

Advanced Velocity Modelling

Where do we need velocity for?

Velocities have many uses. They are used in processing as well as interpretation. In processing they allow, for example, Normal Moveout (NMO) corrections to offset arrivals which facilitates stacking of events. This increases the signal-to-noise ratio significantly and makes interpretation easier. In processing the correct velocity-depth model allows “true-to-nature” imaging of the subsurface. But especially in interpretation there are huge benefits in obtaining accurate velocities for the different “geo-bodies”, as they can be used for lithology and pore fill determination. In some processing methods, take Full Waveform Inversion (FWI), they can be the main aim of its application. It is fair to say that for an accurate image of the subsurface, an accurate velocity-depth model is paramount in obtaining a “true” image of the subsurface, in terms of structure/geometry as well as amplitudes of reflections needed for quantitative interpretation.

Kinds of velocities.

Wave Velocity, Particle Velocity, Interval Velocity, Average Velocity, Stacking Velocity, NMO Velocity, DMO Velocity, Migration Velocity, Phase Velocity, Group Velocity, Instantaneous Velocity, Love wave Velocities, Rayleigh wave Velocities and maybe many more. Each of these velocities are derived either by a special method or serve a specific purpose. Also, the accuracy varies. It is important to aim for the appropriate velocity, that means a velocity of sufficient accuracy for the purpose. In the course various velocity determination methods will be discussed and it will become clear that for increasing accuracy not only more advanced processing methods are needed, but also more sophisticated acquisition. Think of multi-azimuth acquisition to derive azimuth dependent velocities providing information on fractures and in situ stresses.

The Course

All items of importance to velocity model building will be dealt with in the course; by studying course material based on recent publications, videos and by applying the theory in many practical exercises, thereby enhancing the learning.

Learning methods and tools

The course is based on a user-friendly Learning Management System, called Moodle. In Moodle different modules provide study material, videos, and exercises. Also, each day contains a quiz which is meant to reinforce the learning. The quiz using “Mentimeter” software. In addition, an excellent EAGE book by the Velocity Model Building “guru” is used for background reading.

Requirements

An understanding of the role of geophysics in the context of exploration and production of oil and gas and a basic knowledge of geophysics, but above all an inquisitive mind is required.

References

An Introduction to: Velocity Model Building by Ian F. Jones, EAGE Publications, ISBN978-90-73781-84-9.