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Abstract

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Integrated Earth Modeling: From Seismic Interpretation to Flow Simulation in Reservoirs

The modelling of fluid flow in oil and gas reservoirs is a critical element in the successful and cost effective development and production of oil and gas fields. This is a complex task which requires input from a broad range of technical disciplines and can be very time consuming. During the 90s, many people in the oil and gas industry advocated an integrated approach to geo-modelling which led to the concept of "Shared Earth Model" (SEM), which was more hope than reality. Unfortunately, due to the lack of a unified vision, most solutions (both software and methods) offered so far have focused on one particular step of the modelling process rather than on the entire process from interpretation to flow simulation and beyond. As a consequence, all these "Shared" Earth Models are not sharable and therefore must be downgraded to the status of "Earth Models" (EMs). For example, in the early 90s all the so-called SEMs were mainly focused on seismic tomography but are now focused on flow grid construction implying severe (and dangerous) approximations of the real structures and properties of the studied geological domains.

The first part of this talk reviews some of these (non sharable) Earth Models (EM), stressing their respective weaknesses and showing why they cannot reasonably be considered as "Sharable" between the different disciplines involved in the modelling process from seismic interpretation to flow simulation.

The second part of this talk focuses on the concepts of "Fine Geostatistical Grid" (FGG) and "Rough Flow Grid" (RFG) and the needs for upscaling FGG's into RFG's. An analysis of the real needs of geostatisticians and reservoir engineers leads to the conclusion that the two grids are irreconcilable… at least using current technologies based on regular structured grids whose cells all are hexahedral.

The final part of this talk aims to provide a clear definition of an "actually sharable" Shared Earth Model and then offers a new paradigm reconciling the demands of seismic interpreters, structural geologists, geostatisticians and reservoir engineers. This has the potential to streamline integrated earth modelling and reduce the cycle time for the modelling of fluid flow in oil and gas reservoirs.

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Jean-Laurent Mallet

Education:

1974 PhD – Supérieure de Géologie Institut, Nancy, France

1968 B.S. – National Poly - technique de Lorraine, Nancy, France

Experience:

1981-Present Professor at the Ecole Nationale Supérieure de Géologie

1968-81 French CNRS in the field of numerical data analysis and automated mapping

Publications and Awards:

2003 *Doctor Honoris Causa"* University of Freiberg, Germany

2003 *Grand Prix Dolomieu*

2000 *SPE Anthony Lucas Gold Medal*

1997 *"Italgaz prize"* for his work in computer science. Developed gOcad, the first 3D Modeler in Earth Science.

Several *"Best Paper"* awards for his scientific papers (IAMG, SEP, etc.)

Professional Memberships:

Member of the steering committee of the Ecole Nationale Supérieure de Géologie.

Professional Interests:

In 1989 he launched the gOcad research consortium dedicated to 3D modeling and visualization of the geometry, topology and physical properties of the subsurface currently sponsored by more than 20 companies and 75 universities. Jean-Laurent Mallet continues to lead the gOcad research consortium and his personal research is at the frontier of applications in the geosciences, computer sciences and applied mathematics. He is also consultant and scientific advisor for Earth-Decision, the company in charge of the industrial version of gOcad. Jean-Laurent Mallet is a member of several scientific associations related to geomodeling such as SPE, EAGE, IAMG, SEG.