Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

STT07-17 Room:421 Time:April 29 15:15-15:30

AVO waveform inversion for estimating the fluid contact with fluid transition zone

IWAKI, Yunosuke[1] ; MIKADA, Hitoshi[1*] ; GOTO, Tada-nori[1] ; TAKEKAWA, Junichi[1]

[1]Graduate School of Engineering, Kyoto University

The fluid distribution in the hydrocarbon reservoir affects waveforms acquired in reflection seismic method. A reflected wave changes its waveform at the transition zone of the interface of two different fluids as a function of volume fraction of the two. AVO is in general used to estimate the difference in the P and S wave velocities for the interfacing two media at the interface without any assumptions on the existence of the transition zone. The consideration of the effect of the volume fraction of a fluid to the other in the waveform could be a key for evaluating the fluid mixture around the fluid contact in the reservoir. Therefore, we try to use the waveform directly to estimate fluid distribution in the transition zone that has not been done in the practice of AVO.

In our research, we consider the effects of the transition zone at a gas-water contact (GWC) in a horizontally stratified medium on seismic waveforms. The numerical simulation reveals that the fluid distribution of transition zone distorts the seismic waveform both in amplitude and in phase. Then we use the difference in amplitude and in phase for estimating some necessary parameters expressing the fluid-mixture. We apply a waveform inversion method to the fluid substitution problems to see if the method is applicable to estimate the fluid contact with the transition zone, while the conventional AVO only utilizes the amplitude derived from observed data. Our numerical approach uses full waveform and the results imply the advantages in the estimation of the parameters including the thickness of the transition zone under that assumption of linear trend in the volume fraction in a contrast porosity condition. We suggest that the phase information should be used simultaneously for the inversion process to get the closer contact image.