EAGE
EUROPEAN ASSOCIATION OF GEOSCIENTISTS & ENGINEERS

EAGE Student Lecture Tour 2014-2015

Integrated Geophysical Models

Theory, examples and implications on creativity

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Summary

The necessity to integrate multidisciplinary geophysical data has been increasing significantly over the past one or two decades. This is the effect of several interdependent factors.

1) Hydrocarbon exploration moved to deeper targets and more complex geological contexts. In these cases, models derived exclusively by one single type of geophysical measurements could be not adequate for describing the prospect and the geological setting.
2) The recent technological and scientific development nowadays supports and encourages the acquisition of huge multi-disciplinary data sets. This heterogeneous information is useful only if it is properly integrated, otherwise it introduces only additional interpretation problems.

In fact, added value can be extracted from multi-disciplinary data sets if and only if integration is performed appropriately. There is always the risk that redundant data sets can produce chaos instead of knowledge improvement, especially when the complex information flow is not properly managed. For this reason quantitative integration in geosciences should be considered as a rigorous discipline by itself.

The main objective of this lecture is to introduce this discipline, with particular focus on the integration of seismic, electromagnetic and gravity data. The lecture is addressed especially to university students. However, it can be useful also for professionals geoscientists, like exploration geophysicists and geologists, reservoir geophysicists, engineers and petrophysicists.

The lecture will be focused on the following linked aspects:

a) the value of integration in geosciences, with particular reference to geophysical methods, rock physics and geology;
b) the implications of the process of integration of information on general questions linked to problem solving, creativity and innovation.

The author will introduce the theoretical fundamentals of geophysical data integration with the support of practical examples extracted from his 30-years experience in the field. Methods based on constrained, cooperative and simultaneous joint inversion will be introduced. Real case histories will be used for highlighting the benefits offered by integrated seismic, electromagnetic and gravity methods. Moreover, the open questions and the intrinsic limitations of the various geophysical integrated approaches will be critically analysed.

Contextually with the technical subjects, the author will discuss also the fundamentals of integration of information, creative thinking and problem solving in the geosciences. He will present the Earth disciplines in the expanded frame of the Sciences of Complexity.

Students and researchers will be introduced to the theoretical and practical aspects of modern integrated geophysics; at the same time, they will be motivated to investigate the epistemological and cognitive background of their field of study.

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