iCRAG PhD position: Feasibility of machine learning for seismic forward modelling and inversions

Full title: Feasibility of machine learning for seismic forward modelling, location and source inversion for volcanic long-period (LP) seismic events
Supervisors: Dr. Ivan Lokmer (UCD), Dr. Gareth O'Brien (UCD), Prof. Christopher Bean (DIAS)
Start-date: 1st November 2022 - 1st January 2023
Duration: 4 years
Stipend: €18,500 per annum + student fees
Collaborations: University of Liverpool; INGV Pisa, Italy.

The School of Earth Sciences, University College Dublin (UCD) seeks applicants for a PhD position funded through the Geodata Platform of the Irish Centre for Research in Applied Geosciences (iCRAG). The successful candidate will be based in The School of Earth Sciences at UCD. She/he will collaborate with researchers in other institutions, notably the Dublin Institute for Advanced Studies (DIAS), University of Liverpool, and INGV, Italy.

Projects scope: The accurate interpretation of fluid-related seismicity is of key importance for gaining a better understanding of physical processes beneath volcanoes, hydrothermal areas and for monitoring the development of geothermal reservoirs. Our ability to relate the complex seismic waveforms to physical processes in such fluid-reach fractured media critically depends on locating seismic sources and determining their mechanisms. Due to their complex noisy seismic waveforms owing to small-magnitude shear/tensile source mechanisms and wave propagation through heterogeneous fractured media, standard source inversion techniques use the full-waveform numerical simulations, which require lengthy model-building, huge computational times, and the understanding of physics-based computational schemes. This causes that the speed and reliability of the analysis can be very compromised in a crisis, when very large volumes of complex data are streaming into the interpreter. There is a need for more reliable and automated system at aid in the interpretation of data in times of crisis.

This project will apply Fourier Neural Operator (FNO), machine learning (ML) based method, to perform both the forward modelling and the source inversion of seismic wavefield. In particular, the ability of FNO to perform the source location and inversion in the presence of the velocity uncertainty will be investigated.

The results will be presented at iCRAG meetings, and Irish and international conferences (IGRM, EGU and AGU).

How to apply: Applications are invited from motivated geophysics, physics, applied mathematics, and computer science graduates with good grasp of basic computer use, familiar with Python, Matlab and Linux operating system, who has interest in machine learning methodology. The position is fully funded for 4 years (stipend + student fees)
To apply send a full CV, contact details for 2 academic referees and a letter of motivation.
Applications or requests for further information should be sent to Ivan Lokmer at ivan.lokmer@ucd.ie. The deadline for receipt of applications is **September 30th 2022**.