Earth Sciences Department
University of Toronto, St. George Campus

A SPECIAL GEOPHYSICS SEMINAR

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Towards reservoir monitoring using electromagnetics: Understanding the effect of steel infrastructure

Controlled-Source Electromagnetic (CSEM) methods have the potential to be powerful geophysical tools for monitoring and tracking the distribution of electrically resistive hydrocarbons during oil and gas production. However, the presence of infrastructure (well casings, pipelines etc.) presents an enormous challenge, because the highly conductive steel masks the electromagnetic response of subsurface geology and any associated changes in the reservoir. Therefore, numerical techniques to predict and remove the contamination caused by pipelines and casings on CSEM surveys are critical for real world time-lapse applications.

In 2014, the Colorado School of Mines launched a collaborative project with Shell International Exploration and Production, with the aim of finding an efficient way to include the effect of well casings and pipelines in the modeling and inversion of CSEM data. A prototype modeling code was successfully implemented based on the Method of Moments technique. This approach provides a good balance between required accuracy, numerical efficiency, and scalability for real field scenarios where many casings and pipelines are present. In a second phase of the project, we are now aiming to validate the calculation of these effects using real measurements gathered in the lab and in the field. Early results are encouraging, showing good match between experimental and modeled data. In this talk we will discuss our novel method for modeling steel infrastructure and show how we have validated our approach against various types of numerical and real data. We will motivate the problem at hand by describing a unique electromagnetic survey carried out at a heavy oil field in the Netherlands, and show a preliminary result of our infrastructure modeling approach in this complicated production setting.