Is Repeatable Noise Acceptable in 4-D Seismic?

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A reasonable understanding now exists of the quantitative relationship between errors in source and receiver position and the effect of various noise sources at different depths upon repeatability. It is only partially true that coherent noise repeated within reasonable thresholds will effectively cancel during data differencing of baseline and monitor surveys. It is not true that all noise types are acceptable for 4-D – even if they are repeatable. Noise that can be accurately modelled from the recorded seismic data can be removed for the stand-alone analysis and interpretation of baseline or monitor surveys, and can be accurately removed during the differencing step. In contrast, noise that cannot be accurately modelled from the recorded seismic data is not acceptable for either stand-alone or differencing purposes – even if it is repeatable. Case examples from the North Sea and Australasia demonstrate how a detailed analysis of the important noise mechanisms in a particular 4-D survey location is critical during the feasibility study stages, and how such an understanding is necessary when managing the expectations of data repeatability. Accurate data regularisation and wavefield reconstruction are potentially significant processing tools that must also be factored into any consideration of noise issues when pursuing 4-D seismic.