



Development of the amplitude versus offset technique for the study of Quaternary sediments in Lake Geneva from high-resolution seismic reflection data

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The amplitude versus offset (AVO) method is well known to assess variations in physical properties of sediments such as porosity (void percentage filled with gas or fluid), bulk modulus and fluid density. Changes of these properties affect the sediment P- and S-wave velocities and their density. We used this method coupled with preserved amplitude processing to better understand the penetration of seismic signals into different sediment settings of river deltas in Lake Geneva.

To ensure that our system provides correct amplitude information, our streamer sensors were calibrated. We verified the sensitivity of each hydrophone and compared it with a calibrated hydrophone. The hydrophone responses were thus measured over a frequency range that corresponds to the frequency range of our seismic sources (mini GI airgun and S15 water gun of SODERA).

Measuring of the reflected amplitudes with offset requires a specific geometry of the seismic acquisition system in order to cover a large range of incidence angles. We towed a 66 channel streamer with 2.5 m hydrophone spacing behind the recording boat. Offsets thus ranged from 2.5 to 165 m. The seismic source was a mini GI 15 cu.in. air gun with a dominant frequency of 330 Hz. A dGPS controlled system was used for accurate navigation and to trigger air gun pops with distance. Limited data processing that preserves amplitude information was carried out to plot the gradient of the signal amplitude and of its envelope. These displays reveal evidences of lateral amplitude variations along the same reflector.

To understand how signal penetration varies under the Rhone and Dranse deltas and

under river channels, high-resolution seismic lines were gathered. Generally, signal penetration decreases under the deltas as we approach the river mouth. The presence of gas is likely responsible for this observation. Under river channels no reflections at all are visible. AVO information helps to understand the lack of signal penetration in these areas.