
Investigation of the Behavior of Surface Noise within Seismic Arrays of Variable Geophone Density

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The behavior of surface noise within seismic arrays of variable geophone density was investigated by means of recording a dense grid of single geophones. Common single geophone gathers were generated and processed in order to separate the seismic signal from non organized noise present in the data. Arrays with variable geophone densities were subsequently simulated from the common single geophone gathers. The non-organized noise was evaluated as the residual RMS amplitude of the simulated geophone gathers after separating the signal.

The result confirms the existence of spatial correlation of non-organized noise manifested by decreasing array efficiency attenuating the noise beyond a certain intra-geophone distance.

The effect is visible over the full seismic bandwidth but is frequency dependent and more pronounced with decreasing frequencies of the non-organized noise. At lower frequencies, the spatial correlation of the non-organized noise will manifest itself as a deviation from the square root law at relative larger intra-geophone distances.

The resulting relationships between bandwidth, intra-array geophone distance and non-organized noise attenuation suggest a maximum useful geophone density of seismic arrays. Using these relationships may yield a better signal-to-noise ratio and a more efficient use of the field equipment, a main contributor to the overall cost of present day seismic surveys.
