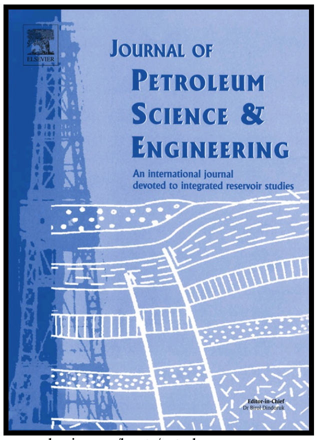
Author’s Accepted Manuscript



www.elsevier.com/locate/petrol

Uncertainty assessment of volumes of investigation to enhance the vertical resolution of well-logs

Pedram Masoudi, Tahar Aïfa, Hossein Memarian, Behzad Tokhmechi

PII:	S0920-4105(16)31301-8
DOI:	http://dx.doi.org/10.1016/j.petrol.2017.04.026
Reference:	PETROL3966

To appear in: *Journal of Petroleum Science and Engineering*

Received date: 14 December 2016
Revised date: 13 April 2017
Accepted date: 19 April 2017

Cite this article as: Pedram Masoudi, Tahar Aïfa, Hossein Memarian and Behzac Tokhmechi, Uncertainty assessment of volumes of investigation to enhance th vertical resolution of well-logs, *Journal of Petroleum Science and Engineering* http://dx.doi.org/10.1016/j.petrol.2017.04.026

Uncertainty assessment of volumes of investigation to enhance the vertical resolution of well-logs

Pedram Masoudi[1], Tahar Aïfa[1,*], Hossein Memarian[2], Behzad Tokhmechi[3]

[1] Géosciences-Rennes, CNRS UMR6118, Université de Rennes 1, Bat.15, Campus de Beaulieu, 35042 Rennes cedex, France

[2] School of Mining Eng., College of Eng., University of Tehran, North Kargar, 1431954378 Tehran, Iran

[3] Department of Petroleum Engineering, University of North Dakota, 243 Centennial Drive Stop 8154, Grand Forks, ND 58202-8154, USA

[*]Corresponding author: tahar.aifa@univ-rennes1.fr

Abstract

Whereas well-log data are dense recordings, i.e. low sampling rate, there is a high depth uncertainty. The depth uncertainty originates from the volumetric nature of well-logging that each record belongs to a volume of investigation, around the logging tool. The developed algorithm in this work consists of two parts: (i) uncertainty assessment using Dempster-Shafer Theory (DST). The lower (upper) uncertainty boundary of each well-log is calculated by belief (plausibility) function. (ii) Four simulators are designed for scanning the uncertainty range in order to enhance the vertical resolution of well-logs (~60 cm) by generating simulated-logs (vertical resolution of ~15 cm). Shoulder-bed effect is reduced simultaneously with resolution improvement, resulting in more accurate thin-bed characterization. In order to validate functionality of the simulators, two error criteria are considered: ideal- and constraint-based errors. Ideal-based error is applicable in synthetic-logs where the rock specifications are completely known through ideal-logs. However, constraint-based error does not need ideal-log. It measures the error due to the volumetric nature of the well-logs, hence applicable in the real cases. The high correlation (R^2=0.89) between both the errors indicates that the second criterion is precise for validation. Step-by-step procedure of the algorithm is shown in detail on synthetic and real data (a cored interval). Finally, DST-based algorithm is not only automated but also more accurate than geometry-based thin-bed characterization method. The error bars of characterizing gamma, density and neutron porosity of thin-beds are lower in DST-based algorithm by 100%, 71% and 66%, respectively.