Some Fundamental Issues on the Effect of Sampling on Wavefield Imaging

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The fundamentals of wavefield sampling are usually introduced with an explanation of some very basic notions (Lines et al., 2001). For example, the concepts of minimal sampling, the Nyquist frequency, and aliasing in one dimension might be explained with a picture of two sinusoids, with one of them well-sampled at the Nyquist sample rate and the other one under-sampled, and aliased, at half the Nyquist sample rate. The concepts of 2-D aliasing, often called spatial aliasing, are often explained with a picture of some sinusoidal events that appear to dip in one direction, but actually dip in another direction.

These basic concepts are all important, but they also leave a lot of issues about the impact of sampling on the final seismic image unexplained. For example, the basic notions are always explained with signals that are regularly sampled in time and space. Seismic data are almost always sampled irregularly, at least to some degree, and for land data, the spatial sampling is typically sparse. Even on 2-D lines, sources and receivers are almost never spaced in a perfectly regular fashion. We are able to sample the data regularly in time, but not in space, and our spatial sampling is almost always sparse. What impact do these important issues have on the final image? The object of this presentation is to address some of these important issues.

References

Lines, L., K. Brittle, I. Watson, and P.W. Cary, 2001, Aliasing for the layperson: Recorder, **26** , no.4, 10-16.