

The investigation of coastal cliff instability due to extreme weather conditions

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Project description:

With increasingly evident impacts of climate change, there is a growing focus on safeguarding the resilience of geo-infrastructure under extreme weather conditions. While a significant body of research has addressed rainfall-induced failures, this perspective does not fully capture the broader climatic threats to geotechnical stability.

In 2022, two major coastal cliff collapses occurred near Sidmouth, Devon. What made these events particularly striking is that they did not follow rainfall, but instead coincided with a record-breaking heatwave, with temperatures in the UK exceeding 40°C. These failures highlight an emerging hazard that remains poorly understood, geotechnical instability triggered by excessive heat/drying. Although factors such as thermal expansion, desiccation cracking, and reductions in soil strength are all plausible contributors, the mechanism by which extreme drying alone may lead to large-scale failure has never been systematically investigated.

This PhD will address that gap by investigating the hydromechanical response of unsaturated coastal geomaterials (predominantly those of the Mercia Mudstone Group) under extreme drying conditions representative of current and future UK climates. The research will combine *advanced element testing* in the world-leading geotechnical laboratories at Imperial College London with the instrumentation and long-term monitoring of a field site in Devon. The project will include interaction with local council authorities and collaboration with industry to guide field monitoring campaigns.

The project includes close collaboration with Geotechnical Observations and the British Geological Survey (BGS). Geotechnical Observations will provide expert guidance on field instrumentation, while collaboration with BGS will enable the student to: (i) access their National Landslide Database (NLD), (ii) utilise BGS laboratory facilities, and (iii) engage directly with stakeholders through the Engineering Geology and Geohazards Team.

Applicant requirements:

Academic background (essential)

- Applicants should hold, or be on track to achieve, a First Class or Upper Second Class (2:1) degree (or international equivalent) in Civil Engineering, Engineering Geology, Geology, or a closely related discipline.

Technical background (desirable)

- Prior laboratory or experimental experience in geotechnical engineering, soil/rock testing, or related geological or geotechnical investigations.

Skills and attributes (essential)

- Strong analytical and data processing ability and a clear interest in geomechanics, unsaturated soil behaviour, or climate-driven geohazards.
- Good written and verbal communication skills in English.

Scholarship:

The studentship will provide funding for up to 3.5 years, including home tuition fees (3 years) and a tax-free stipend at the standard UKRI London rate, currently £22,780, for 3.5 years. **Full funding is available to Home students only.**

How to apply:

Applicants wishing to be considered for this opportunity should send the following application documents to Dr Tiago Gaspar (t.gaspar@imperial.ac.uk):

1. Cover letter, explaining their motivation and suitability by addressing the requirements
2. Current CV including degree result and, if possible, class ranking.
3. Undergraduate and/or postgraduate academic transcripts illustrating grades for each module undertaken

Application via the Imperial College Registry is not necessary at this stage. Applications will be regularly reviewed until the position is filled, at which stage a successful candidate will be invited to formally submit their PhD application to the Registry.