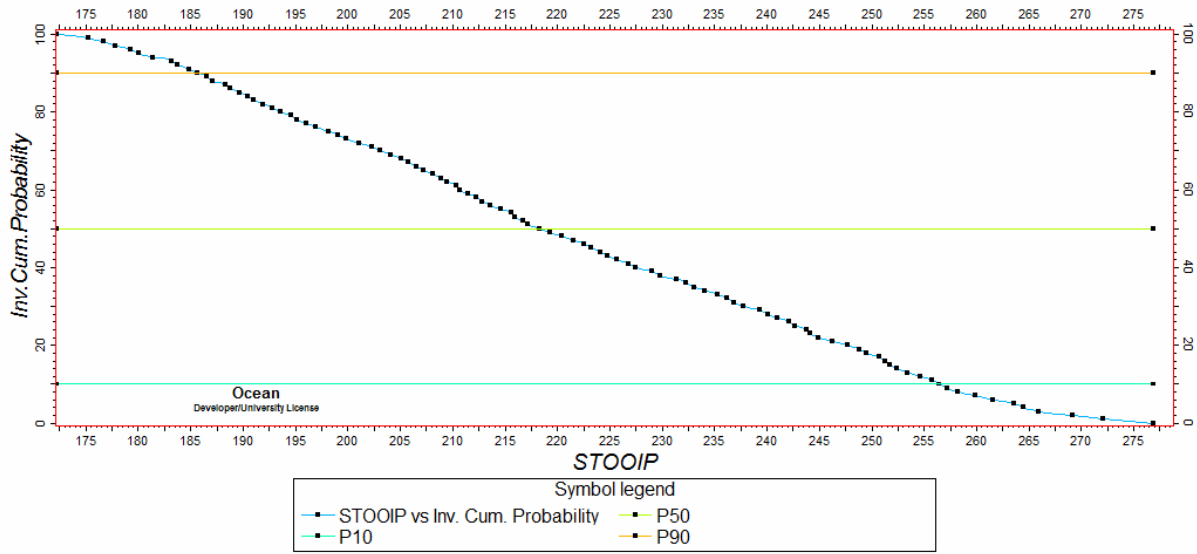


Fig. 3. Graph showing the Monte Carlo uncertainty graph. The horizontal lines are the P90, P50 and P10 lines from top.