

Research engineer or post-doctoral fellow in

Geomechanical modeling of carbonate cliffs in Normandy

12-month fixed-term contract starting January 1^{er} 2024

General context

The position is linked to the regional project DEFHY3GEO (Détection et Étude de la Fracturation par approche HYdrologique, GEOMorphodynamique, GEOlogique et GEOphysique) funded by the Normandy Region (RIN Tremplin) for three years (January 1, 2022 to December 31, 2024). This DEPHY3GEO project concerns the study of risks associated with coastline erosion in a cliff context, and aims to develop a strategy for detecting and studying fracturing to better define coastline recession hazard mapping. The research project, coordinated by Cerema-Rouen, brings together four research structures (UMR IDEES-Caen, UMR M2C-Rouen, LMI EA 3226-INSA-Rouen and ENDSUM-Cerema-Rouen) and mobilizes various natural science specialties (geophysics, geology, geomorphology, climatology, hydrology, modeling, signal processing, mathematical modeling and digital simulation, image processing, etc.). It also benefits from other national and international partners (BRGM-Orléans, Institut des Sciences de la Terre de Université de Lausanne (UNIL)). Two cliff sites are located in Normandy: the chalky cliffs of Sainte-Marguerite-sur-Mer (76) and the clay-marl cliffs of Les Vaches Noires at Villers-sur-Mer (14).

The position is particularly relevant to WP3 "*Hazard assessment, modeling and mapping to define areas of high susceptibility and hazard zoning*" and its task 3.1 "*Numerical approach using physically-based geomechanical modeling of the impact of cracking on hydro-gravitational movements*". Soft skills

Various investigations and monitoring activities (geomorphological, geological, geophysical, imaging, etc.) have been carried out as part of this and previous projects. Based on the data acquired and in collaboration with the project partners, conceptual models will be proposed for the investigated sites, based on various hypotheses and field interpretations.

Missions

On the basis of these conceptual models, a numerical approach based on physical modelling will enable us to verify the hypotheses, taking into account material parameters, fracturing and changes in water saturation. This physics-based numerical modelling will be carried out using UDEC 2D (*Universal Distinct Element Code*) software, based on the distinct element method, which is particularly well suited to modelling fractured rock systems, as it enables displacements with non-linear behaviour to be modelled using different behaviour laws.

The engineer or post-doctoral fellow will be responsible for:

- Literature review on UDEC and distinct elements in the themes of this research;
- Testing hypotheses of mechanisms deduced from field observations;
- Verify the impact of crack orientation and density in carbonate massifs;
- Identify thresholds for changes in hydrological and kinematic regimes responsible for landslide triggering;
- Predict the scale of mass movements (volumes mobilized);
- Propose transposition keys to assess the degree of stability of linear cliffs with morphologies similar to the profiles treated;
- Be proactive in exchanges with partners (especially other researchers, engineers and post-docs involved in project tasks);
- Valorize results in the form of high-level scientific articles;
- Keep abreast of the latest developments in your field;
- Participate in project follow-up actions.

Contract duration:

12 months

Reporting relationship:

Reporting to: Stéphane Costa, Director of UMR IDEES-Caen Géophen.

Functional attachment: Olivier Maquaire, scientific supervisor UMR IDEES-Caen Géophen and Michel Jaboyedoff, scientific co-supervisor.

Internal relations:

Within UMR IDEES-Caen Géophen

Within UMR IDEES: all colleagues and staff at the three sites (Caen, Le Havre and Rouen)

External relations:

The work will be carried out in close collaboration with the Institute of Earth Sciences at the University of Lausanne (UNIL) and Professor Michel Jaboyedoff (scientific co-supervisor).

Other project partners: ENDSUM Cerema group, INSA Rouen mathematics laboratory, M2C Rouen.

Skills:

Knowledge

- Very good knowledge of geotechnical engineering and numerical modelling;
- Familiarity with UDEC 2D, FLAC or other discrete-element software for rapid learning of UDEC;
- Knowledge of programming languages (C++, Python, Fish, ...) and data processing (Matlab, ArcGis or similar);
- Sensitivity to geomorphology would be a plus;
- Excellent ability to write scientific articles in English and French.

Know-how

- Ability to work in a project team and network;
- Ability to develop methodologies;
- Know how to mobilize resources and optimize their use;
- Ability to analyze, summarize and write in English and French;
- Make proposals.

Soft skills

- Sense of responsibility and team spirit;
- Thoroughness and organizational skills;
- Sense of initiative, innovative spirit.

Conditions and constraints:

Materials

Personal office;

Provision of a computer.

Schedules and seasonality:

No specific seasonal time constraints.

Special conditions:

Occasional travel to DEFHY3GEO project sites (Sainte-Marguerite-sur-Mer and Villers-sur-Mer).

Salaries:

Monthly: €2,815 gross

Annual over 12 months: €35,126 gross

Contacts:

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How to apply:

By **Friday, October 20, 2023** at the latest, send a CV, covering letter and photocopies of diplomas to the above contacts, together with any individual work (research dissertation, report, scientific article, etc.).