Quantitative Reservoir Characterization
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Introduction
Although a F2F course, use will be made of Moodle for the extra options it provides: a News Forum and a Discussion forum, plus extra files, and videos of interest for you to download. Therefore, check these fora regularly during the course.

What kinds of Geophysical Data could be used?
Various kinds of geophysical data are available. They are usually separated into Seismic and Multi-Physics data, which used to be called Non-Seismic data). Seismic is, without any doubt, the main method used in the oil and gas industry. But Multi-Physics data (gravity, magnetics, electrical, electromagnetics, spectral, etc.) is the main source of information in shallow subsurface applications (engineering, mapping pollution, archaeology, etc.) and at the early basin reconnaissance stage. However, seismic has its limitations and therefore also multi-physics methods are used successfully as complementary tools in subsurface evaluation. In combination with seismic data, they can significantly reduce the uncertainty of subsurface models as they measure different physical properties of the subsurface.

Seismic data and Processing
From seismic we not only need to obtain the structure that could contain hydrocarbons, but also the rock properties so we can decide on whether we are dealing with reservoir rocks (sandstone, carbonates, even shales), sealing rocks (shales, salt) or source rocks (shales, coals). To know what type of rock is present is important, but also what its porosity is and whether it is fractured, as that is important for permeability (How easy do the hydrocarbons flow through the rocks). To obtain accurate information on the rock properties we need, in principle, to consider two-way elastic wave propagation. Considering elastic propagation, which includes mode conversion, is necessary when we analyze the (pre-stack) amplitude variation with offset (AVO) or more accurately defined as amplitude variation with angle of incidence (AVA).

Quantitative Reservoir Characterization
Clearly most information will be obtained from seismic data. From quantitative analysis of pre-stack seismic data, elastic properties of the reservoir will be derived. But these need to be translated into rock properties relevant for exploitation, that is porosity and fluid saturations. That means that a rock-physics model need to be chosen. For clastic reservoirs that is relatively easy, for carbonate reservoirs it is much more non-unique. Machine Learning, which is part of Artificial Intelligence is applied more and more in all domains of the geosciences, including reservoir characterization. Therefore, I have included applications for classification and clustering of seismic reservoirs, using open-source software like Weka, Keras and TensorFlow.

The Course
The above items will be dealt with in the course; by presentations and discussions, watching videos and by doing many practical exercises. Also, each day contains a quiz which is meant to reinforce the learning. The quiz consists of multiple-choice questions.

In addition, we will be using ChatGPT, a Chat Generative Pre-trained Transformer, that is a large language model–based chatbot. We will investigate how accurate the answers to your questions are and learn how to build-up a conversation (Chat) with the program.