



NERC Centre for Doctoral Training in Oil & Gas (2017 start)

Project Title:

Controlled source electromagnetic data analysis to evaluate potential fluid flow pathways associated with carbon capture and storage sites

Host institution: University of Southampton

Supervisor 1: Dr. Romina A. S. Gehrman

Supervisor 2: Prof. Tim A. Minshull

Supervisor 3: Prof. Jon Bull

Project description: The marine controlled source electromagnetic (CSEM) method is a popular tool to detect electrical resistivity contrasts in the sub-seafloor that may relate to resistive material such as free gas or other hydrocarbons. The conductivity of marine sediments is mainly controlled by conductive pore water and resistivity contrasts relate to changes in porosity, permeability and hydrocarbon content among other factors (Constable 2010).

Carbon Capture and Storage (CCS) has been identified by the European Commission as an important strategy to reduce anthropogenic CO₂ emissions. Safe and efficient operation of CCS sites will require the development of new site assessment approaches in order to reduce risks associated with CCS operations and facilitate leak detection. Potential fluid flow pathways are seismically-imaged fault and chimney structures along which fluids containing natural gases may rise to the surface given the pore pressure and permeability are sufficiently high (Connelly, D. et al., 2015, STEMM-CCS).

CSEM data will be acquired alongside reflection and refraction seismic as well as shallow logging data in the summer 2017 above a chimney structure to study the electrical resistivity distribution and anisotropy. The goal of the project is to determine rock physics parameters such as porosity, permeability and free gas content as well as place bounds on the uncertainties associated with these parameters.

S. C. Constable. Ten years of marine CSEM for hydrocarbon exploration. *Geophysics*, 75(5):75A67-75A81, 2010.

Connelly D. and participants, 2015. STEMM-CCS: Strategies for Environmental Monitoring of Marine Carbon Capture and Storage, Call for competitive low-carbon energy, LCE-15-2015

CDT Research theme(s): Environmental Impact and Regulation

Research context: The student will join the UK's most active marine geophysics group. The student will have the opportunity to participate in CSEM data acquisition at sea and will have access to a range of relevant high-level courses taught at NOCS, and state-of-the-art modelling hardware and software. The student will join an active group of researchers in a large interdisciplinary EU programme.

Research costs: The data acquisition will be covered by the STEMM-CCS project. Project costs for the PhD student are modest and comprise computer, IT consumables, travel, tuition and subsistence.

Career routes: The student will develop expertise in CSEM and seismic data processing and inversion methods, will specialize in state-of-the-art data analysis, will experience marine data acquisition, and will build contacts with academic and industry partners. He/she will be well equipped to progress into a career in hydrocarbon exploration, either in a contractor or in an oil major.

Submissions must conform to this single-sided A4 format. The Awards Committee reserves the right not to consider submissions that do not adhere to this condition.