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Deblended-Data Reconstruction Using a Closed-Loop Approach for Time-Lapse Seismic Monitoring

Tomohide Ishiyama[2], Mohammed Y. Ali[2], Gerrit Blacquiere[3], and Shotaro Nakayama[1]

[1]Technical Division, INPEX, Tokyo, Japan.
[2]Khalifa University of Science and Technology, Abu Dhabi, United Arab Emirates.
[3]Delft University of Technology, Delft, Netherlands.

ABSTRACT

In this paper, we introduce a method of deblended-data reconstruction. Using this method, we expect to ensure high repeatability in time-lapse seismic monitoring, even if we use best practices in the industry today for the monitor surveys, such as blended-acquisition methods, rather than legacy ones used for the baseline survey. For deblended-data reconstruction, we use the properties of blended signal introduced by blending codes in acquisition: the coherency of blended signal versus the incoherency of blending noise in the pseudo-deblended domain. This process can be posed as an inverse problem with quantifying the coherency and its solutions by selecting optimal metrics of the coherency. To solve the inverse problem, we consider an optimization scheme using a so-called closed-loop approach, where the deblended data are iteratively estimated. The general concept of deblended-data reconstruction includes all shot-generated-wavefields separation, regularization and interpolation, and both at the source and receiver side. For this concept, we face challenges to reconstruct deblended data from complicated blended data, such as spatially and/or temporally, blended and/or non-uniformly sampled data at the source and/or receiver side. At the time of writing this abstract, we have obtained reasonable results even under the challenging situation. We expect to obtain and present more successful results in the conference. It should be noted that our method is highly applicable to time-lapse seismic monitoring. Using this method, we can reconstruct from blended data on an irregular observed grid of a monitor survey into corresponding deblended data on a fine and regular nominal grid, which is adaptable for the baseline survey. This significantly reduces the repeatability problem because reconstructing deblended data is much more realistic and reliable than positioning sources and receivers exactly as the baseline survey. Therefore, we could acquire blended data and reconstruct deblended data without any problems but with the benefit of blending to acquire a large amount of data in an economical way. For time-lapse seismic monitoring, many studies have been carried out for the detectability, but relatively few for the repeatability. Therefore, our method should have significant impact in oil and gas fields where expectation to time-lapse seismic monitoring is increasing in order to achieve their business objectives.