Comment on "Fast Multifrequency focal beam analysis for 3D seismic acquisition geometry" by Wei Wei, Li-yun Fu, and GerritBlacquière, 2012, Geophysics, 77, 2, p11-p21.

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In the nineties of the last century it became clear that improved seismic acquisition design is the key to further increase the value of the seismic method for the oil & gas industry. This is particularly true in the situation of complex subsurfaces. In conventional acquisition design, however, we see that subsurface independent criteria such as fold, bin-size, maximum offset, azimuth range, etc. are assessed only. This procedure is just a first-order approach as the influence of the subsurface is critical in acquisition design. After all, the subsurface determines how the seismic source wavefields travel from the surface to the (potential) reservoir and how the reflected waves travel from the reservoir area back to the detectors at the surface. Therefore, information about the subsurface must be taken into account in any advanced method for seismic acquisition analysis & design. In 1996, I extended the DELPHI Consortium programme at the Delft University of Technology with an Acquisition & Preprocessing project. Its aim is to investigate the influence of the source and detector distribution on the quality of seismic images, explicitly taking into account the influence of the subsurface.

A seismic image is the result of depth migration. This means that an advanced acquisition analysis & design method must be capable of *predicting* the quality of migrated images prior to acquisition. For this reason we developed the focal beam method with the following properties (Berkhout et al., 2001):

- It fully takes into account the influence of the subsurface on the propagating wavefields;
- It separately assesses the illumination properties of the source distribution and the sensing properties of the detector distribution;
- It accurately predicts the quality of the depth migrated image in terms of spatial resolution and angle-dependent reflectivity at each subsurface gridpoint;

Unfortunately, the computation of focal beams is numerically an intensive process. Particularly in the case of a high-resolution seismic survey – for which the temporal bandwidth is large – the beams must be computed for a large number of frequency components. It makes the focal beam method time consuming. This is a drawback because application of the acquisition analysis & design process is preferred in real time, allowing interactive assessment of many alternative geometries.

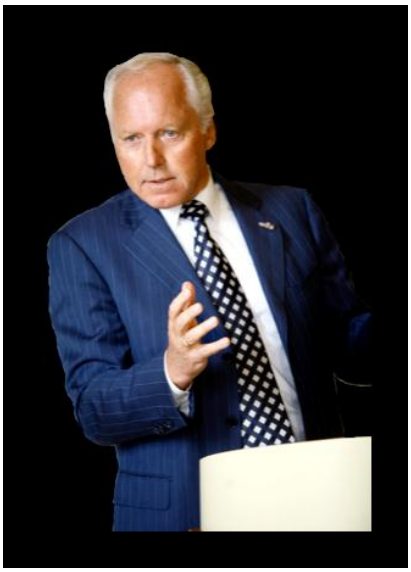
For this reason I was delighted to see that Prof. Li-yun Fu and Dr. Wei Wei of the Institute of Geology and Geophysics of the Chinese Academy of Sciences in Beijing took the initiative to further improve the computational efficiency of the focal beam method. To compute multi-frequency beams from a single-frequency version is very clever indeed. The speed improvement that can be obtained with their method enhances the applicability of the method considerably. It makes interactive acquisition design a practical proposition.

I wish prof. Li-yun Fu and Dr. Wei Wei success with their scientific work and look forward to a fruitful cooperation between their Institute and the DELPHI Consortium.

Reference

Berkhout, A. J., L. Ongkiehong, A. W. F. Volker, and G. Blacquière, 2001, Comprehensive assessment of seismic acquisition geometry by focal beams — Part I: Theoretical considerations: Geophysics, 66, 911–917, doi: 10.1190/1.1444981.

Biography



Professor A.J. (Guus) Berkhout started his career with Shell in 1964, where he held several international positions in R&D and technology transfer. In 1976, he accepted a Chair at Delft University of Technology in the field of geophysical and acoustical imaging. During 1998 – 2001 he has been a member of the University Board, being responsible for scientific research and intellectual property. In 2001 he also accepted a chair in the field of innovation management. Guus Berkhout has developed a large number of geophysical concepts and algorithms, which are now being commercially used in the upstream oil and gas industry. He has written several hundred scientific papers and a number of books in the field of geophysics and innovation. In the early-eighties he founded the DELPHI Consortium, a Science-Industry Consortium on Geophysical Imaging, which is currently financed by more than thirty international companies. Professor Guus Berkhout is a member of the Royal Netherlands Academy of Arts and Sciences (KNAW), The Netherlands Academy of Engineering (AcTI), honorary member of the Society of Exploration Geophysicists (SEG) as well as honorary member of the European Association of Geoscientists and Engineers (EAGE).