Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

STT13-10 会場:102A 時間:5 月 28 日 11:45-12:00

拡散過程を含む波動現象の新しい逆伝播手法の開発
Development of a novel backpropagation technique for waves traveling with diffusive process

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In the field of geophysics, several electromagnetic processes using waveforms, such as the full waveform inversion technique or the migration procedure, have been applied to visualize the subsurface structure.

While this process is very powerful and effective to interpret the subsurface structure, there are some difficulties in this process when the phase velocity takes complex value, i.e., the propagation of waves includes diffusive process. One method to avoid the instability due to the divergence of energy in the back propagation is to use the reciprocity to propagate from the locations of receivers to every imaging point. However, although this method to exploit the reciprocity theorem is a powerful scheme, amplitude attenuation and phase delay affects could be doubled due to the application of two-way forward propagation procedure in the imaging. In the conventional waveform inversion analysis, the result involves phase delay concomitantly during the back propagate process.

Our novel electromagnetic migration process could overcome this problem. Unlike conventional back propagate process, we invert the time of the residual waveform using forward propagation of this waveform. Then, we summed the resulting waveform without phase delay. Although the amplitude would takes place, it is pretty important to recover the phase delay caused by the forward propagation from imaging points to receivers.

We applied this migration process for the improvement of the eddy current testing method that is one of the non-destructive inspection techniques and confirmed this migration works well.