Depth Imaging of OBS Reflection Data with Wave Field Separation

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We propose a newly-developed depth imaging approach for OBS (Ocean Bottom Seismometer) reflection data in active-source structural surveys using wavefield separation and PSDM (Prestack Depth Migration). Wide-angle and long-offset OBS data includes a lot of valuable signals, not only reflection but refraction. The data also essentially contains upgoing and downgoing waves because it is recorded on sea bottom. Therefore, even regarding only reflection, its wavefield is contaminated with various modes of waves that degrade the quality of the depth imaging of reflection. In our OBS survey, the spacing of OBS locations is 3-5 km and typical water depth is more than 2km. The sparse spacing and ultra deep sea water means that signal-to-noise (S/N) enhancement by signal stacking is not expected. Therefore, we should prepare higher quality data input to PSDM to obtain good depth image. We investigate the characteristics of OBS wavefields and separate them into four categories which include primary and multiple reflections. Each of them contains similar features in the signal, and this wavefield separation approach can enhance the S/N ratio of input data. Applying adequate PSDM to the four separated wavefields, we obtain the four depth images without contamination of the different type of wavefields. Multiple reflected waves occasionally have a wide spread of reflection points and we take advantage of this feature to improve the depth imaging after careful processing of acquired OBS data.