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Imaging with Near-Field Hydrophones

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Summary

Near Field Hydrophone (NFH) data are routinely collected during marine acquisition and historically these data were used to QC air-gun timings and/or other air-gun-related issues. More recently (last 10-15 years), these data were recorded and employed during processing to aid both 1D and 2D source-signature deconvolution. The results presented here demonstrate it is possible to obtain a high-resolution image (greater than 100 Hz) of the near subsurface (0-1 s) using passive NFH array data. Similar results are also achieved with the active NFH array although noise handling in processing is more difficult. NFH data for imaging, can be a natural by-product of conventional marine seismic acquisition, with minimal additional processing cost. Potential uses could include: replacing requirements for a high-resolution 2D acquisition for site surveys, utilizing a source-only vessel for localized overburden and reservoir 4D monitoring, as well as improved deghosting and integration with distributed acoustic sensor vertical seismic profile data.

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Near Field Hydrophone (NFH) data are routinely collected during marine acquisition and historically these data were used to QC air-gun timings and/or other air-gun-related issues. More recently (last 10-15 years), these data were recorded and employed during processing to aid both 1D and 2D source-signature deconvolution. Kragh et al. (2009) noted geology-generated reflections in NFH data may permit construction of a zero-offset trace after attenuation of direct arrival energy. Chevron conducted two imaging tests in collaboration with CGG Crawley, UK, and Schlumberger Cambridge Research, UK, in 2015/17 using NFH data acquired during a 2015 node on a rope survey acquired by MagSeis over the Captain field. The Captain field is located in the outer Moray Firth North Sea, UK, in approximately 90 m of water depth. NFH data were recorded for every shot instant, with a source geometry consisting of a dual array with 25-m separation and shot 25-m flip-flop. NFH data recorded on the array that is firing, is referred to as 'active' while the non-firing array recording is referred to as 'passive'. Results demonstrate it is possible to obtain a high-resolution image (greater than 100 Hz) of the near subsurface (0-1 s) using the passive array data. Similar results are also achieved with the active array although noise handling in processing is more difficult. NFH data for imaging, can be a natural by-product of conventional marine seismic acquisition, with minimal additional processing cost. Potential uses could include: replacing requirements for a high-resolution 2D acquisition for site surveys, utilizing a source-only vessel for localized overburden and reservoir 4D monitoring, as well as improved deghosting and integration with distributed acoustic sensor vertical seismic profile data.

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