ERC FEASIBLe – 2-years Post-doctoral Fellowship

Investigating post-glacial transient phases as hot-moments of landscape dynamics - combining numerical modelling and topographic analysis

Scientific context - Most present-day landscapes in active mountain belts are witnesses of the very particular Quaternary climate, oscillating between (peri-)glacial and interglacial conditions. This represents an opportunity to understand how these climatic oscillations have impacted mountainous landscapes, potentially leading to an increase in erosion, valley incision and sedimentary fluxes. Progressive climate cooling during the Quaternary, culminating in widespread glaciations and associated glacial erosion, is classically invoked as being responsible for such erosion and landscape changes. However, another likely candidate is the permanent disequilibrium of the landscape itself, constantly alternating between glacial- to fluvial-conditions and thus switching between contrasted geomorphic processes. Post-glacial times, i.e. during and after glacier retreat, are particularly crucial in landscape transience as they probably focus the most intense disequilibrium between the dominant active geomorphological processes (e.g., river erosion, landslides) and the landscape shape (e.g., U-shape valleys, over steepened hillslopes, high-relief typical of glacial shaping). This transient phase is thought to be characterized by a coupled hillslope-river system associated with intense landsliding and high-elevation permafrost degradation, downstream export of glacial sediments and upstream incision wave along valley floors. However, few modelling studies have focused on this enigmatic post-glacial phase, although its duration and impact on geomorphic conditions have strong implications for modern landscapes and erosion dynamics. The objective of this postdoctoral project is therefore to investigate the impact of post-glacial transient phases on landscape evolution by combining numerical modelling, topographic analysis, and quantitative data synthesis. Applications to the western European Alps, the Southern Alps of New Zealand and/or western Norway are expected. This work will also offer timely insights on the ongoing to future evolution of high-mountain landscapes currently affected by glacier retreat, with strong implications for high-elevation reliefs worldwide and associated natural hazards. This fellowship will be part of the FEASIBLe (Finding how Earthquakes And Storms Impact the Building of Landscapes) project led by Philippe Steer (University of Rennes) and funded by the European Research Council, and perfomed in close collaboration with Pierre Valla (University of Grenoble). The candidate will be part of an international and dynamic group of scientists in a team including geomorphologists, glaciologists and modellers working on surface processes and landscape dynamics.

The main steps of the scientific work - These questions will be investigated using a combination of numerical modelling, topographic analysis and quantitative data synthesis. The work will consist in several main sub-tasks:

- Using a newly-developped landscape evolution model, able to simulate landsliding and river hydro-morphodynamic, to investigate how landscapes with an initial (peri-)glacial topography respond to post-glacial climatic conditions dominated by fluvial and hillslope erosion.
- Acquiring and aggregating complementary quantitative data on landslide volume-frequency and spatial distribution, sediment volumes and fluxes, as well as typical morphological markers for landscape transience along the European Alps.
- Analyzing topographic data and performing moprhometric analyses to characterize landscape glacial or fluvial “signatures”, using space-for-time substitution to investigate the intensity and modes of post-glacial landscape dynamics along retreating glaciers.

- Exploiting these results to explore the long-term impact of post-glacial phases on landscape evolution over the Quaternary, eventually to assess the future evolution of mountainous landscapes affected by ongoing glacier retreat.

The ability of the candidate to work with different and up-to-date quantitative methods will be pivotal. Numerical modelling will represent an important part of the work, as well as the ability to efficiently handle topographic data and geochronological data. The work is not focused on field work, but some field missions can be organized during the course of this post-doctoral fellowship to target specific field investigations related to modelling/topographic analyses.

Scientific and technical skills required by the candidate - Candidates are expected to be trained in Earth Sciences, Quaternary Sciences and/or in (Geo)physics with preferably a solid background in Geomorphology and Numerical Modelling applied to surface processes. Ability to work in an international and collaborative environment, to communicate scientific research to diverse audience and to write scientific papers are expected. Although prior knowledge of French is not mandatory, spoken and written English proficiency is needed. Visits to the partner univeristies (Grenoble, Loghborough, Aarhus, Potsdam) are expected.

Context - Rennes, the capital of Brittany, is a very lively, green human-scale city, recognized as one the best city to live in France, and is located just 1,5 hour away from Paris and less than 1 hour from sunny beaches. University Rennes is amongst the ten main universities in France. It is a multidisciplinary university, famous for its excellence and dynamic research. The Geosciences department is a large and multidisciplinary research centre which is internationally recognized for its quality in environmental research, in particular in hydro(geo)logy, geomorphology and numerical modelling.

Practical considerations:

- Employment period: 01/06/2023 – 31/05/2025
- Location: Univeristy of Rennes (France)
- Main advisors: Philippe Steer (Rennes), Pierre Valla (Grenoble)
- Collaborators: Boris Gailleton, Dimitri Lague, Philippe Davy (Rennes), Edwin Baynes (Loghborough), David Egholm (Aarhus), Wolfgang Schwanghart (Potsdam)
- Net salary: 2000-2500 € (funded by the ERC FEASBILe project)

Questions - How to apply? – Please contact philippe.steer@univ-rennes1.fr for questions regarding the position. Applications should be sent by email to philippe.steer@univ-rennes1.fr and pierre.valla@univ-grenoble-alpes.fr with your CV, a motivation letter and contact for two references. Review of applications will start **beginning of April 2023** and will be continued until the position is filled.