Geophysical Research Abstracts
Vol. 13, EGU2011-5457, 2011
EGU General Assembly 2011

Sensitivity analysis of marine CSEM surveys for detecting a gas-hydrate layer

Hangilro Jang, Hannuree Jang, Ki Ha Lee, and Hee Joon Kim

Department of Energy Resources Engineering, Pukyong National University, Busan 608-737, Korea (hejkim@pknu.ac.kr / +82-51-629-6553)

A computer program has been written to calculate frequency domain and time domain electromagnetic (EM) responses for a one-dimensional model with multiple source and receiver dipoles that are finite in length. With the use of this code, we conducted sensitivity analysis of marine controlled-source EM methods to a gas hydrate layer in the shallow section. In the frequency domain we used a normalized amplitude and amplitude difference of EM fields simultaneously in determining the detection capability of the hydrate layer. The normalized amplitude can be numerically large, but if the field amplitude is smaller than the threshold, it would be misleading and therefore is useless. A large normalized amplitude is detectable at high frequencies more than 10 Hz and short offsets less than 2000 m. These frequencies and offsets will be best to distinguish the top of hydrate. At the same time, we can find that there are plenty of useful offset ranges and frequencies where amplitude difference is large enough to detect the hydrate layer. Furthermore, the effect of air waves is almost absent in amplitude difference. Because the useful hydrate signal can be obtained at short offsets, it may be dangerous to ignore the effect of dipole length. When a point source is used for a background model, to which real field data are normalized, the target signal is distorted especially at higher frequencies and longer dipoles. As a result, the thickness of the hydrate layer would be overestimated because elevated electric-field responses especially at short offsets persist indefinitely off the upper boundary of the target layer. In addition, navigation plays a key component in gas-hydrate detection because navigation errors are more significant at short offsets than at long ranges.