Seismic indicators of petrophysical properties

Seminario
Data: Tuesday, 19 April, 2016 - 16:30
Relatore: Prof. Alfredo Mazzotti
Abstract:

Geophysicists and geologists have the task of inferring the geometry and the petrophysical characteristics of the subsurface targets from the information brought by seismic observations. Therefore, they are challenged by an inverse problem: by examining the seismic response, which is controlled by the reflectivity properties, they try to estimate the depth geometry and the petrophysical nature of the deep geological structures. Note that even approximate estimates of parameters such as porosity, fluid saturation, clay content, fracture density and orientation are of great value for the exploration of the subsurface.

As it always happens, to understand the interplay among the various controlling factors it is easier to consider the forward problem, that is to analyze the cause-effect relations between petrophysical parameters and the seismic response. This is the case because we are not challenged by ambiguities, or by sensitivity or ill-posedness issues that get in the way of the attempts to solve inverse problems.

Therefore, this short lecture illustrates a conceptual trail that drives the understanding of the petro-seismic relations that are the foundations of several modern seismic technologies and ongoing research projects. Fracture detection in hard rocks, monitoring of the changes in fluid content due to hydrocarbon production or CO2 injection, porosity and fluid saturation estimates, are the main objects of my talk and are illustrated making use of real data cases.

Afferenza: Dipartimento di Scienze della Terra, Università di Pisa
Proponente: Giorgio Cassiani

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