“Assessing frequency bandwidth and resolution enhancement of seismic data: a broadband perspective”

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Summary

Improved resolution and enlarged bandwidth are key direct expectations of broadband data, which stem from the definition of a broadband signal – which will be recalled. How should both be assessed and preserved or improved across seismic acquisition, processing and reservoir characterization, possibly including seismic inversion? Examples aim at stimulating thoughts on how our habits should evolve on these topics to adapt to modern high-bandwidth data.

In a first part we will focus on how the concept of seismic resolution could be revisited when considering broadband data: event separability and detection issues which are mainly determined by bandwidth and signal/noise ratios will be discussed. Examples of both non-broadband and broadband signals will be used in order to study how these measurements should be assessed.

Handling time-variant signals involves a bit of mathematical concepts to preserve relations between different variables such as temporal or spatial ones and frequencies or wavenumbers. It is especially when the bandwidth becomes much larger than the carrier frequency that these must be correctly taken into account throughout the design and use of signal processing tools. At this level, the topic of wavelet estimation will be a subject of particular attention knowing its importance for the reliability of reservoir characterization.

Across various examples, some guidance for best practice will be proposed for discussion.