Wide-azimuth towed streamer data acquisition and simultaneous sources

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Summary

Wide-azimuth towed streamer acquisition (WATS) is quickly gaining acceptance as a method for better imaging of subsalt targets, such as in the Gulf of Mexico. The method makes use of one or more streamer vessels and two or more source vessels, all following parallel tracks. Although successes are being reported for this type of acquisition, the method is extremely expensive and various shortcuts are applied to reduce cost. An inherent disadvantage of the technique is that no short offsets can be acquired and that it is sensitive to feathering effects. To increase efficiency, it has been proposed to use simultaneous sources, but as yet nobody has discussed how to implement simultaneous sources in WATS.

In this paper, analysis of a typical WATS implementation shows that this WATS can be best described as an attempt to acquire areal geometry with 3D shot gathers in a sparse grid. This has important consequences for the criteria used in the design of "areal" WATS. In particular, rather than two source vessels, four source vessels with two sources each might be used to double the source sampling interval in the inline direction. This would make source sampling more balanced between inline and crossline direction. A direct consequence of this is that simultaneous sources can only be beneficial if more than 8 sources are used.

This paper proposes to use zigzag WATS as an alternative to areal WATS. In the ideal zigzag WATS configuration the source vessel crosses the streamers halfway. This geometry would also acquire short offsets and is much less sensitive to feathering. Zigzag WATS should provide better sampling and produce better imaging results than areal WATS. In zigzag WATS it makes sense to use simultaneous sources. In fact, two simultaneous sources have to be used minimally to make the number of boat passes approximately the same as for areal WATS.

Zigzag WATS has its drawbacks as well; the main problem being that the streamers have to be crossed. For conventional shallow-tow streamers this is not really feasible. In that case two source vessels should be used on either side of the streamer swath that turn 90° at a safe distance from the streamers. However, with deep-tow streamers, such as used in the over/under technique or with dual-sensor streamers, it seems feasible to cruise across the streamers.