Postdoctoral Research Position in Hydro-Sedimentology:

Impacts of Extreme Hydrological Conditions on Sediment Fluxes in the Var Watershed (France): Implementation of Operational Numerical Models

Institution: UMR 7329 Géoazur / Mediterranean Institute for Risk, Environment, and Sustainable Development (IMREDD)

Contract Type: Fixed-term (36-month contract)

- **Category**: A
- **Workload**: Full-time
- **Location**: UMR 7329 Géoazur, 250 Rue Albert Einstein 06905 Sophia Antipolis / IMREDD, Technopole Nice Meridia 9, Rue Julien Lauprêtre 06200 Nice

Position Overview

Extreme hydrological events, including intense runoff, flash floods, and drought periods, play a critical role in transforming watersheds. These events shape sediment mobilization and transport, influence morphology and exchange processes (aquifer/river) within the riverbed, and impact interfaces with infrastructures. The Var River watershed (France) provides a rich variety of configurations to analyze these complex dynamic processes, particularly: (i) at the head of the watershed where debris flow phenomena have strong impacts (e.g., on the Vésubie canal intake), (ii) in the lower Var valley, where resource management is crucial and where interactions between surface water and groundwater are influenced by hydro-geomorphological changes. On the Var watershed, physically-based numerical modeling tools (hydrological, hydraulic, and coupled hydrogeological models) are integrated into an operational decision-support tool (AquaVar) managed by the Régie Eau d'Azur water utility (REA). However, these numerical models do not explicitly or in any simplified approximation, include sediment evolution processes. This omission limits the accuracy of calculations for various key hydraulic variables (velocity, water levels, flow discharge, etc.) and is essential to adress for understanding recharge mechanisms and their evolution. The Géoazur laboratory possesses transdisciplinary expertise and instrumentation for monitoring sediment transport in the Var watershed, from landslides in the headwaters to the Var submarine delta. These measurements and this expertise will be further enhanced by satellite-based remote sensing analyses (with another postdoctoral researcher arriving for 24 months in march 2025). Here, for a three-year postdoctoral researcher (starting in March 2025) the ambition of the study will be to contribute to a better understanding of sediment transport processes for their numerical modeling using physically-based computation codes (IBER, TELEMAC 2D, HEC-RAS, etc.). The goal is to assess trends and impacts of sediment transport on riverbed morphology and water resources in a changing context.).

This postdoctoral position is part of the "Act and Innovate for Water" (AIO) France 2030 – ADEME project, conducted in partnership with Xylem, Eau d'Azur Authority, and Université Côte d'Azur. Working within the "Risks on a Changing Planet" research team at the Geoazur laboratory and IMREDD, and in collaboration with another postdoc focused on hydrodynamic flow modeling, you will address these challenges by developing an operational methodology

for integrating remote sensing data on the spatio-temporal evolution of hydromorphological features, snow cover, and other hydrological variables into the AquaVar decision-support system.

Missions

In synergy with the research team (Geoazur) and IMREDD, local partners and stakeholders managing water resources (Régier Eau d'Azur, the local water utility), and another postdoctoral researcher working on hydrodynamic modeling, you will develop and apply an operational methodology with adaptive complexity depending on processes and challenges. Thus, within this position, you will contribute to an ambitious project where your inputs will:

- Qualify and quantify the dynamics of sediment pulses
- Identify processes driving extreme sediment-laden floods at the watershed scale
- Identification of hydrodynamic forcing's responsible for sediment dynamics in the study areas
- Analysis of conditions triggering the movement of different sediment classes
- Analyze morphological changes resulting from these extreme events
- Evaluate the effect of recurring floods and droughts on braided riverbed structuring
- Identify feedback mechanisms related to these transformations on riparian systems and water resources
- Model hydro-geomorphological changes at different spatial and temporal scales with modular process complexity: develop and optimize numerical modeling experiments using deterministic, physically-based calculation codes
- Explore the impacts of extreme events amplified by climate change
- Propose future evolution scenarios by integrating various assumptions, which you will test

Key Responsibilities

Share results and knowledge internally and externally, and, where necessary, support Ph.D. students and interns in their research projects. Publish findings in scientific journals.

Required Qualifications

You hold a PhD in hydrology, geomorphology, sedimentology, or numerical modeling, with expertise in fluvial systems and the analysis of extreme events.

Your field of expertise covers several of the following fields:

- Concepts of hydro-geomorphology.
- Hydraulic modeling, with initial experience in sediment transport modeling (cohesive, non-cohesive, or mixed; 2D or 3D).
- Advanced physically-based software and calculation codes (e.g., IBER, TELEMAC 2D, HEC-RAS).
- The use of computing clusters and GPUs.
- Statistical approaches and programming tools (Python, MATLAB, etc.).

- You have a proven ability to work in multidisciplinary teams and experience in publishing scientific articles.

You are comfortable and enjoy working in a transdisciplinary team. You are a dynamic person and comfortable with communication, preparing and conducting field campaigns, including sampling and measurements. Proficiency in French is positively evaluated.

Background

PhD in hydro-sedimentology, hydrology, or fluvial geomorphology, following training (Research Master's or Engineering School) that enabled mastery of hydro-sedimentary processes and methods for analyzing fluvial systems and extreme hydrological events. You have expertise in numerical modeling approaches to quantify water and sediment fluxes as well as morphological transformations at various scales. You possess skills in analyzing the spatio-temporal dynamics of fluvial systems, particularly braided rivers, and in characterizing sediment-rich flows triggered by extreme floods. You have demonstrated these competencies through scientific publications in international journals, articles, and conference presentations. PhD defended before January 2025. One or more successful pre- or postdoctoral experiences will be positively valued.

Research Environment

the Geoazur lab contributes significantly to understanding geophysical and geological phenomena, anticipates natural hazards, and fosters scientific collaboration at national and international levels. Under the supervision of Dr. Morgan Abily (Hydraulic Engineer) and Dr. Benoît Viguier (Hydrogeologist), you will contribute to advancing water resource knowledge in Mediterranean regions, focusing on recharge processes, hydromorphological evolution, and numerical modeling. Your work, in collaboration with the Eau d'Azur Authority, will support efficient water resource management amid increasing anthropogenic and hydroclimatic pressures.

As an innovation and partnership institute, IMREDD fosters collaboration between research, industry, and local governments in four strategic areas: Energy, Mobility, Risk, Environment. You will contribute to projects experimenting with inclusive and innovative solutions for the future of regional development, engaging with "Smart City" challenges and supporting the resilience and quality of life in our communities.

Application

Please apply via email to morgan.abily@univ-cotedazur.fr. The ideal application includes a CV and a motivation/recommendation letter, which we will review carefully. Please mention the reference 2025-IMREDD01 for this position in the subject line of your email and cover letter.