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Electroseismics as a methane hydrate prospecting tool

F. I. Zyserman (1,2), P. M. Gauzellino (1), J. E. Santos (2,3)

(1) Facultad de Ciencias Astronómicas y Geofísicas - UNLP, Paseo del Bosque s/n, B1900FWA La Plata, Argentina (zyserman@fcaglp.unlp.edu.ar), (2) CONICET, Argentina, (3) Department of Mathematics, Purdue University, 150 N. University Street, West Lafayette, Indiana, 47907-2067, USA

In this work it is numerically shown that methane hydrate-bearing sediments located below permafrost can be detected using electric currents as sources; the seismic signals originated where the conversion from electromagnetic to seismic energy takes place could be measured by means of geophones or accelerometers located on the surface and/or in wells.
In order to appropiately model seismic wave propagation both in permafrost and gas-hydrate bearing environments, an extended Biot-type formulation taking into account the different mechanical properties of the solid matrix, ice and gas hydrates is included in Pride's electroseismic equations.
The latter are considered in a two dimensional Earth, along with two different electromagnetic sources, namely an infinitely long solenoid giving rise to the PSVTM mode and an infinite current line giving rise to the SHTE mode, and complemented by absorbing boundary conditions for both the electromagnetic and poroviscoelastic portions of the model equations.
The numerical solutions are obtained by means of finite elements algorithms
devised to be efficiently run on parallel computers. An example consisting of a gas hydrate-bearing slab located underneath the permafrost base is presented, the obtained results indicate that the seismic response is sensitive to the methane hydrate concentration.