Technical University of Crete
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Department of Mineral Resources Engineering

Marine seismic data acquisition and processing. Current practices – examples from the Mediterranean Sea and the Gulf of Mexico

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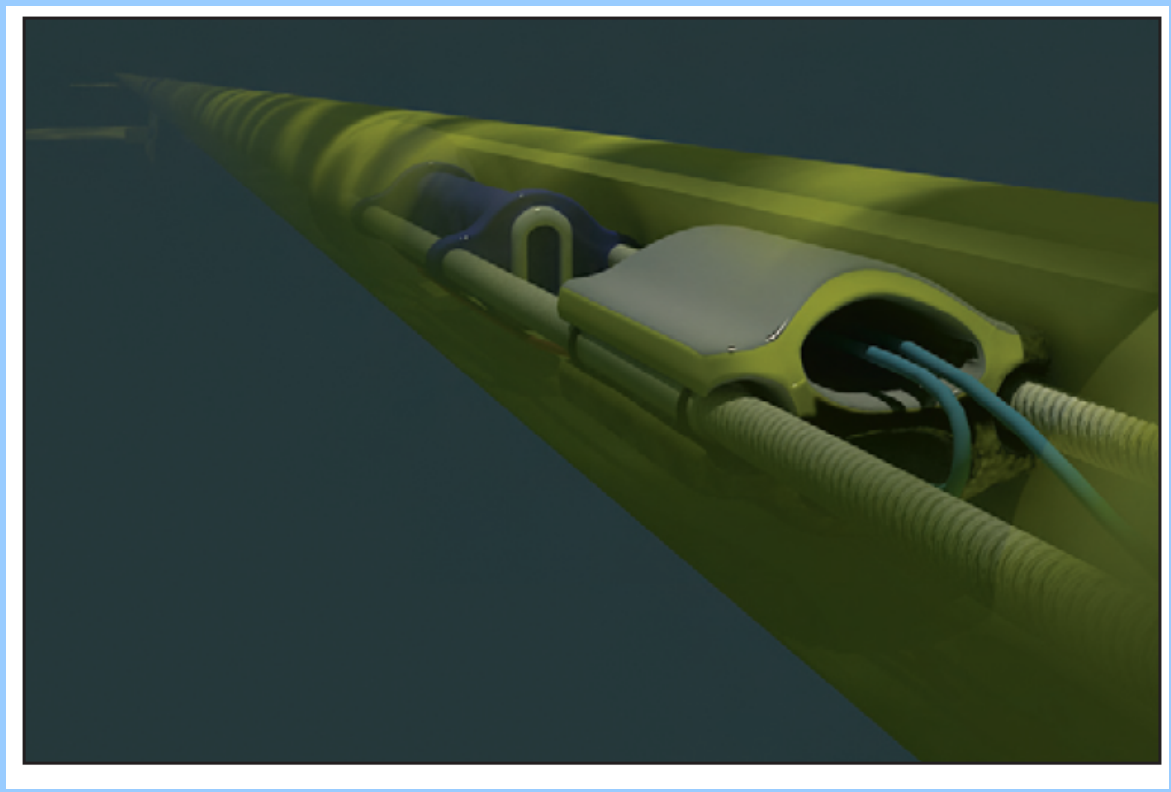


OUTLINE

INTRODUCTION

COIL SHOOTING

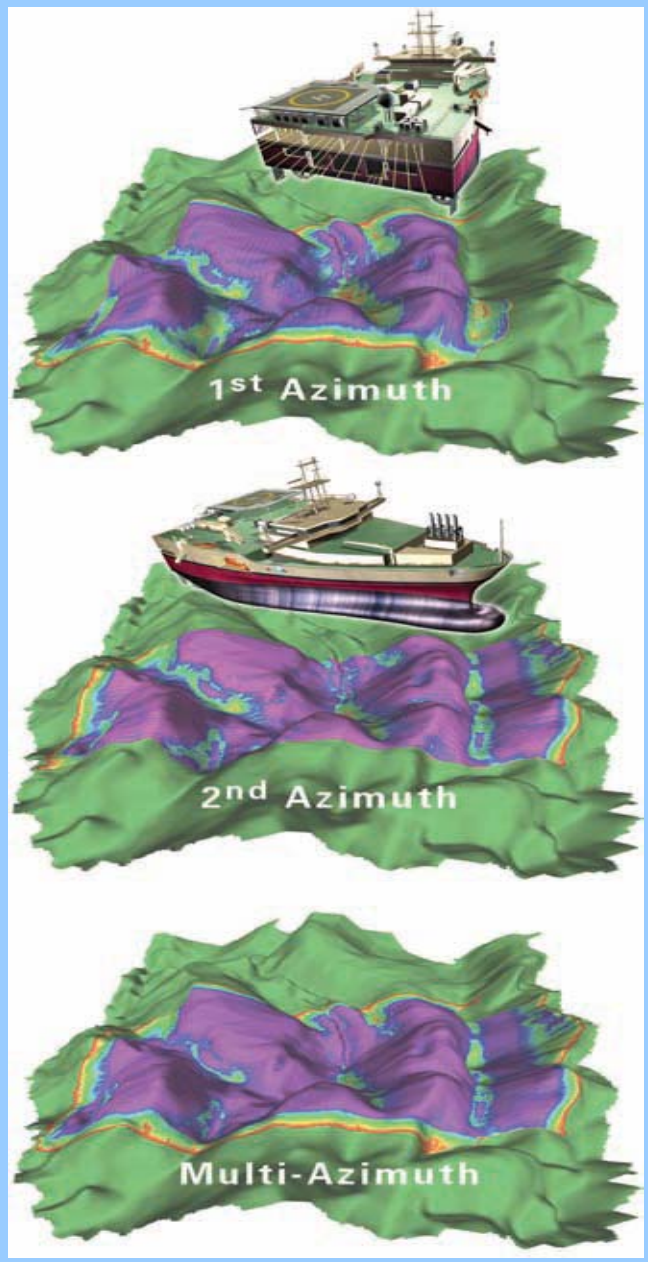
DUAL SENSOR STREAMER

EXAMPLES

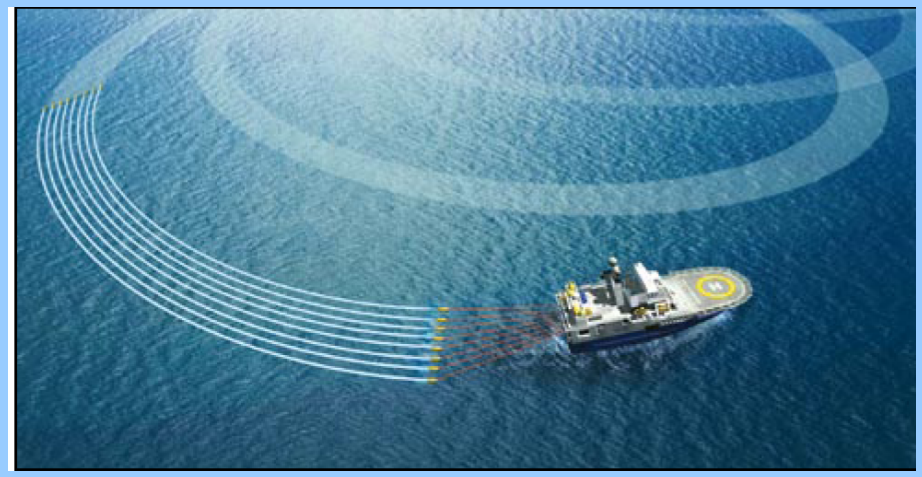
CONCLUSION

INTRODUCTION

Multi azimuth

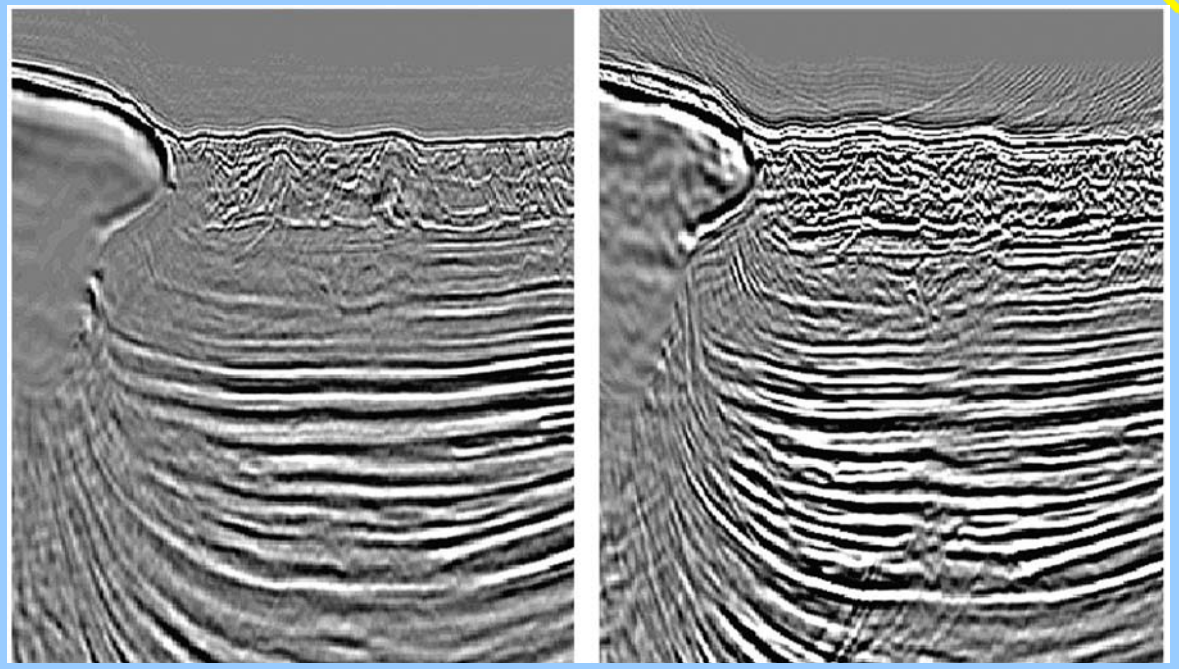


Coil Shooting acquisition geometry



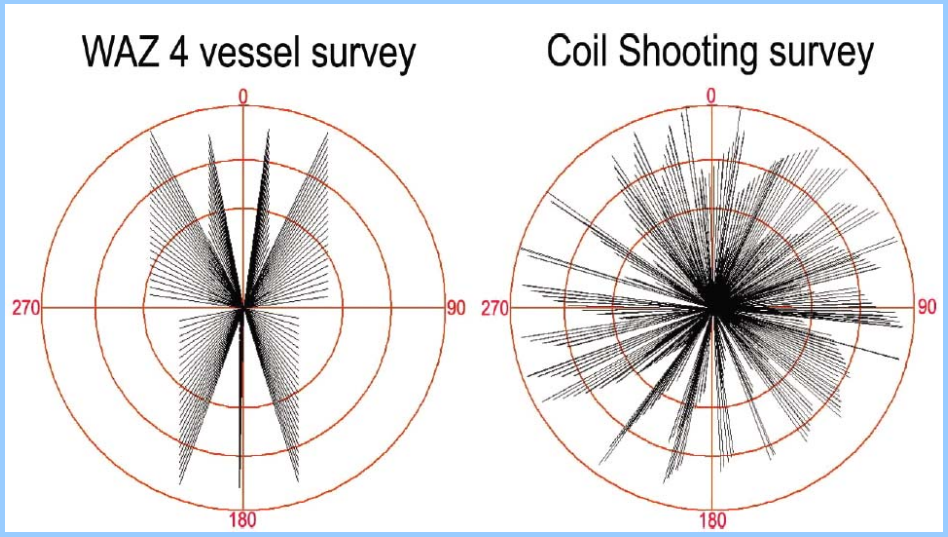
(Taylor et al., 2009)

3D prestack depth migration



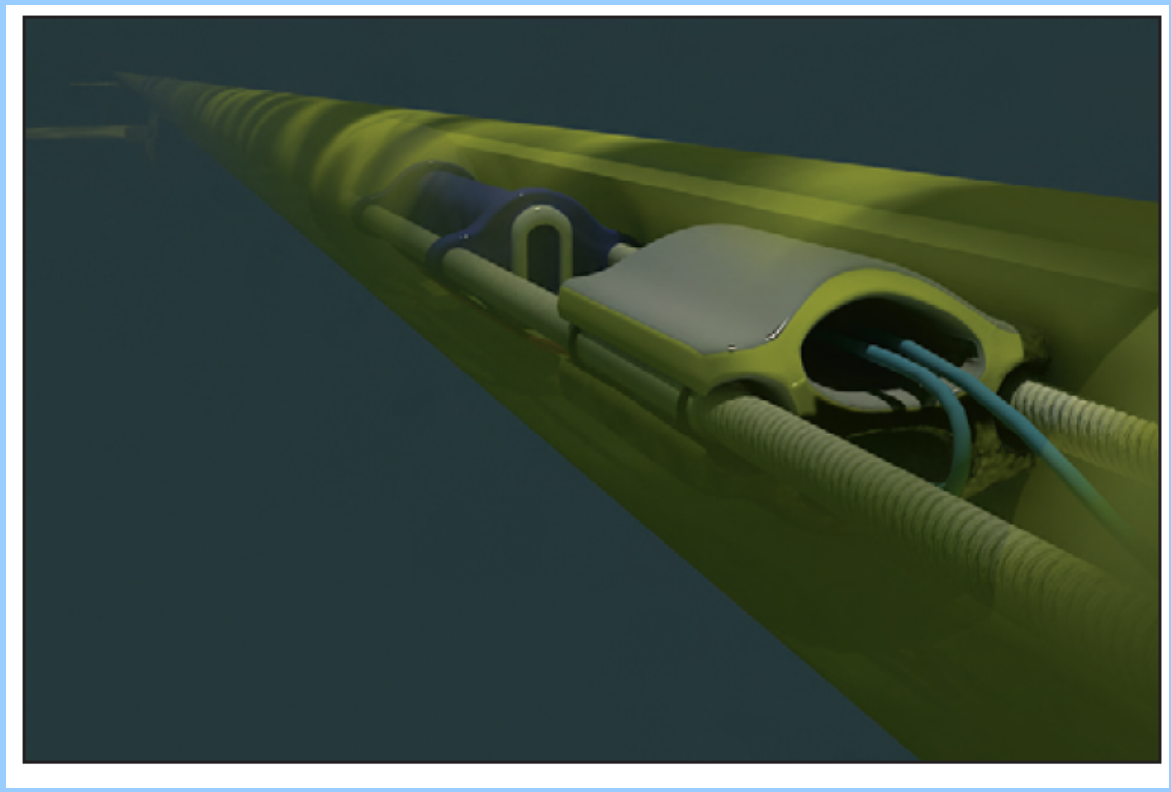
Offset/azimuth sampling "spider plot" comparison for one typical full-fold bin.

Crossline sampling for the parallel four vessel WAZ geometry is highly discretized.



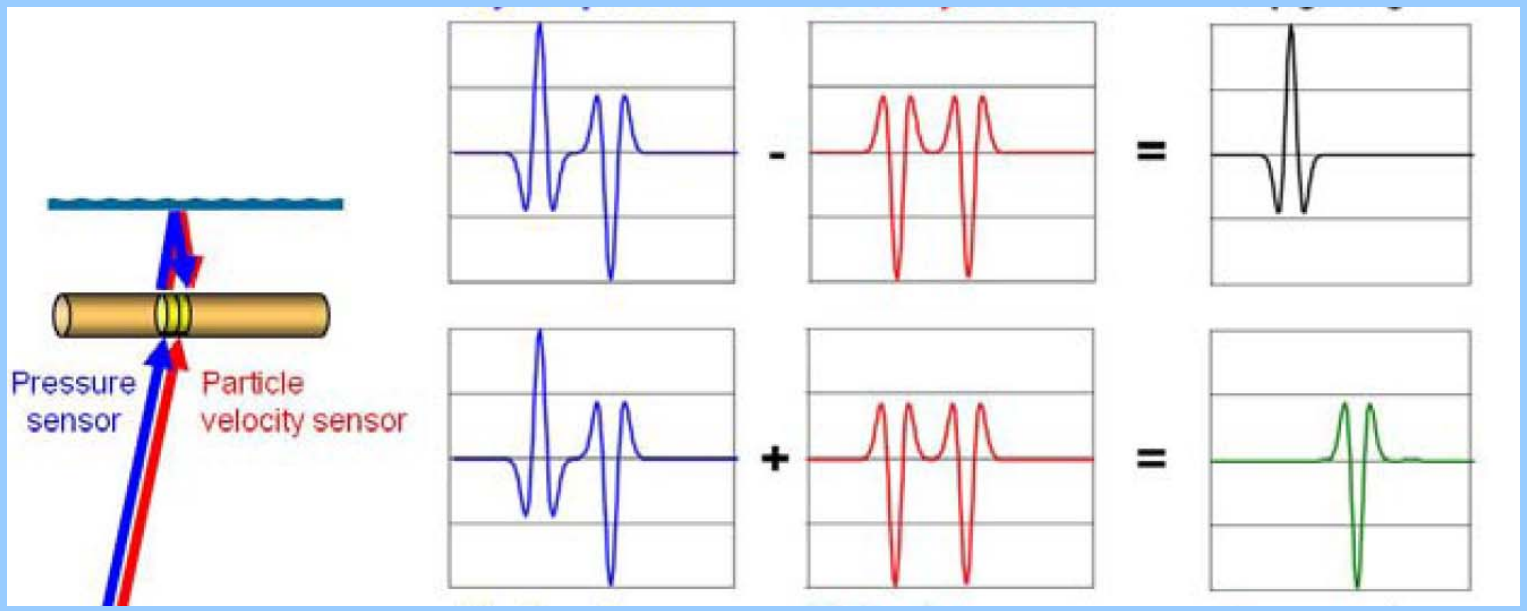
(Ross, 2008)

DUAL SENSOR STREAMER



Removal of the effect of the ghosts reflections from the sea surface.

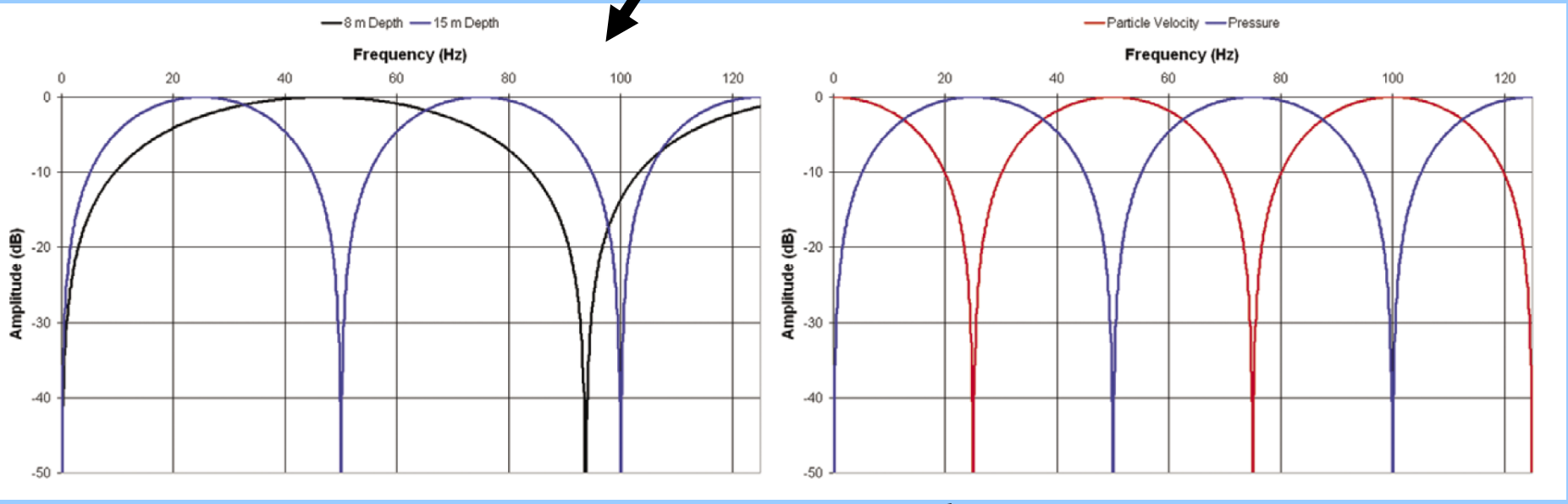
Velocity sensor - Hydrophone = Upgoing



Velocity sensor + Hydrophone = Downgoing

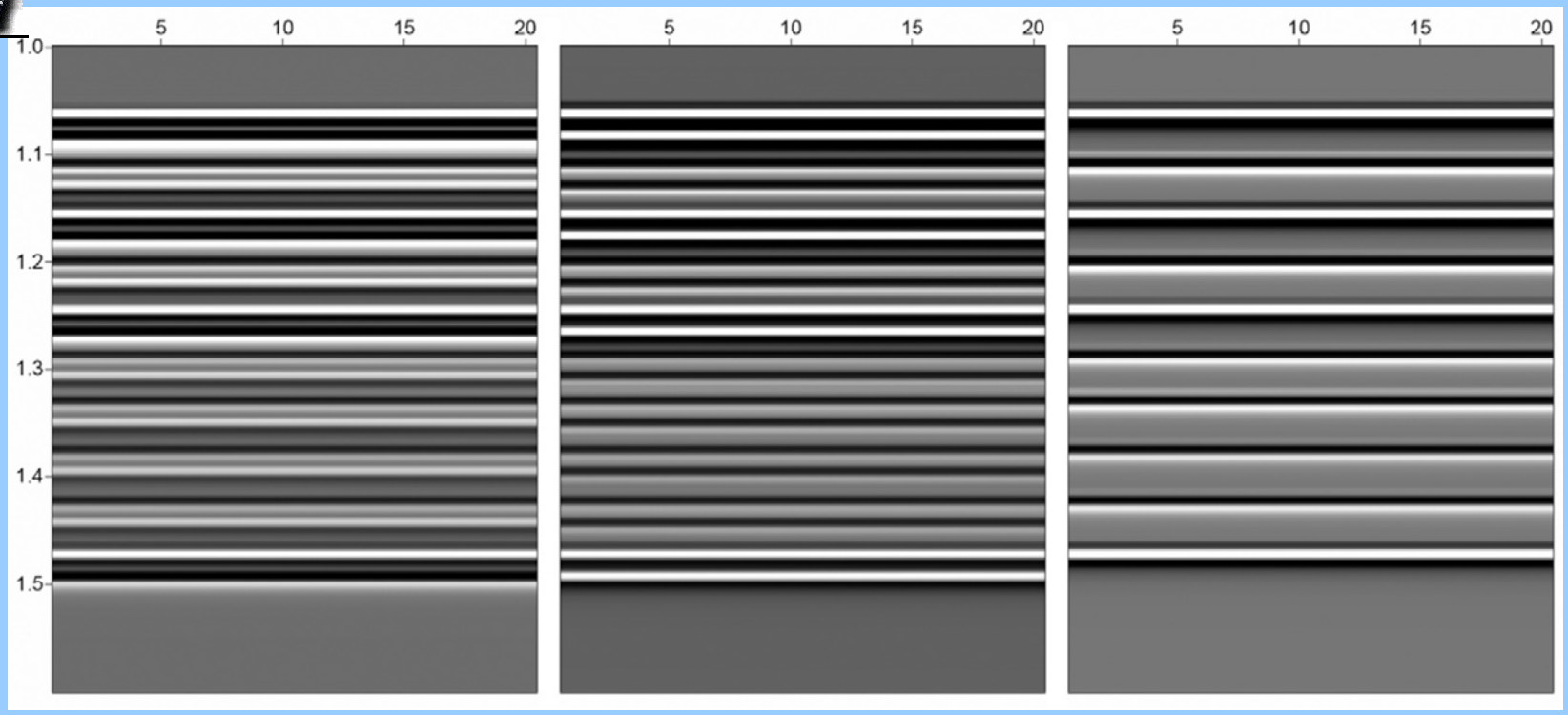
Widmaier et al, 2009

Receiver amplitude spectra for a pressure sensor towed at 8 m and 15 m depth. The wavefield is assumed to have vertical propagation (zero angle of incidence). Black is 8 m receiver depth, and blue is 15 m receiver depth.

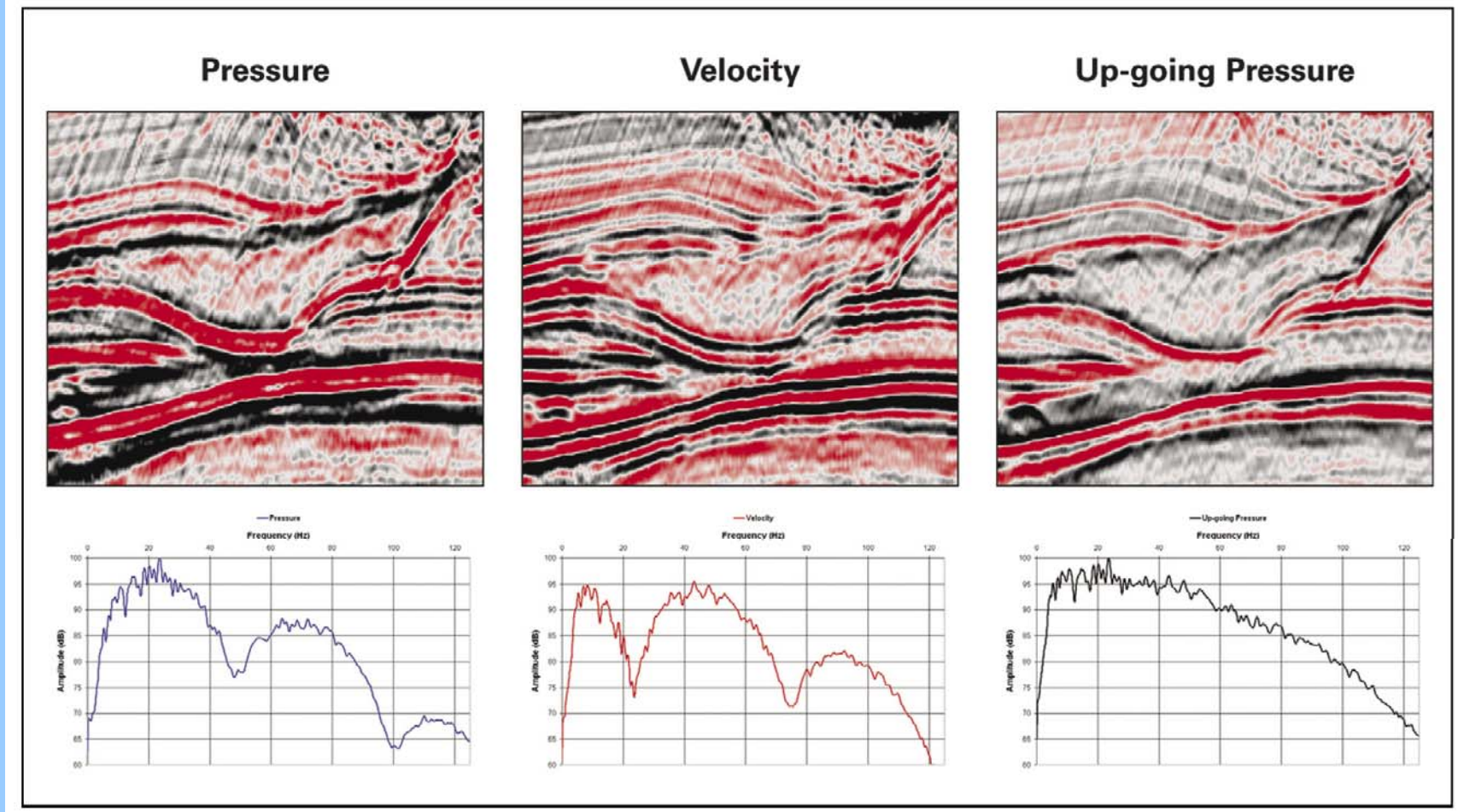


(Montadert et al., 2010)

Amplitude spectra for both the pressure and velocity sensor at 15 m depth for zero angle reflections. Blue is the pressure wavefield spectra, and red is the velocity wavefield spectra

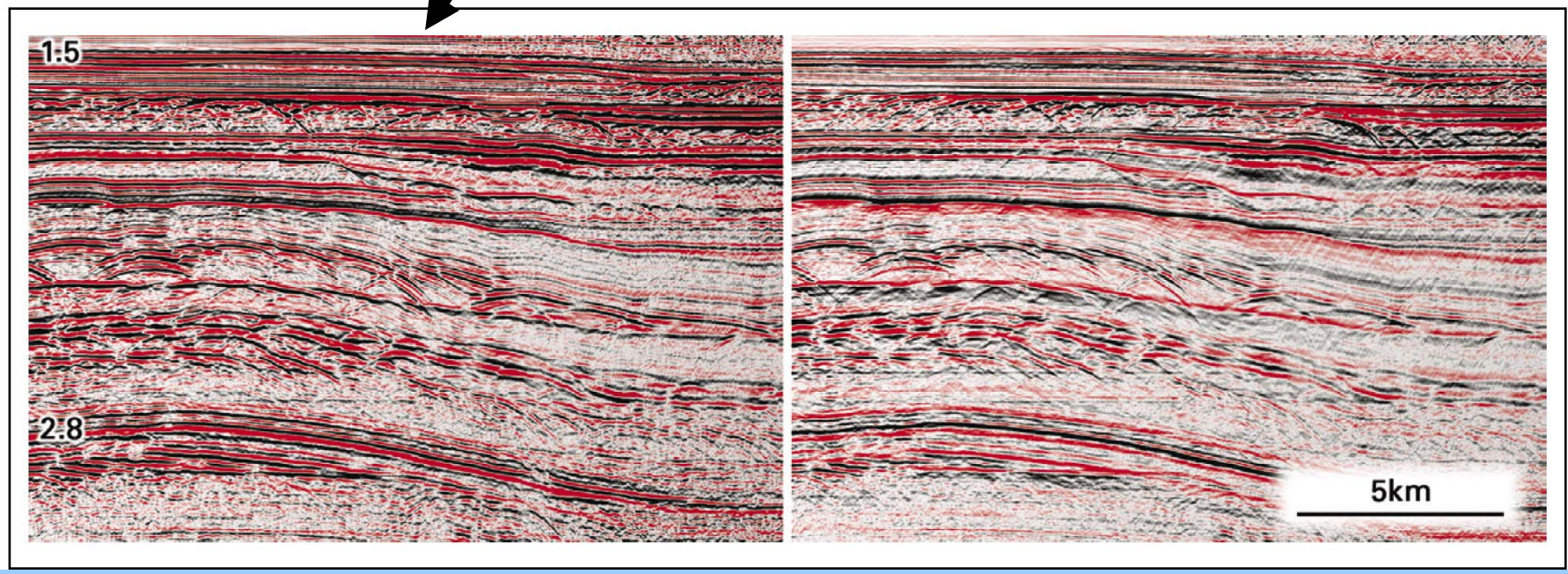


Pressure velocity upgoing pressure



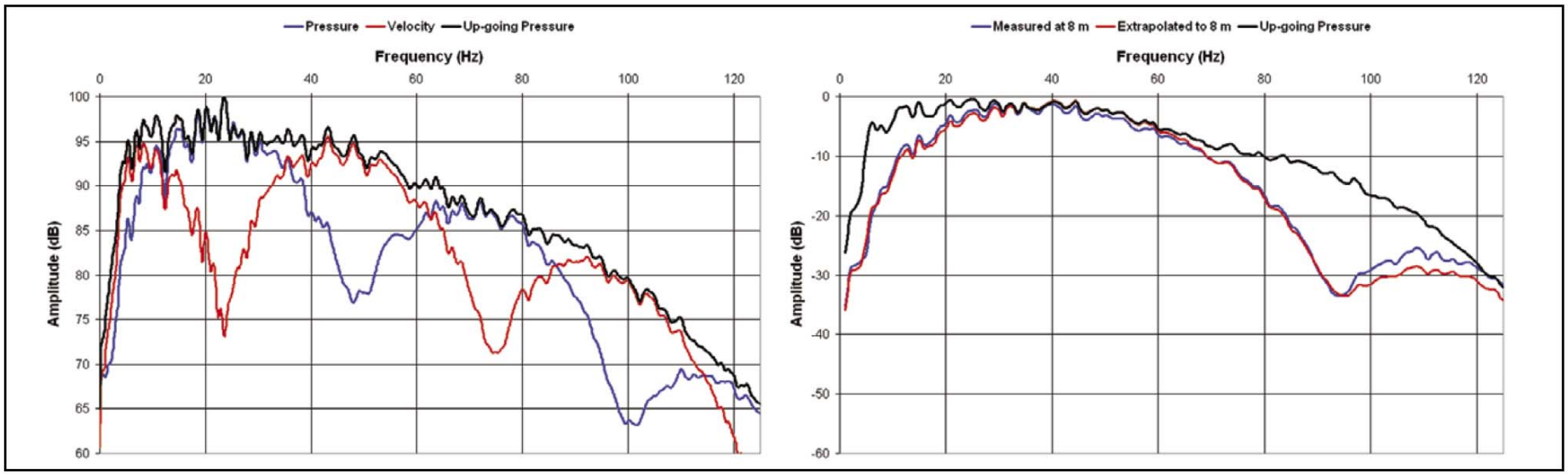
(Carlson et al., 2007)

Unmigrated total pressure stack



De-ghosted up-going pressure

Amplitude spectra

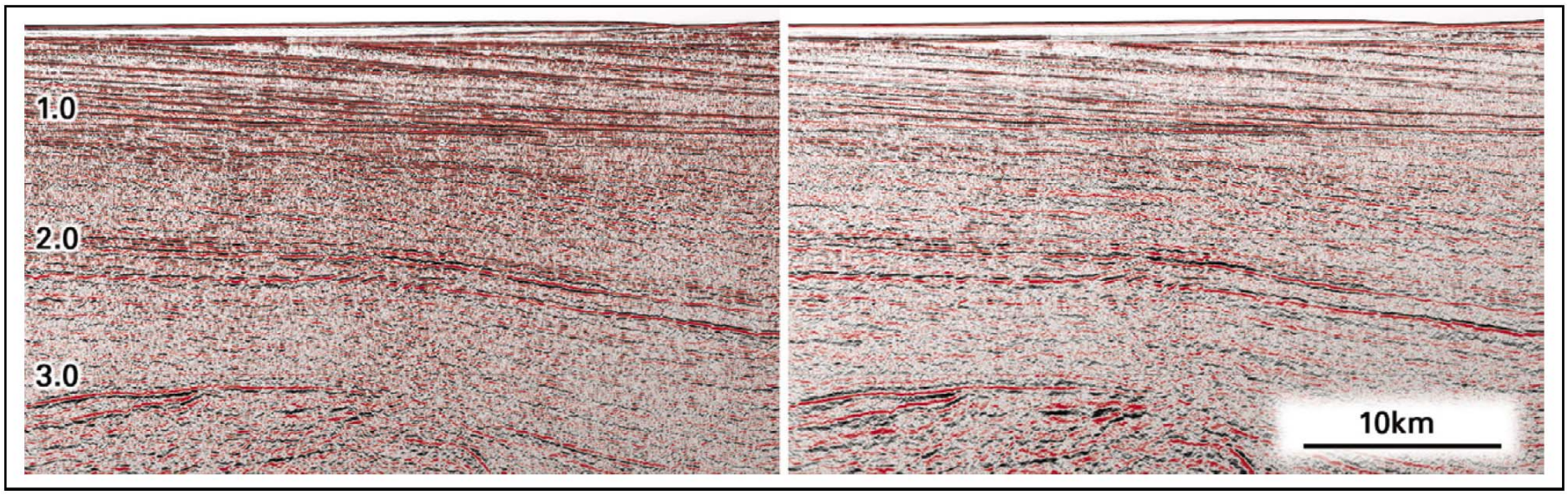


15 m

8 m

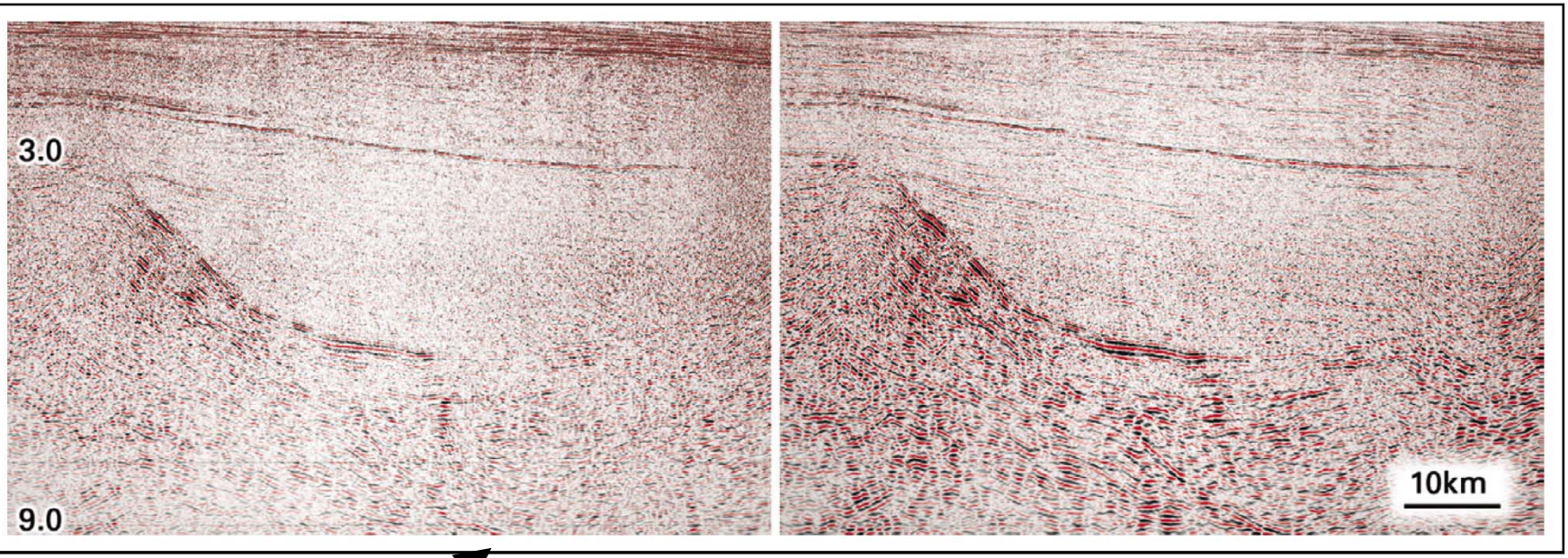
Dual-sensor data were acquired at a streamer depth of

De-ghosted up going pressure

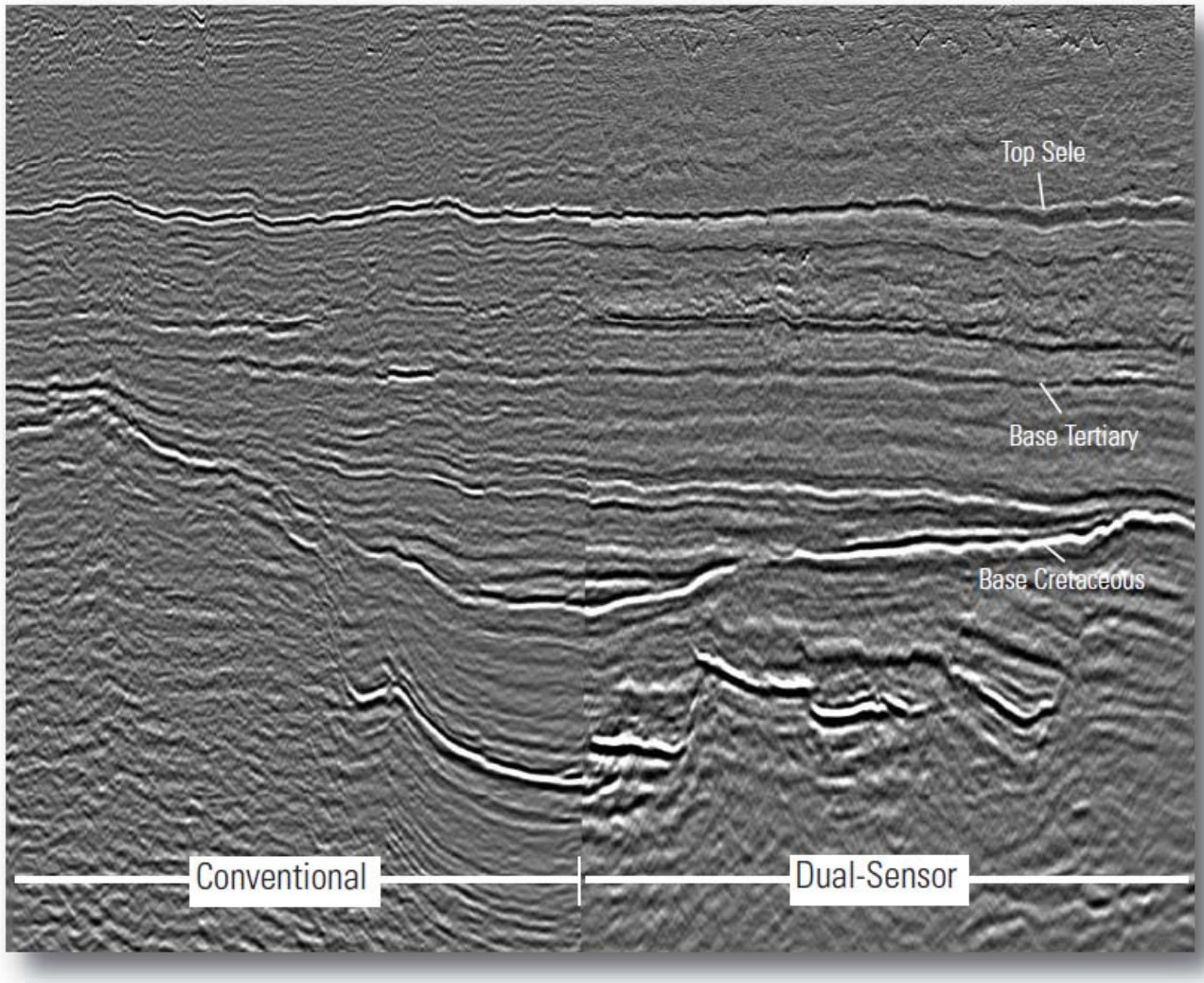


Migrated total pressure stack

De-ghosted up going pressure



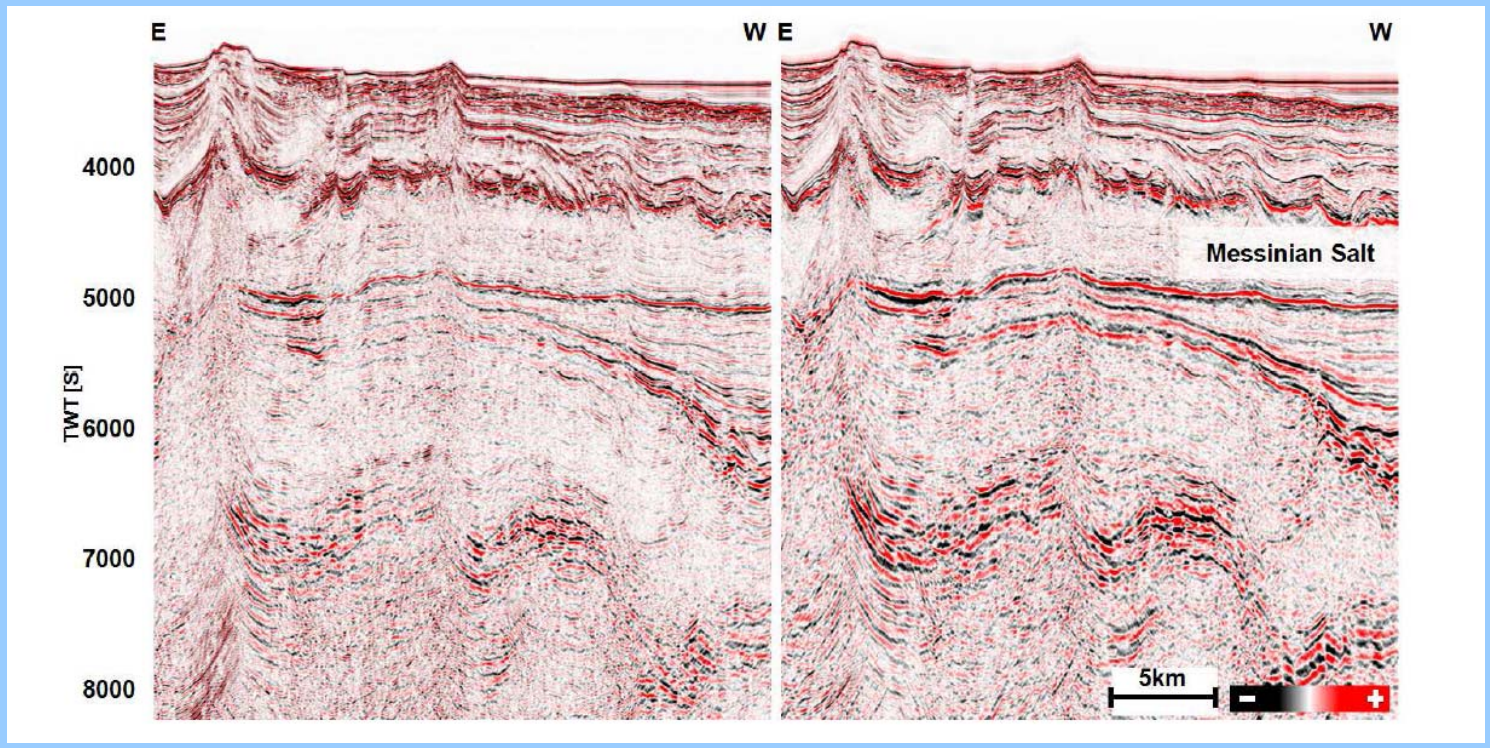
Migrated total pressure stack



The line illustrates a direct comparison between a conventional and a dual-sensor streamer acquisition. A seismic imaging improvement with the dual-sensor streamer is clearly visible throughout the section: from the Paleocene down to the Jurassic level. At the Tertiary level, the various sequences are clearer on the dual-sensor section. At the Jurassic level the image of the tilted fault blocks is significantly improved.

EXAMPLES – OFFSHORE CYPRUS

hydrophone data **dual-sensor data**



(Montadert et al., 2010)

CONCLUSION

Current technology including coil shooting and the dual-sensor streamer provides a significant uplift in the data quality with benefits visible in three key areas −

•enhanced resolution of the seismic image both shallow and deep, due to a broader frequency bandwidth;

•better signal penetration revealing sub-salt and deeper targets and

•increased signal-to-noise ratio due to the receiver ghost cancellation.