

2024_22_ESE_RB: Geological and geophysical investigation of the environmental evolution of the southern North Sea for offshore wind applications

Supervisors: Dr Rebecca Bell (<mailto:rebecca.bell@imperial.ac.uk>); Prof. Gary Hampson, Department of Earth Science and Engineering; Dr. Mark Vardy, SAND Geophysics; Mr. Gareth Carter, BGS; Mr. Abdulqadir Cader, GeoTeric

Department: Department of Earth Science and Engineering

The European Green Deal aims to increase the EU's current offshore wind capacity by at least 25 times by 2030. This will be achieved by widespread offshore windfarm development in the 5 EU sea basins including the southern North Sea. Geophysical surveys are vital to provide information on the seabed morphology and shallow subsurface geology to plan cable routes and wind turbine installation sites. These data are accompanied by geotechnical boreholes that provide information on the physical properties and geology of sediments, including some age information. These datasets are used by geotechnical companies to develop site characterisation models for engineering. However, these ultra-high resolution datasets also image an exquisite record of the history of glaciations and deglaciations in northern Europe. Locally, they allow us to recover how depositional environments have changed over multiple glacial cycles and uncover the loading history soils have experienced- important information for engineering and infrastructure development. Globally these insights into ice advance and retreat will inform our understanding of ice sheet dynamics.

In this PhD project you will work to develop a geological model of how depositional environments in the southern North Sea have evolved from the Elsterian glacial cycle (500,000 to 300,000 years ago), through the Saalian glacial cycle (300,000-120,000 years ago) to the present day. This will be achieved by integrating geotechnical borehole information with ultra-high resolution 2D and 3D seismic reflection data. You will have the chance to apply advanced seismic attributes (eg. frequency decomposition) and machine learning technologies to automatically detect faults and geobodies to aid in the development of a geological model. The project will involve visits to analogue onshore exposures with field work guided by our project partners the BGS. You will develop models of Quaternary glacial-tectonic features observed in outcrops and use these to produce synthetic seismic data to aid your interpretation of the ultra-high resolution subsurface datasets.

This project would suit a student with a background in geoscience (geology or geophysics) and an interest in the offshore wind industry. Experience of interpreting seismic reflection data would be an advantage, but not essential. A desire to educate and enthuse wider society in the importance of geoscience in the energy transition is a must. You would join the dynamic Landscapes and Basins Research Group at Imperial College and conduct visits to project partners SAND Geophysics (based in Southampton), BGS (Nottingham) and GeoTeric (based in London).

For more information on how to apply to us please visit: <https://www.imperial.ac.uk/grantham/education>