Australian Society of Exploration Geophysicists

Webinar

Date/Time: Tuesday May 5th | 12 pm AEST

Title: Constraining the resistivity of pore fluids in the crust with Bayesian joint inversion of MT and surface-towed CSEM data

Presenter: Daniel Blatter

To register: Email secretary@aseg.org.au by Monday May 4th, 12 pm AEST

Abstract:
Electromagnetic methods such as MT and CSEM are sensitive to the bulk electrical resistivity of the subsurface. Often, however, Earth scientists are more interested in Earth properties related to bulk resistivity, such as the resistivity of pore fluids. Standard, deterministic methods for inverting EM data for bulk resistivity typically produce just one model estimate, without a quantitative understanding of the associated uncertainty. This makes it difficult to place quantitative constraints on related properties, such as pore fluid resistivity. Here we jointly invert seafloor MT and surface-towed CSEM data collected offshore New Jersey, USA, using a trans-dimensional Markov Chain Monte Carlo (MCMC) algorithm, a type of Bayesian inversion method. Deterministic inversions of this data by Gustafson et al (2019) revealed a freshwater aquifer within the upper continental shelf extending dozens of kilometers offshore. Here we introduce a workflow for converting the quantitative uncertainties on the inverted bulk resistivity to related uncertainties in pore water salinity using a Monte Carlo approach. We also demonstrate how joint inversion of data containing complementary information about the subsurface (such as MT and CSEM data) reduces the size of the model space compatible with the inverted data.

Bio:
Daniel Blatter is a doctoral candidate in geophysics at the Lamont-Doherty Earth Observatory at Columbia University. His research interests include marine electromagnetic imaging; Bayesian inversion algorithms; quantitative uncertainty estimation; Lithosphere-Asthenosphere Boundary (LAB) geodynamics; and more. He hopes to defend his thesis in the summer and will be the John W. Miles postdoctoral scholar in computational and theoretical geophysics at the Scripps Institution of Oceanography, UC San Diego, starting in the Fall of 2020.